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American Machinist

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION

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ISSUED WEEKLY

VOLUME LV

July 1 to December 31, 1921

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McGRAW-HILL COMPANY, INC.
10TH AVENUE AT 36TH STREET
NEW YORK

AMERICAN MACHINIST

INDEX TO VOLUME LV

July 1 to December 31, 1921

EXPLANATORY NOTE

Illustrated articles are marked with an asterisk (*), book notices with a dagger (†), and new shop equipment as described in the departments "Shop Equipment News" and "Condensed Clipping Index of Equipment" with a double dagger (‡). Cross references to a particular initial work may apply also to its derivatives. The cross references condense the matter and assist the reader but are not to be regarded as complete or conclusive. So, if there were a reference from "Milling" to "Jigs and Fixtures," and if the searcher failed to find the required article under the latter topic, he should look through the "Milling" entries, or others that the subject might suggest, as he would have done had there been no cross reference. The plural of any given item may not necessarily follow the singular immediately, as the items are listed in alphabetical order. All articles written by any given author are listed directly under his name in the special author's index which starts on page 13. Articles that are not credited to any author may be found under the heading "No author," listed under "N" in the Author's Index.

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American Machinist

Volume 55 NEW YORK, JULY 7, 1921 Number 1

The Hard Times—Their Cause and Cure

Hard Times Are Chiefly Psychological—The World Is Just as Rich Now as Before the War —We Must Have Faith, but Faith with Works

BY THEODORE H. PRICE
Editor, *Commerce and Finance*

THE hard times—their cause and cure, is a big subject and he who is doctrinaire in dealing with it is almost certain to be wrong in his conclusions.

I have just finished reading an article by Professor Whitney in the *American Machinist* of June 16. It is headed "Obstacles to Business Revival" and gives a great many reasons for the present business depression. The disparity between wholesale and retail prices, the fear of a further decline in values, the large amount of comparatively worthless paper money in circulation, the uncertainties of the tariff and taxation, the great public debts, the scarcity of capital and the inefficiency of labor are among the obstacles enumerated and described.

That all of the conditions named are present is to be admitted, but it is, I think, at least questionable whether they are the cause or effect of the hard times. *Post hoc propter hoc** states a rule of deductive reasoning that must be applied with great circumspection and often leads to erroneous conclusions. Personally I am inclined to think that Professor Whitney has reversed the logical sequence and that his obstacles are the product or effect of the hard times rather than their cause.

If this be true then the way to remove the obstacles is to end the hard times. How are they to be ended? An intelligent answer to this question involves an understanding of what we really mean by "hard times." It is doubtful whether any two persons will agree upon a definition of the phrase but nearly everyone will admit that it describes a period when men are depressed, feel poor and fear to take risks or make new commitments. It connotes a psychological rather than a physical condition, except in so far as psychic disorders are nearly always related to physical disease or weakness.

It is in this relation of the psychological to the physical that both a definition and a reason for the hard times are to be found. During the seven years that have elapsed since August, 1914, we have been under a great strain. We made a prodigious effort to help in winning the war after we entered it in 1917. The excitation of the struggle continued for nearly two years after the Armistice and because we are now physically tired and exhausted we are depressed.

In our depression we are irritable, nervous and disposed to exaggerate troubles or imagine difficulties that are non-existent as we excuse our lack of courage or confidence by pointing out what seem to be insurmountable obstacles to success and prosperity.

Those who remember Bunyan's wonderful story will recall that when "Pilgrim" commenced to climb the "Hill of Difficulty" he had two friends with him, "Timorous" and "Mistrust," who turned back when they saw and heard some roaring lions in the way. But Pilgrim kept on and as he came closer to the lions he saw that they were chained and unable to harm him. The lesson is one that business America should take to heart just now for most of the lions by which so many of us are terrified are chained.

It is the fashion to refer to the figures of the world's indebtedness, the alleged prostration of Europe and the losses of the war with gesticulations of despair as we ask hopelessly—when shall we ever get back to normal?

THE PUBLIC DEBT—WHAT IT IS

Now, as a matter of fact the public debt so-called consists simply of the obligations that attest the loan of wealth previously created. In so far as the world collectively is concerned it is much as if a man took money out of one pocket and put it in another. True, much of this money has been spent for ammunition that has been used, ships that have been sunk and other things that have been destroyed, but upon the whole it is demonstrably doubtful whether the losses of war much exceed the waste of peace except as the former may include the economic value of the men killed or crippled.

In times of peace vast sums are spent for luxuries and pleasures of which we are deprived or deny ourselves when we are at war and as there is no imperishable wealth except perhaps gold and silver it is very questionable whether, as measured in money, the property waste of war much exceeds the wear and tear of peace. Take the United States for instance—everyone admits that we are richer than we were in 1914, for although we spent about forty billions in the struggle we have been able to pay all our debts abroad and have changed from a debtor into a creditor nation to which Europe owes tremendous sums.

It is true that our Government has borrowed some twenty-five billions from its citizens, but this does not mean that our national wealth is diminished for the things of which wealth consists, land, houses, railroads, mines, etc., are still here.

CONDITIONS IN EUROPE

England must be richer than she was before the war for she has added nearly three million square smiles to her Colonial Empire and her wealth producing equipment is uninjured. The sum total of the French national wealth must also be greater than before the war, for the value of Alsace and Lorraine must exceed that of the property destroyed in the territory where most of the fighting took place. The French debt is heavy but it is due chiefly to the French people and in a national balance sheet which included the assets and liabilities of each citizen as well as those of the government, the obligations held would offset the debt owed. Belgium, supposed to have suffered more than any other country, has recovered with such marvelous speed that we are compelled to believe that her losses were greatly exaggerated.

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*Meaning literally "After this, on account of this," a Latin phrase which assumes that sequence necessarily implies causation.

Germany is intact except for the territory and the shipping she has lost. Her factories, her lands and her buildings are almost as they were before the war and her remarkable facility in industrial production is unimpaired. The same statement applies to Italy and the various self-determined political entities into which the Austrian Empire has been divided. Switzerland is admittedly richer than she was before the war. So are Holland, Scandinavia, Denmark and Spain, the last-named country having profited enormously by her war trade with both Germany and the Allies.

Russia's war losses could not have been great for she did not fight very long, but her limited industrial equipment must have suffered through disuse, though it is questionable whether her national wealth, which consists chiefly of land, has been much reduced by her adventures in Socialism. Japan is far better off than before the war and as to Canada, South America, Africa, Asia and Australasia it may be said that in an economic sense they were unconscious of the struggle except as it stimulated their productive energies.

If we had an inventory of all the property of the world as of June 1, 1914, and could compare it with another made June 1, 1921, it would probably be found that the value of humanity's assets had increased sufficiently to offset the debts incurred during the last seven years and that the world is just as rich now as it was before the war.

This statement will doubtless be challenged by some who will ask how the losses caused by what is called "the waste of war" have been met. The answer is that these losses were met by intensive production and effort while the war was being fought.

Impossible to Borrow from the Future

This was made clear time and time again by various economists while the struggle was in progress. Current losses could not have been met in any other way, for though it is popular to say that we are borrowing from the future when the Government floats a loan, it is as a matter of fact as impossible to borrow from the future as from a bank that is not yet in being. In the last analysis the proceeds of the war loans made came into the possession of the borrowing governments in the shape of the labor and material necessary for the conduct of the war. These were concrete things that had to be in existence before they could be delivered, and when delivered other forms of tangible wealth were exchanged for them.

This point is stressed because so many have been taught to believe that the future has been hopelessly mortgaged to pay the war debts of the past. To mortgage the future is impossible and the war debts now outstanding represent a lien upon values already created and not upon the production of generations yet unborn.

And as to the wastes of war—are they so much greater than those of peace?

The implements of war, dreadnoughts and aëroplanes, guns and ammunition, are of course destroyed or worn out, but a great many things which represent the investment or expenditure of capital in times of peace are just as perishable.

Our clothes wear out whether we are fighting or not. Our houses go to ruin unless they are constantly painted and repaired. The machines and machinery of industry must be constantly overhauled or renewed. The paving of our streets rarely lasts more than four years and our roads have to be made over almost every spring. The cost of maintaining our railroads in good condition is enormous and even our farm lands must be constantly cultivated and fertilized if they are to remain productive. When we are at war some of this upkeep work is neglected and the resulting deterioration is an important addition to the "overhead costs" of the conflict, but an engineer who has gone carefully into the question tells me he has concluded that the average life of all the products of human labor is not more than seven years. In his computation he has included at one extreme the modern sky-scraper as likely to last fifty years and at the other bread and butter, which are almost instantly consumed, but he points out that human energy is chiefly employed in producing the food which is eaten and the garments that are worn out within a year.

In the light of this statement it will be clear that the wastes of war do not much exceed those of peace and that in trying to account for the "hard times" we must abandon the idea that they are caused by the world's poverty.

We Are Depressed Because We Lack Faith

Wealth consists of things other than money, and of these, especially wealth producing things and opportunities, we have just as many as ever.

Why then should we be depressed after the war's strain is ended and we have rested up sufficiently to recover our normal energy and cheerfulness?

The answer is, I think, that we lack the faith in the future that has been so gloriously defined as "the substance of things hoped for and the evidence of things unseen." To the economist who insists upon relating business activity or idleness to some material fact or condition this may seem an inadequate answer, but not many economists have as yet come to understand how close is the correspondence between the spiritual and the material.

Probably this is because there is a mistaken tendency to regard the words spiritual and religious as nearly synonymous, which they are not. Faith is a spiritual quality because it enables us to project a picture of the future upon the canvas of the present and then to make the picture a reality, because it gives us confidence in ourselves and in our fellow man—because in the face of present discouragement it enables us to believe,

> "That through the ages one increasing purpose runs
> And the thoughts of man are widened with the process of the Suns."

It was through faith that this Government, then an entirely new political experiment, was established. It is through faith that it has been made a success. It was through faith that we won the war—and it is through faith that we can win the peace if we will but stop looking backward upon the big profits and high wages that we were able to get while all the world competed for the products of our labor and content ourselves with a reasonable compensation for the services that we can render.

But "faith without works is dead" and it is not enough to believe. We must be industrious and if we cannot find employment at what we think we are worth we must be willing to take less.

It is impossible to avoid some injustice in making the complicated readjustments that have now become necessary, but life is one long series of compromises. To be happy and useful we must compromise with our wives and our husbands, our children and our friends, our employers and our employees. It is natural that we should try to get all we can, but we must learn to give as well as to take, for the important thing is that the machinery of the world's industry should now be started up and it can't be done unless we all put our shoulders to the wheels and start them turning without regard to whether others will make more or less than we do when activity is resumed.

Our resources are undiminished, our opportunities are numberless and the obstacles in the way of their development are chiefly the creatures of our imagination.

The fellow who generally gets a job and oftenest comes to be a boss is the boy who says "put me to work and pay me what you think I am worth." He has faith and industry—the qualities that will triumph over all the obstacles that the economists can conjure up.

The Cost of Cost Systems

By John R. Godfrey

Just as charity covers a multitude of sins, so cost systems cover a multitude of non-productive expenses. And it's these non-productive costs that must be discovered and pruned to the quick before we get back to a really economical manufacturing basis.

In the days when the boss kept most of his costs in his head and the bank balance was his only measure of success, we seemed to be a long way from scientific or economical operation. Then cost systems became fashionable along with time clocks, typewriters and other paraphenalia. Not that we didn't need them all, the difficulty was that we either got the wrong kind or else didn't know how to use them.

The trouble with most cost systems is that they are postmortems after the patient is dead. They tell us what the machines cost, but it's after they are made and the money has gone up the flue. And they are usually so far behind that the next lot may be well under way before you know how much money you lost on the last lot.

One of my good friends had that kind of a cost system some years ago. He stopped in the cost office one morning to get some figures on a new lot of machines that were coming through the shop. The cost department couldn't tell him because it was three weeks or more behind in posting the data from the time cards and it hadn't much notion as to when it might catch up. There were so many cards in this particular system that it was some job to keep them all straight.

Burning Up a Cost System

Now this friend is a forceful individual, who wants what he wants when he wants it, and particularly when he knows that he ought to have it if it's going to be any use to him. So he called the janitor, ordered him to gather up the whole lot of cards and chuck 'em under the boiler. Said they might be some use as fuel and they weren't a darn bit of use to anybody as they were. Then he told the petrified cost keeper that until he could devise a cost system that would tell what costs were while it was still a live subject, they would worry along without any system.

In another case where they are building a standard product which has practically not changed in any important item for ten years, the "old man" threw out a cost system and six hundred cost clerks which had been acquired during his absence from the shop and they are still running without any cost system. His contention was that they had built this product so long that there ought not to be any question about costs if the department heads were on the job as they ought to be.

This is pretty drastic medicine of course, and it might not work in many places. But hasn't it, after all, a great big grain of horse sense tucked away in it, perhaps unconsciously? Haven't we become so absorbed in systems and records that we've failed to make the best use of either the men or the department heads? Haven't we gone to extremes in making records which no on ever uses and which in many cases are never available in time to be of any real use on the job that is under way?

Some of my friends have cast their lot in railroad circles and have worked their way to the top. They now regretfully spend much of their time poring over reports which come in by the carload and might easily account for much of the paper shortage we hear of occasionally. And they admit, on the Q. T, that they don't begin to read them all, because if they did, there wouldn't be time for anything else.

Now I haven't any intention of starting a crusade against all systems and records. But the man who will head a movement for the abolition of useless and unnecessary records will be a benefactor in more ways than one.

And just to show that all this may not be as crazy as it may sound to those whose idea of business is rules and systems and records so that the human equation is represented by the office boy, I may say that some of the really big men in the industry are spending a lot of time and thought on how to eliminate some of the many systems and records which our yearning for things scientific have brought upon us. One of the basic principles of such a plan, is that the average man can develop a little common sense if he has the chance to exercise it.

Now that times are less strenuous than they were, it will pay the big boss of almost any establishment to miss an afternoon or two of golf and study some of the non-productive costs, or perhaps "indirect costs" may sound better even if it isn't quite so accurate. After he recovers from the shock of what those systems and records of his are costing, he might look a little further and see just how much or how little use is made of the data after it is collected.

He may find that it's all useful and well worth the money—and then again he may decide that it is his patriotic duty to help conserve the national paper supply. In any case it's worth trying. And he may be surprised to find that his direct or productive costs are less than he supposed.

"Don't let your cost systems cost too much" might not be a bad slogan just now.

Metal Cutting Tools

By A.L. DeLeeuw

XII. Form Tools—Plate Tools, Bar Tools and Circular Form Tools—Advantages and Disadvantages of Each—Shaving Tools and Their Action

FORM tools are tools that will produce the desired shape of a piece of work without the assistance of the feed motions of the machine. If we wish to turn up a cylindrical shaft we would normally use a single point tool and depend on the feed motion of the lathe to move the tool in such a way that the result will be the desired cylinder. If we wish to produce a taper shaft we would use the same tool, but make some adjustment in the machine so that the feed motion will produce a cone. We could produce either of these shapes by using a broad tool and forcing it against the work, either by hand or by power, without making use of the feed movement. This broad tool would then be a form tool. As a rule, form tools are not of such simple shape.

With the exception of some special cases, it would be very poor policy to try to produce a cylindrical shaft by the use of a form tool, especially if the shaft is rather long. Yet it may very well be that we would apply such a tool in some hand-screw machine or a Gridley Automatic or, for that matter, in any other automatic machine. We might wish to turn up a short shaft with shoulders at both ends so that it would not be possible to turn up more than half the shaft by means of box tools. In that case, it might be good practice to turn up the second half of the shaft simultaneously by means of a form tool. However, the great advantage of form tools becomes evident when the piece to be turned up or planed or milled is of complicated section.

We have already made the acquaintance of a number of form tools such as the button tool for a planer, and the formed cutters, gear cutters, etc., among the milling tools. We will now consider form tools in their narrower sense; that is, such tools as are used for the production of irregular work on planer, lathe and especially the screw machine.

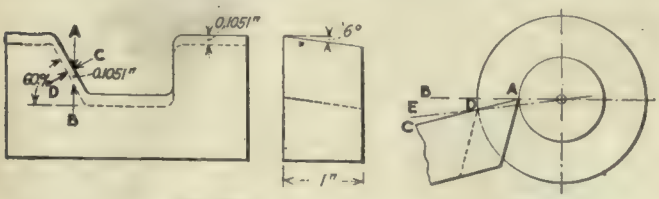

FIG. 189 FIG. 190

FIG. 189. PLATE TYPE FORM TOOL. FIG. 190. SIDE VIEW OF SAME TOOL MADE WITH RAKE

The most obvious advantage of a form tool is that the entire section of the work is produced at once without change of tools, without complicated feed motions, and without great skill on the part of the operator. A second advantage is that it is necessary to measure one diameter of the finished work only in order to be sure that the entire section is correct, provided, of course, that the form tool itself is correct and that it has been adjusted in the proper manner. In other words, the form tool lends itself particularly well to repetition work.

The most obvious disadvantages of form tools are that it is difficult to produce them—in other words, that they are not economical except for repetition work—and that it is not possible to obtain the same speeds and feeds which might be used with single point tools. This is due to the inherent difficulties of a form tool in regard to presenting the proper angles to the work.

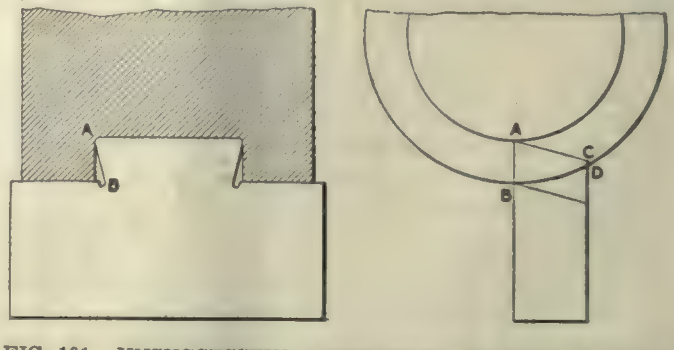

FIG. 191. UNSUCCESSFUL ATTEMPT TO ELIMINATE DRAG

Form tools are made in many ways. Fig. 189 shows a tool of the plate type. Such a tool is merely a plate of tool steel with a contour corresponding to the contour of the work to be made. The cutting side is made to a bevel. Fig. 189 represents this bevel as being 6 deg. The tool represented here has three lines parallel to the axis of the piece to be turned up, one line with an angle of 60 deg., and one line at right angles to the axis. The thickness of the plate is supposed to be 1 in. The top of the plate is shown in full lines, while the bottom of the bevel portion is shown in dotted lines. It may be said then that the full and dotted lines show the clearance of the tool. The distance between the two lines on the horizontal branches is $1 \times \tan 6$ deg. $= 0.1051$. On the bevel portion the distance between A and B is, of course, also 0.1051, but this distance is not the clearance. We will have to take the distance CD at right angles to the bevel portion of the tool to find the true clearance. This distance equals $AB \times \sin 30$ deg. $= 0.0526$. In general, if we call the clearance angle A, and the angle of an element of the form tool with the axis of the work B, the amount of clearance

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which we will have at that element may be expressed thus: tangent of clearance angle equals tangent *A* times cosine *B*. When *B* approaches 90 deg. its cosine approaches the value zero, and therefore the clearance angle approaches zero. We see then that on the vertical branch of the form tool there is no clearance and as a consequence this side will drag along the work, will not make a satisfactory finish, and will be the first part of the tool to break down.

The tool as represented here has no rake. Fig. 190 shows what the result would be if we attempted to construct the tool with rake. The same tool is represented here constructed with rake and turning up a piece 2 in. on the larger, and 1 in. on the smaller diameter. The point *A* is set to the center of the work, and the angle *BAC* is the rake. We will suppose this angle to be 15 deg. We will further suppose that the point *D* is at the deepest part of the tool. The angle of rake at this point is the angle *DEC*. It will readily be seen that this angle is not the same as *BAC*. The following calculation shows that this angle is 7 deg. 20 min.:

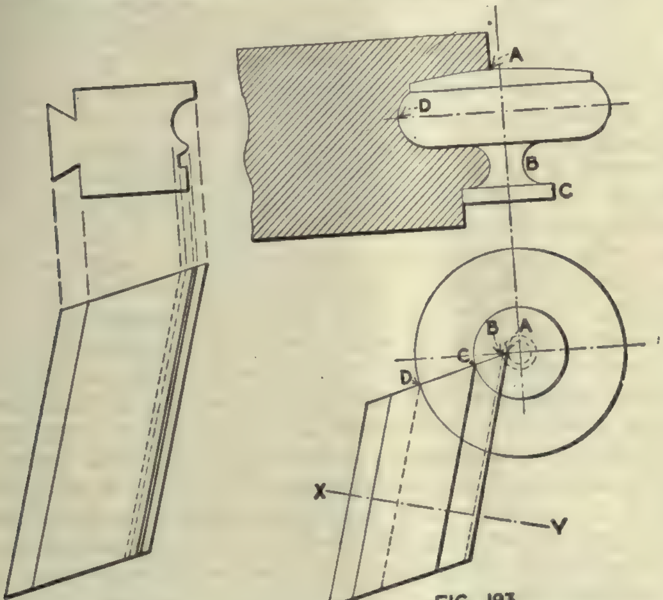


FIG. 192 FIG. 193

FIG. 192. TYPICAL BAR TOOL. FIG. 193. AN EXTREME CASE SHOWING A COMMON DIFFICULTY WITH BAR TOOLS

In triangle OAD, $OA = \frac{1}{2}$ in., $OD = 1$ in. and angle $OAD = 180$ deg. — 15 deg. = 165 deg. Also.

$$\frac{DO}{AO} = \frac{\sin OAD}{\sin ODA}$$

$$\sin ODA = \frac{AO}{DO}\sin OAD = \frac{\sin OAD}{2}$$

$$= \frac{0.2588}{2} = 0.1294$$

$\therefore$ angle $ODA = 7^\circ\ 20'$

Not only does the rake change for the different points of depth of cut, but it also changes with the angle which the element of the tool makes with the axis of the work. We would find, for instance, that any angle of the bevel part of the tool (see Fig. 189) has less rake than that of a horizontal element cutting to the same depth, and we will further see that the vertical branch of the tool has no rake at all. Not only, then, has the vertical branch a tendency to drag over the work, but it has a much more severe duty than any other part. This unfavorable condition of the vertical branch is brought out very strongly if a horizontal and vertical branch join without chamfer or curve. However, we must not forget that as a rule, the amount of feed per revolution of the work is very small where we use a form tool and it is only this amount of the feed for which the vertical branch comes into action. So that if there is a chamfer the fact that the vertical branch has no rake is of much less importance than that it has no clearance. In many cases there are branches of the form tool which are not exactly vertical but very nearly so. In that case, this branch must remove metal over its entire length, and that without having any rake, practically speaking.

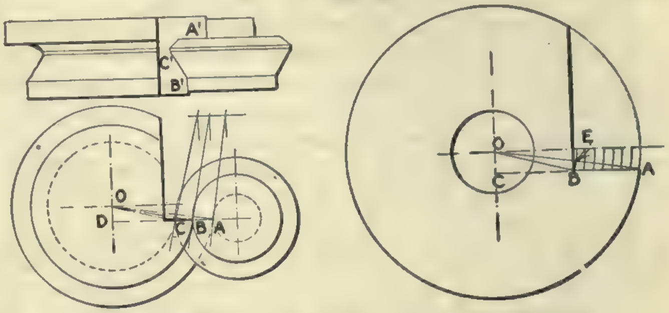


FIG. 194 FIG. 195

FIG. 194. CIRCULAR FORM TOOL. FIG. 195. DEVELOPING CIRCULAR FORM TOOL CONTOUR

In the great majority of cases a form tool is used without any rake whatsoever.

Fig. 191 shows an attempt at avoiding the drag of the vertical branch of the form tool over the work. The branch *AB*, if made vertical, would drag along the finished part of the work which is shown by shaded lines. Realizing that the feed per revolution of the work at the point *A* is very small, the line *AB* has been made to retreat from the finished work and a very small land is provided at the point *A* for the purpose of avoiding grooves in the finish. Looking merely on top of the form tool, one might think that this wrinkle overcomes the difficulty. As a matter of fact it does not. On the contrary it causes the tool to break down sooner on account of drag. The side view shows a cross-section of the work with the tool in position, and indicates that the part of the tool from *A* to *C* will rub against the finished part of the work. If the line *AB* had been made vertical instead of sloping, the entire surface *ACDB* would be bearing against the work and would be subject to wear. As the tool is shown in the illustration, only the sharp edge *AC* is bearing against the work and will of course wear out much sooner than if the entire surface *ACDB* were coming into play. We will come back to this matter in the discussion of circular form tools.

There are many possible constructions of form tools, but they may be classified as follows: 1, plate tools; 2, bar tools; 3, circular form tools. Each of these three constructions has its own applications.

The plate tool is easily constructed and is easily resharpened on a surface grinding machine but its life is not very long, so that the percentage of tool steel wasted would be an important item in regular production. However, where parts must be made in relatively small quantities, this tool is preferable on account of its cheapness of construction. Tools of this kind are almost invariably made without rake and have a greater tendency to spring the work and chatter than tools with rake.

Bar tools are of the general construction shown in

Fig. 192. They can be made with rake, are easily ground and will stand many resharpenings; but the way in which they must be held in the machine makes them less applicable for smaller machines.

When making a bar tool with rake, careful consideration should be given to the special features of the case. It may be an excellent thing to provide rake in one case and entirely inadvisable in some other case. In Fig. 193 an extreme case is represented in order to bring out that rake on a bar tool may lead to serious trouble. The circles *A*, *B*, *C* and *D* in the end view correspond with the points *A*, *B*, *C* and *D* of the plan view. The tool is on the center at the point *A*, and is supposed to have the proper amount of clearance and the proper amount of rake. It will be seen that under the conditions as shown the clearance increases and the rake diminishes going from *A* to *B*. In fact, the illustration shows that there is negative rake at *D*, so that cutting would not be possible at that point. It also shows that the amount of clearance is entirely too much at the same point. However, this should not be construed as condemning the use of rake in this type of form tool, but merely as a warning to consider carefully and preferably lay out the exact conditions under which the form tool may have to work before deciding the amount of clearance and rake to give at any one point, and even before deciding whether *any* rake should be given. If rake is given at all, great care must be taken in laying out the normal cross section of the tool. When planing or shaping or milling the tool the movement of the generating tool (planer or shaper tool or milling cutter) is at right angles to the line *XY*, or in other words, at right angles to the cross-section of the tool. And this cross-section must be made so that the points *A*, *B*, *C* and *D* become located in their proper position. If the tool is made without rake, but is set so that it makes an angle with the vertical plane equal to the clearance angle, then the normal cross-section of the tool would be merely a projection of the desired section at the angle of the clearance; but if rake is given, then each point must be studied out individually.

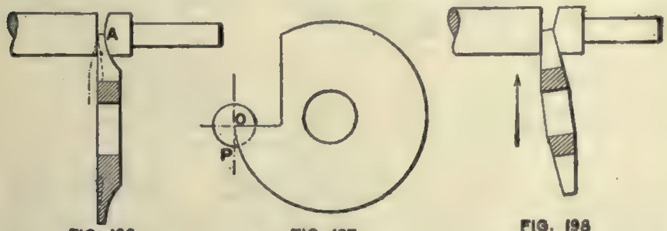


FIG. 196 FIG. 197 FIG. 198

FIG. 196. CUTOFF TOOL COMPLETING CUT. FIG. 197. END VIEW OF SAME TOOL. FIG. 198. CUTOFF TOOL WITH CLEARANCE ALL OVER

Circular form tools are used more and are known better than any other kind. They are not quite so easy to make, but have a long life, and waste very little tool steel. They are easy to regrind and to reset. On the other hand, they are not easily controlled as to clearance and rake.

Fig. 194 shows a circular form tool in section and in side view. As is well known, a notch or gap is made in the tool so as to obtain a cutting edge. In order to have clearance the gap should be made below center; in other words, the line *AC* should not be a radial line, but should be a line tangent to some circle struck from the center of the tool. If the radius of this circle were ¼ in., then it is very important that for every regrinding this distance of ¼ in. be maintained. It is, therefore, advisable to mark on the form tool the size of the circle to which the line *AC* should be a tangent. As a rule, this is not done.

The clearance at the point *A* depends on two things: the radius of the cutter at this point, and the diameter of the circle to which *AC* is tangent. If the radius of the cutter is *R*, and the radius of the circle to which the line *AC* is a tangent is *a*, then the sine of the angle of clearance equals $\frac{a}{R}$. Now it will be seen that the various points of the form to be produced will have different distances to the center of the tool, and that, therefore, the amount of clearance varies for the different parts and is greatest for those parts which are closest to the center.

We did not have this condition with the plate or bar form tool. In them the angle of clearance varied with the angle between an element of the tool and the axis of the work. The clearance was a maximum only when this element of the cutting edge was parallel with the axis of the work, and a minimum when the element was at right angles to this axis. This same condition prevails of course with the circular form tool but in addition there is to be considered the variation which comes from the fact that the tool is circular in form and that various points of the outline are located at different distances from the center line of the tool.

Fig. 194 shows the various clearance angles at the points *A'*, *B'* and *C'*; provided, of course, that we consider only those elements which are parallel with the axis of the work. It would be perfectly feasible to make such a tool with rake. As shown, the line *AC* is in a horizontal plane. If this line had been drawn in a plane of which *A* is the higher and *C* the lower point, the tool would have been provided with rake. The amount of rake would be a variable quantity, just as it was with the bar or plate form tool; and furthermore, if we had placed the point *C* lower for the purpose of getting rake, the amount of clearance at that point would be still further increased.

Where the form tool is very large and the length of the line *AC* is very small, the variations in clearance angle would be rather small and would not need to be considered, but this is not the way circular form tools are made. One reason why they are used at all is to reduce the amount of waste steel, and if the diameter were made large in proportion to the length of *AC*, a very large portion of the tool would have to be thrown away. Furthermore, if the line *OA*, the diameter of the tool, were made large it would be necessary to make the distance *a* quite considerable in order to have sufficient clearance at the point *A*. If such procedure were followed it would mean that we would need a high toolpost and this is very undesirable. If such a high toolpost were used, not only would we have all the difficulties of too much leverage, but it would prevent us from using a small form tool, for with a large distance *a* and a small

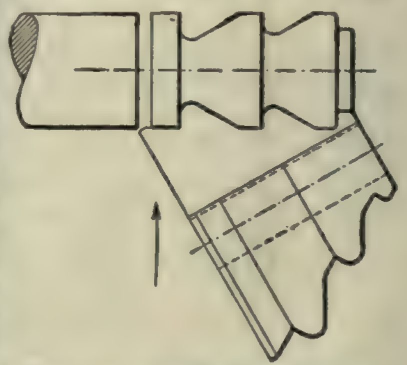


FIG. 199. SPECIAL CIRCULAR FORM TOOL

radius *OA* the clearance at the point *A* would be too much and the clearance at the point *C* would be still worse.

Generally speaking it is desirable to keep the center of the tool as low as possible. If we do this and keep the form tool reasonably small, the only trouble we are apt to meet is that we may have too much clearance at the point *C* when we have considerable depth of cut.

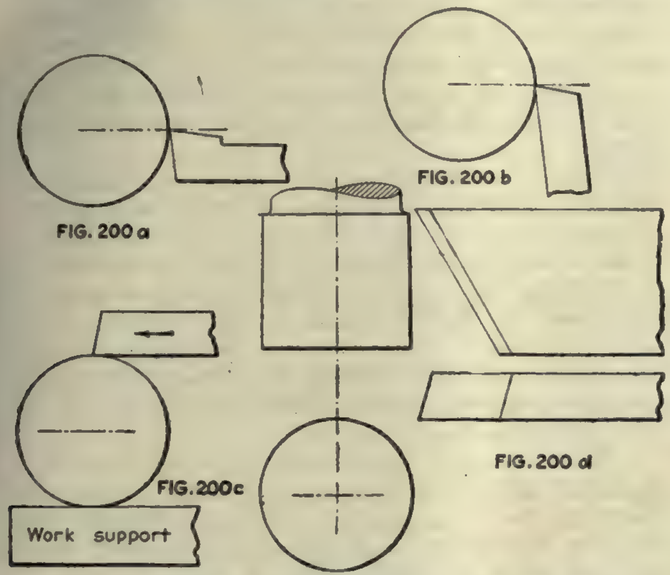


FIG. 200. ACTION OF SHAVING TOOLS DIAGRAMMATICALLY ILLUSTRATED

Too much clearance means a weak tool at the cutting edge and resulting chatter. For this reason the circular form tool is as a rule not desirable for large and heavy work, especially where deep impressions must be made. These difficulties are of not much importance where the work is small and where the depth of impression cannot be very great.

To illustrate this further by example, let us suppose a form tool is to be used on a ⅝-in. screw machine, where the depth of impression cannot be more than 5/16 in., in case we use the form tool for cutting off. Such a form tool would not be less than 2¼ in. If we make the clearance at the point *A* seven degrees, the center of the tool would have to be 0.137 in. above the center of the work. The point *C* which is located 5/16 in. further inward, would be 13/16 in. from the vertical centerline of the tool. Its clearance angle is the angle *OCD*. Tan $OCD = OD \div CD = 0.1686$, which shows that angle *OCD* equals 9 deg. 35 min. Though there is a marked variation in the clearance angles, the difference is not enough to cause any trouble.

Now let us suppose that we also use a circular form tool in a 6-in. automatic. Of course we would not make the form tool in proportion to the size of the work. If we did, we would have to use a form tool of more than 21 in. in diameter. What we would do is to use a form tool in which we can make a 3-in. impression and yet have some metal left around the stud holding the tool. Such a tool would be, perhaps, 8 in. or 9 in. in diameter. Let us assume it to be 9 in.; then the distance, *a*, figuring on a clearance angle of seven degrees, would be 0.5485 in. The distance *CD* would be 1½ in., and the tangent of angle *OCD* would be 0.3657; so that angle *OCD* would be 20 deg. 5 min., which is entirely too much.

Referring again to Fig. 194, it is easily seen that the contour of the tool around the cutting edge is not the same as the radial section; so that if we wish to make a circular form tool we must take care that its shape shall be correct on that plane which we are going to use for the cutting edge. We found the same thing to be the case with plate and bar form tools, and we found also that all we had to do there was to project the correct form into another plane, making an angle equal to the clearance angle with the top of the plate or bar. This is not a difficult matter to do and was discussed at some length in the chapter on formed cutters.

Form tools are often used in screw machines for the purpose of making pieces which receive no further operation, and it may be necessary to have the different diameters of the piece correct to a high degree of accuracy. If this is the case, it becomes important to have the form tool also accurate to a high degree. In the plate or bar form tool, all points of the outline could be projected on some other plane, but in the circuular form tool this cannot be done if theoretical accuracy is required, because the clearance at each point of the cutting edge depends on the distance of that point from the center of the tool.

In Fig. 195 a form tool is shown in which *AB* is the cutting edge. In order to find the correct shape of the radial section of this tool, the various points of *AB* should be circled over with *O* as center. One of these points, *E*, is shown. It is the proper projection of the point *B*. If we should draw a line from *B* perpendicular to *AO*, we would not have obtained the point *E*, and the distance from this point to the point *E* would be the error. As a rule this error is very small.

To illustrate this we will assume that the form tool is 3 in. in diameter, so that the line *OA* is 1½ in. We will further assume that the depth of impression, that is, the line *AB*, is ¼ in.; and that we desire a clearance angle of eight degrees at the point *A*. With these assumptions we find that the line *OC*, that is, the distance to which the center of the tool must be set above the center of the work is 1½ in. × sine 8 deg. = 0.208755 in.; and from this we find that *AC* = 1.485 in. As *AB* equaled ¼ in., we find that *BC* equals 1.235 in. We can now calculate the line *OB* in the triangle *OBC* and find that its length is 1.2525 in. If we circle this line *OB* over, we obtain the point *E* on the radius *OA*, and as *OA* equals 1½ in., and *OE* equals 1.2525 in., we find that *AE* equals 0.2475 in. This is the depth of the

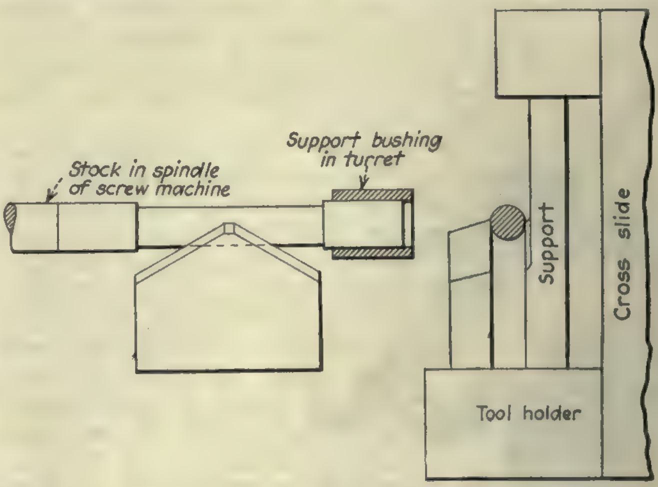


FIG. 201. AN EXAMPLE OF SHAVING TOOL WORK

impression of the templet or generating tool required for our form tool.

If we had drawn a line from *B* perpendicular to *AO*, we would have found a point E_1, and the length AE_1 would have been $AB \times \cos 8$ deg. = 0.2478 in. This is 0.0003 in. more than the theoretically correct distance. For any other point of the line *AB*, this error is even smaller.

There are very few cases where such a small error would not be permissible, and where this error is allowable, we can use the method described in the chapter on formed cutters; that is, take a wedge-shaped piece of metal with an angle or wedge equal to the clearance angle, draw the correct outline on one side and file out the shape at right angles to the other surface. Then this other surface will give the correct outline for the templet or generating tool.

If the depth of impression is greater, or if the clearance angle is greater, or the diameter of the tool smaller, the amount of error increases; so that with a small form tool with relatively deep impression and which stands relatively high above the center of the work, the error may become of sufficient magnitude to cause trouble, especially when accurate work is desired. It is, therefore, well to look carefully into the merits of the case before deciding whether this simple method of projection is applicable.

It often happens that after a piece has been cut off in the screw machine, the end of the bar requires no fuurther finish after it has been fed out for a new piece, at least as far as accuracy is concerned. It may be desirable, however, to have this end look presentable. If we use a circular cut-off tool with straight sides, we are almost sure to have a rough finish at the end of the bar. Fig. 196 shows a cut-off tool which has just finished its operation. The right side of the cut-off tool is made curved and has therefore some clearance at all points except the extreme forward point *A*. The left side of the tool being a straight line has no clearance anywhere and the end of the bar is almost sure to be ragged and to present a torn-up surface. Sometimes an effort is made to avoid this condition by cupping this side out as shown in the dotted line under the impression that the tool will then have clearance. This, however, is a mistaken idea.

In Fig. 197 the same bar and the same tool are shown in end view. This figure shows clearly that the edge of the cutoff tool rubs against the bar from *O* to *P*. The only cutting point on this line is the point *O*. As a result, the point *O* loses its cutting qualities almost at once and causes the torn-up surface. In order to overcome this difficulty, one should have made the tool as shown in compound lines in Fig. 196. A very small amount of taper will be enough to produce a better finish, 0.001 in. or 0.002 in. might be sufficient for small work. As a rule the taper end of the bar is not objectionable.

In many cases the end of the work where it is cut off receives some further operation before the piece is entirely finished. In that case, it is not necessary to have the point *A* without clearance, and if this is so, we can arrange our cutoff tool so as to produce a straight end of the bar and yet have clearance all over. Fig. 198 shows this condition. In Fig. 196 the side of the cutoff tool nearest to the bar was a plane surface; in Fig. 198 this side is made part of a cone. It will readily be seen how this causes clearance at all points of the cutoff tool. Such a tool must be set in an angular position in relation to the toolpost, and for that reason may require a special toolpost.

Many times the contour of the piece to be produced has a vertical branch which must be carefully finished because it does not receive any further operation. Where there is only one vertical branch, or where all the vertical branches point in the same direction, the same little artifice as shown in Fig. 198 can be employed. Fig. 199 illustrates this. The only objectionable feature to this wrinkle is that the form tool becomes somewhat larger than it otherwise would have been; but it has so much longer life and makes the work so much more presentable, that one should not hesitate to use it wherever possible.

For rapid production on screw machines, high-speed steel form tools should be used. Where a large number of form tools of the same shape are employed, that is, where several screw machines are busy all the time on one and the same piece of work, it pays to generate form tools by the process of circular milling. This requires a formed cutter of the proper shape, and such a cutter can be made of high-speed steel. But where a single form tool must be made, this system of circular milling no longer applies.

In that case, a flat generating tool is made and it is generally found that it is very difficult to keep this generating tool to size when cutting high-speed steel. This has a tendency to produce a form tool of which the shape is not entirely correct.

A further error is introduced by hardening. This error caused by hardening appears twice when we produce the form tool by the circular milling method. In addition, the high temperature to which the high-speed steel must be subjected for hardening has a tendency to roughen the surface, so that not only does a high-speed steel form tool have a tendency to be off shape, but in addition has a tendency to present a rough cutting edge and to produce a rough piece of work. The roughness of this hardened high-speed steel, seen under the magnifying glass, appears often as little globules and little hills. These hills may cause a lack of clearance at some points, and if this is the case, the tool will have a short life.

For all of the above reasons, it is advisable to grind the form tool to its correct contour after hardening. At the present time, there is no machine in existence specially adapted to this kind of work, but there are now several machines which might be rigged up to do this kind of work very satisfactorily. Any contour-grinding machine, such as the Pratt and Whitney or the Barnes, can be arranged for this purpose. The form tool should be mounted on an arbor just as if it were a formed cutter. The arbor should be held in a spindle which can rotate in a fixture, and should be driven by a belt from the countershaft. A templet should be made just as for the contour grinding of a formed cutter, and the form tool should be moved past the grinding wheel while it is rotating.

A peculiar kind of form tool is the so-called shaving tool. Whereas the feed of the ordinary form tool is from the outside of the piece toward its center—that is, radial—the feed of a shaving tool is tangential.

Fig. 200 shows a straight piece of work in cross-section, and a broad nose tool finishing the piece. There is nothing out of the ordinary in this arrangement. If we should modify it as shown in Fig. 200*b*, we will still have the same conditions, but, used in this form, the tool might be called a shaving tool. As a rule the work is supported when a shaving tool is used, as shown in Fig. 200*c*. In this form, shaving tools are used to obtain the size of the piece to a high degree of accuracy and the amount of metal removed is always very small. If the piece to be finished is short, a broad-nose tool will do the work very nicely, but if it is long, the pressure in the direction of the arrow would be quite considerable, would cause chatter and would deflect the piece sufficiently not only to prevent getting the correct diameter, but, as the deflection would not be the same at all points along the length of the piece, there would also be a variation of diameter. Fig. 200*d* shows the same piece and the shaving tool, which is shown in dotted lines. It will be seen that the cutting edge is set to an angle with the axis of the piece, so that only a short piece of the tool is at work at any time.

Such a shaving tool has been used in a rather peculiar way for the work shown in Fig. 201. The piece of work was a rather long and very frail shaft of which the central portion that was by far the greater part of the length, had to be recessed. The shaving tool used in this case had a double bevel, so that the recess was started at its center and continued toward the ends. The piece had to be reduced in diameter about $\frac{1}{64}$ in. The bottom was supported on a plate of practically the same shape as the tool. The total width of the tool was about 6 in. In this manner it was possible to take what really amounts to a forming cut of great length, on a piece of very small diameter.

In the chapter on shear tools, a further discussion will be given of the action of shaving tools and their limitations.

A History of Post-War Crises—III

Conditions During and Following the World War—Rise and Fall of Prices from 1914 to 1920—What Is to Be Expected After a Prolonged Conflict

BY H. H. MANCHESTER

THE boom which took place after the World War was by no means confined to the United States. This is very evident from a brief review of the course of prices in the various countries. In some countries the most available data deal principally with foodstuffs and other items directly involved in the cost of living, as the H. C. of L. was the most discussed, and "cussed," feature of the times.

With prices in the period just before the war taken as 100, food prices in Great Britain in January 1919, practically at the close of the war, had reached 230, and general prices 217. In July 1919, food prices dropped to 209, but general prices increased to 239. Then the boom began which carried food prices to 236 in January 1920, and general prices to 288. The high point for general prices was reached in March at 310. They then gradually dropped and in July were 293. At that time food prices averaged about 258. The spring or middle of 1920 seems to have been the peak of the boom throughout the world.

In France food prices had reached 248 in January 1919 and general prices 347. The success of the war produced such a feeling of elation there that there was no decided drop, but a comparatively steady rise in prices. In July 1919, food prices were 261, and general prices 349. In January 1920, food prices had reached 290, and general prices 488. Then a decided boom began which lifted general prices to 587 in April, after which they began to drop. Food prices in July were 373, and general prices probably about 450.

In Belgium food prices were quoted at 639 in January, 1919, which in itself gives an idea of conditions in the territory which had been occupied by the Germans. In the next six months they dropped to 354. Then the boom began which raised them to 410 in January 1920, and to 479 in July of the same year.

It Italy food prices were 259 in January 1919, and general prices 327. A drop in food prices to 206 occurred in the next six months, while general prices rose to 359. From this point both began to rise rapidly; general prices reached 504, and food prices 275 in January. The peak in general prices was reached in April at 679, at which time a rapid drop began. In July food prices were 318, and general prices probably about 570.

It must be remembered that all of these countries are on a paper basis, and that the prices are quoted in such currency. The situation is much the same as in the United States at the close of the Civil War when prices were stated in greenbacks.

In Canada general prices were 211 in January 1919, and 217 in July. Food prices were 186 in both January and July of 1919. They rose to 206 in January 1920, and to 227 in July of that year. In the meantime general prices had jumped to 250 in January 1920. They reached their peak at 263 in May, and sagged to 256 in July.

By far the most important of all the foreign countries in the history of prices after war was Japan. Although far distant from the seat of the conflict, general prices there rose to 214 in January 1919, and to 242 in July of that year. By January 1920, they arrived at 301. The peak was reached in March 1920, at 321.

Raw silk in the meantime, had jumped from a pre-war price of perhaps 900 yen, or $450 per bale, to 1,670 yen in June, 1919, 2,200 yen in October, 1919, and to 4,500 yen in January 1920. Thus the price, it will be noted, was five times that before the war.

In the meantime a remarkably heavy flotation of companies had been going on. In 1919 these had ten times the capitalization of four years before. The government was optimistic and did all it could to assist the companies, which it in fact controlled, to hold up prices, but the price of silk had outrun the market abroad and on April 7 began a panic which closed a number of the exchanges. The price of silk plunged suddenly to almost a pre-war level, and general prices slumped also. In July they reached 239, eighty points below their March peak. Many manufacturing plants were closed and wages took a big drop.

This was the first crisis and, in fact, the first decided break in prices after the war. A careful consideration will probably show that it was this crash which precipitated the fall in prices in other countries. This slump showed itself first in England, which in many ways was most closely associated with Japan. There prices fell off four points in April 1920, the month of the Japanese crisis. In May the drop showed itself in France and Italy, and in June there was a slight fall in prices in the United States.

THE SITUATION IN THE UNITED STATES

This brings us to the economic events in the United States since the World War.

After a drop in the early part of 1919, an important boom began in the peace industries, which made up for the cessation in munition making. Prices in general, which had reached 206 in December 1918, after a brief fall to 197 in February, began a gradual rise to 207 in June. The next month there was a jump to 218, and in August to 226. In September there was a slight fall to 220, after which followed another gradual rise to 238 in December. This increase was kept up for the first part of 1920, and reached the peak in May at 272. This it will be remembered was the month after the Japanese panic. From that point prices dropped off slightly to 262 in July, then the fall became more rapid, reaching 250 in August, 225 in October, 207 in November, and 189 in December.

Thus after the war, prices in general in the United States took a two months' fall, followed by a fourteen months' rise, and another drop which has thus far lasted eight months.

There is sufficient variation in the different groups of products to justify particularizing. The price of metals and metal products, for example, averaged 208 in 1917, and dropped to 181 in 1918. In January 1919 they were 172. In January 1920 they were 177, then took a decided jump to 189 in February, and reached the high point after the war of 195 in April. They clung closely to this height for the next six months and were still 192 in September. Then a rapid drop began which brought them down to 184 in October, 170 in November, and 157 in December. Farm products which had averaged 220 in 1918, and 234 in 1919, reached 246 in January 1920, and again in April. There was a slight fall to 243 in June, and then a rapid drop which brought them down to 144 in December.

Food in general had averaged 189 in 1918, and 210 in 1919. During the last year it had risen steadily, reaching 253 in January 1920. After a slight drop to 244 in February there was another quick rise to 287 in May. This marked the peak, and was followed by a fall to 268 in July, and a still more sudden drop to 235 in August, 204 in October, 195 in November, and 172 in December.

One of the groups which mounted the highest was clothing. This averaged 239 in 1918, and 261 in 1919. It rose rapidly during the latter part of that year and in January, 1920, reached 350. Its high mark was at 356, during the next two months. It was, however, the first to feel the effect of the Japanese panic, and began a slow decline to 317 in July, and then a more rapid fall which brought it down to 220 in December.

THE RISE IN WAGES

Wages in the meantime had been rising more or less proportionately to prices. During the war wages in the peace industries did not rise as fast as prices in general, but those in the munition industries leaped higher. Workers increased their pay by changing their jobs. After the war wages increased faster than prices and they have not yet dropped anywhere nearly as consistently as have prices. A comparison of the average weekly earnings in the factories in New York State and in food prices runs about as follows: 1914, food 105, earnings 98; 1915, food 102, with earnings 101; 1916, food 115, with earnings 114; 1917, food 147, with earnings 129; 1918 food, 170, with earnings 160; 1919, food 188, with earnings 185; 1920, food about 195, with earnings about 220. In November, 1920, food was 195, and earnings were 226.

An analysis of the average earnings in the factories in New York State discloses that in the metal, machinery, and conveyance group, wages increased to 229 between 1914 and the end of 1920. In the wood working factories, wages increased to 230; in the stone, clay, and glass plants, to 241; in printing to 204; in the paper mills to 244; in food and beverage establishments to 227; in textiles and clothing to 228; and in furs, leather, and rubber to 221.

In New York from 1914 to October, 1920, the union scales for the metal workers show an increase in the rate per hour to 212 for machinists; 182 for blacksmiths, 186 for boiler makers; and 179 for sheet metal workers. As a class, iron workers seem to have fared better than the carpenters whose wages in October, 1920, had increased only to 144 per cent of the 1914 figure.

In Boston the general average of union wages had increased from 100 as par, to 172 in July, 1920; while the pay of the metal workers and machinists had risen to 199.

The slump in prices has caused a reduction in wages in certain lines, but where prices have dropped some eighty points from their peak, wages, even where already directly affected, have dropped at the most only about twenty points.

THE UNEMPLOYMENT SITUATION

But so many factories have been closed, and so many others have reduced their forces, as to give a percentage of unemployment in certain fields that is almost staggering. It was said that there were 3,473,000 fewer employed in January, 1921, than the year before. The number of unemployed reach 35 per cent in metals and metal products, textiles, and leather; in wood products 32 per cent, and 19 per cent in food products and in clay and glass products. It is even declared that these figures are too low.

The automobile industries of the Middle West showed the greater slump. Between January 1920 and 1921, employment in Michigan dropped 82 per cent, in Ohio and Indiana 40 per cent, and in Illinois 44 per cent. Connecticut showed a decrease of 43 per cent, Massachusetts 38 per cent, and New York 28 per cent. While it is too much to say that such a percentage of unemployment is equivalent to a drop in wages of this per cent, there is no doubt that the closing of factories, and reduction of forces in general predict a reduction in wages which will probably be found to bear a definite relation to the percentage of unemployment.

In considering what the future may bring one of the most obvious methods is to see what has happened in Japan where the fall in prices started first, and where the crisis has probably been worst.

After the break came there in March, 1920, raw silk dropped from 4,500 yen, down to nearly the pre-war level, or 900 yen per bale. Sugar, rice, and the cotton yarn made in Japan likewise plunged downward to nearly their previous level. The government instructed the banks to give the greatest possible assistance to "such concerns as gave promise of substantial development and readjustment, and to business men who have carried on their business on a solid basis, and who are likely to develop it successfully if they are given the time necessary for adjustment."

Government controlled corporations were formed to hold up silk and rice, and 30,000,000 yen were advanced to the sugar interests. An attempt was made to peg silk at 1,500 yen per bale, but without conspicuous success, and sugar and rice have continued to drop. The situation in Japan at the beginning of the year, according to *Eastern Commerce*, published at Yokohama, is in part as follows:

"The condition of commerce and finance in Japan at the end of the year is undoubtedly bad. Any real recovery can hardly be expected early in the new year. The futility of trying to help business circles out of their depressed and disorganized condition by artificially keeping up prices is more than ever clearly shown by occurrences in Japan during the last few weeks of the year. For instance, silk fabric producers started an agitation to wind up the Imperial Silk Company which was recently floated with the help of the government and entrusted with the function of keeping up the price of raw silk. In the middle of December the Yokohama Exchange was reduced to a helpless condition, clearly showing the futility of trying to maintain prices at an unnatural level.

"Cotton mills have also had to admit the mistake of the policy of keeping up prices by means of the curtailing of production.

"The mistake is now being repeated by farmers.

"These few representative facts disclosed during the last few weeks, indicate that a general depression is being introduced in Japan, and it is apparent that prices must come down."

The same journal states that although the government pegged silk for export at 1,500 yen per bale, it is easy to purchase it for 1,100 yen.

The lessons from Japan appear to be that the end of the falling prices is not yet in sight, and that artificial attempts to prevent this fall will be useless and probably do more harm than good.

The failure of the state bank of North Dakota to hold up wheat prices is another indication of the same fact.

If then prices are still going down, how far will they go? Let us stop a moment and ask what has happened which should increase the price of goods over the pre-war level. Prices are increased primarily by demand. What new demand has been developed? Western Europe may have need, but cannot pay for them; Russia is, at least temporarily, out of the market; China is threatened with starvation; even South America is at present less able to absorb imports from us because her own exports to Europe are in less profitable demand. The one country which appears to be in a better condition for trade than it has for the past few years is Mexico.

There is no doubt, however, a greater latent demand in the United States than ever before. One proof of this is the fact that bank deposits between 1914 and 1920 increased about $18,000,000,000, an amount considerably more than the total United States debt with the loans to other countries subtracted. But the people of this country have shown pretty conclusively, in their consumers' strike, that they will not continue to pay war-time prices.

While prices are made principally by demand, the cost of the goods, in the case of necessities, indicates a minimum price. If nothing has happened to increase demand, what has taken place that will increase the cost of necessities? So far as the writer knows, only one thing, and that is the increase in wages. But while wages are hard to reduce they are by no means fixed at their recent high level, and are already showing a tendency to drop. Wages are themselves governed largely by demand and supply, and may be increased by the greater productiveness or the scarcity of labor. It is only fair to suppose that labor will be scarcer in Europe than before the war. For this reason, there is likely to be an important permanent rise in wages in Europe, which will result in bringing both wages and prices there to more nearly the level in the United States.

In considering the future, inasmuch as the demand in Europe is unquestionable and is nullified at present only by the inability to pay, there is no doubt that business will be better, as conditions in Europe improve. The payments on the German indemnity are very liable to create a boom in France, which may easily run into over-speculation, but will tend to hold up, at least temporarily, both prices and wages.

In the United States the increasing productiveness of labor, either through personal efficiency or improved processes, may at the same time assist in maintaining wages and in lowering prices.

THE OUTLOOK

In general, data which we have brought together suggest the following outlook. It will not take more than a year and a half from last May for industry once more to reach fairly normal conditions. This means that business should be reasonably good next winter. But prices in each industry will have to approach somewhere near the pre-war level before demand will be active and permanent. Inasmuch as the pendulum usually swings too far, prices will probably drop lower than they will remain. They will most likely find a level at about 30 per cent above pre-war prices. Industrial stocks were already below this level in December 1920 and farm products reached within 5 per cent of it in January 1921. General prices, however, though they dropped 95 points from May to January, would have to drop almost 50 more points to reach the level predicted. But this is only 28 per cent of the January average. Metal and metal products, which had dropped to 151 in January, would need to drop less than 20 per cent more to reach our estimate. Food would require only a 20 per cent fall from its January level of 163. Clothing, however, which was 208 in January, would still have to go down 37 per cent before reaching our estimated stable basis.

Funds may be used with caution to ease the fall, but if they are employed to keep prices high the result is almost sure to be failure, and the effect disastrous.

Wages also will drop, but they will do so more slowly than prices and in many cases only when it is absolutely necessary to reduce them in order to produce goods for a price at which they can be marketed. In the industries where circumstances are most favorable to labor, wages may remain at an average of possibly 40 or 50 per cent above the pre-war level.

As for the years following 1921, business will depend very largely upon the progress made in the reconstruction of Europe and the revival of our foreign trade.

Apprenticeship System of the Southern Pacific Railway

Obtaining Good Mechanics by Training Them—Methods of Instruction—Rates of Pay While Learning—Summary of Periods of Instruction

BY FRANK A. STANLEY

THE apprenticeship system of the Southern Pacific Co. has been in successful operation for a number of years in the various shops of the company. The term of apprenticeship is four years, the first six months being a probationary period during which a boy's fitness for his chosen work is to be determined. In the selection of apprentices, applicants are given an oral and written examination by the superintendent of apprentices and must pass this examination in addition to the regular physical examination. The range of ages for applicants is between 16 and 22.

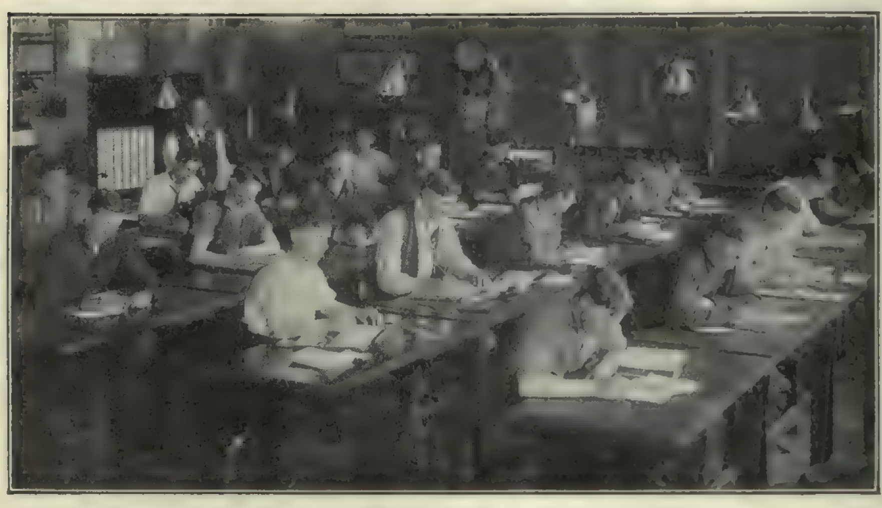


FIG. 1. APPRENTICE SCHOOL IN SACRAMENTO SHOPS

The apprentice board is composed of the general foreman of the department, the shop foreman, and the apprentice and school instructors, and this board passes upon the fitness of all boys in the probationary period, so that if any are found lacking in aptitude or other qualifications, they may be eliminated from the apprentice courses.

The rates of pay during the four-year apprenticeship are advanced every six months. The range is as follows:

First year,	First six months,	42 cents per hour
	Second six months,	44½ cents per hour
Second year,	First six months,	47 cents per hour
	Second six months,	49½ cents per hour
Third year,	First six months,	52 cents per hour
	Second six months,	54½ cents per hour
Fourth year,	First six months,	59½ cents per hour
	Second six months,	67 cents per hour

At general shops and wherever there are a sufficient number of apprentices to warrant it, apprentices are under the direction of a superintendent of apprentices. He keeps a record of all apprentices and sees that they receive proper instruction in their work and that the instruction is varied in accordance with the regular schedule of shop training. While he does not have direct authority over the work of the apprentices in the shops, he takes up and arranges with the foreman all matters pertaining to any desired changes affecting the apprentices. At shops where there are only a few apprentices, a foreman or assistant foreman acts as head instructor of apprentices. All apprentices are required to attend the schools of instruction for four hours each week, held within the shops, during working hours. They are paid straight time for the period spent in school. Attendance at the school is continued throughout the four years of apprenticeship. The school year is divided into two terms of 21 weeks each, there being eight weeks during July and August and two weeks during the Christmas and New Year holidays when the schools are not in session.

This schedule of shop training is followed in all shops on the system: First two years on machines; third year on erecting floor; fourth year on erecting floor or on machines, according to qualifications of the apprentice.

At the end of the second year, apprentices so inclined, may, with the consent of the apprentice board, be assigned to airbrake work or toolmaking for the remaining two years.

The accompanying report gives in tabular form data pertaining to the activities of the apprentice schools at the different shops of the system. This report is for the month of January, 1921, but a summary will be found in the section showing the activities since 1912.

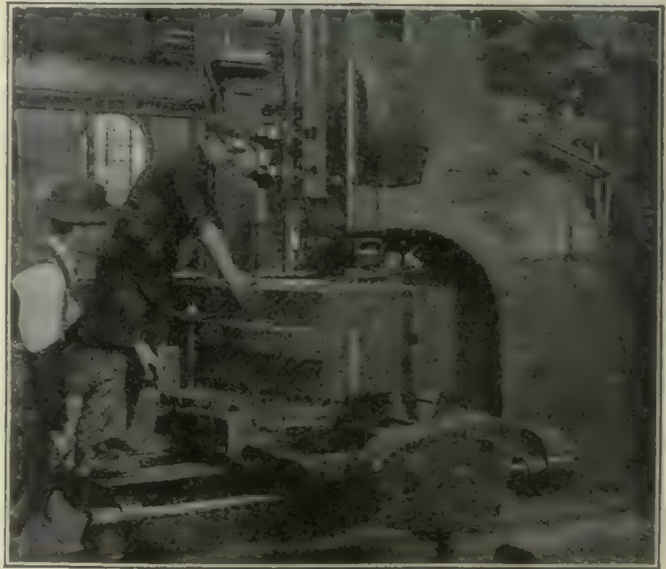


FIG. 2. MACHINIST APPRENTICE RECEIVING INSTRUCTION ON SLOTTER

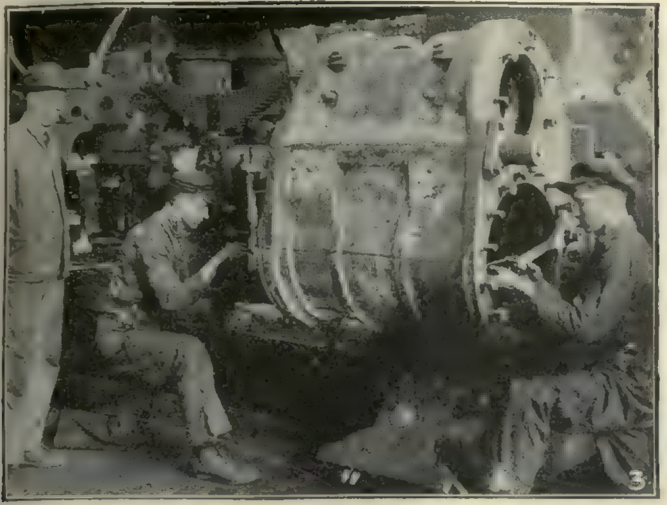


FIG. 3. LEARNING HOW TO ALIGN GUIDES.

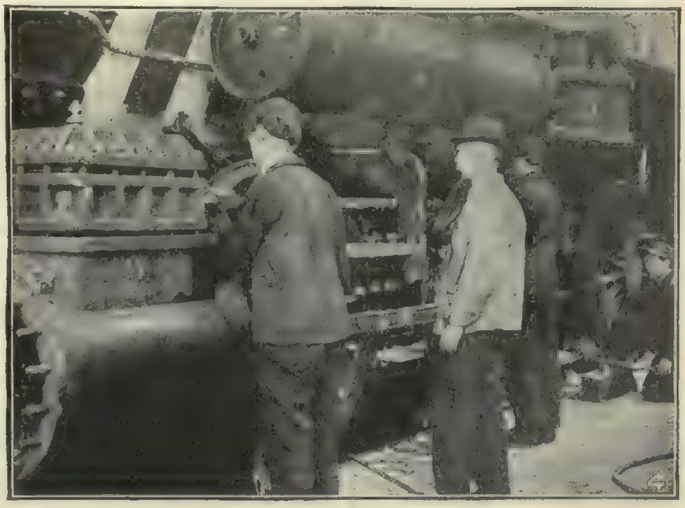


FIG. 4. SETTING VALVES UNDER INSTRUCTION

Coppersmiths, Tinsmiths, and Pipers (Car Department)

Helping mechanic (piping work and toolroom)	2 months
Water system, cars	3
Gas system, cars	3
Steam system, cars	4
Air system (including test rack)	6
Locomotive boiler and engine piping	2
Locomotive air piping	4
Locomotive copper work (piping, gaskets, etc.)	6
Helping mechanic (general tinsmith work)	2
Working at bench with mechanic (tinsmith work)	2
Working at bench alone (tinsmith work)	4
Dining car work	6
General jobbing work on cars and in shop	4
	48 months

Cabinetmakers

Helping machine hands	3 months
Light common work at bench	6
Office furniture, etc	9
Getting out material in mill	6
In car shop as car builder	6
In cabinet shop on general work	6
In car shop on inside finish	6
In cabinet shop on general work	6
	48 months

Coppersmiths, Tinsmiths, and Pipers (Locomotive Dept.)

Helping mechanic (piping-work and toolroom)	2 months
Locomotive boiler and engine piping	6
Locomotive air piping	9
Car piping (water, gas, steam and air,) 1 month each	4
All classes piping, general, stationary and air	3
Locomotive copper work (piping, gaskets, etc.)	6
Helping mechanic (general tinsmith work)	2
Working at bench with mechanic (tinsmith)	4
Working at bench alone (tinsmith work)	4
Car (copper and tinsmith work)	4
General floor work (copper and tinsmith work)	4
	48 months

Detailed Schedule of Machine Work

Small lathe	3 months
Large lathe	3
Turret lathe	2
Planer	3
Shaper (crank)	2
Shaper (draw cut)	2
Milling machine	3
Boring mill	3
Drill press	1
Slotter	2
	24 months

SOUTHERN PACIFIC COMPANY
Pacific System
REPORT OF APPRENTICE SCHOOLS, MONTH OF JANUARY, 1921

Craft	Oakland	Sacramento	Roseville	Sparks	Ogden	Dunsmuir	Brooklyn	Albany	Marshfield	Dallas	Roseburg	Beaverton	San Francisco	San Luis Obispo	Bakersfield	Los Angeles	Tucson	Shipyard	Total
Machinists	18	89	11	23	25	11	12	2	..	3	2	..	29	2	12	57	2	3	301
Boilermakers	5	25	4	5	6	2	3	..	..	..	1	..	10	4	3	16	....	...	84
Blacksmiths—A	..	10	...	1	2	1	...	..	..	..	..	..	....	..	....	3	....	...	17
Sheet-metal workers—B	2	20	1	4	4	2	1	..	..	..	2	..	6	2	1	14	....	...	59
Electrical workers	3	3	1	3	2	1	...	..	..	..	..	1	2	..	....	3	....	1	20
Carmen—C	1	47	...	4	1	...	2	..	..	..	..	..	2	..	....	32	19	1	109
Molders	..	14	...	...	...	...	...	..	..	..	..	..	....	..	....	....	....	...	14
Total, Jan. 31, 1921	29	208	17	40	40	17	18	2	..	3	5	1	49	8	16	125	21	5	604
Total, Dec. 31, 1920	24	209	17	39	40	18	18	2	..	3	5	..	50	8	15	116	21	5	590
Total, Jan. 31, 1920	47	229	17	56	54	18	18	2	..	2	3	..	41	16	18	142	56	2	721
Activities during Jan., 1921:																			
Percentage of attendance	13.0	93.5	89.6	87.0	98.0	95.0	94.0	†	†	†	†	†	96.0	†	81.0	90.0	100.0	71.0	.....
New apprentices employed	7*	2	...	4*	3*	...	...	..	..	..	..	1	....	..	2	14	....	...	33
Resigned	....	3	...	1	...	...	...	..	..	..	..	..	....	..	.....	1	....	...	5
Discharged	....	...	...	...	...	1	...	..	..	..	..	..	....	..	....	3	....	...	4
Transferred (to or from)	....	...	...	...	...	...	...	..	..	..	..	..	....	..	....	....	....	...	.....
Graduated, Jan., 1921	2	...	...	2	3	...	...	..	..	..	..	..	1	..	1	1	....	...	10
Graduated, Dec., 1920	1	2	1	...	2	...	1	..	..	..	..	..	....	..	....	2	....	...	9
Activities since Jan., 1912:																			
Total employed	364	1,058	69	252	276	74	75	13	..	16	7	3	179	64	108	810	265	57	3,690
Total graduated	39	207	21	41	47	8	26	1	..	3	..	..	20	..	4	117	24	5	563
Per cent graduated	....	...	...	...	...	...	...	..	..	..	..	..	....	..	....	....	....	...	15.25
Total grad. still in service	15	150	18	28	36	7	11	1	..	1	..	..	15	..	3	103	20	1	409
Per cent grad. still in service	....	...	...	...	...	...	...	..	..	..	..	..	....	..	....	....	....	...	72.64
Graduates re-employed	14	26	...	2	2	...	...	..	..	..	..	..	....	..	....	....	....	...	44

A—Includes Springmakers. B—Includes pipers, coppersmiths and tinsmiths. C—Includes cabinetmakers, car builders, carpenters, painters, patternmakers and upholsterers. † No school during January. * Shows apprentices laid off who returned to work.

BOILERMAKERS

Heating rivets	1 month
Toolroom	1
Sheet-metal working	3
Bracing boilers	6
Tank shop	3
General riveting	3
Chipping and caulking	3
Flange turning	3
Fitting up	6
Erecting shop (general repair work)	10
Round house and running repair work	3
Laying out bench	6
	48 months

ELECTRICIANS

Helping electrician around shop	6 months
Car wiring and wiring repairs	12
Wiring buildings and car wiring installation	12
With electrician on axle lighting equipment	6
Locomotive wiring	6
With electrician on motor repairs and installation	6
	48 months

BLACKSMITHS

Helping (small fire)	6 months
Small fire (without helper)	6
Car forgings, blacksmith tools, etc	12
Locomotive work of medium weight and machine-shop tools	12
Average grade of work in shop, including heating and forging heavy material	12
	48 months

PATTERNMAKERS

Caring for machinery, making dowel pins, planing wood fillets, making glue, keeping material in order, helping mechanics at machines	6 months
Simple lathe work, sand papering, varnishing patterns, helping mechanics by jointing and gluing up stock	6
Helping molder in general foundry	9
Working with mechanic on general work in pattern shop	15
Working alone on general work	12
	48 months

MOLDERS, GENERAL FOUNDRY

Core room	12 months
Helper molder at loam work	6
Dry sand work, locomotive cylinders	6
General floor work	12
Green sand molding	6
General all round work	6
	48 months

CAR BUILDERS

Common work around cars, such as repairing fish racks, underlining, floors, etc	12 months
With mechanic on such work as side door steps, baggage car siding, roofing and inside lining	6
Platforms	6
Passenger car sheathing, framing of cars, on steel work, placing of underframes	6
Sheathing, dressing and surfacing	6
General car building	6
Laying out steel work, and placing steel underframes	6
	48 months

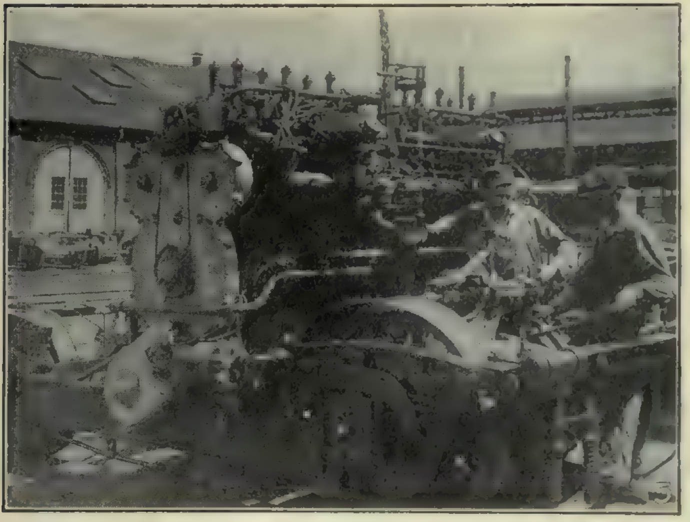


FIG. 5. WORKING ON A MOTOR-CAR ENGINE.

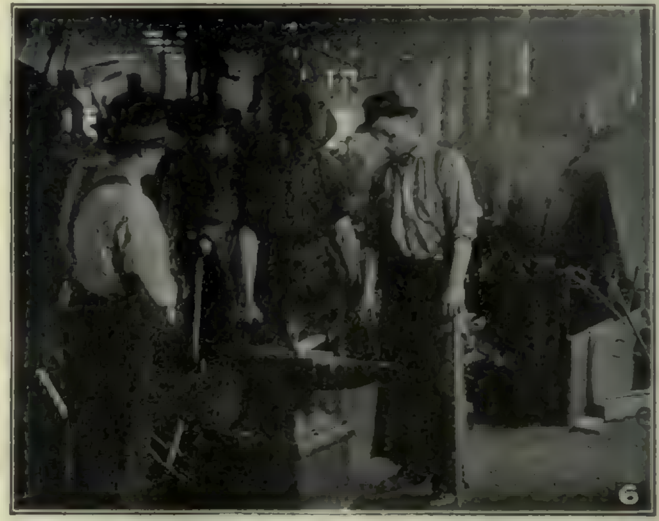


FIG. 6. BLACKSMITH APPRENTICE LEARNING TOOL DRESSING

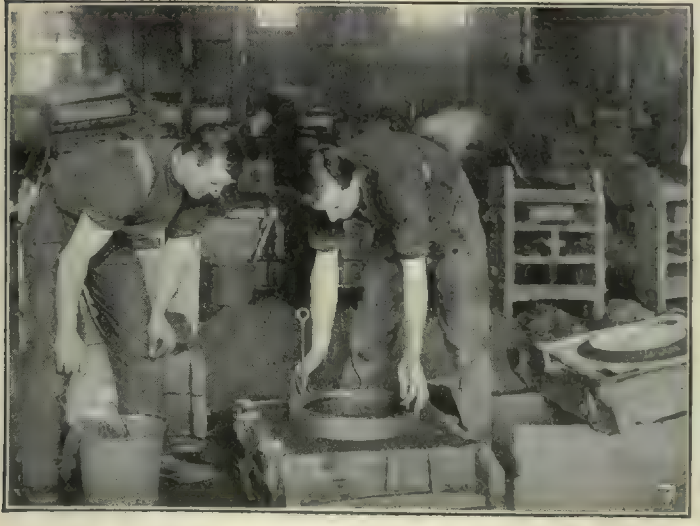


FIG. 7. FIRST-HAND INSTRUCTION IN MOLDING.

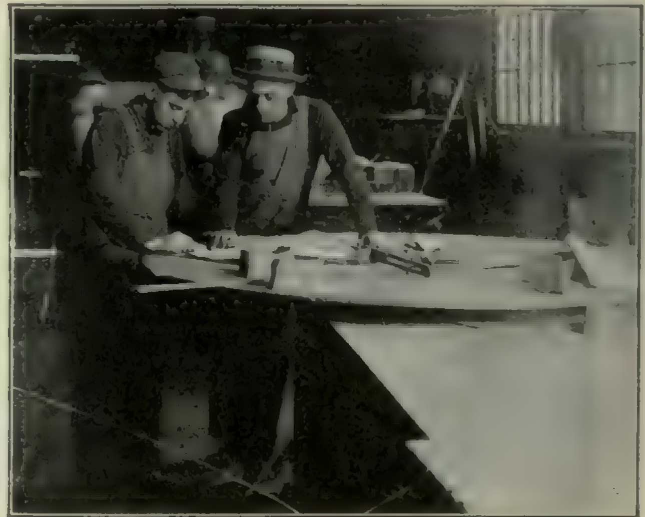


FIG. 8. A BOILERMAKER APPRENTICE AT THE LAYOUT BENCH

MOLDERS, BRASS FOUNDRY

Core room	6 months
Third-class work	12
Second-class work	12
First-class work	18
	48 months

ERECTING FLOOR WORK

Valves (including all work pertaining to valves)	6 months
Shoes and wedges	3
Frames	2
Cylinders	2
Cab work	2
Spring rigging	2
Brake rigging	2
Boiler fittings	2
Injectors and lubricators	1
Guides	2
	24 months

The courses for upholsterers and car painters are similarly of 48 months each, but details are not included in this article.

The illustrations are from photographs taken of apprentices in school and in the shops. The illustration, Fig. 1, is a view in the school at the Sacramento general shops. The next view, Fig. 2, shows a machinist apprentice with instructor, the work in hand being underway on a vertical slotter. In Fig. 3 two apprentices are aligning guides under instruction. An apprentice engaged in setting valves under the direction of the instructor is represented in Fig. 4, and in Fig. 5 two boys are shown at work on a motor car engine.

In Fig. 6 is shown a blacksmith apprentice receiving instruction in tool dressing. The foundry view, Fig. 7, illustrates the method of giving molder apprentices first-hand instruction, and the final illustration, Fig. 8, shows a boilermaker apprentice working on the layout bench.

Purchasing Technical School Equipment

BY A. W. FORBES

On page 870 of the *American Machinist*, J. R. Camm advocates the purchase of first-class equipment for trade and technical schools, and he presents some arguments that sound reasonable. I can agree with him that there should be one first-class machine of each kind, so that each pupil would have the chance to try it before graduation; but when it comes to using first-class equipment throughout the school, there are as many objections as points in favor, aside from expense.

If the trade school is to teach principles, a poor machine is usually better than a good one. Take the subject of chatter for example. A light lathe will chatter on any possible excuse, and will give practice in grinding and setting tools so as to avoid the chatter without reducing speed, which it is impossible to get on a rigid machine. The effects and causes are on so large a scale that the student can see them.

Again, if all the bearings and the ways are in good condition, how is the student to get practice in making allowance for the faults of the machine? The skilled toolmaker working to 0.0001 in. has to consider the weakness of the machine even with the best, but if the machine is more accurate than the boy's hands, he is liable to look upon the machines as perfect, and to expect them to turn out the work without the aid of brains.

It is difficult for one who is experienced with good machines to do good work with poor ones, but to go in the opposite direction is easy.

Want Ads—Discussion

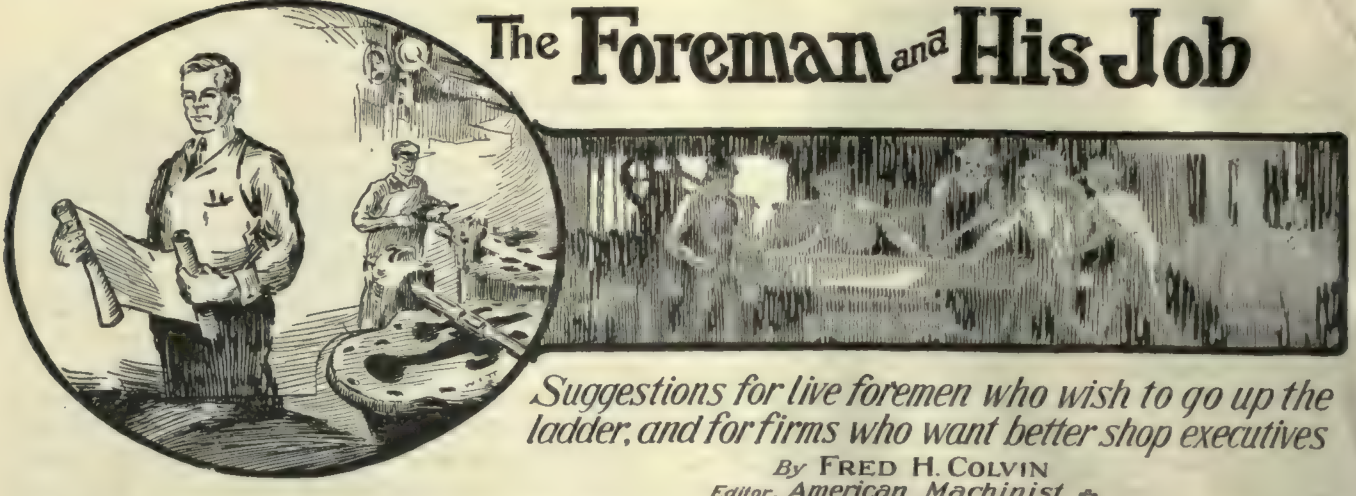
BY A. SPALDING

Referring to the article of Charles F. Smith on page 103 of the *American Machinist* and various discussions both previous and current on the subject of want ads, it may be interesting to consider the impressions and experiences gained from contact with both sides of the subject. It is surprising how the opposite viewpoint will enlighten one on points not hitherto given consideration and applications to blind ads are no exception. The blind "Help Wanted" ad seems to be employed more commonly than would seem justified with the possible exceptions that the advertiser may wish to avoid the annoyance of a swarm of applicants in person during periods of general unemployment and with the intention of avoiding the necessity of replying to each application, which seems to be the general custom. There may be other reasons, but it would seem that they are more imaginary than real. Generally speaking, it would appear that a more desirable applicant will reply to an "open" advertisement as he has more assurance in applying to a known concern and can judge in a measure if the position is sufficiently attractive to justify an application without wasting more of his time or that of the advertiser.

In the writer's experience of some twenty years a number of applications have been submitted to blind ads and replies were received to but a very limited number; barely sufficient to justify the time and labor of preparation and certainly not sufficient to justify the possible inconvenience to those who had been named as references.

On the other hand the writer has been guilty of resorting to the use of the blind help-wanted ad and took full advantage of the opportunity of avoiding replies to applicants with the exception of applications enclosing photographs of value, which were returned. However, the enclosing of a valuable photograph cannot be assumed to be a guarantee of a reply.

The real enlightenment of inspecting a number of applicants is derived from the reactions that each one has on the recipient. We must first consider that the application is the representative of the applicant and is the only immediate means of judging his fitness, and as it is a matter of selling his services, a business-like application is received with more favor than one carelessly composed. To be exact, a good quality of standard unruled 8½ x 11 in. business paper is preferable to any other such as paper suited to social correspondence or low-grade odd size paper, such as is usually sold in pads or blank books. Remember that you are supposedly writing a business letter to an employer accustomed to business correspondence, and a letter of application that does not conform gives a bad impression. Improper spelling is almost fatal, and a typewritten letter is half the battle. The composition of the application represents the sales talk, which may or may not appeal to the recipient and is a subject too broad to be covered intelligently in a short article, but generally speaking the applicant must state his fitness fully and concisely. A photograph is a great help in gaining an idea of an applicant and assists greatly in making the application equivalent to a personal interview.



The Foreman and His Job

Suggestions for live foremen who wish to go up the ladder, and for firms who want better shop executives

By FRED H. COLVIN

Editor, American Machinist

WE TALK a lot about psychology these days. But most of us would have a hard time defining just what it is in language that would mean anything to a man who didn't already know what we were talking about. It's much easier to think of it as horse sense in understanding human nature, in trying to understand how the other fellow looks at things in the shop.

First of all we've got to drop the notion that all men are alike and that what we call "plain English" means the same to different nationalities. Some are temperamental, other stolid. Some are used to bargaining. They have been forced to become traders and to drive close bargains, just as men in certain parts of our own country have developed into traders of jack knives, horses and now—tin Lizzies.

These differences must be remembered when setting rates, when making changes in schedules and in other ways. Some of the temperamental races do not know how to bargain. If they think a piece of work is worth 60 cents and you say it is only worth 50 cents, they consider it a personal accusation. They feel that their honesty has been assailed, that you accuse them of lying. Men of other races and sections will be happier if they get 50 cents by splitting the differences between 40 and 60 than if you offer them 50 cents at first.

This does not mean that you must have several entirely different methods of dealing with men in the same shop. But it does mean that you must consider the differences in the men in presenting new ideas of any kind. They must not be presented so as to antagonize any group if it can be avoided.

GOETHALS' SUNDAY MORNING COURT

We all know how well General Goethals handled the Panama Canal Zone during the building of the great canal. One of his customs was to hold a sort of court every Sunday morning where any person in the Zone could come and discuss any problem there. He formed a sort of grievance committee for the Zone. And the lowliest laborer of any nationality could get a hearing as readily as an official.

That was a place to unburden the soul of any kind of a grouch or grievance, and many petty annoyances and abuses were wiped out at that court. In many cases it was only necessary to explain the reason for what appeared to be an injustice, and the air was immediately cleared. It furnished a safety valve where fancied wrongs could be aired and the temperaments of different races given full recognition. Goethals understood human nature, whether he could define psychology or not. And this understanding probably had about as much to do with his success as his engineering ability. The combination gave us a piece of work which will stand long as a monument to his memory.

Try to understand the men you have to deal with. Try to get their viewpoint, to see what sort of things appeal to them, interest them and secure their co-operation. This is just as important as your technical knowledge of the business. Some contend it is the biggest asset a foreman can have.

TELLING IT TO THE GENERAL

THE DREAD OF CHANGES

There is another point which every foreman should put away in his memory to soak, and not let it get too far in the background either. It should be taken out and dusted every time he wants to make a change in methods of any kind. And this point is that nearly every one dreads, or is in fear of a *change*. It is the *unknown* which looms up as a barrier to new things of any kind.

Most people, unconsciously or otherwise, look askance at a change of almost any kind. They dread to tackle a new job; to move into another house; to go to a new town. They know the bad or disagreeable things of the old one, but who knows but what the new may be even worse?

A case came up in the clothing trade regarding the counting of the day's work. The men were told by their representative that the firm had a perfect right to count the work—that there was nothing to fear. The answer is worth considering. "We don't really object to counting the work. What we fear is what may be in the boss' mind when he asks to have it counted. He never asked us before and he must have something up his sleeve or he wouldn't ask us to count it now."

Suspicion and objection to change have been at the bottom of most labor disputes and their attendant evils. Opposition to new methods, violence and the destruction of new machinery, can all be laid to the same cause. Even admitting that it is foolish, isn't it better to pave the way for changes by establishing confidence and even to spend considerable time showing the reasons for the change, than try to force changes through regardless of the attitude of the men? The most economical production cannot be secured with antagonism among the workers. Even if they do meet your schedules under such conditions you can be sure that these schedules can be greatly exceeded by securing real co-operation.

SATISFIED WORKMEN GIVE THE AGITATOR THE "GO-BY"

Pave the Way for Changes

It is always best to pave the way for radical changes by a campaign of education. The time spent will be well repaid by increased production, and a better feeling in the plant. Show just why the changes are to be made and what they should accomplish. Just put yourself in the other fellow's place and see if you wouldn't respond better if you were told the reasons for new methods. Also try to remember that as foreman your experience has given you a broader vision of manufacturing and of life in general than the worker in the shops.

Study your men. Learn what appeals to the different types and how to reach them. Play fair—be sympathetic and interested in their troubles and their ambitions. Technical knowledge alone will not make a successful foreman or superintendent. A knowledge of the habits and thoughts of men is even more necessary.

Drafting Room Notes

By John S. Watts

If they had to work in the machine shop, using their own drawings, the majority of draftsmen would be disagreeably surprised at the amount of information which could and should be incorporated on the drawing, but is not, and therefore has to be dug up by the machinist. That the drawings being turned out now are, in this respect, much superior to those made in earlier times cannot be denied, but there is still room for much improvement.

Take for example the dimensioning of so simple a thing as a tapped hole for a stud. In the majority of cases, after giving the dimensions necessary to locate the center line of the hole, the draftsman is content with merely specifying the diameter of the tapped hole. The machinist who drills and taps these holes has to decide what size drill to use, how deep to drill the hole, and how far the stud should project when screwed home. This last item often involves the machinist having to spend considerable time locating the part to be held by the stud, and measuring the thickness of its flange. This information can be quite easily put on the drawing, as indicated in Fig. 1, and in a very few words give all the data that are required to drill the hole, tap it, and screw in the stud. If, in addition, the drawing has a bill of material on it, giving all the studs, bolts, etc., that go with this part, it may be considered really complete in so far as this phase of the matter is concerned.

It would be desirable to have the draftsmen occasionally work to their own drawings in actual production in the shop, but as this is hardly practicable, the next best idea is for the draftsman to check his drawing by making the part shown, in imagination, thus assuring himself that the information necessary to perform each operation is clearly shown on the drawing. This studying out of the work to be done in producing the part will very often bring to light a difficult operation which can be simplified by some slight alteration in the design, and will almost always lead to a more economical design than will be produced if this study is neglected.

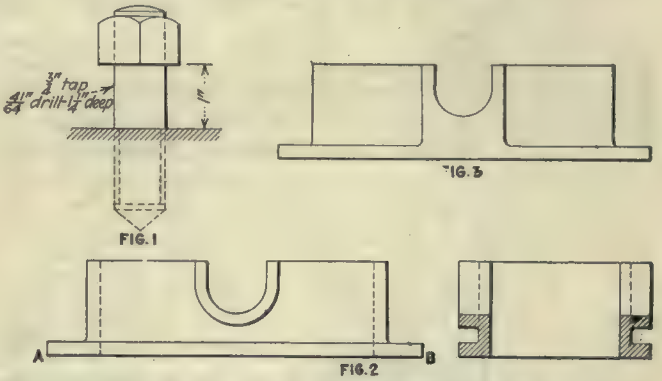
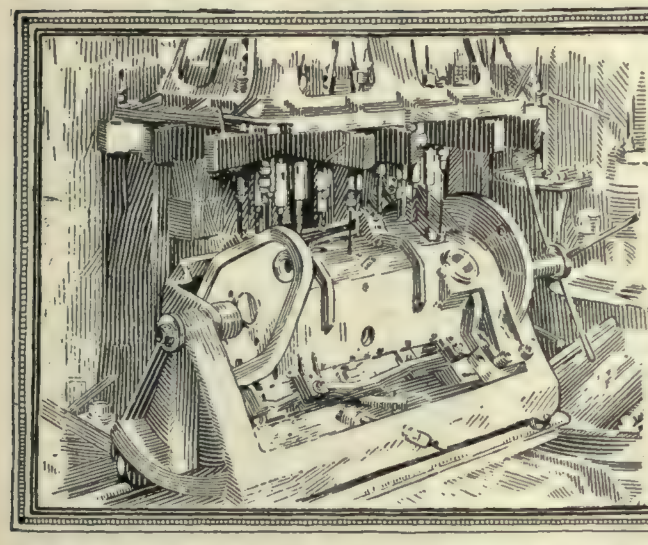


FIG. 1. EXAMPLE OF COMPLETE INFORMATION ON DRAWING. FIG. 2. DESIGN OF CASTING NECESSITATING CORES. FIG. 3. SAME CASTING WITHOUT CORES

Especially in the matter of castings is the average draftsman likely to turn out designs which are more costly than they need be, as few draftsmen are as familiar as they should be with the methods used in molding. By forming a habit of studying out what the method of molding will be on each piece that he designs, and when unable to decide this himself, consulting with the molder, he will soon be able to design castings that will be cheap to make, besides accumulating a fund of information that will make him of more value to his employer.

To illustrate this point, we may take a common example as shown in Fig. 2. This casting would be made with the parting at line *AB*, leaving its own core inside. The bosses on the sides cannot, however, be withdrawn from the mold, and would require the making of two cores. This could be avoided by making the casting as shown in Fig. 3, which would require no core work of any kind. It would, however, weigh a trifle more than the casting shown in Fig. 2. In the example taken, the cost of the extra metal would be considerably less than the cost of making and handling the two cores. Consideration should be given to this cost, however, as it will happen in some cases that the metal saved by coring will repay the cost of the cores, when the weight saved is great or the metal high in price.



Tool Engineering

By

Albert A. Dowd and Frank W. Curtis

President and Chief Engineer

Albert A. Dowd Engineering Co., New York City

Drill Jig Design Continued—Principles and Methods of Indexing—Index Plungers and Latches—Combined Index and Latch—Specific Examples of Indexing Jigs

IN DISCUSSING the methods used in indexing various fixtures for drilling we must first consider the matter of accuracy. It must be remembered that indexing surfaces, plugs, bushings, wedges or any other members which are used to locate from in the process of indexing should be kept as free from chips and dirt as possible in order that the indexing may be accurate. This is a fundamental point which must always be thought of by the designer. Let us refer to Fig. 90, in which two indexing plugs are shown at *A* and *B*. The design shown at *A* has a plug which is located radially so that it will enter the index plate *D* as far from the center *E* as possible. It may even be advisable to make a very large index plate for a comparatively small index jig if the accuracy required is great. In example *B* the plug *F* is quite close to the center *G* so that any errors in indexing would be multiplied in the work in direct proportion to the distance of the surface being drilled from the center *G*.

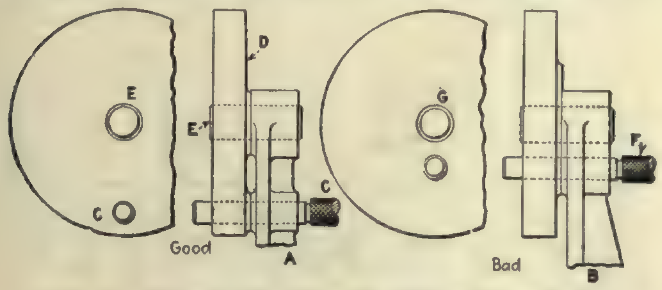


FIG. 90. EXAMPLES OF GOOD AND BAD METHODS OF LOCATING THE INDEX PIN

It may be taken as a general principle that the further away from the center the indexing pin can be located the more accurate the work will be.

INDEX PLUNGERS AND LATCHES

When an indexing jig is rotated into its various positions there must be a positive method of location provided for each position. There are a number of methods in common use, some of which are illustrated in Fig. 91. The simplest type of indexing pin is shown by the first sketch. *A* is the indexing member and *B* is the fixed member. Each of them is provided with a hardened bushing, at *C* and *D* respectively, in such alignment that the plug *E* can be pushed into them to form a lock as the various indexing positions are used. An objection to this form of indexing is that the plug is a loose piece which may be easily lost; it may, however, be attached to a piece of closet chain and fastened to the fixed member. It can also be arranged with a special bushing and a spring to keep it in place.

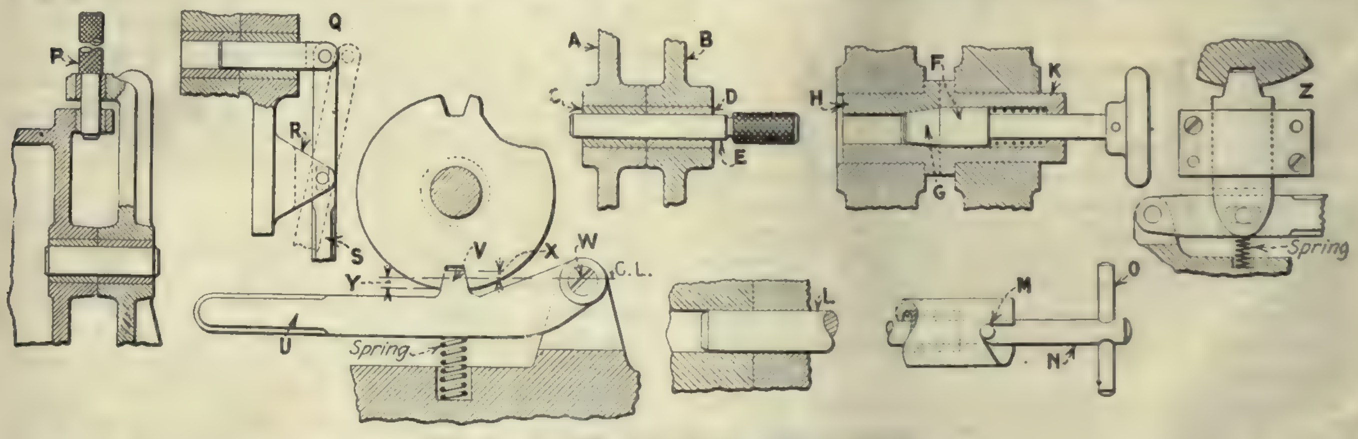


FIG. 91. INDEX PLUNGERS AND LATCHES

Another form of indexing plunger, shown at *F*, is

For the authors' forthcoming book. All rights reserved.

used by many designers and has much to recommend it. The plunger is tapered at the end and seats itself in the tapered end of the bushing *H*. It has a long bearing in the bushing *K* and is provided with a spring to hold it in position. Some designers prefer a straight pin instead of a taper, as indicated at *L*. The writers believe that this is a matter of personal preference although it is claimed that a taper plunger will adjust itself for wear when the straight plunger will not. Care must be taken in designing a tapered plunger, and the sides should not taper more than 10 or 12 deg. on each side of the center line.

In some cases it is necessary to use a heavy spring for holding a plunger in position; a construction that requires considerable pulling on the part of the operator. This can be remedied by inserting a pin in the stem of the plunger as indicated at *M* and then cutting a cam-path on the end of the bushing at *N*.

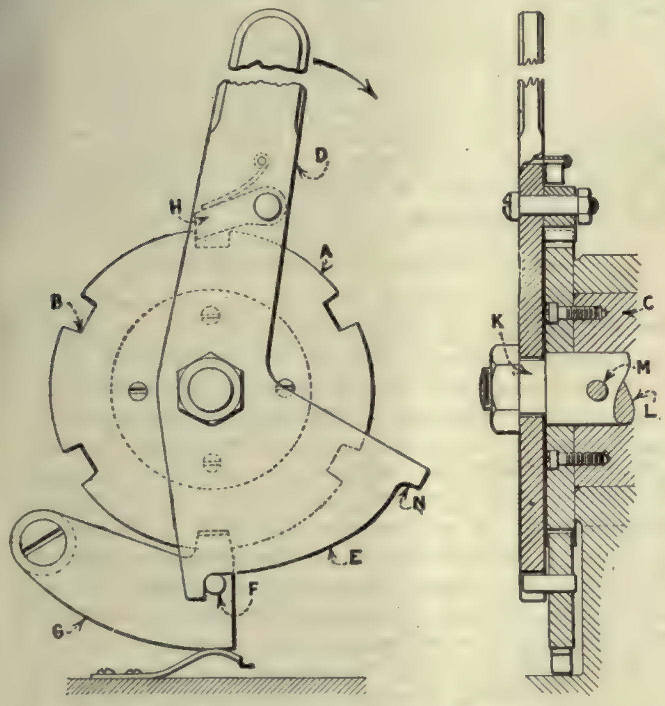


FIG. 92. COMBINED INDEX AND LATCH

The insertion of a rod handle at the end *O* makes it possible to pull out the plunger by a turning action, much easier than a straight pull.

A form of index which is much in use on large work and which has the advantage of placing the pin as far as possible from the center, is shown at *P*. There is no particular comment to be made on this method except to say that it is good.

On large trunnion jigs it is often difficult to operate a pull-pin by means of a knob and it is much more convenient for the operator to provide a lever. An example is shown at *Q*. A lug *R* is attached to the base of the fixture to act as a fulcrum for the lever *S*. The fulcrum should be so placed that the length of the lever will permit the operator to withdraw the pin easily. It is evident that an elongated slot must be provided in the lever or the index pin to take care of radial movement when a spring is used. Many times it is desirable to use a steel plate instead of a bushing as an index plate, as shown at *T*. In one of two methods that are common practice, the lever, as shown at *U*, is formed at *V*, so that it will seat itself in the angular slot in the steel disk *T*. When an arrangement of this kind is made the designer must be careful to position the center *W* so that the distances *X* and *Y* will be equal in order that the angles on the lever will coincide with the angles on the disk.

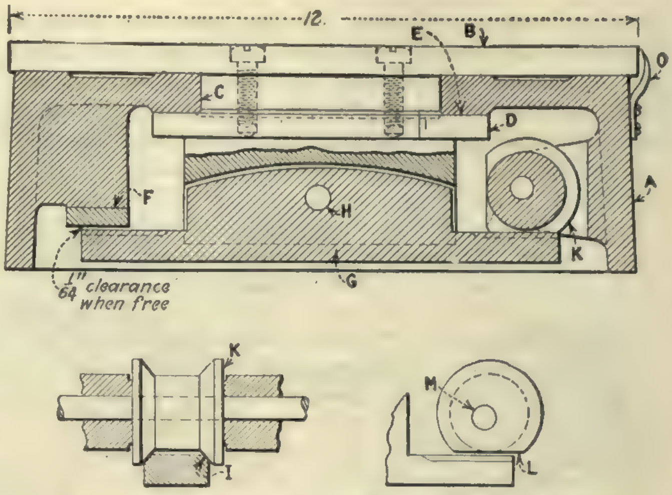


FIG. 93. INDEXING TABLE FOR DRILLING

The other method is shown at *Z*. The plunger is mounted in a slide and is operated by a lever. The second method is to be preferred on account of its greater accuracy but space will not always permit its use. Care should be taken that the plunger is given a long bearing in the slide in order to obtain accuracy.

COMBINED INDEX AND LATCH

In indexing fixtures for high production work and in other designs of indexing fixtures it is desirable to make a very quick operating index and latch, one which will be so nearly automatic that a man can operate it rapidly and without giving it much attention. Such a latch is shown in Fig. 92. This form can be used in many cases and can even be arranged so that the movement of the drill press spindle as it passes up after drilling the work will index the fixture. A steel disk *A*, having a number of index slots *B*, is mounted on a center plug *C* to which the body of the jig to be indexed is attached. The lever *D* has a cam cut on it at *E*, this cam being used to control the movement of pin *F* in the latch *G*. The lever is provided with a dog *H* which engages with the edges of the various index slots. The lever itself swings freely on the bearing *K* which is a part of the stud *L*, fixed in the member *C* by means of the pin *M*.

In operation, when the lever is moved in the direction indicated by the arrow, the pin rides up on the cam thus pulling the latch out of the slot until restrained by the shoulder of the cam at *N*. At this

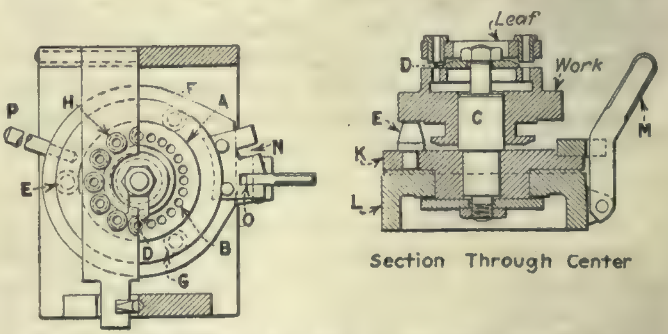


FIG. 94. INDEXING JIG FOR A NUMBER OF HOLES CLOSE TOGETHER IN A CIRCLE

point the dog drops into the slot and the lever is moved in the opposite direction until the latch drops into place once more, thus completing the indexing. This principle can be applied on both large and small jigs, preferably for indexing from four to eight stations. All of the working parts should be hardened to insure long life and accuracy.

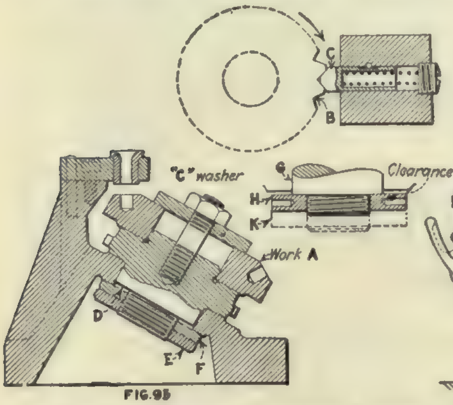


FIG.95

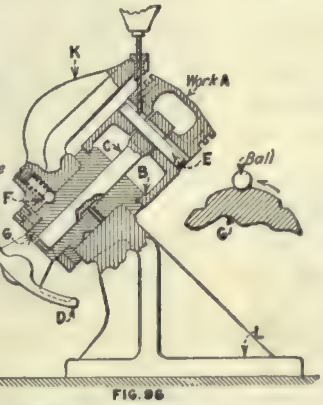


FIG.96

FIG. 95. INDEXING FIXTURE FOR ANGULAR HOLES. FIG. 96. INDEXING JIG FOR ANGULAR HOLES IN A PISTON

In Fig. 93 is shown a form of indexing table which can be made up and carried in stock. It can be used for many purposes requiring a rapid and accurate index. Frequently, indexing of a number of holes is desirable and yet the number of pieces to be made is small, or for some other reason it does not seem advisable to make up an indexing fixture. In cases of this kind an index table can be used to advantage. A circular cast-iron base *A* has been faced on the upper surface and fitted with a table *B*, having a center bearing by means of the plug *C* to which it is firmly screwed. The plug has a flange *D* fitted to run freely against the surface *E*. A hardened shoe *F* is attached to the fixture at one side. The lower part of the bearing plug is slotted to receive the index rocker *G* which is pivoted loosely on the pin *H*. The upper surface of the rocker is beveled to the form shown at *I*. This bevel surface acts as the index for the plate when acted on by the spool *K*. The form of this spool is shown clearly in the diagram *L*, and it will be noted that the flatted side allows clearance for indexing. A great advantage in this type of indexing mechanism is the fact that there is clamping action of the rocker against the hardened block.

In the particular instance illustrated, the device is made for indexing to 180 deg., but the same principle can be used for various numbers of index spacing by making suitable modifications in general construction. The cam *K* can be operated from outside the fixture by means of a simple lever attached to the pin *M*. An approximation of the indexing used can be determined by reference to the pointer at *O*. The advantages of this device are that it is accurate, very rigid in construction and all the working parts are protected from dirt and chips.

INDEX FIXTURE FOR HOLES IN A CIRCLE

We referred to a condition in Fig. 83 in which a number of holes were drilled so close together that drill spindles could not be spaced close enough to drill them all at once, and we showed a method of handling such a condition. The holes were arranged in rectangular form. We will now consider indexing jigs arranged for a group of holes so spaced in a circle that it is not possible to set the spindles of a drilling machine close enough together to drill them all at one time.

Such a condition is shown in Fig. 94, the work being shown at *A* and the holes indicated at *B*. In this jig the work is set up and located on a central plug *C* and clamped in position by means of a C-washer *D*. It rests on the three pins *E*, *F* and *G*. The bushings are spaced for alternate holes as indicated at *H*. The stud on which the work is located is mounted in a revolving plate *K*, supported by the base *L*. Indexing is done by means of the lever *M* which engages with the slots *N* and *O* in a hardened plate. Another lever *P* is used to swing the index plate from one position to the other. This is a very good example of an index jig to take care of a condition such as that frequently found in the main driving shaft clutch gear of an automobile. There are many other cases when a jig of similar form can be used, as the general simplicity of the construction makes it readily adaptable to a variety of conditions. Any one of the several methods could be used for indexing instead of the one shown. It is advisable to provide some means of fastening the jig down to the drilling-machine table.

INDEX FIXTURE FOR ANGULAR HOLES

The fixture shown in Fig. 95 is an indexing drill jig for a series of blind holes drilled at an angle in the work *A*. Great accuracy in the location of the holes is not of supreme importance, and therefore a method of indexing can be used which will give approximate locations but not to exact dimension. The index plate has a series of notches cut in it at *B*, spaced in such a way as to give the correct spacing for the drilled holes. A spring plunger *C* with a rounded end is mounted in a block so that the plunger engages the notches in the index plate. A weak spring should be used when a design of this kind is made in order that the indexing may be as easy as possible.

The index plate can be mounted in either of two ways: As shown at *D* it is held in place by the two locknuts *E* and *F*, which are adjustable to permit regulation of the pressure on the bearing and adjustment for wear. A more common method of mounting is shown at *G*, where the stud is fitted so that it comes through the hole a few thousandths and is fastened by one or two nuts as shown at *H* and by the dotted lines *K*. If the work is to index in one direction only, one nut might be sufficient, providing the direction of the indexing is such as to tend to tighten the nut

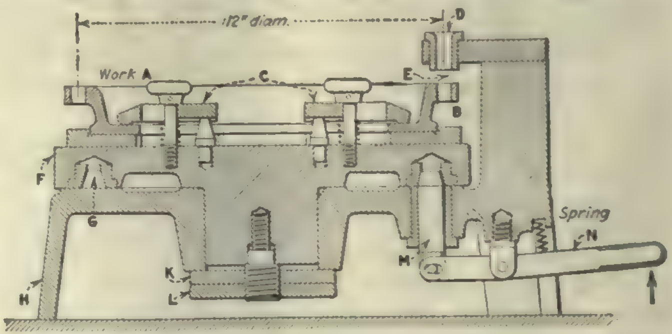


FIG. 97. INDEXING JIG FOR AN ANNULAR RING

rather than to loosen it. If the indexing is likely to be in both directions two nuts are necessary.

In Fig. 96 is shown another angular jig for drilling a series of angular holes in an automobile piston. The work *A* is located on a stud *B* and drawn down against its shoulder by the pull back rod *C* which is tightened by the hand knob *D*. In tightening this rod a clamping action takes place on the pin *E* inserted in the wrist-pin hole.

As the angular-drilled holes need not be particularly accurate in their spacing, the indexing is done by means of the ball *F* which snaps into notches cut around the plug *G*. The bushing in this jig is carried in an overhanging arm *K* which forms a part of the jig body *L*. The designer should pay attention to the stability of jigs of this character and should provide a base of sufficient dimensions so that it will be well supported.

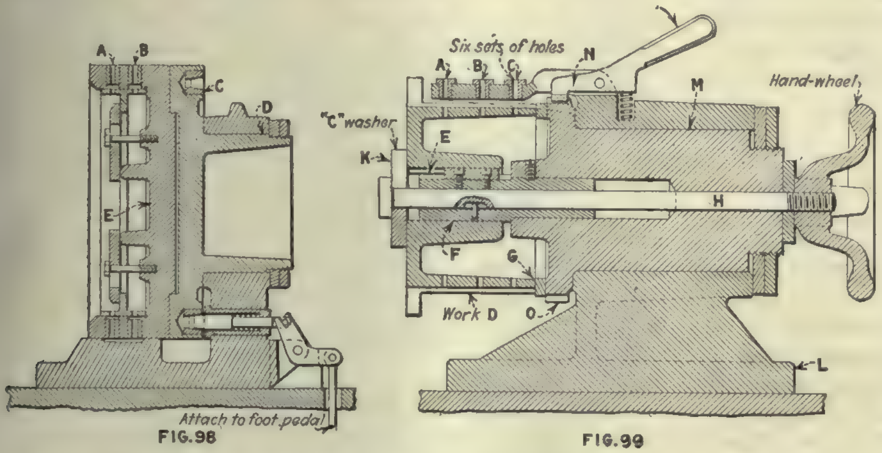


FIG. 98. INDEXING JIG FOR RADIAL RIVET HOLES. FIG. 99. INDEXING JIG FOR A CLUTCH DRUM

When several holes are to be drilled in a ring such as that shown at *A* in Fig. 97, two methods can be used. If there is available a multiple drill of capacity suited to the work, a simple jig can be made so that all the holes can be drilled at one time. If, however, such a machine is not available, one solution of the problem is to use an indexing jig. The type shown in Fig. 97 is exceptionally good from the indexing point of view, because there is very little chance for dirt or chips to get into the mechanism and thus cause errors in indexing.

The work is clamped on the locating ring *B* by the sliding clamps shown at *C* and a bushing *D* is so placed that the holes will be located the correct distance from the center of the ring. Sufficient clearance must be allowed between the work and the bottom of the bushing at the point *E* so that there will be no difficulty in the removal of the work. The indexing mechanism consists of a circular plate *F*, in the underside of which are located the bushings *G*. The index plate is centered in the base *H* and is held in place by the two locknuts *K* and *L*.

The index plunger *M* is operated by means of the lever *N* which projects out through the side of the fixture in a location convenient for the operator. The work can be indexed either by pulling it around, by grasping the ring or by means of holes in the index ring *F*. This type of jig is excellent for many purposes and the principles shown can be applied not only to drill jigs but to other indexing fixtures for various machining operations. It should be borne in mind that the class of work for which an index fixture is designed and the amount of pressure which it is called upon to withstand will affect to a large extent the general design and proportions of the fixture.

Fig. 98 shows a large jig designed for use in drilling a series of holes *A* and *B* equally spaced around the periphery of an automobile brake band. This jig is quite different in construction from any of those shown previously and it may be considered in the nature of a "horrible example." In other words it is something which is neither practical nor well designed, yet it is expensive and much unnecessary work is involved in its construction. The entire construction is very clumsy and heavy. A very large bearing is given to the index plate *C*. The index plate and the casting *E* which carries the bushing, have been made separate, for no apparent reason except the possibility of breakage while machining the casting or on account of replacement in the event of serious wear in the index plate. In addition to these points a series of bushings *A* and *B* have been located around the periphery of the jig when two bushings that would have answered all purposes could easily have been carried on the stationary member. The only really good feature about the fixture is the indexing mechanism which is designed so that it can be operated by a foot pedal.

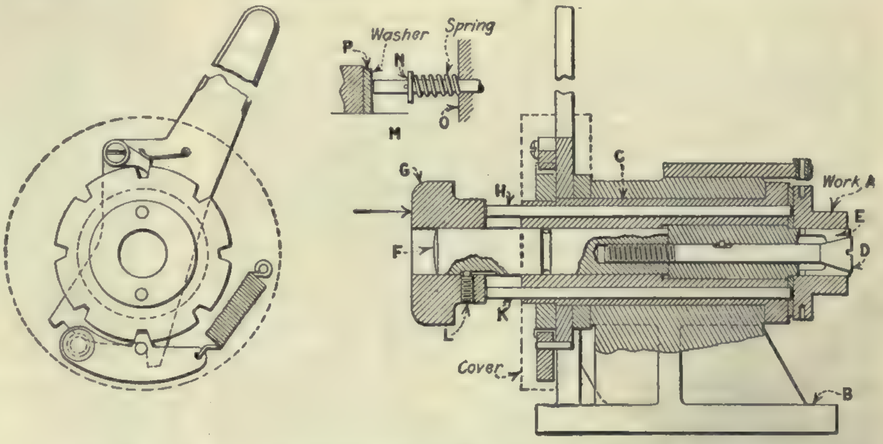


FIG. 100. RAPID PRODUCTION INDEXING JIG FOR A SMALL HUB

It is suggested to the student of these articles that he make an alternative design of an indexing jig for the same piece of work, employing some of the principles which have been illustrated. The brake drum diameter was 14 in. and the face 3 in.

A decided improvement on the jig shown in Fig. 98 is that illustrated in Fig. 99. A series of six slots containing three holes each, *A*, *B* and *C*, are spaced equally around the periphery of the work *D*. Previous to the drilling operation the work has been bored, turned and faced and a keyway has been cut at *E*. It is necessary to locate the various holes in relation to the keyway mentioned, so the jig is made with a locater to provide for this. The work is slipped over the locating plug *F* and is drawn back against the hardened locating plate *G* by means of the rod *H* operated by the handwheel.

Rapid removal is assisted by means of the C-washer *K*. The base *L* is of substantial construction and has a bearing of large diameter in which the locating member *M* revolves. The correct location of the various holes is obtained by means of the index lever *N* which engages in a series of notches *O* in the outside diameter of the plate. The construction of the lever is somewhat similar to one of those shown in Fig. 91.

In general construction this jig embodies some good features in design and should be studied carefully. Some of the advantages are that it can be cheaply made, and can be easily adjusted for wear by simply "papering up" under the locating ring *G* and making suitable adjustments on the bearing *M*.

HIGH PRODUCTION INDEXING JIG

In Fig. 100 is shown an excellent example of a high production indexing jig for a small hub *A* which has a series of eight small holes drilled radially in its outside diameter. It will be noted that the indexing mechanism is similar to the one illustrated in the earlier part of the article. The base of the fixture *B* carries a spindle *C* which is provided with a taper plug *D* so designed that it will expand the split end of the arbor *E* on which the work locates. The plug is actuated by the rotation of the threaded plug *F* which is operated by means of the hand knob *G*.

Due to the fact that the work is of a nature making removal from the arbor difficult, the two ejectors *H* and *K* are provided. When the operator loosens the taper plug by means of the knob *G* a slight blow of the hand on the knob in the direction indicated by the arrow will force the work from the arbor. A sliding member is provided for the knob which permits it to act after the screw is tightened to the taper plug. This is done by means of a setscrew *L* which engages with a longitudinal slot in the outside of the plug. An additional refinement can be made on the ejector by using the construction shown at *M*. A coil spring is interposed between the collar *N* and the face *O* so that it tends to pull the plungers back after they have been operated. A hardened washer also can be fastened against the face of the knob *G* as indicated at *P*. For small work produced in large quantities variations of this design will be found to give excellent results.

Notes on the Machine Industry in India

By C. F. Meyer
Landis Machine Co., Waynesboro, Pa.

The future for India has great possibilities, but at the present moment it would be erroneous to look upon India as a manufacturing country. There is no mass production and for the present it must be considered as a big repair shop.

Calcutta is the industrial center of India. Jute mills numbering between fifty and sixty, line both banks of the Hooghly, the principal mouth at the delta of the Ganges. Each has a well-equipped repair shop for plant maintenance, and one or two have in addition larger machine shops for building their combing and weaving machinery. Bombay ranks second in industrial importance, having in its vicinity some very fine railway shops and ship yards.

The Tata Iron and Steel Company, Jawshedpur, is one of the finest and best equipped plants in the whole of India. This company was founded by H. N. Tata, a wealthy Parsee, but is now managed by American and British engineers. Another plant worthy of mention is that of the Bengal Bridge & Bolts, Ltd., located just outside Calcutta. This concern is managed by J. C. Banneejee. Most of the railway shops are also equipped with modern machine tools.

EUROPEAN EXECUTIVES

All of the railway shops and most private companies employ European managers, engineers and foremen. These are the men who have made industrial India what it is today and much credit is due them. Native labor, like the man from Missouri, must be shown. It is out of the question to give the average native a blueprint or drawing of a machine part and expect him to produce the finished article. Take for example a turret lathe job. The foreman sets up the machine and makes several pieces while the operator looks on. The operator observes that a movement of the turret handle toward the headstock will advance the tool then in position, that the next tool is brought into position by a reverse movement of the turret handle and that the die head, if there be one, is closed by a pull of the lever provided for the purpose. He is now ready to proceed; but as regards the theory of the operations he knows nothing and cares less.

The majority of the people of India are Hindus divided into numerous castes. Each cast can perform only certain duties and no Hindu will undertake a task foreign to his particular caste. Members of certain castes will not handle leather belting because the cow is sacred to them. Others will not permit the use of certain lubricating oils. If an operator is killed by a machine, no one except a member of the lowest caste will touch his body.

One finds much of interest on entering a machine shop in India. To the right you see a native perched on the table of a large planer riding backward and forward. His clothing consists of a turban wrapped around his head and a piece of colored cloth girded about his waist. On the left you see another workman squatting on the bed of a lathe. The women are the beasts of burden. They carry the work to and from the machines. They wear a sari draped gracefully over their heads and wrapped about their bodies. Neither the men or the women wear shoes and it is a remarkable sight to watch them at work in a foundry. They carry the moulten metal from the cupola to the moulds and step among the red hot iron castings without injury.

Native labor is plentiful, but not cheap. The wage of the so called mechanic is very low when compared with the American standard, but this is offset by his superstitious and lazy nature. The average native is afraid of a machine tool and it is almost impossible to find one who will operate a machine at any other than its slowest speed. Multiple spindle machines are absolutely useless, unless an operator is employed for each spindle. As for the automatic machine, the native mechanic looks upon it as a thing possessed with an evil spirit and will not go near it.

Labor in India is not organized, but this does not prevent it from interfering with industry by indulging in periodic strikes.

Manufacturing Applications of Ingersoll Drum-Type Milling Machines

Continuous Milling on Work of Medium Size — Three Types of Job Performed — Specia Fixtures for Holding Work — Automatic Clamping Devices on Some Fixtures

By J. V. HUNTER

THE continuous milling machine of the so-called drum type mounts the work on a continuously revolving drum and carries it between sets of cutters that finish one or more faces, according to requirements, so that the operation has been completed and the work is ready for removal when it again returns to the loading station. Many other classes of work can be handled on these machines, including slitting and cutting-off operations. In order to handle parts of medium size, the Ingersoll Milling Machine Co., Rockford, Ill., has developed several types of these machines, which in the main resemble the large drum-type milling machine that was described in the *American Machinist* on page 645, Vol. 51. However, the new machines are smaller, more compact units and are rated by the builder according to the diameter of the wormgear that drives the drum.

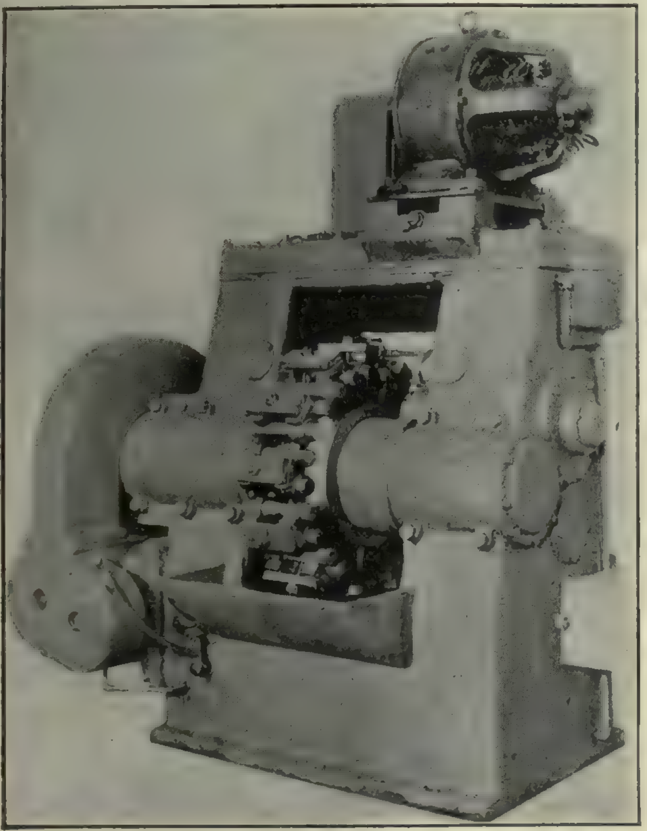


FIG. 1. LOADING SIDE OF 30-IN. DRUM-TYPE MILLING MACHINE

CONSTRUCTION OF THE MACHINE

The small machine, Fig. 1, designated as the 30-in. size, has a base and frame made of a single box-form casting inclosing all the operating gears and mechanism. The latter is designed in units and placed in compartments insuring the exclusion of dirt by cover-plates, which may be seen in the front view of the machine, Fig. 2. The drive motor is mounted on the top of the frame and its power is carried by a chain drive to the main jackshaft inclosed in the upper section of the frame. From the jackshaft the power is transmitted to a vertical shaft in each side housing; and that in the right-hand frame housing, in turn, distributes it to the drum-feed gear box and to the gearbox for the spindles on that side of the frame.

The machines are each intended for a single purpose, and it has, therefore, been unnecessary to provide an elaborate system of gearing for changing the speeds and feeds; but they may be altered when necessary by removing the gearbox coverplates and changing pick-off gears. The rate of feed of the work is regulated by the speed of revolution of the work-carrying drum, which is driven by a worm and wormgear located in the large projection of the housing at the right-hand side of the main frame.

The cutter spindles are located in the frame on both sides of the drum and toward the front of the machine, leaving the rear free to serve as a loading station. One or more cutter spindles can be provided as the nature of the work demands.

Almost as much of the success of manufacturing ma-

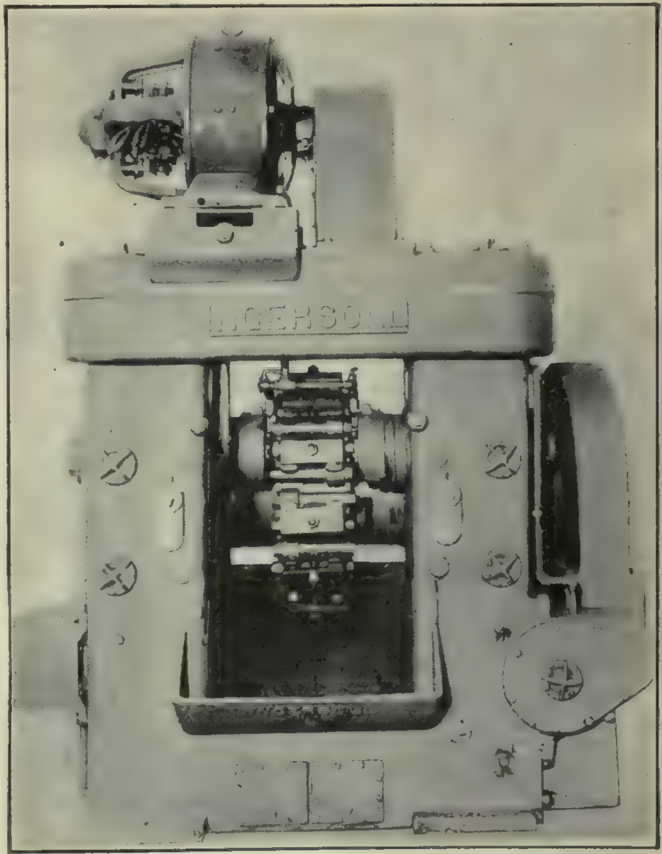
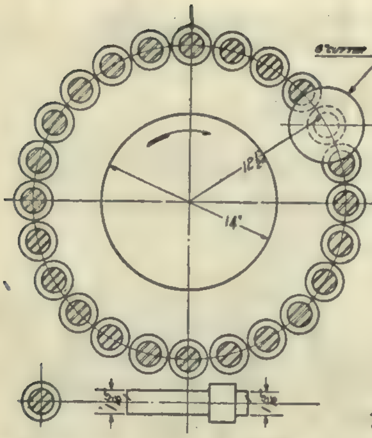


FIG. 2. FRONT OF MILLING MACHINE SHOWING CUTTER SPINDLES



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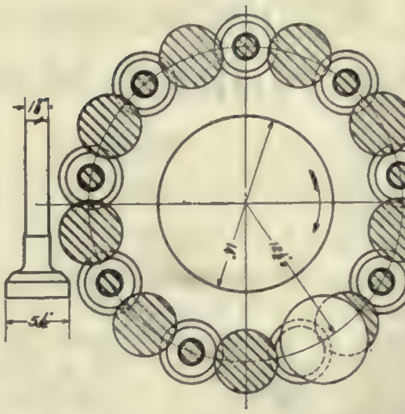

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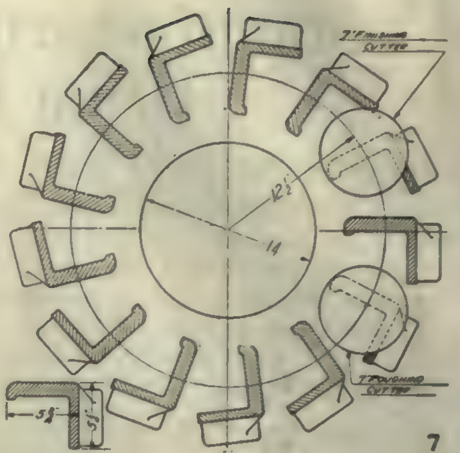

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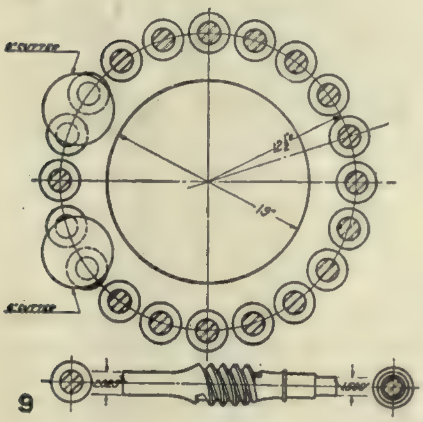

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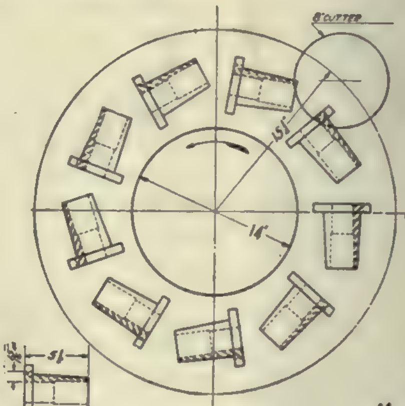

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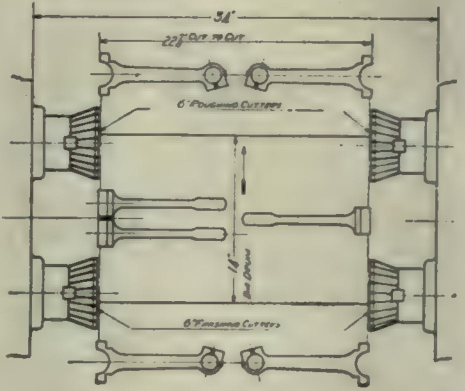

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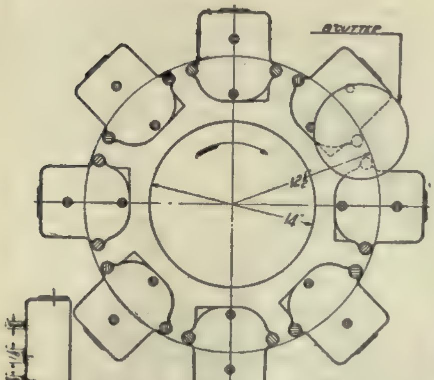

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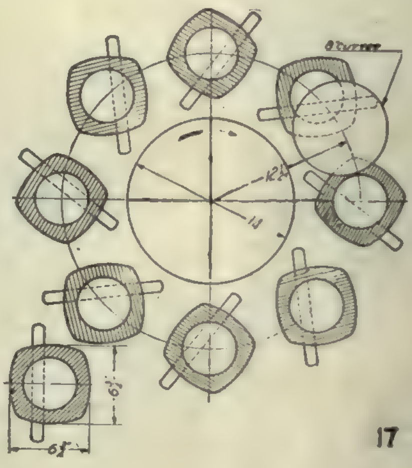

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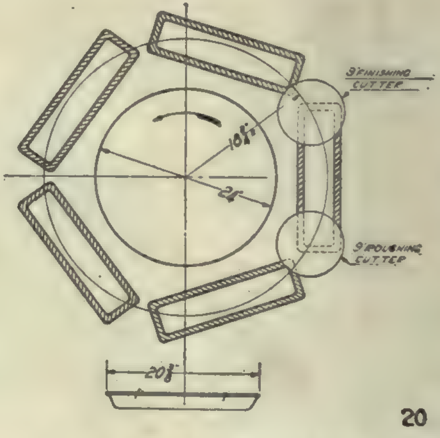
FIG. 3. LOADING DIAGRAM OF DRUM FIXTURES FOR MILLING SHAFT TO LENGTH. FIG. 5. WORK-LOADING DIAGRAM ON TRANSMISSION-SHAFT MILLING JOB. FIG. 7. POSITION OF CASTINGS ON DRUM. FIG. 9. DETAILS OF WORMSHAFT MILLING JOB. FIG. 11. BUSHING AND WORK DIAGRAM FOR SLOTTING OPERATION. FIG. 13. POSITION OF CONNECTING RODS FOR MILLING OPERATION. FIG. 15. SURFACES FINISHED ON CASTING. FIG. 17. DIAGRAM OF DRUM LOADING FOR DRAWBAR MILLING OPERATION

chines of this type is due to the design of the work-holding fixtures as lies in the character of the machine itself. Therefore, each machine is largely a special job, and its manufacturing application must be studied and its work-holding fixtures designed at the time the machine is laid out. The operations to be performed on the work naturally have a controlling influence on the design of the machine; and lead to three different methods of arranging the work on the holding fixtures.

In one case, when parts can be milled on two ends or sides simultaneously, they are so mounted that this



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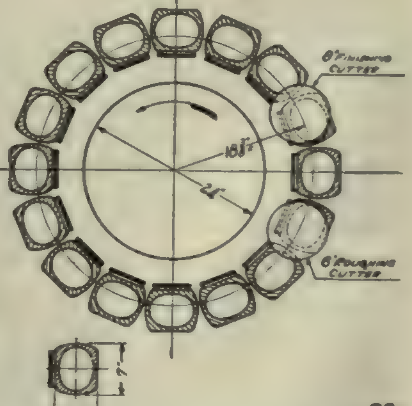

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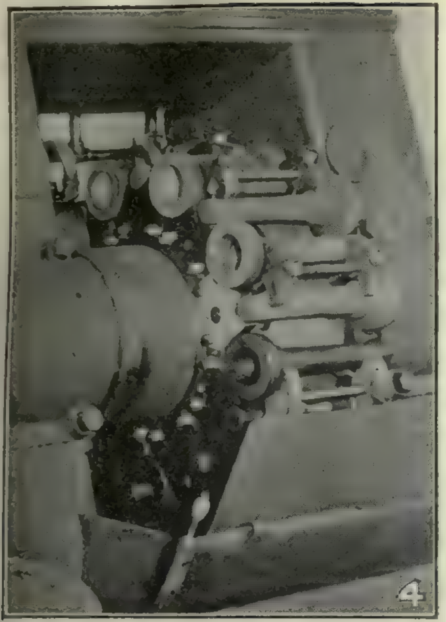
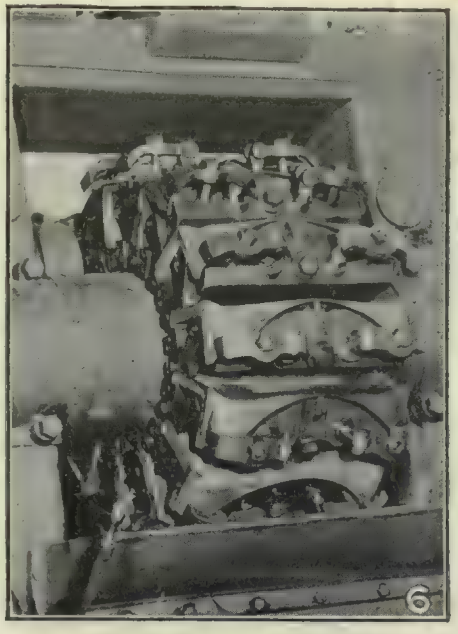
FIG. 20. FLANGES FACED ON MACHINE SHOWN IN FIG. 19. FIG. 22. DIAGRAM ON SECOND SETTING FOR DOUBLE MILLING JOB





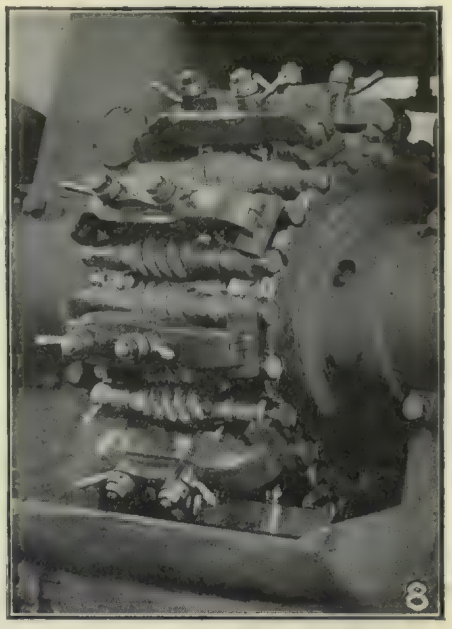


FIG. 4. DRUM FIXTURES FOR MILLING TRANSMISSION SHAFT. FIG. 6. LIGHT CASTING HELD FOR MILLING. FIG. 8. DRUM FITTED WITH AUTOMATIC CLAMPING DEVICE

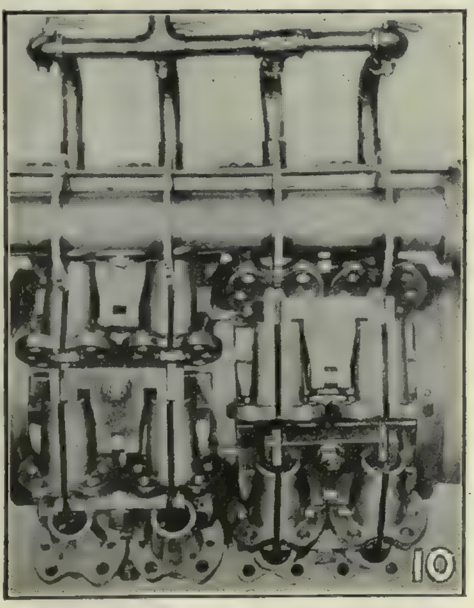
may be accomplished as shown in the transmission-shaft operation in the two illustrations already considered. Secondly, parts that are milled on only one face are mounted in pairs, or staggered so that the spindles on both sides of the housing are both engaged in finishing parts. A third class includes parts with surfaces to be finished lying at an angle to one another; and they may be machined by first milling one face while held in fixtures on one end of the drum and then shifted to fixtures on the opposite end for finishing the remaining face.

MILLING SHAFT FORGINGS TO LENGTH

The machine shown in Figs. 1 and 2 was built for milling a shaft forging to length; and the diagram shown in Fig. 3 shows the size of this forging and the position of the successive forgings when mounted on the drum fixtures. The diameter of the drum shaft is 14 in., and on it are mounted fixtures for holding 24 pieces placed so that their centers are at a radius of 12½ in. from the shaft center. Only three pieces of work can be in contact with the cutters at any one instant. The loading station is at the rear of the machine, and the pieces are clamped on in pairs, a single bolt serving to pull them into the V-shaped notches of the fixture. The machine rating is based on a factor of 85 per cent of the possible production capacity; and at this rating the production is 72 pieces per hour. A 15-hp. motor is required for the drive.

A job involving alternate light and heavy cuts, illustrated in Fig. 4, shows the operation of milling a transmission shaft to length. The forging has a diameter on its small end of 1⅞ in., Fig. 5, and on the large end it has been upset into a cup-like form with an outside diameter of 5 1/32 in. Its size permits mounting only 16 forgings on the drum at a time. However, owing to the nature of the material, the spindles and feed can be run at a higher rate, so that based on the production factor previously used it is found that this machine will produce 96 pieces per hour.

It is a decided step from the heavy, stocky forging, just described, to the light, almost fragile castings that are handled on the machine shown in Fig. 6. The design of the work-holding fixtures are a distinct factor in the success of handling this peculiarly shaped casting. The pieces stand in the fixture in the position indicated in section, Fig. 7, with a possible total of 13 pieces mounted on the drum. The parts are held by hinge-shaped clamps, secured by a single bolt at each end; and when the bolt is loosened the clamps may be swung to the side to clear the bolt and then raised to free the casting. This arrangement prevents the necessity of handling a lot of loose clamping pieces when



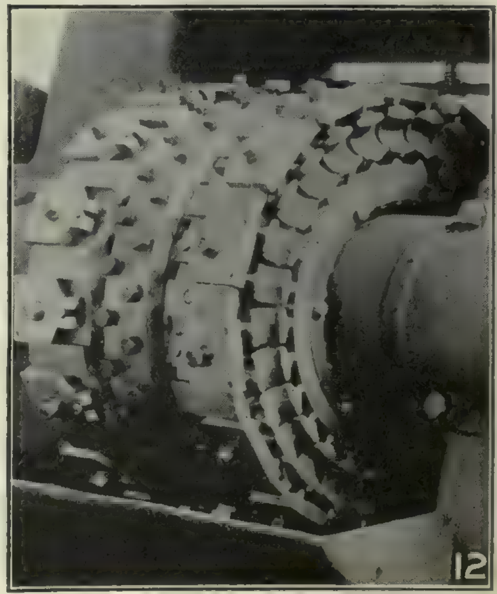
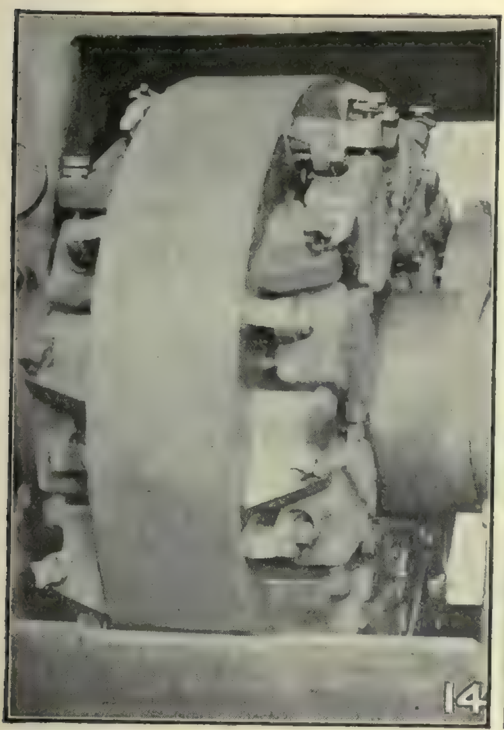


FIG. 10. MACHINE FITTED FOR A SLOTTING OPERATION. FIG. 12. DOUBLE-END DRUM FOR MILLING CONNECTING-ROD FORGINGS



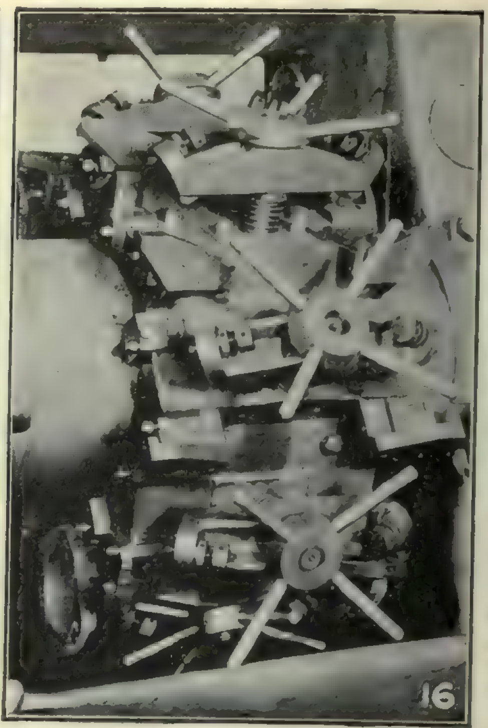
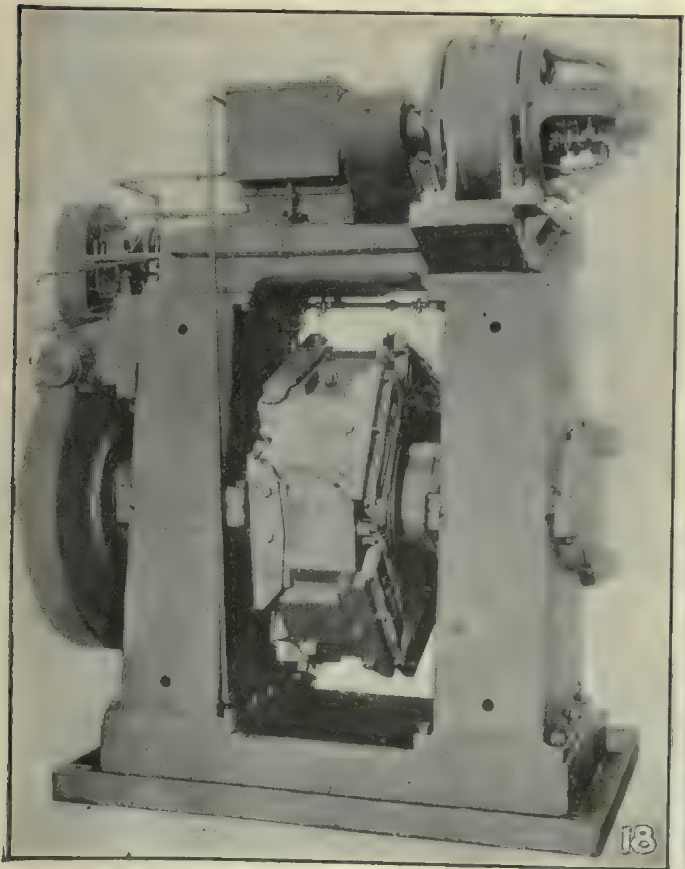


FIG. 14. CASTINGS BOLTED TO SIDES OF DRUM FOR FACING OPERATION. FIG. 16. QUICK OPERATING MECHANISM FOR CLAMPING A FACE-MILLING JOB

replacing the work. A third bolt in the center of each fixture is provided to control stops in the center and at each end of the casting that are drawn up to prevent springing under the strain of the cut.

Roughing and finishing cuts are required on this casting in order to hold it to close limits of accuracy. Therefore, two spindles are provided on each side of the machine frame, so that one cut will follow the other as the piece progresses from one spindle to the next. The drum turns toward the operator as he faces the machine at the loading station in the rear; and as the spindles are located in the front of the frame it is necessary to have the roughing cutter below and the finishing cutter above. This arrangement has a further advantage of preventing the heavy chips from the roughing cut falling on the finishing cutter. Rated on the production basis previously mentioned, this machine will finish 171 castings per hour. Adjustment of the cutter spindles is provided for by means of quills that project through the front of the housing on each side.

An automatic work-clamping fixture is used on the machine shown in Fig. 8, in a milling operation on a forged-steel worm-shaft to size it to length. The clamping action is regulated by means of a cam carried on a stationary shaft passing through the center of the hollow drum shaft and secured in the housing at one end. The pull of the holding bolts is governed by a spring tension that accommodates itself to the irregularities of the rough worm-shaft forgings.



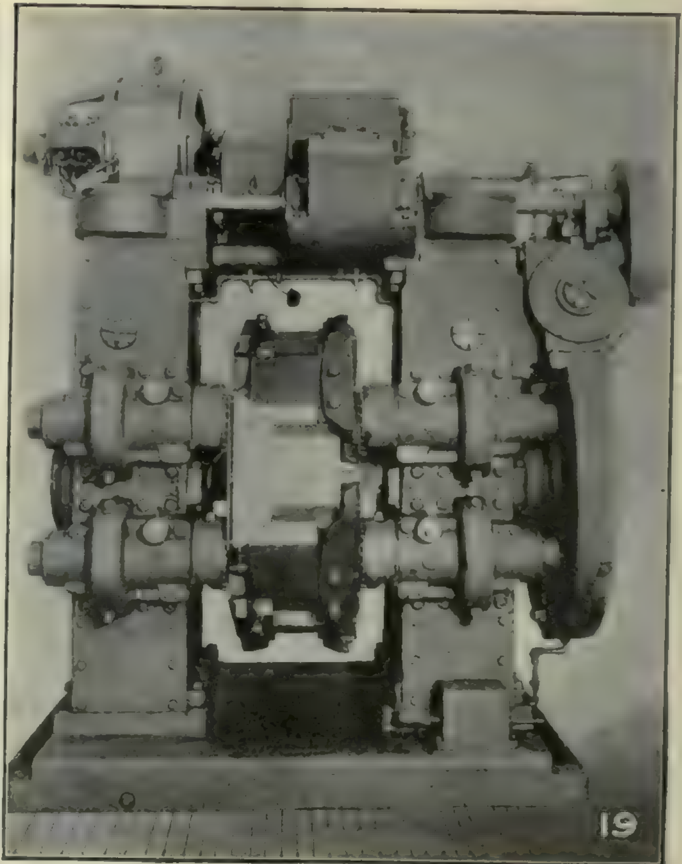


FIG. 18. LOADING SIDE OF 42-IN. DRUM-TYPE MACHINE. FIG. 19. SPINDLE SIDE OF MACHINE FITTED FOR FACING FLANGES

Just before each section of the drum reaches the loading station, the cam releases the tension on the holding bolts and the operator is then able to grip the small handles and swing the spacing bar into a vertical position about its central pivot so that it clears the bolts. The main clamping bar will then slip out far enough on the bolts to release the forgings for removal. After the work has been replaced with fresh pieces, the main bar is slid in place over the forging and the spacing bar again swung into position on the bolts, thus holding the work in the fixture until clamping pressure is applied by the cam and releases the springs as each successive section of the drum begins to pass through the top of the frame housing.

Seventy-five pieces of the work, Fig. 9, can be produced per hour. The machine is fitted with two spindles for milling each end of the work. The first serves merely to remove the surplus material from the end of the bar, since some forgings are considerably over length. The second spindle finishes the shaft to length, making a cut to the depth of $\frac{1}{16}$ in. in average specimens.

The machine shown in Fig. 10 performs a slotting operation on the bushing detailed in Fig. 11. Four rows of bushings are carried in the drum fixtures, clamped up in pairs, and the pairs are staggered so that the full load does not come on the cutter spindle at one time. Despite the length of the cut, there are so many pieces in process that an hourly output of about 155 pieces is obtained. Opposed spindles are placed in the housings and carry a cutter arbor extending from one spindle to the other and parallel to the drum axis. The arbor carries four slotting cutters.

MILLING ENDS OF CONNECTING RODS

An operation of the second classification, milling work on one end only, is done on the machine, Fig. 12, that is used for milling the ends of connecting-rod forgings. The machine has been designed with a drum of sufficient length so that the rods may be placed end to end, as indicated in Fig. 13, with their crank ends facing the spindles in opposite housings. The pieces have been staggered on the drum so that the opposed spindles are not taking up new cuts at the same instant. Six-inch diameter cutters are used for both the roughing and finishing cuts. The forgings are so closely spaced in the fixtures that 56 pieces are held at one time, and an hourly production rate of 376 pieces results.

For milling the faces of castings the parts are frequently mounted on fixtures on the sides of the drum, as shown in Fig. 14. In this operation the casting, detailed in Fig. 15, is faced off on four bosses. The fixtures are staggered for the reasons previously given and the drum will hold a total of 16 castings. The feed of the drum is arranged to give an hourly production of 110 pieces.

A heavy cast-steel drawbar cap is faced off in the machine shown in Fig. 16. Sixteen castings held on opposite sides of the drum fixtures complete a load and result in an hourly production of 96 pieces when the machine is rated at a production factor of 85 per cent. The position of the drawbar caps on the drum is detailed in Fig. 17. It will be noted that in this case the castings have not been staggered, but are so placed that a single-spoke wheel for each section of the fixtures operates a clamping bar to force the castings against hardened-steel stop plugs provided for correctly locating the castings.

A larger machine is used when the area of the work is too great to permit mounting it on the drums of the 30-in. machine. The larger machine has a worm drive wheel of 42-in. diameter; but its other general characteristics, as shown in Fig. 18, are similar to the machine already described. The most noticeable change is in the housings, which, owing to the greater size of the castings, are built in sections and bolted together. The drum shaft is inclosed in bearings in the housing, and the position of the spindles, Fig. 19, has been changed so that they are held in bearings bolted to the side of the frame. On this machine the thin shell, shown in Fig. 20, is finished on its bottom flange at the rate of 71 pieces per hour.

MILLING NON-PARALLEL SURFACES

The third class of milling operations previously mentioned relates to work on a part with two or more surfaces so located that it is necessary to remove the piece from its holding fixture after the first milling cut and place it in a second fixture for completing by another pass through the machine.

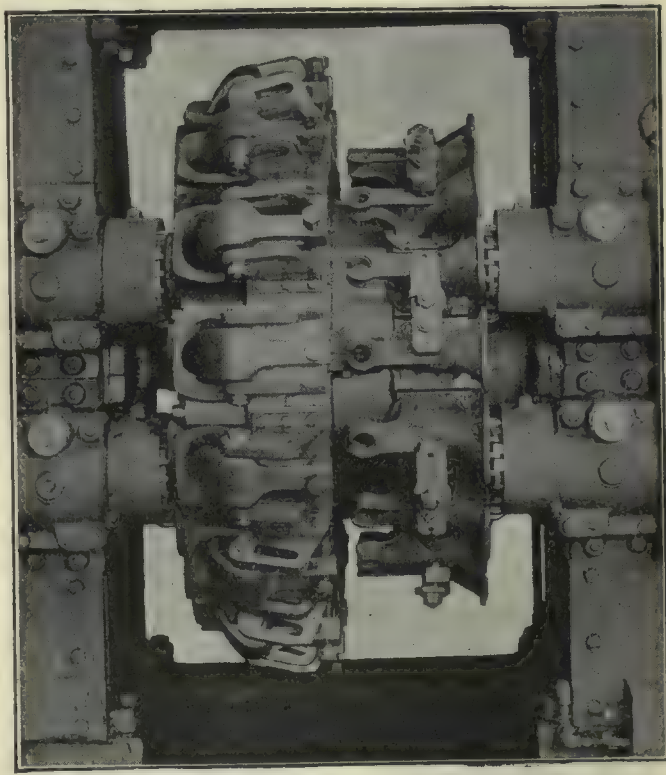


FIG. 21. MILLING RIGHT ANGLE FACES ON A SINGLE MACHINE

This sequence of operations is performed on the tank top machined on the 42-in. machine and illustrated in Fig. 21. For the first cut, the castings are held in fixtures on the larger, left-hand end of the drum in a radial position with their small ends toward the center of the drum Blocks that fit into the hollow openings of the castings clamp them against the locating points on the sides of the fixture.

For the second cut, Fig. 22, the pieces are located from the surfaces already milled, and mounted in fixtures on the other end of the drum. Each set of fixtures holds 16 castings and they are transferred from the set of fixtures used for the first cut to the second as each casting returns to the loading station. At the same time, a fresh casting is inserted in the fixture of the first operation so that both sides are constantly carrying a full load.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Machining Side Cams on a Gear Cutter

By Ethan Viall

In the shop of Wappat Bros., Pittsburgh, Pa., side cams are machined on a gear cutter as shown in Fig. 1. The milling cutter is set as shown at *A*. The cam to be machined is mounted on an arbor *B* which passes through the work spindle of the machine, and is free to slide vertically. The master cam is keyed onto this arbor, just below the work, and rests on a fixed roller. Two pins in the lower side of the master cam run through holes in the faceplate of the machine, and drive the arbor.

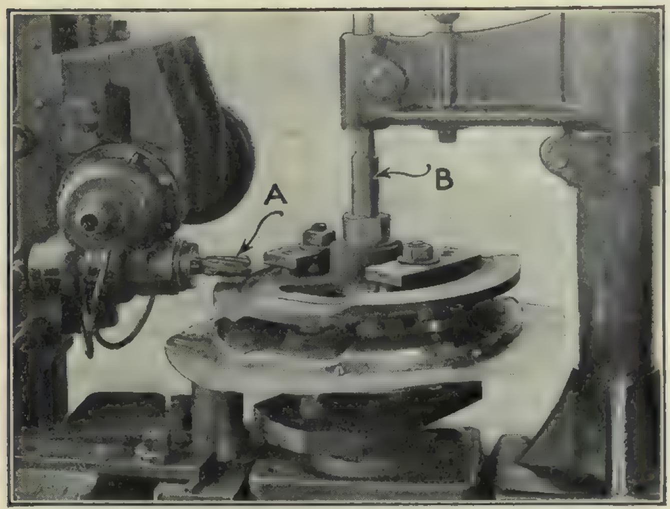


FIG. 1. GEAR CUTTER ARRANGED FOR MILLING SIDE CAMS

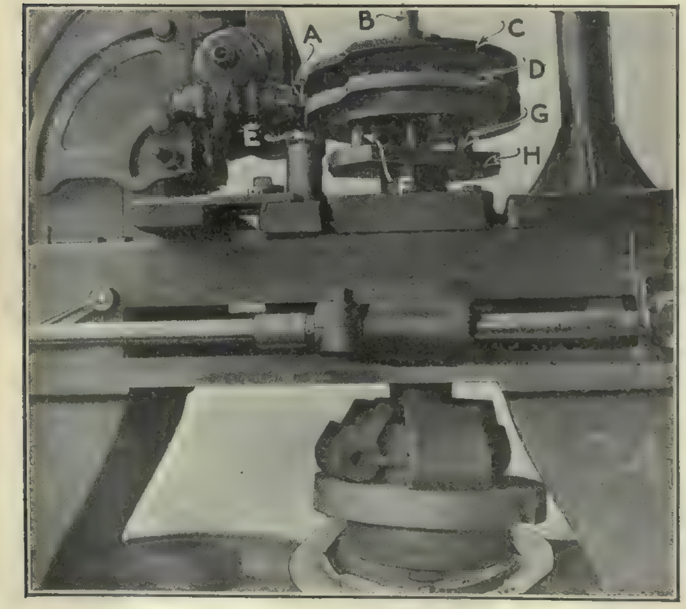


FIG. 2. AN UNDERNEATH VIEW OF CAM-CUTTING MECHANISM

A better understanding of the method will be obtained by studying Fig. 2. In this illustration, *C* is the cam to be cut; *D* is the master cam; *E* is the fixed roller, over which the master cam rides; *F* and *G* are the two pins set into the lower side of the master cam, and which go through the holes in faceplate *H*; *I* and *J* are weights used to keep the master cam in contact with the fixed roller; *K* is a tin chip guard, which has been removed, but is shown in place in Fig. 1. In this view also the milling cutter *A* is shown set to mill the under side of the cam, while in Fig. 1 it is set for milling the upper surface. The work spindle is, of course, geared to revolve continuously, and not merely index, as in gear cutting.

A Screwdriver of Merit

By Milton Wright

The cut shows a screwdriver that has been in service on the assembling job in a factory building a line of heavy machinery, for a good many years. It is always on the job for the reason that it can't get lost. When you want to "sock-up" a screw you put a piece of drill rod through the hole and this gives you a leverage that will easily break any screw with which it can be used. (You must use judgment with the drill rod; the tool is not foolproof.) When you are through with it, don't throw it under the bench, hang it up on a nail; that's what the hole is for.

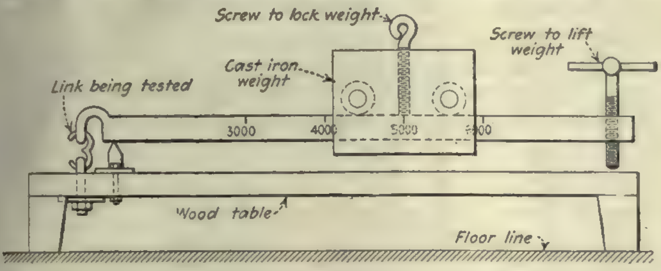
THE SCREWDRIVER "WITH A HOLE"

Inexpensive Pull-Test Equipment

By H. Wyman

The writer has the supervision of the heat-treatment of small forged pieces in the form of a figure "3" that are subjected to a pulling strain when used. It was desired to make frequent tests of the pulling strength of these pieces as they came from the rotary hardener performing the last heat-treatment. A regular power-driven, accurate, laboratory type of machine was available but it was located in a building nearly a mile away from the work, so the device shown in the accompanying cut was made to take care of these routine tests.

The balance bar was made from a piece of industrial railway track. One end was forged out into an eye into which the figure "3" hook would enter, and the other end tapped for the screw which enables one man to manipulate the casting or weight easily. As close to the eye end as possible a notch was made and the fulcrum was formed by resting the bar, or beam, on a knife-edge piece of ordinary machinery steel bolted to a platform. Directly under the eye an eyebolt was fastened through which the other end of the test piece was hooked. A casting weighing about 500 lb. was the only real item of expense, and this (equipped with rollers to facilitate handling) was mounted on the balance bar with a large setscrew through its center, bearing on the bar to hold it in place while making the test.



SIMPLE PULL-TESTING MACHINE

The application of the test is as follows: The bar and weight are raised by means of the elevating screw; the test piece is hooked in and the slack taken up by the nuts on the eyebolt. The weight is set at the desired point and fastened by means of the setscrew. The test is then applied by lowering the weight by means of the elevating screw. If the piece supports the weight at this point the pull can be increased by rolling the weight farther along the bar, and when the piece finally breaks the amount of pull is read from the graduations marked along the side of the balance bar.

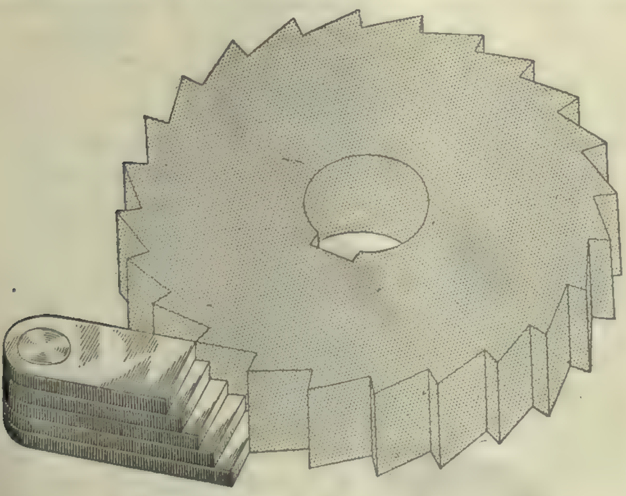
Naturally, the results secured by this machine are not absolutely accurate to the fraction of a pound, but in this case its constant use gave a more uniform and greatly improved product.

Ratchet With Multiple Pawls

By John S. Watts

Cases frequently arise where it is desirable to have a finer adjustment of a rachet wheel than can be made by the ordinary method without making the teeth so fine that they will not carry the load. The accompanying sketch shows a simple and ingenious way of getting over this difficulty, and consists mainly in making the pawl in sections or laminations as shown.

The ratchet wheel shown has twenty-four teeth, and is 9 in. in diameter, which with a solid pawl, would allow a travel of 1⅛ in. between the teeth. If the pawl is made in five sections as shown this travel will be reduced to one-fifth of this amount or under ¼ in.



RATCHET WITH MULTIPLE PAWLS

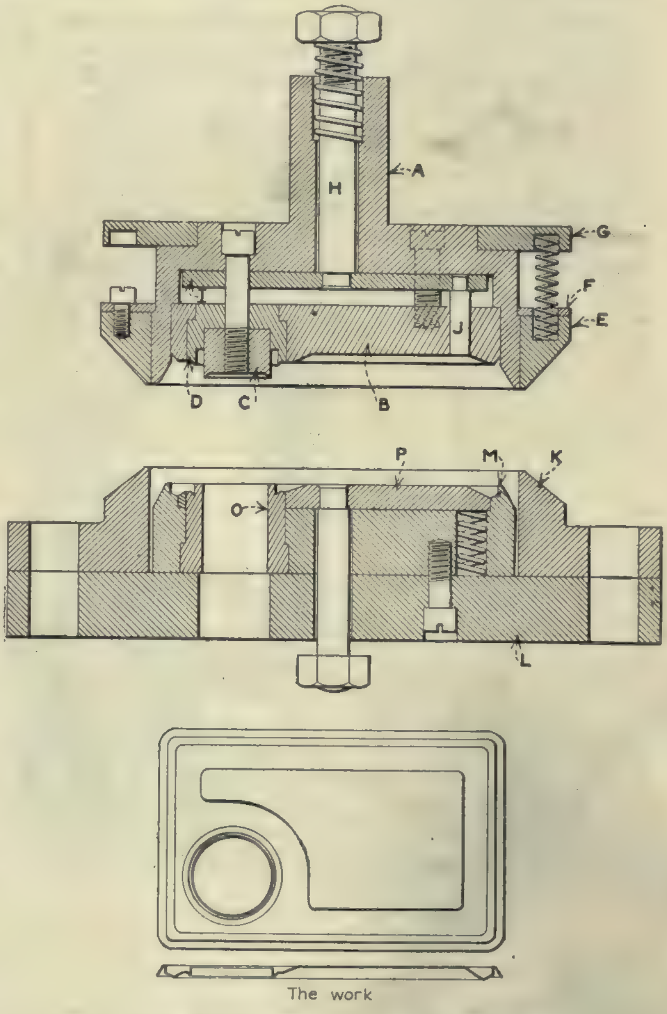
There is practically no limit to the fineness of adjustment that can be had by this arrangement, as a smaller movement simply means more pawls, which can be accommodated by making the face of the rachet wheel wider, so that each pawl will be capable of carrying the load.

Blanking, Drawing and Piercing a Varnish Can Top in One Operation

By S. A. McDonald

The die for blanking, piercing the opening, and forming the flange in one operation on a ½-gal. varnish can top is shown in the illustration herewith.

The blanking punch *A* is made with a machine steel shank welded to a tool steel cutting edge. The punch center *B* is secured to the punch by three screws, and contains the piercing punch *C* and the hole flange forming bushing *D*. The bronze stripper ring *E* is secured to the punch by two plates *F* which are secured to the stripper by screws. The downward motion of the stripper is stopped by these plates coming in contact with a shoulder on the punch. The spring backing plate *G* is secured to the body of the punch. To the knockout stem *H* is riveted a plate *I* containing four knockout pins *J*.



THE PRESS TOOLS AND THE WORK

The blanking die *K* is made of a machine steel plate with a tool steel cutting edge welded to it, the shoe *L* is fastened to the blanking die by screws and dowel pins. The die center *M* is also secured to the shoe in a like manner, and it contains the hole flanging die *O* and the spring actuated die pad *P*.

When the punch descends it blanks out a round cornered blank, and carries it down with the spring pad until the hole piercing punch *C* cuts the hole. As the punch continues to descend it draws the tin over the die *O*. At the same time the outer flange is formed over the die center *M*.

On account of the small flange no drawing ring is necessary, and the corners form smoothly by bumping the punch and die centers together. The groove formed around the hole flange is to retain solder when a nozzle is soldered on in a later position. The spring pad *P* ejects the tin on the return stroke and brings the pad flush with the cutting edge.

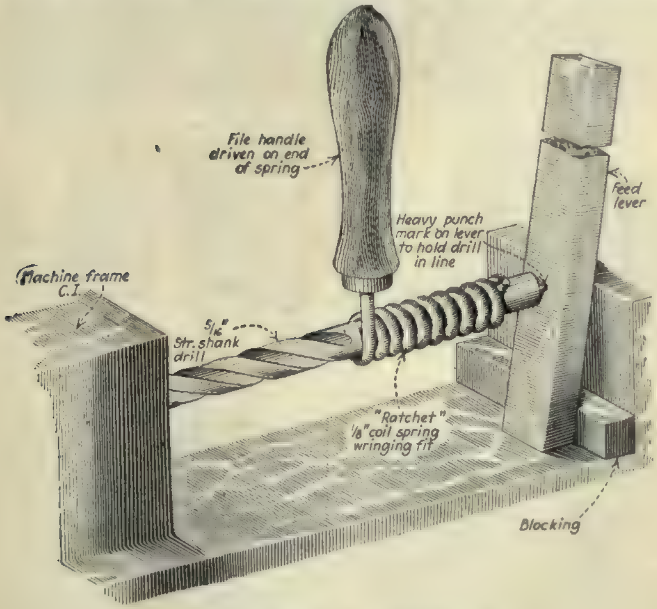
When the punch nears the end of its stroke the four pins *J* eject the tin from the punch. The press is inclined so that the tin falls clear of the die.

A "Ratchet" for Restricted Spaces

By George Siegrist

Here is a simple drill "ratchet." The idea may be as old as most such "kinks" but it is new to me.

We had some 3/8-in. tap holes to drill in a recess on a machine frame and, having no ratchet short enough to go in the space, I rigged up the one shown by winding a spring of 1/8-in. tool-steel wire tightly around a 9/32-in. rod for about 10 turns. This left the opening in the coil smaller than was wanted so it was reamed out with a 0.309-in. drill leaving the opening with a "flat" bearing inside and allowing the coil to be swung on the shank of a new 5/16-in. drill. The "feed" was by means of a lever with a punch mark in it to hold the end of the drill. This lever to be backed up by using increasingly thicker packing as the drill went in.


File handle driven on end of spring
Feed lever
Heavy punch mark on lever to hold drill in line
Machine frame C.I.
5/16" Str. shank drill
"Ratchet" 1/8" coil spring wringing fit
Blocking

A QUICKLY MADE "RATCHET" DRILL

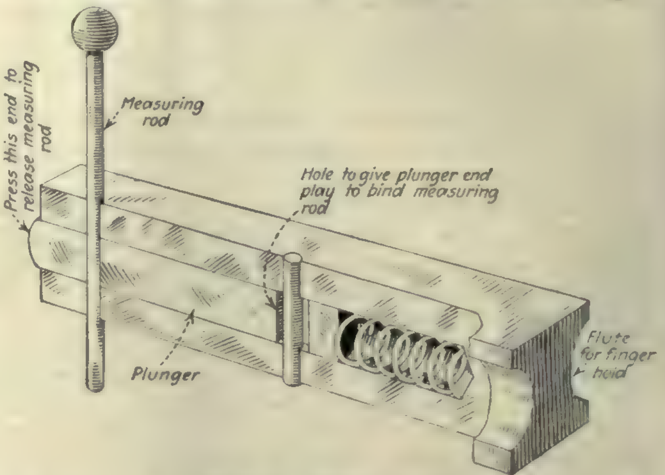
The ratchet and lever end of the drill were oiled and put to work. The ratchet never failed to drive the drill under pressure, or to release every time on the back stroke. With a rig of this kind it is possible to drill very close to the bottom of a recess, or in a narrow slot, the depth depending upon the length of the drill.

A "One-Hand" Depth Gage

By Richard H. Kiddle

The sketch herewith shows a depth gage that is very handy because of the fact that but one hand is necessary to manipulate it.

Take a piece of square stock of convenient size and mill flutes along opposite sides to provide a finger hold. Drill in from one end nearly through the piece lengthwise and put a rod in the hole that will slip nicely without too much shake. The rod should have a nicely rounded outer end and should bear at the inner end upon a compression spring. With the spring under compression and the round end of the movable rod just projecting from the base part, drill a transverse hole through both parts of a size that will just allow the measuring rod to slip through.


Press this end to release measuring rod
Measuring rod
Hole to give plunger end play to bind measuring rod
Plunger
Flute for finger hold

SIMPLE DEPTH GAGE

The friction imposed upon the measuring rod by the action of the spring will hold the measuring rod in any position with a reasonable degree of firmness though allowing it to be moved in either direction by a slight pressure upon the end.

Another Type of Trepanning Tool

By E. A. Dixie

Mr. Hunter's interesting article on page 549 of the *American Machinist* reminds me of a difficult trepanning job of many years ago, which was brought to a successful conclusion only after we had developed a new trepanning tool and a novel manner of using it.

Among other things, the job in question demanded that the ends of a large number of brass cylinders should be recessed as shown in Fig. 1. The dimensions given are only approximate, as the job was done over thirty years ago and I have only my memory to rely on for the figures. When this part of the work was reached the foreman and shop boss pleaded with the inventor that the rolls should be made in two pieces and pressed together to simplify the work but the inventor insisted they should be made from a single casting.

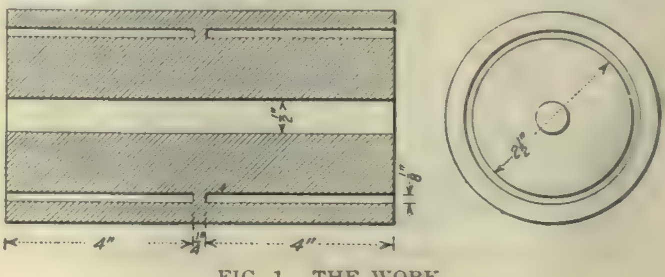


FIG. 1. THE WORK

Owing to the narrowness and depth of the slot we appreciated at the start that some sort of a trepanning tool would be required to finish it. The first trepanning tool had four lips but gave much trouble by choking with chips. We accidentally broke out one of the lips and got so much better results that we made a new one with three lips equally spaced. However, before we got very deep with this it also choked and the operator spent more time removing the tool and blowing the chips out with a mouth blow pipe than he did in making them. We then went back to the first tool but removed another of its teeth, thus leaving only two. On going deeper into the hole the same trouble developed as before; the chips choked up and had to be removed, also the operator had to be very careful not to overfeed the tool. Having gone thus far we had learned a number of things *viz.:* The fewer the teeth, the greater the chip space available; overfeeding was a cause of broken tools and spoiled work; choking with chips retarded the work even when it was not accompanied by tool breakage.

The ideal tool therefore was one with as few teeth as possible, so made that it could not be overfed, and provided with some means for evacuating the chips from the slot as soon as they were made.

Obviously, a single tooth was as few as could be used. With this as a start a piece of tool steel was bored eccentrically, as shown in Fig. 2. The outside was turned concentric with the tapered shank *C* which fitted the tail spindle of the lathe. A single groove was milled as shown in Fig. 3. This gave the single tooth considerable strength as it was supported by about two-thirds of the circumference of the tool. The hole was bored a few thousandths tapering, being larger at the back than at the front. The outside was also ground tapering, being smaller at the shank end. This provided clearance both inside and out when it was in the slot. The matter of overfeeding was taken care of by grinding the face of the tool as shown in Fig. 4. I have forgotten the exact amount the cutting edge *A* projected beyond the flat face *B* but it was only two or three thousandths. It was therefore impossible for the operator to force the tool to take more of a cut than the vertical distance from the cutting edge *A* to the "heel" *B*, as the flat heel *B* would come in contact with the previously finished surface of the slot and prevent further feeding. This heel also prevented automatic digging in, a pastime in which trepanning and other tools sometimes indulge without any outside encouragement.

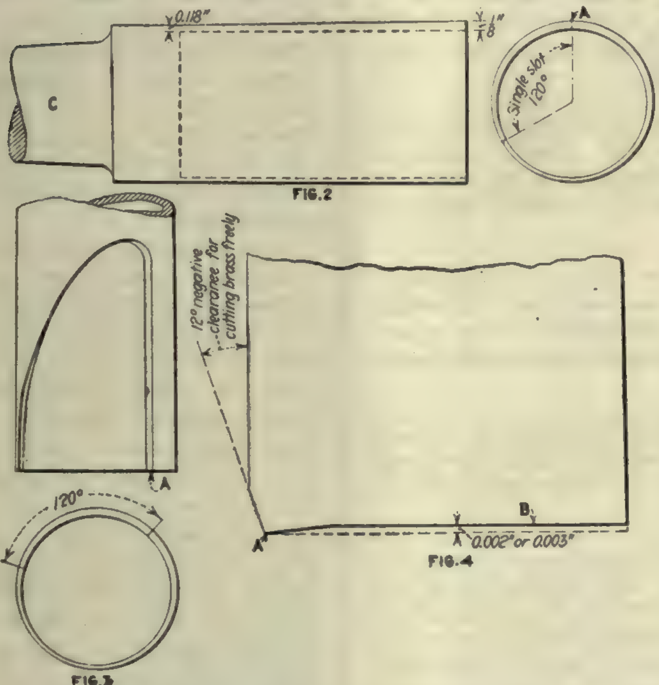


FIG. 2. THE TOOL IN COURSE OF MAKING. FIG. 3. THE FINISHED TOOL. FIG. 4. PROJECTION OF FACE OF TOOL

We had solved the two first problems, but the clearing of the chips was still to be dealt with. The lathe in which the work was being done was a small one of about 14-in. swing by about 6-ft. bed. As the brass was very free cutting, the chips could have been easily blown out by an air jet but for the fact that we had no compressed air. We therefore decided to make them fall out by gravity.

Distributed about the shop were a number of 12 x 12-in. wooden pillars which supported the floor above. To one of these we bolted two pieces of 4 x 12-in. timber about 4 ft. long. The upper one was about 6 ft. from the floor and the other just at the floor level. The lathe was then turned on end with the headstock uppermost and the feet lag-screwed to the timbers. The drive for the lathe was obtained by securing a pulley to the top of the spindle of a drill press where it projected beyond the upper bearing. This afforded a horizontal drive. With the aid of a rope, pulley and weight, the lathe carriage was counterbalanced and the carriage clamping screw was tightened enough to give sufficient friction to hold the carriage where it was put. Except for being a little clumsy to handle during the chucking operation the rig worked all right. The chips from the trepanning tool dropped out of the slot as soon as they were made and the job was finished in good time. It may be mentioned that the single toothed tool stood up for the whole of the rest of the job without breaking.

Calculating the Size of a Gage Plug by Triangulation

By A. D. Hallet

A short time ago a problem arose in regard to checking rectangular broached holes. Common practice has been to make a plug gage, with tolerance, the size of the hole, or check with four round plugs.

The inspection department desired a rectangular plug to determine whether or not the holes in the work were diamond shaped. They specified that the thickness should be 0.500 in. as shown; the size of the hole being 2.000 in. x 4.000 in. The distance in question was determined and the gage proved satisfactory as long as the corners held up.

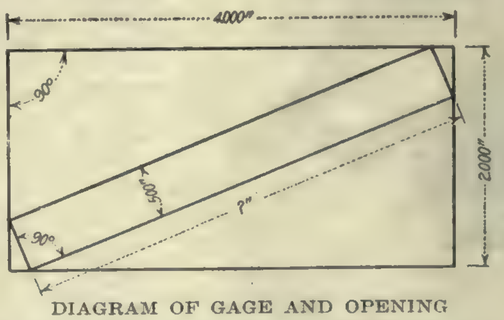


DIAGRAM OF GAGE AND OPENING

Will some of the readers of the *American Machinist* kindly submit the solution; using as short a method as possible.

IN THIS ISSUE

After we have been kicked by a mule and get our eyes open again, it's a little satisfaction to figure out just why he kicked and why we landed so hard. It doesn't ease up any on the aches and sore spots but it may help us keep out of range next time. We've all been kicked good and proper by the business slump and so we asked Theodore H. Price, well-known in financial circles, to tell you how it happened and why. His "Hard Times—Their Cause and Cure" is a carefully written study of the situation and ought to help us all. It isn't a lot of platitudes or Pollyanna mottoes, but a heart-to-heart talk on the whys and wherefores of it all. This is the leading article of the issue as it should be.

In his twelfth article on "Metal Cutting Tools," De Leeuw, on page 4, takes up form tools, plate, bar and circular form tools showing the advantages and disadvantages of each. He also takes up shaving tools and shows how they act when in use. Few men have had De Leeuw's opportunities for experience and observation along this line, and nearly every one can study these articles to advantage.

Another post-mortem on business depression begins on page 9 where H. H. Manchester, who has been telling us the aftermath of other wars, gives us some interesting details of the present post-war crisis. He doesn't bore you with statistics but uses enough to show why and how things are as they are. While including all countries, he pays particular attention to the U. S. A. and takes up wages and expectations for the near future.

It is pretty well agreed that a systematic effort must be made to secure more and better trained mechanics. And while the old apprenticeship will probably never come back in its entirety, we seem destined to use a substitute which has the good features of the old, modified to suit our new conditions. The Southern Pacific Railway has been studying and experimenting along this line for years, and on page 12 Frank A. Stanley tells us of the work at the shops in Sacramento, Cal. It is not only an interesting story but it gives specific data as to subjects, hours and the results obtained at seventeen places besides Sacramento. It is good data for any shop large enough to have apprentices to study with considerable care.

In this issue page 16, Colvin winds up his talks on the "Foreman and His Job." Not that he's exhausted either the subject or himself, but because he doesn't believe in playing too long on one string. This deals with that half mysterious factor of human nature which the professor calls psychology.

As Colvin says "Most of us would have a hard time defining what it is in language that would mean anything to a man who didn't already know what we were talking about." He points out the difference in temperaments and the necessity of understanding them and points out the value of the open court such as General Goethals held Sunday mornings in the Panama Canal Zone, where all hands could get next to the big boss and spill their tale of woe. He agrees with Gladstone who said: "The free expression of opinion is the safety valve of passion. The noise of the rushing steam when it escapes alarms the timid; but it is the sign that we are safe." He believes that satisfied workers have no time for the agitator.

The eleventh paper on "Tool Engineering" on page 18, includes indexing pins, plungers and latches of different forms and for various purposes. The examples show work from automobile factory practice as well as other kinds of product. The principal value of articles of this kind is to suggest other uses or adaptations and no toolmaker or designer can fail to pick up ideas for future use.

One of our good friends, C. F. Meyer, who has been visiting India, tells on page 22 of the machine industry in that far away country in a most interesting manner. Native labor is not cheap though wages are low, as the output per man is correspondingly small. The many castes interfere with anything like co-operation and altogether the shop manager has his problems the same as here.

The development of continuous milling has made possible higher production than we dreamed of a few years ago. The article beginning on page 23 shows a number of applications which will suggest many others to the progressive shop man. Then there are about the usual number of practical ideas and kinks from our various readers. Some consider this the best part of the paper—it certainly is worth reading.

Coming Features

Another far-west story is due for next week — this time from Alameda, Cal., and in it Frank Stanley shows how big Diesel engines are being built on the Pacific Coast.

Jumping about three thousand miles east there's an article from the Flather shop in Nashua, N. H., which shows how lathe parts are made interchangeable in a thoroughly practical way.

Another article on the "Design of Springs" takes up flat springs of various types. Like the other articles by Joseph Kaye Wood, they represent actual experience and are especially valuable on that account.

The use of "Roller Tools in Finishing Axles" in an Indiana railroad shop will show the latest practice along this line. It shows the tools in detail.

Then there will be a short story on "Axles for Airplane Landing Gear" and an outline of the "Evolution of the Split Pulley," as well as an interesting article on "Grinding with a Phantom Wheel." Among the serials will be "Modern Production Methods" and "Tool Engineering."

EDITORIALS

Economics—Plus Faith

IT is a proper and wise thing to know your economics. A business launched with the sure knowledge that it is being begun at just the right point in the economic cycle; buying and selling accomplished in the same way; production increased or curtailed, not blindly, but because of knowledge that it is the right time to do so; these are things resulting from a thorough grounding in economics.

But there comes a time, it seems, even for the business run strictly according to economie rule, when a little something more is needed—when the turn doesn't come just as promptly as it should, and it appears that the bottom is going to drop. The additional thing needed is Faith—faith in the future. The present is such a time.

It is not a blind faith that is needed, not merely a waiting faith, but a faith with works. Back of the works, that they may be properly directed, must exist an understanding of how the world stands, inside our country and out. There must also be a realization that a large part of the country's condition of depression is psychological. Then we must know some things about the public debt and its relation to our wealth, what our real wealth consists of, and something of our national war time and peace time wastes. All of which may be said to constitute an analysis.

An analysis is easy to recommend but hard to make, and for that reason we have asked Theodore H. Price, editor of *Commerce and Finance*, who has been at the business of analyzing for a great many years, to make it for you. His report on the findings is our leading article this week. Mr. Price is strong for faith, as we are, and his reasoning makes us feel that he and we are right. So we recommend his medicine, full dose, believing it to be a good tonic.

A Few Rays of Sunshine

WHILE business isn't exactly what we might call brisk there are signs of life in many quarters. There is a little less unemployment in Cleveland for example, that's one good sign. Then there is a little machine business going on, some of it for export. This includes some machine tools and also woodworking tools, mostly for central Europe and in spite of the rate of exchange.

Some large machine tools are also being built for the making of electrical machinery and hydro-electric development. They are for the big companies and special to a great extent, but they indicate an abiding faith in the future which can well be copied by many of the smaller concerns. The big concerns are getting ready to do business in a more efficient manner than ever. This is also a good point to consider most carefully. As an indication of the orderly development of the business cycle, the night-shift operation of the knitting mills in certain districts is not without significance. First to be hit they are the first to get back. Others will follow.

The Improper Inspection of Machines

DURING the war when every machine builder was rushed to the limit, there was some excuse for slighted details and sub-standard and workmanship. The amount of business being done today hardly warrants such an alibi. And yet machines and accessories are coming through which are far from satisfactory.

One small shop we know of has had three exasperating experiences in as many months. They are, fortunately, busy enough to need new equipment, and it is discouraging, as well as maddening to have to spend a day or two in tinkering with every new machine in order to get it to run.

The first was a small punch press which absolutely refused to go on its base or stand. The base had never even been snagged and the upper works had never been put in place; huge lumps on the casting prevented the head from being put in the proper position.

Next came a bench lathe, which was equipped with a special toolpost although the standard had been specifically ordered. It was also fitted with a geared chuck which could not be opened or closed. It took a full day to take the chuck apart, lap the ring gear so it could be moved in its groove, file the rough corners off all the teeth of the gear and the three pinions, and make it usable. It had been forced together and never tested in any way.

Third, there was a sensitive drilling machine which was a beautiful job so far as the machine was concerned. But the drill chuck was considerably out of true because of a burr on the shank. When this was removed it was found that the tapers were not alike, and with such a difference that the chuck would not stay in the spindle.

These were not machines or tools made by war-baby machine builders. They all bear the name plate of well and favorably known concerns, some of which date away back in our machine-tool history. The same is true of the chucks referred to.

Exporters tell a similar story and it is unnecessary to point out that such neglect does not help to extend our foreign trade permanently or make for friendly relations with foreign buyers.

If these instances mean that war time laxity of inspection is still with us, we have a task at hand which needs immediate attention. Nothing makes for better business relations that to have machines complete and ready for work when received. The reverse is also true and nothing tends to divert trade more than the conditions mentioned.

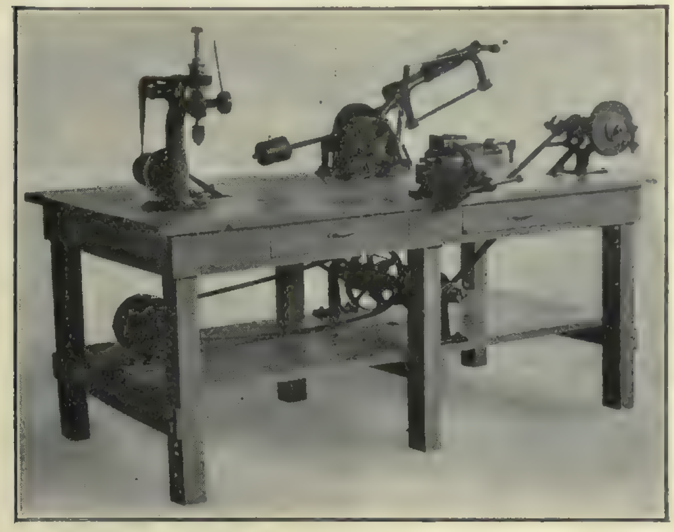
This is a good time to make sure that these conditions are not true of your shop and its product. For nothing tends to demoralize the men in a shop more than to permit carelessly inspected work to go out. If imperfect machines are allowed to pass now what can be expected when shops are busy once more? We must remember that satisfied customers mean more business later.

Shop Equipment News

Myers Combination Work Bench No. 1

The illustration shows the No. 1 combination work bench recently placed on the market by the Myers Machine Tool Corporation, Columbus, Pa. The outfit is intended for use where a small machine equipment is required, as in automobile repair shops and hotels, and by inventors and mechanics doing experimental and general work.

All of the units are mounted on a table 39 in. wide by 78 in. long by 33 in. high, the top, sides and shelf being made of 1¼-in. and the legs of 3 x 4-in. lumber. Two drawers are provided for holding small tools. The motive power is furnished by an a.c. electric motor, mounted on the shelf under the table, and delivering ½ hp. when running at 1,750 r.p.m. on 60-cycle, single-phase current of either 110 or 220 volts. The motor is belted to the countershaft, which permits the use of the machines either individually or simultaneously.


MYERS COMBINATION WORK BENCH NO. 1

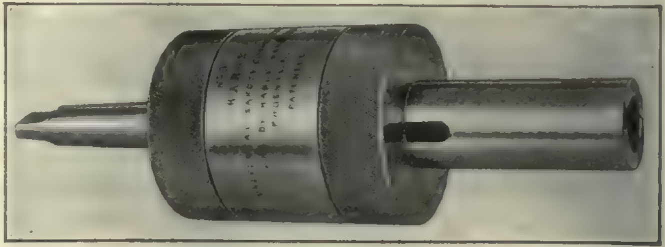
The machine equipment consists of the company's No. 2 geared automatic hacksaw having a capacity of 6 x 6 in.; a 10-in. sensitive drilling machine having a ⅜-in. chuck; and a grinding head equipped with one abrasive wheel and one muslin polishing wheel. A 4-in. machinist's vise having hardened steel jaws is also mounted on the table. The outfit is complete with the belting, and weighs 750 lb. when crated.

Karge "Universal Safety Cushion" Chuck

The illustration shows a chuck recently placed on the market by the Karge-Baker Corporation, Phoenix, N. Y., for the holding of drills, dies, taps and similar tools. It is provided with a "cushioning" feature which permits a moderate relative rotation between the shank and the socket ends of the chuck. A helical steel spring having a square section transmits the driving torque from one end of the chuck to the other, thus absorbing the shocks.

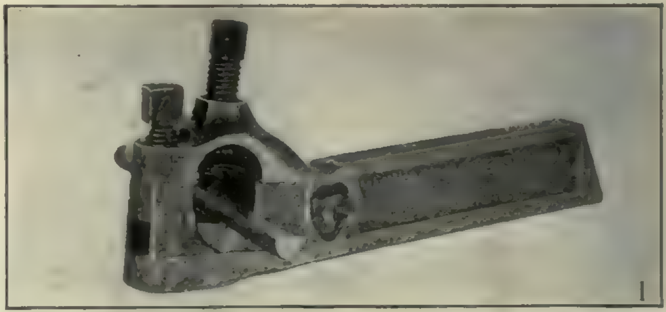
It is claimed that the use of the chuck largely eliminates the breakage of drills, taps and other tools, and because of the cushioning effect serves to eliminate chatter and to prolong the life of the cutting edges of the tool. It is said to act as a chip breaker when drills are used, and to provide a safety feature for such work as cutting threads to a shoulder with a die head.

The shanks and sockets can be furnished in the size and style desired, and different styles are interchangeable on the chuck. The thrust is taken on double ball bearings, and an adjustment is provided to compensate for wear on the friction coil. The chuck is capable of operation in any position, and does not require lubrication. It is made in five sizes to carry drills from ¼ to 4 in. in diameter, taps from ¼ to 7 in., or die heads from ¾ to 9 in. in size.


KARGE "UNIVERSAL SAFETY CUSHION" CHUCK

"Uniheart Rapid Universal" Toolholder

The Rapid Universal Toolholder Corporation, 199 Franklin St., New York, N. Y., has recently placed on the market a toolholder intended for general use in a lathe, boring mill or shaper, and adapted to the



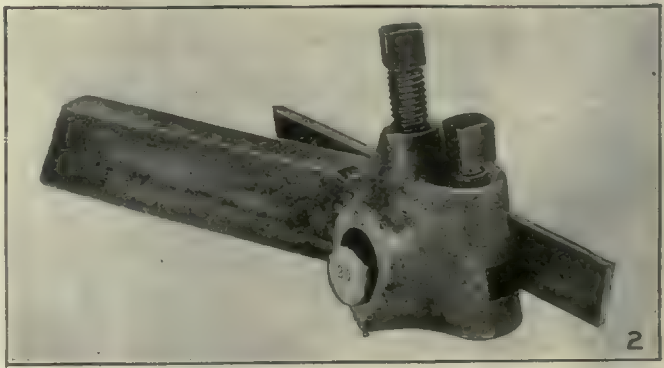


FIG. 1. "UNIHEART RAPID UNIVERSAL" TOOLHOLDER CARRYING A BORING TOOL. FIG. 2. PARTING TOOL IN "UNIHEART" HOLDER

holding of tool stock, boring tools, drills and such articles. The body of the holder is made of drop-forged steel, and is fitted with two setscrews.

As shown in Fig. 1, there is a square hole broached through at the front end of the shank, for the holding of square-section tool bits. When the tool bit is long, both screws can be tightened on it so as to prevent it from shifting. Round, square or hexagon bars can be held transversely to the shank by passing them through the hole and clamping them by means of the setscrew. For small bars the V-block shown in the illustration is placed in the rounded bottom of the hole, so as to hold the bar in place under the setscrews. It is thus possible to hold boring tools, drills, taps, center drills, reamers and indicator stems of any size up to ¾ in. in diameter.

For the holding of a parting or cutting-off tool, a special clamping device is provided. A conical-shaped piece with a groove at its large end to fit over the top edge of the toolstock is placed in the cross hole of the body. The small end of this clamping member can be seen projecting from the hole in Fig. 2. The appearance and construction of this part of the device gives the tool the name of "Uniheart." As the clamping screw is tightened, the parting tool is pressed downward on the shoulder supporting it, and is pulled against the side of the holder.

Besides the universality of uses of the toolholder, the maker claims that it is capable of very speedy operation, because the tools can be so easily changed. It is made in two sizes, the No. 1 for bench lathe use and the No. 3 for general medium-duty work.

Poliakoff "Universal" Machine Shop Rule

The rule shown in the illustration has recently been placed on the market by R. Poliakoff, 709 Sixth Avenue, New York, N. Y. The purpose of the rule is to enable the quick and accurate solution, without making any calculations, of problems relating to the speed of cutting work in a lathe or grinding it in a grinding machine. It is intended for solving the following problems, using only one side of the rule for any one problem.

(1) Given the diameter of the bar and the cutting or grinding speed; to find the number of revolutions. (2) Given the diameter of the bar and the number of revolutions; to find the cutting or grinding speed. (3) Given the speed in feet per minute and the number of revolutions; to find the diameter that can be turned or ground. (4) Given the length of bar in inches, feed in inches per revolution and number of revolutions per minute; to find the time required to turn or grind the bar. (5) Given the depth of cut in inches, feed in inches and speed in feet per minute; to find the volume of metal removed. (6) Given the speed in feet per minute and feed in inches; to find the area machined.

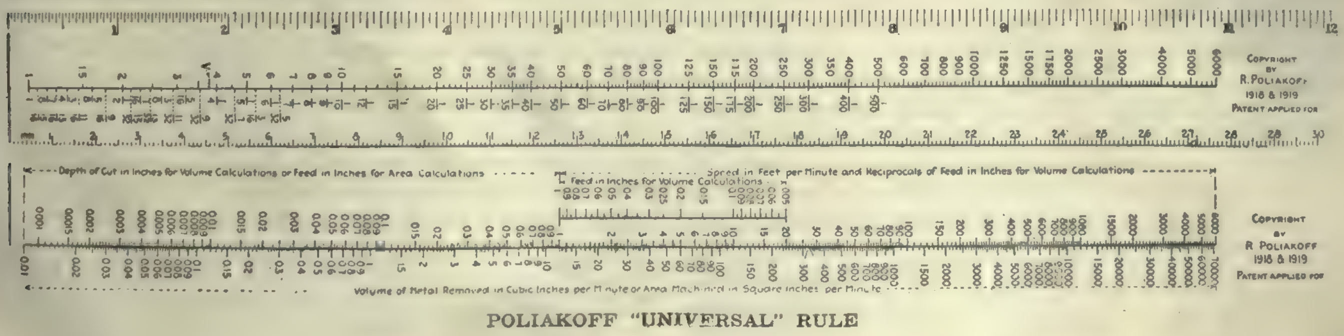
The chart on the side of the rule shown at the top of the illustration was described on page 590, Vol. 49, of the *American Machinist*, while the chart used on the other side was described on page 931, Vol. 50. The inch and millimeter divisions on the former side have been added to permit the use of the rule for measuring. The rule is made of celluloid, but can be made of steel, if desired. It is 12 in. long.

"Normal" Precision Drafting Instrument

A drafting instrument or compass intended for precision work and for general use on a drafting board has recently been placed on the market by E. Lawrenz, 2533 McClellan Ave., Detroit, Mich. The instrument is intended for the drawing of circles from 1/16 to 12 in. in diameter; and by the use of an extension bar, circles 24 in. in diameter can be drawn. In the accompanying illustration, the instrument is shown in its case with two non-hinged ruling pens, as well as with the extension arm and the pen attachment. Plain points are provided to insert in both arms of the instrument when using it as dividers. It is stated that the set is capable of performing all ordinary drafting work, since no small compasses are needed.

"NORMAL" PRECISION DRAFTING INSTRUMENT

The principal feature of the instrument is the fact that the two legs are always parallel, or normal to the plane of working, hence the name of the device. Because of this fact, the centers of circles being described are not gouged out, as frequently occurs when the points strike the paper at an angle. The instrument can be quickly set to the radius desired, and is then readily clamped in position, so that the radius will not change while the circle is being described. It is said


Copyright by R. Poliakoff 1918 & 1919 Patent applied for
Depth of Cut in Inches for Volume Calculations or Feed in Inches for Area Calculations
Feed in Inches for Volume Calculations
Speed in Feet per Minute and Reciprocals of Feed in Inches for Volume Calculations
Copyright by R. Poliakoff 1918 & 1919 Patent applied for
Volume of Metal Removed in Cubic Inches per Minute or Area Machined in Square Inches per Minute

POLIAKOFF "UNIVERSAL" RULE

that there is no back-lash or shake in the joints, as all of the pivots are of conic construction, made of steel and hardened and ground. The tightness of the joints may be adjusted by means of lock nuts.

The grip or handle is of large size. The grip is made of aluminum, while the working parts are made of steel, tool steel being used for some parts and mild steel for others. The arms are rust-proofed by either of two methods. The first is the Parker process, which makes the arms jet-black; the second is by electro-sheridizing, by which process a coating of zinc is amalgamated with the steel, leaving the instrument gray in color. The instrument is said to be very light and yet rigid; to be easily manipulated and capable of rapid work.

Rothweiler Oil Pump

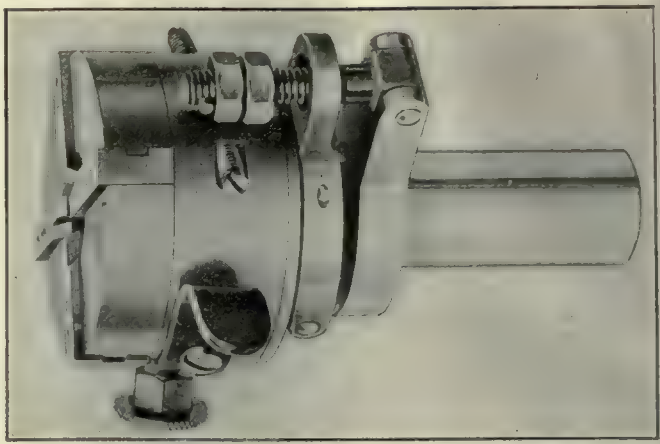
ROTHWEILER OIL PUMP

The illustration shows a pump recently placed on the market by Rothweiler & Co., 2962 First Ave. South, Seattle, Wash. It is intended for the removal from the container of oil of any grade, gasoline, turpentine, paint or other liquids. The suction pipe at the bottom of the pump is placed down in the container, and is long enough to reach through the head of a barrel to the bottom of it; and a bushing on it fits either the 3/4-in. opening in a steel drum or a 1-in. hole bored in a wooden barrel.

The spout can be swiveled, being turned up after using, so that oil does not drop from it. The cylinder is made of seamless steel tubing, the valves ground, and oil-proof leather packings are used. The pump throws about a pint of oil at each stroke, so that 4 gal. per minute can be delivered, it is said. One of the chief advantages of the pump is that since the pipe reaches to the bottom, it saves the elevating of barrels in an attempt to drain the last of the oil through a faucet. The weight of the complete pump is 7 pounds.

Geometric Style DS Self-Opening Adjustable Die Head

The Geometric Tool Co., New Haven, Conn., has placed on the market the Style DS self-opening and adjustable die head shown in the illustration. This die head was designed primarily for use with the Brown & Sharpe automatic screw machine, but is said to be quite as well adapted to other automatics. One feature of the head is that the spindle does not have to be reversed to back the die head off the threaded work. The die head floats to suit the thread being cut, which is said to prevent stripping and shaving of the threads and makes the usual close camming of the machine unnecessary. Buffer springs allow the head to yield slightly when the chasers come in contact with the work, which is claimed to insure a good smooth thread from the start. Two check nuts at the side of the head provide easy adjustment of the point of tripping. A spring closing attachment is provided for the purpose of eliminating shock and wear. This attachment is located in a position to strike a stop on the machine, thus automatically closing the head when the turret revolves. Micrometer adjustment is provided. The die heads are made with shanks to fit the particular sizes of machine on which they are to be used. They are furnished in three sizes, 5/16, 9/16 and 3/4 in., to fit Brown and Sharpe machines from No. 00 to No. 2 G. The work that can be cut varies in diameter from 1/16 to 3/4 in., in lengths from 1 1/4 to 1 3/4 in. and in pitches from 10 to the fineness desired. The shanks are 5/8 x 1 5/16 in. to 1 x 2 3/8 in. in size.

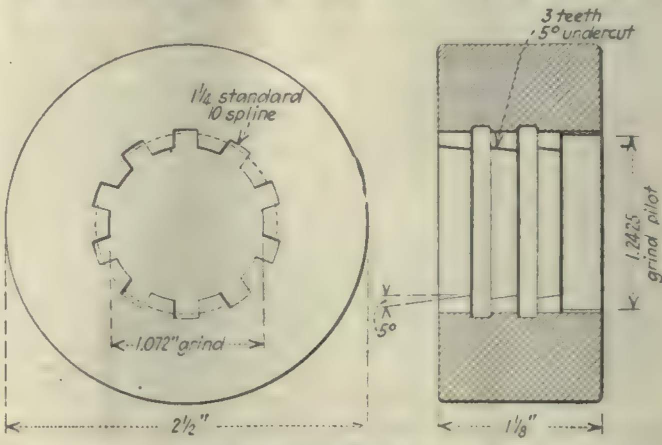

GEOMETRIC STYLE DS ADJUSTABLE DIE HEAD

A Spline Shaft Sizing Die

By C. H. Dengler

Mistakes are bound to occur in the best regulated shops. One that occurred in our shop was the means of trying a new method to bring spline transmission primary shafts to size.

The shafts, which were about 10 in. long and 1 1/4 in. in diameter, had a ten-spaced spline. On inspection they measured a few thousandths high, and as the gears had to slide easily on the shaft correct sizes had to be maintained. To reset and remill the shaft to the required limit was no easy job, especially as an alloy steel with a scleroscope hardness of 40 to 50 was used. We solved the problem by making the sizing die shown in the sketch and pressing the shafts through it on the arbor press, thus producing a shaft of the correct diameters.



DIE FOR SIZING SPLINED SHAFTS

The drawing needs only a word in explanation. A tool steel piece was bored and broached, a pilot provided for entering the work, and recessed to make three teeth for cutting, which were backed off at a 5-deg. angle. The die was hardened and the pilot teeth ground.

Manufacturing With Special Machines vs. Standard Equipment

I—Artillery Recuperators Made in Separate Plants Differing in Equipment—Heavy Forgings Machined to Close Limits—Special Machine Tools Built in Short Time

By COL. G. F. JENKS* and M. H. CHRISTOPHERSON†

THE 240-mm. howitzer carriage was the largest type of field howitzer manufactured for the American army during the World War. The howitzer fires a 356-lb. shell with an initial velocity of 1,700 ft. per second, the maximum range attained being about 17,000 yd. The howitzer itself weighs 10,800 lb. In firing, the howitzer is allowed to recoil a distance of 45 in. along the cradle, and during this recoil a restraining force of about 183,000 lb. is continuously exerted.

The mechanism which restrains the howitzer in recoil and returns it to battery has been commonly designated as the recuperator, although strictly speaking this is not accurate since the term expresses only one function of the part, that is, the recuperation or return into battery.

In order that movement of the howitzer during recoil and counter-recoil shall be entirely smooth and without shock, the recuperator, as we will now refer to it, must be very accurately made. All interior parts are highly finished and closely fitted. It will be appreciated that in order to control the great force just mentioned the mechanism must also be very powerful.

The subject of the following article is the machining of the large forgings out of which the bodies of the recuperators are formed. These forgings as they come from the forge shop are of a somewhat rectangular section and weigh about 17,000 lb. each. They are carbon steel, although some of the forgings first supplied were of chrome-nickel steel. As it is necessary that the interior of the recuperator shall be highly polished and without scratches or defects of any kind, the steel must be very homogeneous and easily machinable. It is prescribed that the physical properties shall be about 42,000 lb. elastic limit and 80,000 lb. tensile strength.

The large forgings weighing 17,000 lb. are reduced to a weight of about 5,000 lb. during the machine operations. It will thus be seen that a very great amount of metal must be removed and it will for this reason be especially interesting to note the processes used.

After preliminary negotiations a contract was finally given the Otis Elevator Co. on Dec. 22, 1917, for the manufacture of 814 of the recuperators, this order being increased to 1,039 in the following January. The informal order for the company to proceed with manufacture was given about the middle of November. An order was also given the Watertown Arsenal on Sept. 1, 1917, for the manufacture of 250 of the recuperators, which order was in July, 1918, increased to 532.

The methods of manufacture followed by the Otis Elevator Co. and by the Watertown Arsenal were radically different. As will be described later, the Otis Elevator Co. decided that the work was quite suitable for handling on single-purpose machines and this feature of manufacture at its plant should be carefully noted. The various operations were studied and for practically all of them special machines were designed and manufactured which would insure accuracy in work and the least loss of time in adjusting the different set-ups. The equipment designed for the operations met every expectation and the loss due to errors in machining was practically negligible.

As the number of recuperators ordered from the Watertown Arsenal was considerably less than ordered from the Otis company, it was felt the order could be satisfactorily performed by using standard machinery. It will be seen that the work was actually accomplished with machinery practically all of standard types, the Arsenal having expended about $700,000 in the procurement and installation of machine tools, jigs, gages, etc. At the Chicago plant of the Otis Elevator Co. about $2,000,000 was expended in the increased facilities provided for this manufacture. Not all of this was applied directly to the purchase of the single purpose machines and fixtures, but as most of it was so applied, a fairly good idea can be obtained as to the amount of preparation made at the two places.

The reader should note the general use of heavy-duty milling cutters at the Otis plant. It must be conceded that by this means metal was rapidly removed and at the same time the somewhat difficult contours formed with a minimum loss of time in making set-ups and machine adjustments. The Watertown Arsenal performed these operations very largely by the use of planers. While various comparisons might be made as to the relative merits of the planer or milling machine, the reader is left to draw his own conclusions but he should note that all the various factors must be considered in any effort to establish preference. The initial cost of milling cutters is, of course, very great and their use must depend somewhat upon the volume of work to be done. Once having constructed the cutters, the machining is rendered very simple and is probably faster than by planing. The tool equipment for the planer is, however, relatively inexpensive. The volume of work is the important consideration.

One is tempted to make comparisons of cost under the two systems of manufacture. Figures are presented on this feature of the manufacture but it cannot be said they are conclusive, as cost is a very indefinite thing, especially where we are including cost of initial equipment and overhead as well as the direct labor involved. In calculating the direct labor and machine costs, both plants were put as far as possible on the same basis so that the figures obtained would have a comparative value. Investigation of comparative costs at the two places indicates that the cost of labor and material was approximately 10 per cent less at the Watertown Arsenal but it is felt that while the comparison is interesting, it will be difficult to form a positive conclusion as to comparative merits of the respective systems of manufacture.

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*Chief of Artillery Division, Ordnance Bureau, U. S. A.

†General works manager, Otis Elevator Co.

In order to give the reader an idea of the somewhat intricate interior mechanism of the recuperator, in Fig. 1, he will find a longitudinal section showing the parts in their assembled positions. The view presented is a section through the recoil cylinder and the counter-recoil or recuperator cylinder. Actually, there are two recoil cylinders. The view does not show the two reservoir cylinders which are contained in the same forging.

In the fall of 1917, after a conference with General Crozier it was decided to equip the Otis company's vacant shops in Chicago with suitable tools for heavy artillery work and to relieve M. H. Christopherson of his duties as general works manager and assign him to the handling of this work in co-operation with E. A. Russell, the vice-president. Later in October Colonel L. T. Hillman (now deceased) and Major E. Tyden, after an inspection of the Chicago plant, decided that the heavy construction of the buildings and cranes were well suited for handling the 9.5-in. Howitzer recuperators, and on Nov. 10, 1917, the Otis company submitted its proposal for the large size recuperators. Several days later Colonel Hillman gave verbal instructions to proceed with the work. December 22, 1917, Purchase Order War Ord. CF-388 was issued for 814 recuperators with tools and accessories for 9.5-in. (240 mm.) Howitzer carriage, Model 1918 (Schneider), including an appropriation by the War Department to cover repairs and alterations to the plant, the purchase of machine tools and equipment, and for the cost of manufacture of the recuperators with the company's profit, on the "cost plus fixed profit basis." Early in 1918 the Procurement Division, Washington, D. C., decided to increase the order to 1,039 recuperators, and the order was issued on Oct. 1, 1918.

The preliminary planning for the work was commenced in October, 1917, and resulted in placing orders with the Otis Elevator Co., New York, for a lot of special machine tools for machining the recuperator sleighs. The order also included the necessary motors and starters which were supplied by the Yonkers works. This equipment is illustrated and described in connection with the machining operations in the second article.

Early in our study of the drawings and the machining of the sleigh, which was the principal part of the recuperator, we were forcibly impressed with the difficulties we would encounter in promptly securing suitable machine tools and we also had in mind the fact that each machine table should have a suitable holding fixture into which the sleigh could be readily placed and that would accurately locate it, so each succeeding machine operation would co-ordinate with the work previously done. The need for extremely accurate workmanship, the shortage of experienced mechanics, and the haste in which the finished recuperators were required led to design and make so-called single purpose machines with fixtures and tool-setting gages that would be better suited for each operation than would be possible to secure in standard machine tools.

Nine types of special machines were decided on and A. C. Smith, works engineer, with his staff in Yonkers, N. Y., was assigned to prepare the detailed drawings and to follow up the work in the company's shops. Altogether 134 heavy machine tools were made, and to expedite delivery the machines were so designed that the beds, tables and many minor parts for the various types were cast from the same patterns with a minimum amount of pattern changes.

The company's standard elevator worm gear drives were used as far as consistent with the requirements; this not only saved considerable time in producing the machines but also developed an astonishing degree of efficiency, particularly in the milling machines, where great reduction in speeds between the driving shaft and cutter arbors was required. The use of spur gears was unnecessary and the constant smooth motion of the worm gear drive, coupled with arbors and driving shafts of liberal dimensions, had pronounced beneficial effect on milling cutters. The vibrations or chatter caused by spur gears generally used on milling machines, with its disastrous effect on high-speed steel cutters was eliminated, resulting in greatly reducing the usual replacements and grinding of cutters.

Simultaneously with designing of the machine tools, the designing of holding fixtures, setting gages and milling cutters, also the various portable machine tools, was carried forward and it is to Louis J. Kirchenbauer that the greatest credit is due for his foresight throughout the entire job, in providing the ingenious devices that proved so successful in making it possible both to speed up the work while maintaining accuracy in workmanship and to greatly reduce the number of possible errors by the machine operators.

The ordnance works in Chicago was engaged 100 per cent on the recuperator contract and all general expenses

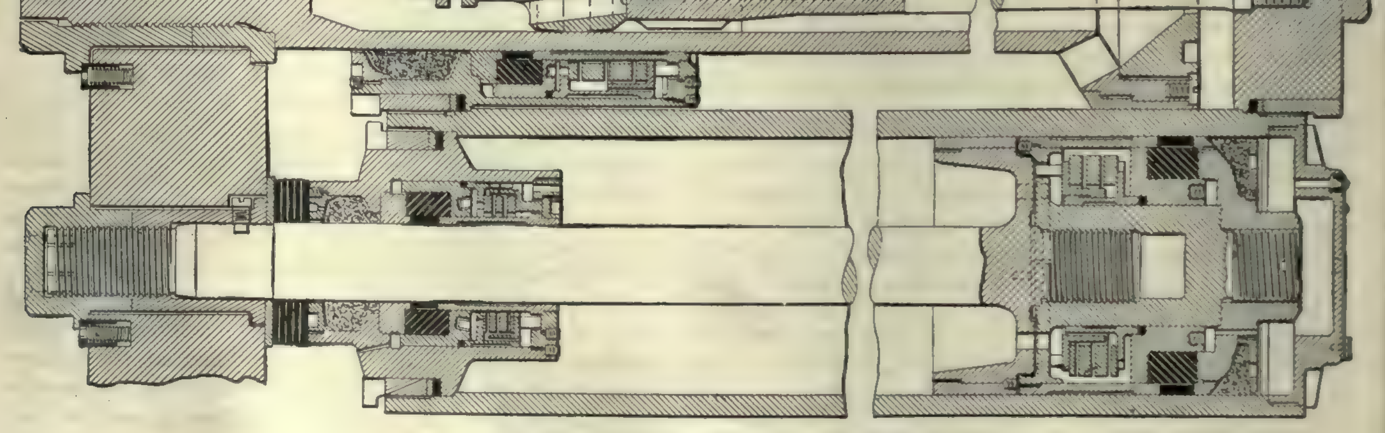

FIG. 1. LONGITUDINAL SECTION OF RECUPERATOR

and the entire payroll, together with the tools and necessary equipment, was paid for by the Government.

Machine work on the sleigh which forms the principal part of the recuperator, also the brake piston, the recuperator pistons and rods and the throttling rods; the final machining of piston liners, the fitting, assembly and testing of the recuperators was all done by the ordnance works as shown in illustrations distributed throughout the articles.

The shops used in Chicago were formerly part of the company's works that were vacated several years before and it was necessary to make building alterations and repairs before tools could be installed and operations begin. Consequently, the entire shop organization from superintendent to sweeper had to be recruited.

OBSERVERS SENT TO FRENCH ARSENALS

In June, 1918, the War Department concluded to send several men from the plants in this country, where the various sizes of French design recuperators were being made, to the arsenals in France to learn the methods used there in the manufacture of the same apparatus. F. H. Blanding was selected from the ordnance works to spend several weeks on this mission and considerable data was secured relating particularly to the relative importance of the various component parts, and on his return, the commanding officer, Watertown Arsenal, whose engineering division was responsible for the specifications for materials and accuracy in dimensions of the various parts, called a meeting to discuss workmanship tolerances of the sleigh and component recuperator parts.

The result of that meeting made it possible to proceed with the work to much better advantage, and credit is due Major P. J. Ryan and F. Brauer of the arsenal for the practical manner they adopted in promptly carrying out their own conclusions, based on evidence presented, and for the consideration which they gave to the various suggestions presented by the manufacturing heads at the arsenal and our ordnance works. Practically no advantage could be taken of the manufacturing methods used in France as presented by the committee sent to its arsenals or by the engineers and others who were sent here from the French arsenals as it was evident that in France no effort was made to produce in quantity or to maintain interchangeability of parts, which seemed to us so very important, as it had a direct bearing on the amount and accuracy of the work performed.

Shortly after the signing of the Armistice orders were issued to discontinue work on all recuperators in excess of 280, and War Order CF-388 was reduced from 1,039 to 280 recuperators with tools and accessories and the parts that were in process of manufacture. This number of sleighs and sets for small parts were completed, but three sleighs developed forging defects in the hydrostatic test and were rejected, consequently only 277 recuperators were assembled when work was discontinued.

The first seven sleigh forgings were received from the Carnegie company April 24, 1918, and work was started on machining the first sleigh on the same day. The final gymnasticator test on the last finished (277th) recuperator was made June 17, 1919. Machining of recuperator small parts was completed by the Otis Elevator Co.'s Yonkers works April 26, 1919.

Using Motion Pictures to Aid American Business in China

BY JULEAN ARNOLD
Commercial Attaché, American Legation, Peking, China

The new era in trade development work places the motion picture film in a very conspicuous position. Business interests have not yet realized the marvelous results which can come through the use of the motion picture film in advancing their trade. This is especially true when used in a country like China where, because of the language situation, it is difficult to get a message to these people on the printed or typewritten page or even by word of mouth.

When the Silk Association of America wished to impress upon Chinese growers and producers the fact that they could sell five and six times as much Chinese silk in the American market over what they had been selling in the past if they would produce the standard American skein, they sent their representative to China with a motion picture film setting forth the methods of preparation of silk in other countries where the standard American skein was produced, and the conditions in the manufacturing industry in the United States requiring this particular skein. When this film was displayed in the silk producing centers of China, thousands of silk men came to see the pictures and incidentally learned the requirements of the American market, with the result that within a few years 25 to 30 per cent of the silk manufactured was prepared in accordance with the requirements of the American industry. Had the silk association spent ten times the amount of money on having elaborately printed and illustrated pamphlets sent to every silk producer in China, or had they contented themselves with sending their representative to talk to the Chinese silk producers about the requirements of the American market they would not have made one-tenth the impression produced.

The American commercial attaché has been trying for five years to secure from American manufacturers, merchants and commercial organizations, industrial and educational motion picture films for use in Chinese Chambers of Commerce, Chinese educational institutions and among the Chinese business public, to advertise in the most effective manner American materials, methods and standards. The response to the request for such films has been most discouraging. Our business interests have not yet awakened to the wonderful results which can be achieved through the proper exploitation of the motion picture film in the development of foreign trade. They seem to be under the impression that because the American people generally are not interested in witnessing industrial and educational films, that peoples elsewhere are equally indifferent. Probably the trouble in America in connection with the display of industrial and educational films has been that the subjects were not selected especially for special groups of people. Undoubtedly our commercial organizations would be glad to replace the ordinary business noon-day functions with a display of well selected motion picture films, or at least to use these films in connection with their noon-day half-hour educational programs.

So far as the Chinese people are concerned, very little interest is taken in American photoplay films, principally due to the fact that the American social customs are entirely different from those of the Chinese. Incidentally we might mention that the American photoplay films displayed in China do America far more damage than good, for the reason that they convey to these people a distorted idea of American social life. Chinese who view these films undoubtedly carry away the impression that the shooting scrapes and other sensational features as shown on the screen are characteristic of American every-day social life. We can do a wonderful amount of good work in a big way for the furtherance of American trade and American interests generally abroad, through the intelligent use of well-selected industrial and educational films, entrusted to men qualified to handle their distribution.

The office of the American commercial attaché in

China should have a man attached to its organization who would devote his whole time to the distribution and display of American industrial and educational films in this country. He could advantageously use a thousand films, and the results which would accrue would be many fold greater than possible with an equal expenditure of money in any other way. The commercial attaché is receiving hundreds of expensively printed and illustrated American trade catalogs in English, and occasionally receives some printed in Spanish. He also receives from American manufacturers hundreds of letters written in great detail descriptive of their products, and imploring assistance in the securing of information useful in extending this trade. American manufacturers send men to China who are unable to meet with many Chinese for the reason that they cannot speak the language, so that they are unable to satisfactorily transact business. The motion picture film would be of great assistance to these men in carrying their message to the Chinese people.

Similarly, a big educational work in a trade way could be carried on in America through motion picture films descriptive of Chinese products, Chinese life and things Chinese generally. These would help the American manufacturer to understand the needs of the Chinese market, to appreciate the sources of supply which China has to offer in certain raw materials, and would be valuable factors in the development of his interests in this country. These films displayed at noon-day luncheon functions throughout the country would do far more than anything else to educate Americans to a better understanding of a country which possesses one-quarter of the world's population and promises to us the greatest market for our manufactured goods.

METHODS OF PROCEDURE

As to methods of procedure: (1) The Department of Commerce should be furnished with funds to defray the expenses of a well qualified man to be attached to its organization in China. He would devote his entire time to the distribution and display of American industrial and educational films throughout the country.

(2) Arrangements should be perfected which would make possible the securing for display in China of a thousand well-selected industrial and educational films which, after their arrival in China, should be prepared with captions in the Chinese language and arranged for systematic distribution throughout the country.

(3) The Department of Commerce should be given the funds necessary for the collection of forty to fifty thousand feet of film depicting conditions in China in a way to best portray to the American manufacturing and business men the opportunities in trade which this country offers and the best methods of meeting these opportunities. Some of this material could be purchased while others would have to be produced at first hand.

(4) Our American commercial organizations such as the Chambers of Commerce of our various cities, should appoint a man in each community to devote his full time to the securing of industrial and educational films which would serve to advance the interests of the manufacturers and business men of that section when displayed throughout the commercial centers of China.

It must be borne in mind that China is now at the inception of modern industrialism—at the parting of ways—and is ready to accept from the West all that the West has to teach by way of modern industrial, commercial and scientific development. The people have no machinery or ideas to scrap. They can begin where we are and carry on with the best and most advanced that we have, with no preconceived ideas of modern industrial commercial methods and materials. Twenty-five years hence they will have established their ideas, standards and methods in a modern industrial and commercial sense, and will not then be so receptive to new suggestions and ideas. Hence *now* is the psychological time to impress upon the Chinese mind the value of the standards and materials of the American manufacturing and commercial world. The motion picture film furnishes the best medium for this purpose and we will be stupid indeed if we fail to take advantage of the wonderful results which can be achieved through the use of the motion picture film in bringing America to China and in carrying China to the United States.

Making the Public Appreciate the Plant

BY FRANK H. WILLIAMS

Of course the relationship of a plant to its employees is highly important and is always emphasized when the industrial management of a plant is being considered. But the relationship of a plant to the community in which it is located is also extremely important, although this phase of plant management is very seldom talked about.

It is, perhaps, not too much to say that the united public opinion of the community in which a plant is located can almost "break" any average plant. So it becomes evident that it is well worth while for the plant to cultivate the good will of the citizens by every means in its power. One of the main reasons why a plant sometimes gets in bad in a community is its air of aloofness. When a plant very evidently wears a label, saying, "We are sufficient unto ourselves; we want no intercourse with the townspeople. We don't want to associate with them, and we don't want them coming around pestering us to let them go through our factory," then it is pretty certain that the townspeople will take pleasure in nagging the plant whenever possible and in continually doing their utmost to thwart all the plant's aspirations and efforts.

It is a mistake, as a general thing, for a plant to be superior to the community. The plant may be the mainstay of the community, and it may feel that without its presence the town will go to pot, still the plant must not be too "up stage" if it wants to prosper in the way that it should prosper. Folks, as a rule, like to feel that the factories in their community are as much interested in the growth of the town, in its various organizations and in its welfare as are the more humble citizens who have no connection with the plant. Folks generally feel proud of the factories in their towns, and the more they know about these plants the prouder they will be and the better the standing of the plant in the community will be.

It pays, for instance, to stage something for the general public or for various organizations of the public every now and then. If the town is too big to do something for all the folks in the town, then it is perfectly possible to do something for some leading organization of the city and through this organization to get a message about the plant into the local newspapers which will be calculated to increase the pride of the townspeople in the institution.

NEWS SECTION

Proposed Tariff Rates for Machine Tools, High-Speed Steel and Automobiles

Machine tools and parts of machine tools are made dutiable at 35 per cent ad valorem in the tariff bill which was reported favorably to the House of Representatives by the Committee on Ways and Means on June 30. This is 20 per cent higher than the existing rate of duty and 5 per cent higher than that provided in the Payne-Aldrich act of 1909. The bill as reported to the House contains the proviso that machine tools shall be held to mean any machine operated by other than hand power, which employes a tool for working on metal.

Steel Ingots Higher

High-speed steel is included in paragraph 304 of the bill which provides duties based on the value. This duty ranges from two-tenths of one cent per pound when the ingot and the steel in other forms is valued at not over one cent per pound, to six cents per pound when the ingot is valued above 32 and not above 40 cents per pound. If the ingot is valued above 40 cents per pound the duty is to be 20 per cent ad valorem. In addition to that duty the present bill provides that a duty of 15 per cent ad valorem be levied when the amount of tungsten or other alloy exceeds six-tenths of one per cent. Under the existing law the duty is 15 per cent ad valorem. The Payne-Aldrich rates are not exactly comparable because the range of values in that law began on ingots valued at three-fourths of a cent per pound, on which seven-fortieths of a cent per pound was assessed as duty. The rates are comparable, however, on ingots valued above 24 cents and not over 32 cents. Steel coming within those values was dutiable at 6 cents per pound under the Payne-Aldrich act but the present bill provides only 5 cents per pound. Steel valued above 32 and not over 40 cents per pound was dutiable at 7 cents per pound in the Payne-Aldrich act but is put in at 6 cents per pound in the present bill. The Payne-Aldrich act also provided a 20 per cent ad valorem duty on steel valued above 40 cents per pound.

Autos Lower

In the present bill automobiles and parts are made dutiable at 25 per cent ad valorem. This is a reduction from both the existing act and the Payne-Aldrich law. The Payne-Aldrich rate of duty was 45 per cent. The Underwood duty also was 45 per cent on automobiles valued at $2,000 or more but provided a tariff of 30 per cent on automobiles valued at less than $2,000. Value is not considered in the present bill but a proviso is inserted that an additional duty may be added to equal the duty imposed by any country on similar articles imported from the United States, but in no case is the duty to exceed 50 per cent ad valorem.

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Penn R.R. Reopens Logansport Shops

Announcement of the recall of 250 shop men of the Logansport division shops of the Pennsylvania was made at Logansport, Ind., recently by officials. It is expected further recalls will follow. The 250 men who will return to work will include machinists, machinists' helpers, boilermakers, blacksmiths and their assistants together with employees of the repair department.

Annual Convention of the American Drop Forge Association

The combined eighth annual convention of the American Drop Forge Association held jointly with the Drop Forge Supply Association, was held in Chicago June 22, 23, 24, 1921. Shortly before the convention, plans for holding the meetings were changed so that they were held at the new Hotel Drake instead of at the Congress Hotel, for which they were originally scheduled. The officers of the Drop Forge Association are: president, Ferdinand Barnickol, Indianapolis Drop Forging Co.; vice-president, J. P. Hopkins, Atlas Drop Forge Co., Lansing, Mich.; secretary, E. B. Horne, Detroit. The local committee in charge of arrangements was under the chairmanship of Samuel M. Havens, of the Ingalls-Sheppard Forging Co., Chicago, Ill.

By prior arrangement the business and program sessions were largely held in the morning in order that attendance at them might not grow too irksome; and the afternoons were devoted to plant visitation trips. Among the papers presented were "Twenty-Five Years of Forging Experience," by C. E. Adams, Cleveland Hardware Co.; "Some Experience in Industrial Co-operation," by Arthur H. Young, International Harvester Co.; "Board Versus Steam Hammers," by R. T. Herdegen, Dominion Forge and Stamping Co.; "The Necessity of Proper Cost Accounting," by J. B. Sehl, Billings & Spencer Co.; and "Previous Changes in Price Levels and Probably Results of This One," by Col. Ayres, Cleveland Trust Co.

At the Friday session another group of papers was presented including "Manufacture of Steel," by John Bruner, Illinois Steel Co., "Electric Furnaces, Heat-Treatment of Dies and Forgings," by E. F. Collins, General Electric Co., and "Furnace Conditions for the Proper Heat-Treatment of Die Blocks," by Dr. Trood, Tate-Jones & Co., Inc.

Owing to business conditions the Drop Forge Supply Association did not have as large an exhibit of supplies as they have shown in some previous meetings. However, there was a full attendance of this association's members and they brought an abundance of enthusiasm to help push things along and aid in getting business restarted in this industry. The officers of the supply association are: President, H. N. Taylor, N. & G. Taylor Co., Philadelphia; vice-president, C. D. Harmon, Jr., National Machinery Co., Tiffin, Ohio; secretary-treasurer, A. L. Wurster, N. & G. Taylor Co., Philadelphia. The location of the next meeting will be announced later.

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Machine Casting of Pig Iron Is Successful

Birmingham pig iron has earned reputation for itself in the new form in which it has been turned out by the Alabama company since the installation of the Heyl and Patterson machine casting process at its Gadsden furnaces.

By the casting machine process the pigs are turned out in uniform size of about 35 to 40 pounds in weight and are absolutely free from sand and dirt. Many consumers of Birmingham iron had not heretofore used machine cast iron in merchant foundries and some were prejudiced against its use because not accustomed to it.

The company sent out more than a hundred letters to its customers requesting their opinion of the machine cast metal after testing it and the replics all praised the quality of the metal.

U. S. Chamber of Commerce Urges Standardization of Machine Tool Sizes

The following statement from the Washington office of the U. S. Chamber of Commerce has been received at the headquarters of the National Machine Tool Builders Association, Cincinnati, Ohio.

"Every live, progressive business man no doubt has had anxious moments since price declines put business out of alignment, and he has had to study to know 'What to do,' and 'How to do it' to improve the situation.

"Have you thought that possibly your line is made in too many styles, sizes and varieties which destroy the operation of that profit-making fundamental, *small variety* and *large volume?*

"The Conservation Division of the War Industries Board during the war, with the voluntary co-operation of many lines of industry did a splendid job of cutting out unnecessary varities. One large manufacturer, whose inventory is 30 per cent less because of adherence to the Elimination Schedule for our line, and we are giving our trade better service.

"Here are a few savings and advantages: Release 'frozen' capital; hasten 'turnover'; simplify and aid distribution; make lower prices possible; reduce depreciation and obsolescence; make for efficient sales forces; a uniform and better product; reduce overhead; reduce storage and handling; better service to, and by, the dealers.

"This work can best be done through Trade Associations representing specific lines, but will make better progress through co-operation and information interchanged."

This letter has been sent broadcast throughout the country to the various technical and trade associations and to builders of machine tools and machinery. It is expected that many associations will consider the suggestions offered by the chamber in the letter.

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C. E. Davies New Editor of "Mechanical Engineering"

The American Society of Mechanical Engineers announces the appointment, as managing editor, of C. E. Davies to succeed the late L. G. French, who was both editor and manager of the Society's publication. The June Issue of *Mechanical Engineering* contains a symposium of eulogies on the work of Mr. French, including resolutions of appreciation adopted by the council of the society and by the boiler committee.

Mr. Davies was graduated from the Rensselaer Polytechnic Institute with a degree of M. E. and for several years afterwards specialized in industrial management work. He became associated with the Smith Premier Works of the Remington Typewriter Co., Syracuse, N. Y., in 1914, and with the exception of fifteen months during the war was engaged in production work with that company until March, 1920.

During the war Mr. Davies was in the Ordnance Department at the Frankford Arsenal, serving as assistant production superintendent on the Artillery Ammunition Division and later as superintendent of the fuse shop. He left the service with the rank of captain.

Mr. Davies joined the editorial staff of the society in March, 1920, as associate editor of *Mechanical Engineering* and assistant secretary in charge of meetings and publicity.

Business Conditions as the Big Banks of the Country See Them

The National City Bank's Observations on Economic Conditions, Price Trend and Transportation

The general trend of business and industry during the month of June has been quiet and repressed. Some further hopeful signs have appeared, side by side with others which give less encouragement.

The plain truth of the thing is that the recovery of business, for which everybody has been hoping and waiting since the depression began late last year, has not yet materialized. No one's interests will be furthered by an ostrich-like attitude which buries its head in undue optimism, and makes glowing predictions for the immediate future, predicated wholly on a magnifying of the favorable symptoms. It is easy enough, and pleasant enough, to lull anxiety by such a process of reasoning, but what is wanted now is a general realization of the obstacles that must be met and overcome, more than a light-hearted prevalence of optimism founded only on half truths.

Undue Pessimism Harmful

On the other hand, an attitude of unwarranted pessimism can be just as harmful, if not even more so. We know that our banking system is intrinsically sound, and that it has already proven its capability to withstand the shock of a period of extraordinary strain, and to emerge unscathed from the most difficult test imposed in many years. We know that our ability, as a nation, to produce the raw materials which our people need, and which the world must buy from us, has been in no wise dwarfed. We know, finally, that our industrial and business organization is geared for production not only ample for our own needs, but on sufficiently large proportions to make export on a considerable scale a necessity.

These are fundamental facts, so plain that they cannot be misinterpreted. It is hard to understand how, knowing the foundation upon which our business life rests to be as rigidly secure as it is, there can be any doubt as to the final recovery. It is progressing no more laggardly now than in 1903 and 1904, when we were passing through a somewhat similar period, or in 1907 and 1908.

Recovery is certain to be slow. Where the artificially stimulated optimist makes his mistake is that, seizing upon a few favorable but quite natural events, he seeks to make them the basis of predictions that the final turn in the road has come, and that next week, or next month, the difficulties into which business and industry have fallen will have lightly drifted away.

Adjustment Question Paramount

It is primarily a question of adjustment between the various component parts in our economic structure. As has been pointed out in these pages before, a great portion of the population—particularly that portion concerned with the production of agricultural commodities—has had its purchasing power bisected by the drop in commodity prices. Finished products have shown no such decline. The result has been that that portion of the population which has had its purchasing power reduced by two is buying only half as much of those products which have not declined materially in price. Industrial stagnation and unemployment has been the inevitable consequence.

Although the process of bringing the price of farm products and manufactured articles into equilibrium must be slow and even painful, the fact does not mean that everyone can sit down, fold their hands, and wait for some mysterious set of economic forces to make things normal again. The result will come most quickly through the combined efforts of everyone, and the sooner every man and woman in this country who either receives wages or pays wages realizes and operates on the basis that the unbalanced state of industry as regards compensations received by important bodies of people must be overcome, the sooner will the real, sound revival of business begin in earnest. It is important to think about the proposition, but it is utterly essential to act upon it.

An examination of any of the particular industries which, because of their basic relationship to the whole industrial structure are considered "key" industries, only shows all the more how this condition of unbalance is backing up its effects all along the line. The iron and steel industry, for example, is operating on a basis variously estimated at from 20 to 30 per cent of normal capacity—the lowest stage the industry as a whole has reached in any year during the present century. Production throughout the year would indicate a total of 13.5 million tons of finished rolled steel products for 1921, as contrasted with some 24.8 million for 1913, and 32.3 million for 1920.

There seems little reason for doubting the assertion that production is not only far below normal consumption, but is likewise considerably below current consumption. Stocks that have been accumulated are being eaten into, and there is doubtlessly a heavy demand that is being deferred until, in the current phrase, "business picks up again." A part of the deferred demand will have to exhibit itself positively in the near future regardless of the general condition of business; purchase on a scale comparable with the present low ratio of consumption cannot be indefinitely sustained.

Reduction in prices that have been accomplished thus far have evidently not stimulated the aggregate present demand. It is contended that the stagnation is not the result of price levels obtaining in the industry, but of business conditions generally.

Price Trends

That prices have a psychological aspect, as well as physical, was never better illustrated than at the present moment. The high peak reached during the war, followed by the very drastic reductions in many commodities, has stimulated a state of mind which, expectant of still further reductions all along the line, occasions that degree of purchase described as "hand-to-mouth." Everybody defers as long as possible the purchase of everything possible. The result is felt in every line of business.

While it is clear that the prices of many products have now reached rock bottom, the situation we are at present experiencing only serves to emphasize more vigorously the necessity for establishing equilibrium, on a stable price basis, between finished products on one hand and raw products on the other.

The Bureau of Statistics of the Department of Labor, in its report for May, shows that commodity prices during that month declined 1.9 per cent, leaving the index number 44½ per cent below the bureau's peak price in May a year ago, but still 51 per cent above the 1913 average. Foodstuffs, with a decline of 53½ per cent from the peak showed the greatest drop, and fuel and lighting materials, with a downward movement of 17½ per cent, showed the firmest resistance to decline.

Freight Rates and Business

The abrupt declines that the prices of farm and other products have suffered have brought freight rates under sharp criticism. Senator Capper of Kansas recently stated that "these rates almost absorb the farmer's grain, also a large proportion of his livestock; they have absorbed the decrease in the price of lumber; they have helped in many ways to demoralize the business of the country and to prevent its recuperation."

Freely granting that the position of the agriculturist has been an unhappy one in the past few months, it seems to us that freight rates are not guilty, as charged. The causes of commercial depression are worldwide and are not to be found in domestic transportation charges. When business was good last Fall the largest tonnage in the history of the country was offered the railroads, despite the advanced rates which became effective August 26th. Today ocean tonnage rates are at the lowest levels in a great many years, but ocean traffic is suffering perhaps even greater stagnation than rail traffic. There are many commodities that would not move even if the roads offered to carry them free for the simple reason that no market exists for them. •

Bank of America Sees Big Future for U. S. in Indian Markets

If American exporters are willing to fight for the new market in India which they developed during the war they have a good chance of keeping it. This is the opinion of R. Stuyvesant Pierrepont, director of the Bank of America, who has just returned from a several months' tour of India in the course of which he made an investigation for the foreign department of the bank.

Conditions for imports from the United States will grow increasingly favorable during the coming years, as exchange differences clear away. As compared with pre-war trade between United States and India, last year's proportion of India's trade was more than doubled, Mr. Pierrepont found.

Japan is the strongest immediate competitor for this new business, declares the foreign department of the Bank of America, reporting on Mr. Pierrepont's findings. In 1913-1914, 6.2 per cent of India's total trade (export and import) was with United States. In 1919-1920, this proportion was increased to 13.8 per cent. In the pre-war year, 6.4 per cent of India's trade was with Japan, while in 1919-1920, this percentage had increased to 12.3. The United Kingdom's share of India's trade in the same years decreased from 40.7 to 37.7 and that of the whole British Empire from 52 to 51 per cent.

Last year, however, the Japanese lost out in the race, owing to the business collapse in that country. The value of all trade between India and Japan increased only 5 per cent from 1918-1919 to 1919-1920, while Japan's share decreased from 14.9 per cent to 12.3 per cent. The United States, on the other hand, increased its exports to India by 56 per cent in that year and its imports from India by 48 per cent, its share increasing from 11.7 to 13.8 per cent.

Many Indian business men feel that American competition with England for India's trade would be very beneficial, says Mr. Pierrepont, in explaining the significance of these figures. They feel that a growing proportion of trade with countries other than the British Empire would force an acceleration of India's development. American manufacturers hold many potential advantages over other non-British competitors, the main ones being the absence of language barriers, the appreciation of America's part in the war, and the favorable attitude towards the value and serviceability of American products.

Iron and steel, mineral oil, automobiles and cycles and machinery and mill-work were the principal products which made up the 428 per cent increase in value of American exports from the pre-war year to last year. Other products in which India's imports from the United States were markedly increased were electrical instruments, railroad equipment, rubber products (chiefly tires), hardware and condensed milk. It is in these fields that American manufacturers can improve their position, declares the Bank of America, if they fight hard and intelligently for the trade. Any attempt in the fields of glass and glassware, silk products and matches, will be met by very powerful and almost secure competition from Japan.

Demand for foreign iron and steel will increase, in spite of the fact that India is developing its own iron and steel industry, Mr. Pierrepont predicts. Such Indian industries as the great Tata steel mills are showing powerful and able enterprise, yet the need for iron and steel will grow beyond their capacity because the use of steel always multiplies the demand for it.

American automobiles are in a particularly favorable position. The nature of the roads, as Mr. Pierrepont observed them, allows American cars to prove their superiority and the Indian buyers appreciate the fact.

While present business conditions are depressed in India, as in all other countries, her large exports which are usually in excess of imports should promptly restore her purchasing power.

Industrial Advertising Conference Proposed

While industrial advertisers were conspicuous by their absence at the recent Atlanta convention of the Associated Advertising Clubs, those who did attend made the trip worth while by launching a well-defined movement to put industrial advertising "on the map" in future conventions.

The Engineering Advertisers' Association of Chicago and the Technical Publicity Association of New York form the nucleus of the movement which all industrial advertising interests will be invited to join. Keith J. Evans, president of the E. A. A. and W. A. Wolfe, president of the T. P. A. are planning to call special meetings in the near future to take official action on the ideas developed in Atlanta.

It was the unanimous opinion of those present at the meeting, which was held immediately after the departmental session of the Associated Business Papers, that more attention should be given to industrial advertising and that definite plans should be made to put on an attractive program in Milwaukee in 1922. It was pointed out that many advertising managers of industrial plants are kept away from the conventions because the programs do not contain sufficient features of direct interest to their business to justify the expense. Many of these men are located in small towns and cities where there are few, of any, others with similar problems. Hence they do not have the advantage of meeting fellow-workers in local advertising clubs. Even where such clubs exist, the majority of the members are interested only in retail advertising and other problems pertaining to the individual consumer.

Intercourse Needed

In many cases, very large manufacturers of industrial products have only a small sales force due to the fact that their product is sold in large units to a highly specialized type of buyers. The advertising manager has a lonesome job indeed. He needs the inspiration and information that may be obtained from an advertising convention far more than the man who is constantly exchanging ideas with a large sales organization.

The importance of promoting the movement of goods from industry to industry and the wide field for industrial advertising were discussed at length in the last *Industrial Letter.* Advertising agencies are showing a keen interest in industrial business and will doubtless give their full support to the conference idea.

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Foreign Air Services Well Patronized

Partly no doubt as a result of the railway restrictions, partly because of the reduced fares now charged and partly by reason of the favorable weather conditions that have recently prevailed, the London-continental air services during the month were well patronized, to the great gratification of all connected with them. Under the conditions imposed by the limitations of the sum available for distribution as government subsidy, the British firms engaged on the service, Handley Page and the Instone Air Line, are restricted to running one machine three times a week. As a consequence of this restriction as many as forty applicants for seats have recently had to be turned away in one week. It is presumed that the majority of these prospective passengers found accommodations in one or other of the foreign-owned machines engaged on the route, which machines are not in any way hampered by their subsidy conditions as to the number of trips per week.

The terminal aerodrome near Croydon from and at which the continental machines start and arrive and the aerodrome at Le Bourget on the other side are situated at a good distance from London and Paris respectively. The journeys to and from aerodromes form part of the aerial service and are made by motor car. From the point of view of saving time there can be no doubt that the terminal services are at present responsible for the chief delay and that the full benefit of aerial travel in the matter of speed will not be realized until the conveyance by motor at the start and end of the journey is eliminated. In this connection the tests, continued during the month, with the Vickers Viking amphibian machine have clearly shown that the Seine and the Thames can be readily utilized for alighting purposes and that passengers can be picked up and deposited actually in the centers of the cities.

The Uses of Stainless Steel

In the popular mind, stainless steel is almost exclusively associated with the manufacture of table knives, and in spite of the extra cost of such implements and a common impression that they do not retain their cutting edge so long as do knives of the ordinary pattern, there seems little doubt that so far as table knife makers have provided the largest and most consistent outlet for the material. For some time past, we understand, a Sheffield (England) firm has been using stainless steel for the manufacture of forks and spoons, and, if report is to be trusted, it would appear that a considerable extension is likely soon to be made in this additional employment of the substance for domestic purposes.

During the war, as is well known, stainless steel was placed under control in order that all the available output might de directed toward the aeroplane industry, wherein it was in particular demand, or was particularly specified, for the manufacture of aero-engine valves. To what extent and for what purposes is the material now being used? In order to elucidate the matter, we recently addressed inquiries to a large number of engineering and other firms, and from the replies received we have compiled the following analysis.

In passing, it may perhaps be noted that stainless steel is distinguished by its high chromium content, and was originally discovered two or three years before the war at the works of Thomas Firth and Sons, Limited, of Sheffield, England. The firm was seeking by a series of experiments with various alloy steels to discover one that would resist the erosive action of the gases in the chambers of gun tubes. The experiments did not result, in the firm's opinion, in any material success being registered in the direction in view, but, as has frequently happened before, discovery was made along other lines than those directly planned. One of the alloys experimented with was found to have a remarkable resistance to rusting and staining, and was ultimately placed on the market under the now universally known name of "Stainless Steel." A typical analysis of the material is as follows:

	Per Cent
Carbon	0.25-0.35
Silicon	0.1 -0.5
Manganese	0.2 -0.4
Chromium	12-14

The replies received to our inquiries indicate that many firms which would have thought likely to find stainless steel useful in some portions of their products are not using it at present, nor have its immediate use in contemplation. The remaining replies divide themselves into two classes, namely, those from firms which have tried stainless steel, but which have not adopted it for various reasons, and those firms which are today successfully using it. With the latter class may be included the replies received from certain firms which, having experimented with the material, having found it generally suitable for their purpose, and which are about to adopt or are seriously considering adopting it as standard. From both these categories much of value is, we think, to be learned.

Stainless steel has been put to many uses. Among the products in which the steel has been tried, though not always satisfactory, are the following: Pipes, springs, motor cars, locomotives, pump shafts, pistons and piston rings, gas engines, bicycles, airplanes, surgical instruments and optical appliances.

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Increased Activity in Manufacturing

It is announced that the Steel Company of Canada, Hamilton, Ont., Canada, will begin to operate its plant eight hours a day for four days a week after a long shut down.

Some departments of the Canadian Westinghouse plant at Hamilton, Ont., Canada, are being increased from four to five days per week.

The Hercules Powder Co., Wilmington, Del., has purchased the Aetna Explosive Co., Inc., of New York, by which it acquires a number of additional plants. These will include a plant for the manufacture of regular blasting caps and of electrical blasting caps, at Port Ewen, N. Y.

The Baxter D. Whitney & Son Co., Inc., Winchendon, Mass., builder of woodworking machinery, which has been operating three days a week for some time has increased the schedule to four days a week. The company is employing about 200 hands at present.

Improved Finances of Detroit Auto Builders

The affairs of the McCord Manufacturing Co., which has its main plant in Dtroit, it was learned are gradually on the mend, also that the cash balance of the company is now well over half a million dollars, and that it has successfully disposed of a large amount of automobile radiators into which it had put copper costing twenty-four cents a pound.

The latter achievement is typical of some of the things which the Creditors' Committee has accomplished since it took over the management of the business early in February. At that time cash balances aggregated less than $100,000 and current assets were less than current liabilities.

The banker from whom this information was obtained pointed out how saving the McCord company from bankruptcy had also saved about thirty smaller concerns dependent on it for business. Eight or ten similar cases had come to his attention. He noted instances in his bank within ten days where whole lines of credit had been retired with one payment, one of $300,000 being a particular one. Some of the larger companies, Hupp, Hudson and Federal Truck, he stated, had reduced their current bank indebtedness to nominal amounts.

There is a growing feeling that things have begun to mend and that the motor industry as a whole has definitely passed its crisis. George H. Kirschner, president of the First State Bank, whose institution handles much of the retail business of the city, notes a similarly recuperative trend among the storekeepers.

Detroit, with its great manufacturing industries is a good barometer for reading the slow but sure improvement of business.

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Jugoslavia Buys Locomotives from Germany

Recent information is to the effect that the Ministry of Communication of Jugoslavia has made a contract with a German firm for the purchase of five new locomotive engines of standard-gage type. The price to be paid is unknown, but it is believed to be very low, particularly owing to the favorable exchange rate. This is the first contract made by Jugoslavia with a German firm for the purchase of railway material.

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Bureau of Information at Washington

The following notice has been issued from Washington over the official signature of Postmaster General Will H. Hays.

"It is the wish of the President that visitors to the seat of Government shall have every opportunity to get full information concerning all governmental departments. It is especially his desire that all those who come to Washington to transact business with any department or bureau of the Government may quickly be advised as to the exact location and means of reaching the particular department or bureau in which may be centered the business which they desire to transact.

"For this purpose there has been established a Bureau of Information on the ground floor of the Post Office Department Building, located on Pennsylvania Avenue at Twelfth Street, which is in charge of competent people who will definitely answer queries of this character.

"The public is advised of this arrangement and invited to make use of the facility."

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Steel Company Opposes Metric System

Representative Henry W. Temple, of Pennsylvania, has laid before the House a petition of the Elliot-Blair Steel Co., New Castle, Pa., protesting against the Britten compulsory metric system bill. The petition has been sent to the House Committee on coinage, weights and measures, which also has the Britten bill.

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Endorses Metric Bill

An unqualified endorsement of the metric system bill introduced at the last session by Senator Frelinghuysen has been voted by the board of directors of the Associated General Contractors.

Washington Notes

By Paul Wooton

Washington Correspondent

Erroneous conclusions are likely to be drawn by the general public as to the meaning of the experiments which have been conducted by the Navy off Hampton Roads. The capital ship is not in the balance. Airplanes did nothing that they have not done many times before. The experiments were of importance in testing material, but they were of far greater significance in that they afforded an opportunity for the technical men in the Navy and in the Army to observe the experiments and to take account of the progress being made in the development of the art of destruction. It was the consensus of opinion among them that the World War has so increased the possibilities of visiting upon non-combatants, as well as combatants, all of the old terrors and many new ones, that the very frightfulness of it is likely to be the most potent factor in promoting efforts to limit the possibility of war.

The airplane, chemical warfare and other new auxiliaries are contributing importantly in making war more terrible, but it was pointed out many times by observers at the Hampton Roads tests that these agencies have not been fundamentally revolutionary in character.

The tests off Virginia capes contribute nothing to the controversy as to whether or not capital ships had best be superceded by a larger number of smaller craft. The experts seem very generally of the opinion that the capital ship is as necessary as ever. The fact that airplanes demonstrated incontrovetibly that they can successfully bomb a target no larger than a submarine strengthens the view that the development of aviation will make necessary some changes in general naval practice, but serves to increase the usefulness of battleships. With the increased efficiency of bombs and with the development of the use of gas in such bombs a greater independence for the fleet is foreseen. Within the next few years the offensive ability of the airplane will have reached a point, it is believed, where it can be relied upon largely for defense of the sea within 200 miles of the coast. No fleet would be able to carry enough airplanes to protect itself from the swarms of such craft which could fly out to meet it once that it neared the shore of a hostile country. Under past conditions our fleet would be handicapped in case of war by the necessity of dividing up to protect a long coast line. The fleet would be precluded from getting together and proceeding to sea to meet the oncoming enemy fleet for fear that the enemy might avoid a conflict at sea, slip around and raid the coast. With the coast able to take care of itself with its airplane and land defenses, the effectiveness of the fleet is multiplied. The day probably never will come when the large-caliber gun will not be a great asset, so that the battleship is likely to become larger and larger.

Sinking of the "U-117"

The progress being made in aviation was brought out with particular vividness at the test on Tuesday. The rusty "U-117" had been anchored 70 miles east of the Cape Charles light. The naval bombers flew from their base at Yorktown more than a hundred miles from their target. Precisely at the time announced the three big bombers soared up out of the horizon and made straight for the tiny, tossing target. Each of the three planes dropped a bomb as it passed over the submarine. This first attempt showed that great accuracy is possible as each of the three great jets of water which followed the explosions of the bombs, was so close as to drench the whalelike back of the former German terror. The big planes turned quickly into a circle and rushed back over the target which lay bobbing 1,200 ft. below. This time each plane dropped its remaining three bombs—nine in all. The spectacle which followed never will be forgotten by observers aboard the "Henderson." The bombs looking like plummets because of the distance, dropped swiftly and gracefully. Then came a mighty upheaval on the placid bosom of the ocean. A great pile of water was lifted skyward. It looked like some giant architectural pile. It was not dissimilar in form from the Woolworth Building. The base was shot through with the fire from the two bombs which made direct hits and were detonated by actual contact with the submarine. From these same bombs came black smoke which was streaked through the glistening white of the countless tons of water which had been hurled hundreds of feet upward as spray. When the great tower of water sank slowly into the ocean again the observers were surprised that a vestige of the submarine was left, but as the water quieted down it was seen that the stern was rising. It rose slowly and then as if its machinery had dropped to the bow, the stern reared high and quivering, shot beneath the surface to its last resting place in an American sea.

The "Pennsylvania"

A striking feature of the trip, to those who do not follow naval matters closely, was the improvements which have been made in recent years in the equipment of battleships. After the tests ample time was given to inspect the "Pennsylvania" and several other of the more recent additions to the Atlantic fleet. Anchored far from shore with no prospect of a rush of visitors, a chance was given the higher officers to take all the time that was necessary for careful explanations of the mechanism and the practice aboard these ships. They took advantage of the opportunity to explain the full significance of the developments in construction and equipment. The public can in no way visualize what remarkable machines battleships have become, nor does it realize that no month passes without some improvements having been devised. Not infrequently several improvements are devised within the span of a single month. The great development of recent years is the adoption of oil as fuel. This greatly increases the space available for purposes other than bunkering fuel. Most of the time formerly lost in the cumbersome task of coaling now is saved and the additional space is used to great advantage. Another revolutionary change is the resort to electricity for propulsion, and practically every other duty which power is called upon to perform. These ponderous floating forts are steered as well as driven by electricity. A touch of the finger on the controller is all that is necessary to throw the rudder all the way over. Four wheels, providing places for ten men, are required to move the rudder ten points over by hand when the ship is in motion. A greater deflection of the rudder can not be attained without the use of mechanical power. Cooking is done by electricity and that agency is employed to a surprising extent in a large number of activities.

Fire Control

Perhaps the greatest improvements in recent years are in range finding and fire control. Inter-communication on ship board is an exact science. The main telephone switchboard is larger than in many towns. In addition there are signals of several sorts and speaking tubes. The peculiar thing about these tubes, which are sticking around everywhere is that you really can hear through them. The radio has eliminated the greatest obstacle of naval navigation—isolation from bases of information.

The coming of the submarine has brought great improvement to searchlights and to lookout facilities while the introduction of the airplane has added the anti-aircraft guns to the upper decks. The increased range of guns and the airplane bomber now make necessary the adoption of a protective deck of heavy armor to guard against shots of high trajectory and the bombs that may be hurled down. Even now thought is being given to an adaptation of the gas mask to be placed over ventilators so that poison gases may be filtered out if the ship should be hit by a gas shell or a gas bomb.

Another development is the water-tight integrity of the ship. It would take four torpedoes doing the average damage of a direct hit to sink the "Pennsylvania."

Saving Fuel in the Industries

The industrial Section of the Super Power Survey has completed the collection of data on the power consumed by the various industries within the Super Power Zone and has made an estimate on the amount of fuel that could be saved by the application of the Super Power System to those industries.

The labor of gathering the large amount of information necessary has been great, but will be more than paid for if the power users will profit by what they can learn from the resultant data.

The data will eventually be published by the Census Bureau, but as the date of publication will be in the somewhat distant future, the *American Machinist* has arranged with Harold Goodwin, Jr., Assistant Engineer, Super Power Survey, for an early release of such part of the data as relates to iron manufacture.

Conditions in the French Iron and Steel Industry

The French pig-iron production during 1920 is reported by the Comité des Forges de France to have been 3,433,791 metric tons, 3,374,135 metric tons of which were produced in blast furnaces and 59,656 metric tons in electric furnaces.

The above figures show an increase of 42.3 per cent over the production for 1919, which amounted to 2,412,149 metric tons.

The situation in blast furnaces was progressively improved during the first part of the year, owing to more normal conditions of the railroads. The Spa protocol of July 16, 1920, placing on Germany the obligation of delivering 2,000,000 tons of coal per month to the Entente has increased the amount of coal available for the French metallurgical industry.

The monthly production of pig iron shows an almost steady increase during the year, with the exception of the months of March and April. It reached a climax in October and remained practically unchanged during the last quarter of the year.

In the works of Meurthe-et-Moselle the number of furnaces blown in was augmented from 21 to 33, and the increased coke supplies gave new activity to the works of Lorraine and permitted the blowing in of furnaces which had to be blown out during 1919.

On the other hand, furnaces in the center and south of France which had been active throughout the war, and were blown out owing to the unfavorable conditions in 1919, have remained inactive. There were 93 blast furnaces in operation on January 1, 1921, as compared with 82 on July 1, 1920, and 69 on January 1, 1920.

Hematite and special pig-iron production is practically the same. Production of phosphorous pig iron shows an increase from 1,905,000 metric tons to 2,931,000 metric tons. This is due to the increased production in two basins producing that kind of pig iron, the Basin of the East Lorraine.

Cast iron production represents 23.6 per cent of the total production of hematite and phosphorous pig iron in 1920; Thomas pig iron, 63 per cent; refined pig iron, 8.9 per cent; Bessemer pig iron, 1.8 per cent; and ordinary pig iron, 2.7 per cent.

In 1919 Thomas pig iron production reached 58 per cent of the total production, while refined pig iron and cast iron came in for 12.5 per cent and 21.5 per cent, respectively.

The total production of steel in France during 1920 is given as 3,050,396 metric tons, 2,951,636 metric tons of which were ingots, and 98,760 metric tons of which were castings, according to the Comité des Forges de France, Paris.

The production for the past year is 67.2 per cent of the pre-war production and represents an increase of 39 per cent over the 1919 production, which amounted to 2,186,260 metric tons. The increase bears mostly on castings, the production of which shows an increase of 66 per cent over 1919, during which year 59,525 metric tons of castings were produced. Works which were not affected by the invasion of northern France turned out 80 per cent of the 1913 production.. Those of recovered Lorraine only produced 49 per cent of the pre-war amount.

During the first part of the year the situation was not considered very satisfactory on account of lack of adequate transportation. However, during May and June traffic on the railroads was practically normal. The difficulty in securing adequate coal supplies also impaired the production.

The prices quoted for coal were constantly increasing. Coal from the north of France which was being paid for at the mine at the rate of 110 francs per ton in January, 1920, increased to 195 francs in May, whereas the same quality of German coal increased from 150 francs to 225 francs; American coal from 320 francs to 440 francs; English coal from 280 francs to 450 francs. Under such conditions long-term deliveries could only be contracted for, and orders accepted at the prevailing prices at the time of completion.

During the latter part of the year the situation improved. There were 1,846,000 metric tons of steel produced during that period, as compared with 1,204,000 metric tons during the first six months of the year. As a result of the Spa Protocol, deliveries of German coal were increased and old orders could be executed. However, at that time the first effects of the world-wide economic crisis were beginning to be felt, as a result of the high prices quoted for raw material and coal, the difficulty of obtaining banking credits, higher freight rates on the railroads, and the decrease in funds available for the reconstruction of devastated regions.

Julius Klein, Latin-American Authority, to Head Foreign Trade Bureau

Engineering and foreign trade go hand in hand in the opinion of Julius Klein, who recently was confirmed by the Senate to be director of the Bureau of Foreign and Domestic Commerce of the Department of Commerce. Exploitation of natural resources, the extension of railroads, the building up of highway systems, the establishment of new enterprises and the expansion of manufacturing industries are a few of the engineering activities which Mr. Klein cites as having a close relationship with the building up of trade abroad.

While Mr. Klein is known better as a Latin-American specialist, he has also traveled widely in Europe for the express purpose of studying trade conditions there.

While it is going to be generations before Latin-America undertakes manufacturing in a highly intensified way, Mr. Klein points out that there is a steady tendency to develop native industries which in the aggregate calls for a large amount of machinery and supplies. It is well within the range of possibility for American contractors and American manufacturers to secure a large portion of the business resulting from this development, Mr. Klein believes. In order to make this possible it is not only necessary to get American engineers on the ground and to stimulate this activity with American money, but it also is necessary to acquaint Latin-American engineers with American methods and American products. He knows of no better plan than in inducing graduate engineers to come to the United States for post graduate work. In many instances, he believes, it would pay private companies interested in a business way in Latin-America to arrange at their own expense such post graduate courses for these young men. after a year in our technical schools, interspersed with visits to our factories and industrial establishments, these engineers will return to their own countries imbued with American practice and familiar with American machinery and materials. As the judgment of one of these engineers is likely to be followed to an increasing extent as he grows in his profession, the United States and its industries will benefit by this special knowledge which was made possible during his post graduate experience in the United States.

The development of the petroleum industry in Latin-America is largely an engineering activity and will result, Mr. Klein points out, in an increasing demand for American made oil well supplies. Another great opportunity offered American industries is the certainty of great increases in the railroad mileage in South America. Some of the lines under contemplation will be of the greatest commercial importance to the United States. For instance the completion of the railroad from Salta in Argentina to Antofogasta in Chile—a line 400 miles long across the Andes from northern Argentina to northern Chile—brings New York and other east coast ports of the United States the equivalent of many days nearer Buenos Aires. A plumb line dropped from New York falls exactly along the west coast of South America. The advantages of reaching Argentine markets by this route is not alone one of distance as navigating conditions are very much more advantageous on the west coast of South America.

Another great South American project to which American engineering skill well might be applied and which will result in numerous trade advantages is the development of hydro-electric power in the Cordivan Hills of Argentina. This constitutes one of the most promising power prospects in the world, Mr. Klein believes. Argentina must look to these same hills for its supplies of stone for road building purposes. The stone of that locality is particularly adapted to use in road construction and is one of the few places in the southern republic where such a supply can be obtained. Highway building throughout South America has been delayed very greatly but the point has been reached where very great development in that respect must come.

Irrigation and reclamation are other engineering fields in which great activity may be expected throughout Latin America in the future. In each case there will be demand for American brains and American equipment.

In all of these enterprises Mr. Klein emphasizes the necessity for American engineers, manufacturers and merchants to keep in mind that Latin-American countries are governed by young men. Not only do young men have the deciding voice in public works but they are the active administrative officials in private enterprise. It is for that reason that he thinks we well may cultivate in every proper manner the favor of the Latin-American student.

Mr. Klein was born in San Jose, California. His early education was obtained in the public schools of that city. Later he attended the University of California for six years where he specialized in economics. During that time he also investigated the possibilities of manufacturing development on the Pacific Coast for the Carnegie Institution.

In 1909 he went to Harvard, where he concentrated his attention on the study of economic affairs in Latin-America and its industrial history.

From 1912 to 1914 Mr. Klein was in Europe studying the trade situation in various countries. Later he traveled extensively in South America. These trips were the basis for a number of courses of lectures delivered at Harvard.

During the war, Mr. Klein was called to Washington to take charge of the Latin-American Division of the Bureau of Foreign and Domestic Commerce. At that time it was particularly necessary to have in that position a man thoroughly familiar with the raw material situation in South America with the attendant problems of ship allocation and the prevention of unnecessarily troublesome curtailment of shipments on which Latin-America was dependent upon the United States.

In 1919 and 1920 Mr. Klein was the commercial attaché of the United States at Beunos Aires. During that time he spent considerable time in Chile, Paraguay and Uruguay.

Since his return from Buenos Aires he has spent most of his time speaking before chambers of commerce and other civic and trade organizations on the possibilities of extending our trade to Latin-America.

◆

Standardization to Eliminate Waste

The subject of standardization of manufactured products as a means of promoting efficiency and eliminating waste was proposed by the American delegation as a question for discussion at the first annual meeting of the International Chamber of Commerce in London this month. Standardization is strongly urged.

The American Committee says, "In the lack of standards and excessive variety in production of commodities is found to be the prime cause of stagnant stocks of commodities and congestion in distribution.

"The efforts of the United States government with the co-operation of industry in reducing this variety during the war gave evidence of the practicability of such an undertaking and the benefits to industry. Standardization in the United States as referred to in the report is at present confined to private initiative except as the work of engineering societies and the Bureau of Standards of the federal government maintained by the United States.

"Efforts are now being made to co-ordinate this work, at least to bring about the adoption of agreed upon standards. The standardization of fabricated products through elimination of excess variety, is still being considered by certain industries, aided by their commercial organizations. It is also being considered by the Fabricated Production Department of the Chamber of Commerce of the United States. There is much opportunity in the proper treatment of this subject to promote greater efficiency in production and to eliminate duplication and waste."

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Air Service in Reval With Ten Machines

Consul Charles H. Albrecht, of Reval, Esthonia, reports that a company has been formed in that country for the purpose of organizing airplane service from Reval. The basic capital of the company is 10,000,000 Esthonian marks (at present the rate of exchange equal to about $33,333). Among its founders are Martin Luther, head of a large woodworking factory, and Otto Strandman, president of the National Assembly.

The company plans to have service organized by summer, with 10 airplanes on the following routes: Reval-Helsingfors, Reval-Stockholm, Reval-Narva-Petrograd, Reval - Dorpat - Walk - Riga. Negotiations are said to have been started by the company for connecting its proposed routes with those of other European air services.

Business Items

The Brown Instrument Co., of Philadelphia, Pa., manufacturer of instruments for indicating and recording temperatures, pressures, speeds, operations and drafts, has opened a branch office in Cleveland, 201 Reliance Bank Building, 1634 Euclid Ave., to render the customers in the Cleveland district service in every way possible. This makes a total of eleven district offices. located in New York, Pittsburgh, Detroit, Cleveland. Chicago, St. Louis, Denver, Los Angeles, San Francisco, and Montreal.

The North Shore Machine Co., of Lynn, Mass., has recently been organized and incorporated with a capital stock of $12,000 to engage in the general machinist business. The officers are L. A. Porter, Lynn, president; Eugene R. Dennert, Cedar Heights, Lynn, treasurer. These men, together with G. A. Porter, form the board of directors.

The Industrial Lock-Nut Co., of Worcester, Mass., has recently been organized and incorporated with a capital stock of $250,000 to engage in the manufacture of lock-nuts, etc. N. R. Thibert, of Worcester, is president; George P. Newton, Worcester, treasurer; and Mr. Thibert and Mr. Newton, with E. P. Cotton, of Worcester, are the directors.

The Stafford Company, of Readville, a suburb of Boston, Mass., manufacturer of weaving and textile machinery, etc., has recently been incorporated with a capital stock of $1,500,000. The directorate consists of president, Clifford H. Walker; treasurer, Joseph R. Watkins and Allison G. Catheron.

The Bridgeport Motor Truck Corporation, of Bridgeport, Conn., has recently been incorporated under the laws of the State of Delaware, with a capital stock of $1,200,000, to take over the stock and plant in Stratford, Conn., a suburb of Bridgeport. of the Bridgeport Motor Truck Co., which some time ago went into the hands of a receiver. The concern manufactures the "Bridgeport" motor truck. The new company plans to increase production at an early date.

The Baker-Payne-Voye Co., of Boston, Mass., has just been incorporated under the laws of Massachusetts, to deal in steel and iron products, etc. The capital stock is $50,000. The board of directors is made up of the president, Vernon J. Voye, of Milton, Mass.; treasurer, Frederick W. Baker, Milton, Mass., and H. J. Payne, of Revere, Mass.

The T. L. Harkins Machine Co., 44-54 Farnsworth St., Boston, Mass., manufacturing and contracting machinists and manufacturers of special machinery and tools, is completing the construction of a fireproof factory building in Allston, a part of Boston. The structure is a two-story 50 x 100 ft. building.

The Cook-Taylor Co., Inc., Fall River, Mass., has just been organized and incorporated with a capital stock of $50,000 to engage in the manufacture of textile machinery, gages, etc. The directors are Albert Cook, president; Edward F. Cook, treasurer, and Ralph E. Taylor.

Lunt - Moss Corporation. of 45 South Market St., Boston, with a factory in Wakefield, Mass., has been incorporated recently under the laws of Massachusetts, with a capital stock of $50,000. The company will manufacture tools, machinery, etc. James W. Moss, Boston, is president and together with Bejamin F. Levy and L. H. White, of Boston, forms the board of directors.

The American Valve and Tank Co., of Delaware, will erect a plant in Indianapolis, Ind., and production is hoped for within three months.

A. H. Petersen Manufacturing Co., Milwaukee, Wis., has discontinued its tool and die manufacturing and will turn over its entire plant to the manufacture of the "Hole Shooter" portable electric drills and other automotive devices.

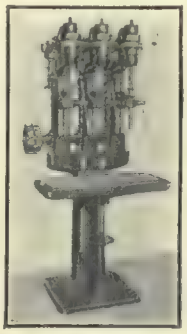
John Wilson, head of the National Steel Construction Co., has established in the corporation's Duwamish Waterway plant the first range boiler factory west of the Rocky Mountains and is now giving steady employment to an increasing force of men. Heretofore Seattle and other Pacific Coast centers have had to draw on the East and Middle West for range boilers. The new factory has a capacity of 80 range boilers a day. They are built especially for the

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Drilling Machine, Sensitive, No. 1B

Edlund Machinery Co., Inc., Cortland, N. Y.
"American Machinist," March 31, 1921



The machine is furnished in combinations of from one to four spindles. Power is transmitted from the drive pulley through two bevel gears and a vertical shaft to the rear three-step cone pulley, from which it is carried by belt to the cone on the spindle. The gears are pack-hardened and are lubricated by the splash system. The machine is equipped throughout with ball bearings. Face of column to center of spindle, 7 in. Maximum distance, spindle nose to table, 30 in. Largest drill machine will drive effectively, ½ in. Weight, 430 to 1,115 lb., according to number of spindles.

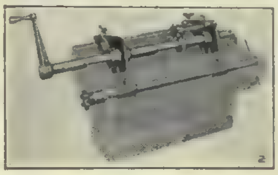
Lathe, Axle, Double, Heavy-Duty, Putnam

Manning, Maxwell & Moore, Inc., 119 West 40th St., New York, N. Y.
"American Machinist," March 31, 1921

The machine is built with two tailstocks and a central driving head, the driving head being driven by means of a broad-faced herringbone gear and pinion running in an oil bath. Both tailstocks are adjustable along the bed by means of racks and pinions. Four speeds are obtainable through a gear box and these speeds may be supplemented by the use of a variable-speed motor. A 1-ton quick-acting crane can be supplied with the machine. The machine weighs, with crane, 18,900 lb. Weight boxed for export, 22,950 lb., made up in three boxes totalling approximately 375 cu.ft..

Babbitting and Boring Outfit, (Re-), Gas-Engine Bearing

Detroit Garage Equipment Co., 268 Jefferson Ave., Detroit, Mich.
"American Machinist," March 31, 1921



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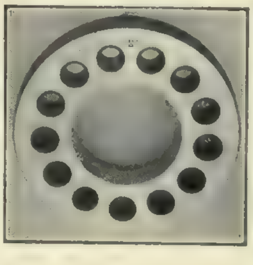
The outfit consists of equipment for rebabbitting and reboring the main crank-shaft bearings of automobile motors and gas engines, there being a different outfit for each style of motor. The rebabbitting bar shown in Fig. 1 is supported and aligned in the motor block by frames that are located by pins from the holes in the crankcase flange. Babbit-retaining collars are held against the ends of the bearings by compression springs. A two-quart combination blowtorch and melting pot is included. The reboring bar is located by means of a line bar placed through the camshaft holes, as shown in Fig. 2. A feed screw is provided, being operated by a pin in the boring bar turning the star wheel.

Gage, Ring, Master

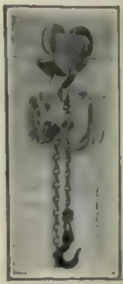
John Bath & Co., 8 Grafton St., Worcester, Mass.
"American Machinist," March 31, 1921



The gage is made narrow so that surface depressions in the piece being gaged can be more readily detected. Its outside diameter is unusually large to provide for rigidity, and its surface is perforated with a series of concentric holes to lessen the weight, and also to provide for air circulation so that it will more quickly return to room temperature after it has been heated or cooled.

Chain Block, Spur Geared, "G. B."

André, Weill & Co., 149 Broadway, New York, N. Y.
"American Machinist," March 31, 1921



The device is made entirely of drop-forged steel and the chains are electrically welded. The load sheave is accurately machined to fit the chain links and each block is fitted with two chain guides so hinged that the hoisting chain can be pulled from any angle without interference. The blocks are made in fourteen sizes with lifting capacity of from ¼ to 20 metric tons (2,205 lb.), and weighing from 62 to 1,036 lb. The pull on the hand chain required to lift the rated load varies from 61 to 127 lb.

Furnace Forging, High Speed, with Preheating Oven

Bellevue Industrial Furnace Co., Detroit, Mich.
"American Machinist," March 31, 1921

The furnace is especially intended for use in forging such work as high-speed-steel drills and reamers, and is provided with a preheating chamber in which the work can be slowly brought up to a heat before inserting it into the high-temperature chamber. The preheating oven is heated by the gases from the high-temperature chamber. Either oil or gas can be used for fuel. The furnace is built in three sizes, to suit various jobs.

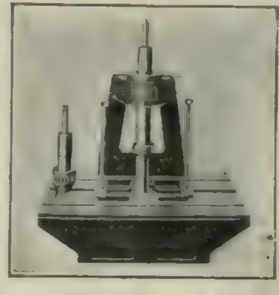
Gage, Micrometer, Plug, Internal

John Bath & Co., 8 Grafton St., Worcester, Mass.
"American Machinist," March 31, 1921

The gage is provided with four jaws fitted to inclined dovetail grooves in the body, and movement of the jaws is controlled by a micrometer screw. The inclination of the grooves is such that the amount of lateral movement of the jaws in relation to changes in diameter of the gage is 5 to 1. The divisions on the body of the plug each represent a change in diameter of 0.010 in., while the graduations on the collar each represent a like change of 0.0001 in. In measuring the diameter of a hole it is only necessary to collapse the jaws of the gage sufficiently to enter it, and to then expand them until contact is secured, when the size can be read from the graduated collar.

Boring Outfit, Ford Cylinder

Detroit Garage Equipment Co., Detroit, Mich.
"American Machinist," March 31, 1921



The complete outfit is intended for use on and has all necessary tools for reboring and burnishing the cylinders of Fordson and Ford model "T" motors. The jig is intended for use beneath any upright drill of adequate capacity. It consists of a heavy iron casting carrying a boring bar. The cylinder is located from the crankshaft flange and is clamped down by T-bolts. The boring bar and burnishing tool are both provided with floating shanks. The burnishing tool is shown standing on the left end of the jig. In operating this tool, the power feed is not necessary as the rollers feed the tool automatically.

Clip, paste on 3 x 5-in. cards and file as desired

high pressure of the city water systems of the Coast.

The John Hill Foundry Supply Co. and the Hill & Griffith Co., Cincinnati, Ohio, were consolidated July 1, under the firm name of the Hill & Griffith Co. John Hill, one of the founders of the Hill & Griffith Co. and one of its officers for many years will be president and general manager and William Oberhelman will be vice-president and manager of the southern district with headquarters at Birmingham, Ala.

The Chapman Valve Manufacturing Co., Indian Orchard, Mass., is to insure its employes against death, sickness or accident while at work. Life policies will range from $500 to $1,000, depending on the length of employment, while $12.50 a week will be paid in case of sickness or accident.

The capitalization of James Cunningham Son & Co., Rochester, N. Y., has been increased from $1,200,000 to $3,200,000. The company is engaged in the manufacture of automobiles. The increased capitalization is intended to take care of extension in the concern's business. The certificate was signed by Augustine J. Cunningham, president and Francis E. Cunningham, secretary. The capital will be divided into $1,200,000 in common stock and $2,000,000 in preferred stock.

The directors of Chicago Pneumatic Tool Co., New York, N. Y., have declared a quarterly dividend of 1 per cent, payable July 25, to stock of record July 15. Quarterly distributions of 2 per cent have been made on this issue for some time. After the meeting the following statement was issued: "Although business has been greatly restricted by introduction of rigid economies the company has been able to operate after liberal charges for taxes and depreciation at a small profit for the first five months of this year."

Machinery valued at $100,000 was sold at auction recently by Samuel G. Freeman & Co., of Philadelphia, at the plant of the Worthington Pump and Machinery Co., Hazelton, Pa., whose equipment is being dismantled. The works turned out munitions during the war, but have been idle since the armistice.

The American Color Process Press Co., Morrison, Del., has been incorporated with $100,000 capital, by L. Irving Handy, Julian C. Walker and M. K. Spicher, to manufacture printing presses and parts.

The Universal Machine Co., Bowling Green, Ohio, has increased its capital stock from $1,250,000 to $1,500,000.

The Pacific Can Machine Co., Los Angeles, Cal., has been incorporated with $150,000 capital, by Samuel B. Irvin, I. B. Stetson and J. E. McComas to manufacture can-making machinery.

The Stamp Electric Hoist Co., San Francisco, Cal., has been incorporated with $75,000 capital, by William T. Burney, C. S. Somers and Horace W. Lash, Monadnock building, to manufacture electrically-operated hoisting machinery, etc.

The American-La France Fire Engine Co., Elmira, N. Y., is booked five months ahead to full capacity, according to Paul Appenzellar, vice-president of the company. The company has not been affected by the general business depression, he said, shipments for the period between Jan. 1 and May 21 totaling $2,011,000, compared with $1,968,000 for the corresponding period last year.

The export office of the Foster Machine Co., the Kempsmith Manufacturing Co., and the Giddings & Lewis Machine Tool Co., which has been located at the Grand Central Palace, New York, under the supervision of L. S. Devos, was closed on June 30. This action was brought about by the decline in export market for machinery.

The Fowler Co., Worcester, Mass., has recently been incorporated to engage in the manufacture of hardware specialties, etc. The directors are T. C. Garbutt, Brookline, who is president and treasurer; and Charles B. Rugg and Henry L. Green, of Worcester, Mass.

The Peerless Manufacturing Co., of Providence, R. I., has recently been incorporated under the laws of Rhode Island, to engage in the manufacture of tools, etc. The capital stock is $300,000, and the incorporators are: Theodore Beauregard, of Providence; Leon S. Courcy, of Attleboro, Mass., and John B. Pineault, of Attleboro, Mass.

Edward Patt and Gustave Stasewick, owners of the Sheboygan (Wis.) Welding and Cutting Co., have formed the **Fond du Lac Welding and Cutting Co.** and will establish a similar business here. A building at McWilliams and Marquette Sts., has been leased. The partners will divide the management of the two shops.

Personals

James E. McKenny, who recently retired as production manager for the Republic Rubber Corp., Youngstown, O., has accepted a similar position with the Standard Spring Co., Cleveland, O. Before going to Youngstown last year he was with the National Works, Worcester, Mass., of the Wickwire Spencer Steel Corp.

W. A. Taylor, formerly Western manager for the LaBelle Iron Works, Steubenville, O., has been appointed manager of the Western offices opened by the Wheeling Steel Products Company, Wheeling, W. Va., in the Rialto Building, San Francisco.

William Weischel has been appointed manager of the Dover and New Philadelphia plants of the American Sheet and Tinplate Co. to succeed W. L. Goodhue who was district manager there for years. Mr. Goodhue recently was transferred to Farrell, Pa., where he is manager of the Mercer works, and the position of district manager has been eliminated. Mr. Weischel was associated with Mr. Goodhue at Dover for several years.

S. H. Truitt, Land Title Buliding, Philadelphia, Pa., has been made manager of the Philadelphia district sales office opened by the Bayonne Bolt and Nut Co., Bayonne, N. J. Mr. Truitt formerly was district sales manager at Philadelphia for the LaBelle Iron Works, Steubenville, O.

E. W. Burbank, district manager for the Allis-Chalmers Manufacturing Company, is now permanently located at Dallas, Texas. He was formerly in New Orleans, La.

C. G. Tolley has recently accepted a position as engineer with John T. Rowland, Jr., architect, of Jersey City, N. J. He was formerly with Arthur D. Little Co., Cambridge, Mass.

Chester C. Jackman, until recently factory manager for the Victor Saw Works, Springfield, Mass., is now vice-president and treasurer of the Dolman Manufacturing Co., Inc., Springfield, Mass.

Winfred H. Van Gorder has severed his connections as factory manager for the Automatic Ticket Selling and Cash Register Co., Inc., New York City and for the present is located in Vestal, N. Y.

F. R. Ginorio for eleven years connected with the sugar industry, working with the Cuban-American Sugar Co., has opened offices as consulting engineer, specializing in all branches of sugar-house work. He is located in Havana, Cuba.

Nixon W. Elmer has opened an office in Quincy, Mass., as consulting engineer in conveying and mechanical handling. He was formerly engineer for the Harry M. Hope Engineering Co., Boston, Mass.

William H. Okun, formerly with the construction department of the New York Central Railroad Co. and more recently production engineer of the Aws Manufacturing Co., manufacturer of brass products, of Brooklyn, N. Y., is now vice-president and works engineer of the Superior Wood and Heel Co. of Brooklyn, N. Y.

William Chambers, known affectionately in the foundry trade as "Uncle Billy," has resigned from the Garden City Sand Co., Chicago, Ill., with which he was affiliated for 25 years.

Ambrose Swasey, president of the Warner & Swasey Co., Cleveland, Ohio, has been elected to honorary membership in the American Society of Civil Engineers.

Dwight T. Farnham, formerly consulting industrial engineer of St. Louis, Mo., is now vice-president of C. E. Knoeppel & Co., Inc., of New York.

Francis M. Waters, for the past two years advertising manager of the Hendee Manufacturing Co., Inc., of Springfield, Mass., has resigned his position with that company to enter business for himself.

H. O. Peterson has recently joined the general sales department of the Gilbert & Barker Manufacturing Co., of West Springfield, Mass., and will leave soon on a sales mission in foreign fields.

Frank W. Gallagher, for the past six years field service engineer in the Chicago office of the Gilbert & Barker Manufacturing Co., of West Springfield, Mass., is now permanently located at the home plant in West Springfield. Mr. Gallagher has been with the company for the past forty-one years.

Trade Catalogs

South Bend Lathes. South Bend Lathe Works, 400 East Madison St., South Bend, Ind. A 48-page catalog describing and illustrating a complete line of lathes as manufactured by this company.

Snyder Upright Drills. J. E. Snyder & Son, Worcester, Mass.. A fifty-one page catalog describing and illustrating and also giving the dimensions of a complete line of drilling machines as manufactured by this company.

Winches and Hoists. The Silent Hoist Co., 302-4 McDougal St., Brooklyn, N. Y., A six-page illustrated and descriptive bulletin of a complete line of power winches for mounting on motor trucks and a self-contained gasoline engine driven capstan winch for car pulling and hoisting.

Tool Service. Mehl Machine Tool and Die Co., Roselle, N. J. A twenty-three page catalog describing and illustrating jigs, dies, fixtures, gages, patterns and special machinery, as manufactured by this company.

Approved Applications. The Electric Hoist Manufactures Association, 165 Broadway, N. Y. C. A catalog describing and illustrating hoists as manufactured by this company.

Q-Alloys. General Alloys Co., 1222 So. Michigan Ave., Chicago, Ill. A sixteen-page catalog describing and illustrating heat resisting metals, known as "Q-Alloys," and their uses for retorts, carbonizing boxes cyanide lead pots, pyrometer tubes, etc.

Hauck Burners. Hauck Manufacturing Co., Philadelphia, Pa., Bulletin No. 112, describing a line of burners for foundries, boiler, machine and repair shops.

Bath Easy-Cut Taps. John Bath & Co., Inc., Worcester, Mass. Bulletin No. 15, describing a precision tap which removes metal easily and is said to produce a perfect threaded hole. Included also is a circular which gives sizes established by the National Screw Thread Commission on Taps.

Hjorth Bench Lathe. Hjorth Lathe and Tool Co., Boston, Mass. Catalog No. 12, describing a late model of Hjorth lathe, with several patented attachments.

Stellite Tools. Haynes Stellite Co., 30 East 42nd St., New York City. Vol. 10 of the Stellite Reference Library, taking up the description of stellite welded-tip tools.

"Little Giant" Air Hoists. Chicago Pneumatic Tool Co., 6 East 42 St., New York City. Bulletin No. 640, covering various types of air hoists, motors and wrenches, all equipped with "Little Giant" gearing.

Centilathes. Cincinnati Lathe and Tool Co., Oakley, Cincinnati, Ohio. Catalog describing a line of Cincinnati lathes.

Obituary

Aubrey G. Robb, for over 20 years superintendent and chief engineer of the Robb Engineering Works, Amherst, Canada, died from blood poisoning on June 20, following an illness of four days. The deceased was in his fifty-first year. He was recognized as one of the ablest mechanical engineers in eastern Canada.

Charles E. Geiger, 64 years old, president of the Louisville Drying Machine Co., died at his residence, Louisville, Ky., on June 18. Dropsy was the immediate cause of death, though he had been ill for six months.

Forthcoming Meetings

The third annual convention and exhibition of the American Society for Steel Treating will be held in the Manufacturers Building, State Fair Grounds, Indianapolis, Ind., during the week of September 19 to 24 inclusive.

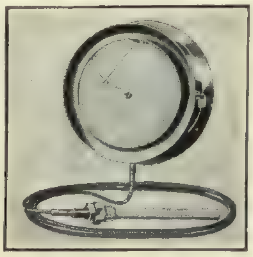
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Thermometer, Recording

Brown Instrument Company, Wayne Junction, Pa.

"American Machinist," March 31, 1921

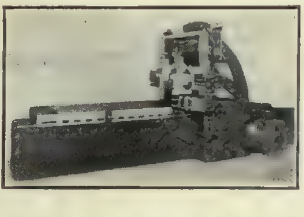


The machine incorporates a number of features not contained in the older types of Brown instruments, and is said to be especially adapted for measuring temperatures of quenching baths, oil-tempering baths, and core ovens. Among other features, the thermometer is provided with means for adjusting the pen arm for "set" and "tension," and the helix is also adjustable for calibrating. The pen is inverted so that the ink cannot run down on the arm, and lifts automatically when the door is opened, resting on the paper again when the door is closed.

Planer, 32 x 32-In. x 10-Ft.

Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass.

"American Machinist," April 7, 1921

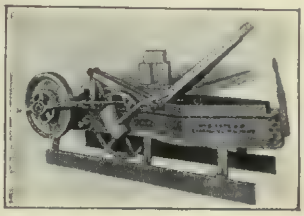


Though a second belt is used, there is an additional reduction obtained by gearing. The cushioning effect of the second belt is said to reduce the shock of reversal. The bed is of the box type, closed at the top and open at the bottom, except for a short space at the center. The table is of box section. The Whitcomb patent lever binder is used to lock the cross-rail, and self-locking table dogs are provided. The machine will plane work 32 in. wide, 32 in. high and 10 ft. long. It can be furnished with belt or motor drive. Driving pulleys accommodate a 3-in. belt. The weight of the machine is 17,500 lb., and the bed occupies a floor space of about 7 x 16 ft. A 15-hp. motor is required to drive it.

Press, Scrap-Baling

Reeves-Boggs Machinery Co., 2926 Grand Ave., Chicago, Ill.

"American Machinist," April 7, 1921

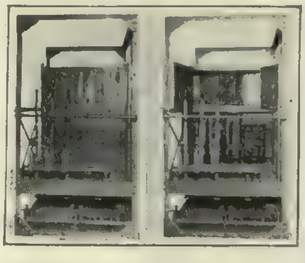


This baling press or cabbaging machine is made in four sizes. The two smaller sizes make bales 5 x 5 x 10 and 5 x 5 x 12 in. in size, respectively, and are intended for baling skeleton punchings of sheet brass, copper, aluminum or other soft metals. The two larger presses make bales of 12 x 12 x 12 and 14 x 14 x 16 in., respectively, and will handle sheet-metal scrap of 14 gage and lighter. The machine is belt driven. The baling pressure is exerted by two side wings that are closed in by wedge-like slides carried by the ram, which is at the same time advancing and exerting pressure on the end of the bale. Five horsepower is required. The net weight for the two smaller sizes is 3,500 lb. and for the larger sizes, 4,000 and 6,000 lb., respectively.

Cab, Crane, Safety

Pawling & Harnischfeger Co., Milwaukee, Wis.

"American Machinist," April 7, 1921

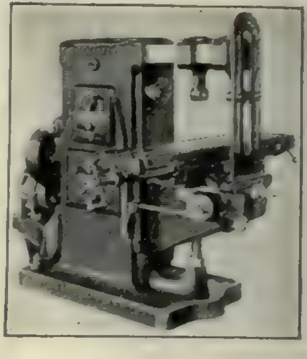


In this crane cab the entire controller equipment and current-carrying parts are enclosed, as shown on the left of the illustration, the arrangement being intended to provide a maximum of safety for the operator. The main switch, which is of the safety type, is operated by a lever extending through the switchboard cabinet. The control levers are placed at the front of the cage and allow the operator an unobstructed view of the floor and the movements of the crank hook. All parts are accessible, the opening of the rear doors exposing the live parts for inspection and adjustment, as shown at the right. Access to the wiring, which is at the rear, can be had by removing a panel.

Milling Machine, "High Power," No. 3

Rockford Milling Machine Co., Rockford, Ill.

"American Machinist," April 7, 1921

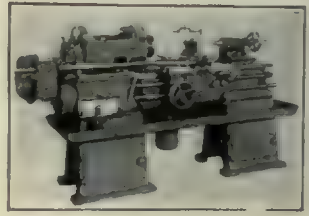


This machine is a redesign of the former No. 3 milling machine, being intended for heavy-duty and having a single-pulley all-geared drive. The overarm is rectangular in sections and can be moved in and out by means of a crank. The feed motion is transmitted to the saddle and table mechanism without the use of telescopic shafts and universal joints. Sliding gears are employed in the feed-change mechanism. A control box on the right-hand side of the machine permits the feed and quick-return motion to be started in either direction by the movement of a single lever. Much of the mechanism is enclosed in the column. A 10-hp. motor can be mounted on the rear of the base. Net weight 7,270 lb.

Lathe, Toolroom, Cone Head, 14-In.

Reed-Prentice Co., Worcester, Mass.

"American Machinist," April 7, 1921

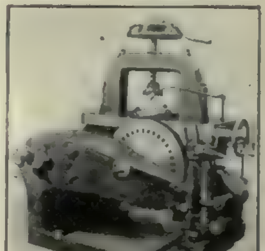


The lathe differs from the company's standard lathe of its type and size only in having a head fitted with a four-step cone, instead of having the regular geared head for constant-speed drive. The largest diameter of the cone is 8⅜ in. and the smallest 4½ in. The steps take a 2½-in. belt. The front bearing is 2 13/16 x 4⅞ in., and there is a 1¼-in. hole through the spindle. The weight of the machine with 6-ft. bed and compound rest is 2,850 lb. All accessories are supplied.

Saw, Cold, Metal, "Lea-Simplex," No. 26

Earle Gear and Machine Co., Stenton and Wyoming Ave., Philadelphia, Pa.

"American Machinist," April 7, 1921

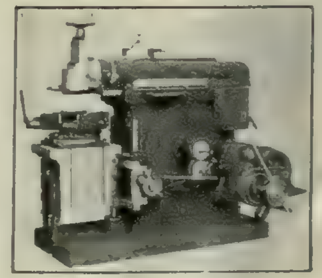


The machine is provided with both a power and a hand traverse, a feed trip and a power return. By means of a quick-change device, the feed can be varied from ½ to 1½ in. per minute and the changes can be made while the saw is cutting. All operating levers can be reached from one point and one attendant can operate several machines. The machine may be driven by either belt or motor. Saw, 26 in. in diameter. Work table: width, 22 in.; length, 44 in.; height, 35 in. Floor space: belt driven 48 x 72 in. Weight, 4,500 pounds.

Shaper, Heavy-Duty, 28-In.

Hollingworth Machine Tool Co., Covington, Ky.

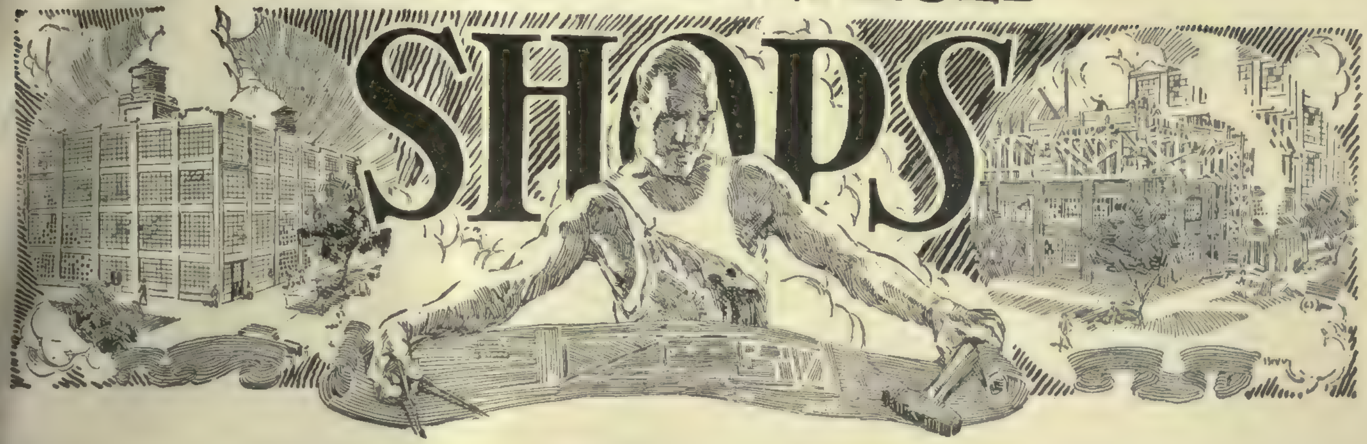
"American Machinist," April 7, 1921



It is stated that changes have been incorporated in the design of the machine to insure rigidity and accuracy. The machine is furnished either cone-pulley or single-pulley driven, the latter type obtaining speed changes by the incorporation in the drive of a gear box with four gear changes. The single-pulley-driven type of machine may be fitted with direct motor drive, as shown. The shaper is of the crank type and fitted with back gears, so that there is a total of eight speeds available.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED SHOPS



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Conn., Bridgeport—B. S. Michniewicz, Ridge Ave. and Walnut St.—garage repair tools.

Conn., Bridgeport—W. Stone & Bros., 810 Madison Ave.—garage equipment.

Conn., Waterbury—The Dexter Baking Corp., North Main St.—garage equipment.

Mass., New Bedford—J. Telciano, 267 Allen St.—small repair tools.

R. I., Providence—A. J. Finan, 83 Standiford St.—garage equipment.

R. I., Providence — B. Kaufman, 109 Bway.—garage equipment.

R. I., Providence — W. E. Phillips, 14 James St.—garage equipment.

N. Y., New York—The Chassis Fabricating Co., 501 5th Ave.—One 6 x 11 in. lathe complete with compound rest, countershaft, etc.

N. Y., New York—Merolle & Paganelli, 26 Watts St., No. 200 V. & O. automatic threader.

N. Y., Port Richmond, S. I.—The Natl. Lead Co., manufacturer of paint material—Buffalo 10 in. power bench drill press with tight and loose pulley drive, etc., 20 in. drill press back geared, etc.

N. Y., Springville—Spencer's Garage, F. D. Spencer, Purch. Agt.—milling machine and 8 in. swivel vice.

W. Va., Wheeling—The Steam Electric Eng. Co., 1512 Market St.—One ⅝-in. universal electric drill and one ½-in. universal electric drill.

Ill., Paxton—The Bd. Educ., c/o J. C. Strong, Pres.—manual training equipment.

O., Columbus—The Shartle Machine Co., 359 Duplin Ave., G. W. Shartle, Pres. and Genl. Mgr.—20 in. drill press, No. 70 Heald grinder, 36 to 42-in. shaft grinder and a 24-in. planer (used).

Machinery Wanted

Pa., Kittaning—The Templeton Limestone Co., Harry & Wolfe, Purch. Agts.—stone crushers, belting, etc.

Pa., Pittsburgh—W. S. Rae, (contractor) Room No. 439 Oliver Bldg.—20 ton electric crane.

Mo., Clinton—The Terrill Tire & Rubber Co.—$42,000 worth of tire machinery.

Ont., Beachville—The Beachville Cooperative Creamery, G. J. Cook, Pres.—refrigeration equipment.

Metal Working Shops

NEW ENGLAND STATES

Conn., Bridgeport—B. S. Michniewicz. Ridge Ave. and Walnut St., plans to build a 1 story garage. Estimated cost $12,000. Private plans.

Conn., Bridgeport—W. Stone & Bros., 810 Madison Ave., are having plans prepared for the construction of a 1 story, 70 x 120 ft. garage and service station on Madison Ave. Estimated cost $25,000. J. E. Stone, Canaan Rd., Stratford, Archt.

Conn., Hartford—The Chopel Co., Chopel St., has awarded the contract for the construction of a 1 story, 60 x 150 ft. garage. Estimated cost $25,000.

Conn., Manchester — W. R. Tinker, Jr., 57 Wells St., has had plans prepared for the construction of a 1 story, 60 x 65 ft. garage on Center and Church Sts. Estimated cost $15,000. Private plans.

Conn., Stamford—W. J. O'Brien, 468 Main St., has awarded the contract for the construction of a 1 story, 75 x 110 ft. garage on Gay St. Estimated cost $30,000.

Conn., Waterbury—The Bradford Auto Sales Co., 476 Meadow St., is having plans prepared for the construction for a 1 story, 70 x 120 ft. garage and service station. Estimated cost $25,000. Private plans.

Conn., Waterbury — The Dexter Baking Corp., North Main St., will soon award the contract for the construction of a 1 story, 60 x 109 ft. garage and repair station. Estimated cost $20,000. J. S. LaDow, 51 Leavenworth St., Archt. Noted June 2.

Conn., Willimantic—H. Israel, 12 Railroad St., will soon award the contract for the construction of a 1 story, 60 x 60 ft. garage on Main St. Estimated cost $10,000. Private plans.

Me., Auburn—The Darling Auto Co. has awarded the contract for the construction of a 2 story, 80 x 100 ft. garage. Estimated cost $40,000.

Mass., Brookline (Boston P.O.)—Gorfinkle & Barkin are having plans prepared for the construction of a 1 story, 151 x 175 ft. garage on Harvard St. Estimated cost $60.000. H. F. Bryant, 334 Washington St., Archt.

Mass., Dartmouth—The Gardner Storage Battery Co., Inc., 126 County St., New Bedford, is having plans prepared for the construction of a 1 story, 55 x 100 ft. factory for the manufacture of storage batteries. Estimated cost $10,000. Private plans.

Mass., Leominster—Cousens & Gustafson. North Main St., will build a 1 story. 40 x 70 ft. garage. Estimated cost $10,000.

Mass., New Bedford—J. B. Ashley. 366 Union St., has had plans prepared for the construction of a 1 story. 60 x 190 ft. garage on Mill St. Estimated cost $25.000. LaBrode & Bullard, 251 Union St., Archts.

Mass., New Bedford—John T. Dawson, 1663 Purchase St., has awarded the contract for the construction of a 1 and 2 story garage and service station on Hope St. Estimated cost $20,000.

Mass., New Bedford—G. G. Sylvia, 543 Union St., will build a 1 story, 80 x 100 ft. garage including a small repair shop on James St. Estimated cost $15,000. Noted June 16.

Mass., New Bedford—J. Telciano, 267 Allen St., will build a 1 story, 50 x 75 ft. garage and small repair shop. Estimated cost $10,000 Noted June 16.

Mass., North Adams—Less & Chornick, 21 State St., will build a 1 story, 40 x 100 ft. garage, etc., on Ashland St. Estimated cost, $20,000. Noted June 30.

Mass., Pittsfield—The Berkshire Auto Co., North St is having plans prepared for the construction of a 1 story garage and service station on South St. Estimated cost $40,000.

Mass., Pittsfield—The City Garage & Sales Co., 501 North St., is having plans prepared for a 3 story, 100 x 130 ft. addition to its garage and service staton. Estimated cost $150,000. Architect not selected.

Mass., Quincy—G. E. Carlson, 86 Huskins Ave., has awarded the contract for the construction of a 1 story garage. Estimated cost $10,000.

Mass., Springfield—A. and M. Batt. 32 Phoenix St., plans to build a 1 story garage. Estimated cost $10,000. Private plans.

Mass., Springfield—The Springfield Bronze Co., 166 Charles St., has awarded the contract for the construction of a 1 story, 40 x 65 ft. foundry on Charles St. Estimated cost $10,000. Noted June 9.

N. H., Charleston—The Bowen Motor Car Co. will soon award the contract for the construction of a 2 story, 57 x 165 ft. garage on Main St. Estimated cost $80,000. G. W. Griffin, 72 North Main St., Concord, Archt. Noted March 10.

N. H., Nashua—H. C. Lintott, 25 Main St., plans to build a 2 story garage. Estimated cost $40,000. Private plans.

N. H, Nashua—The Mercer Bros., 280 Main St., has had plans prepared for the construction of a 2 story 100x100 ft. garage. Estimated cost $100,000. Hutchins & French, 8 Winter St., Boston, Mass., Archts.

R. I., Providence—J. Collicci, Ridge St., plans to build a 1 story, 40 x 80 ft. garage and service station. Estimated cost, $20,000. Private plans.

R. I., Providence—W. J. Farrow, State St., plans to build a 1 story, 40 x 75 ft. garage building on Boone St. Estimated cost, $15,000. Private plans.

R. I., Providence—A. J. Finan, 83 Staniford St., will soon award the contract for the construction of a 1 story garage and service station on Plain St. Estimated cost, $30,000. Private plans. Noted June 16.

THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.80
Northern Basic	25.50
Southern Ohio No. 2	25.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	32.26
BIRMINGHAM	
No. 2 Foundry	22 00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75	27.26
Virginia No. 2	*27.00
Basic	†25.00
Grey Forge	24.40
CHICAGO	
No. 2 Foundry local	22 00
No. 2 Foundry, Southern, sil 2.25@2.75	28.67
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	24.96
Basic	23.46
Bessemer	24.96

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Warehouse Jersey City	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$3.23	$3.33	$3.09	$3.23
Soft steel bars	3.13	3 23	2.99	3.13
Soft steel bar shapes	3.13	3 23	3.48	3.13
Soft steel bands	4.18	4 28	6.25	
Tank plates	3.23	3 33	3.40	3.23

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.20
Warehouse, New York, delivered	3.13
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	4.25	3.85	4 13
No. 12	3.15	4.30	3.90	4 18
No. 14	3 20	4.35	3.95	4.23
No. 16	3.30	4.45	4.05	4.33
Black				
Nos. 17 and 21	3 75	4.80	4.55	5.20
Nos. 22 and 24	3 85	4.85	4.60	5.25
No. 25 and 26	3 90	4.90	4.65	5.30
No. 28	4.00	5.00	4.75	5.40
Galvanized				
No. 10 and 11	4 00	4.75	4.75	5.70
No. 12 to 14	4.10	4.85	4.85	5 80
Nos. 17 and 21	4 40	5.15	5.15	6.10
Nos. 22 and 24	4 55	5.30	5.30	6.25
No. 26	4.70	5.45	5.45	6.30
No. 28	5.00	5.75	5.75	6.40

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb.	$4.73	$4.63	$4.25
Flats, squares and hexagons, per 100 lb.	5.23	4.63	4.75

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	55%
Cleveland	55%
Chicago	50%

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: $\frac{3}{32}$, 8½c. per lb.; ⅛, 8c.; $\frac{5}{32}$ to ¼, 7¾c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	5 50	7.00	8.25
Spring steel (light)	8.00	7.00	10.50
Coppered Bessemer rods(base)	8.00	8.00	6.20
Hoop steel	3.64	3.64	3.83
Cold rolled strip steel	8.00	8.25	7 90
Floor plates	5.30	3.09	5.78

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of April 13, 1921:

BUTT WELD

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
1 to 3	62½	50	¾	33½	18½
			1 to 1½	35½	20½

LAP WELD

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
2	54½	41	2	30½	16½
2½ to 6	58½	45	2¼ to 4	34½	22½
7 to 12	54½	44	4½ to 6	33½	21½
13 and 14	45	37	7 to 8	24½	12½
15	42½	32	9 to 12	19½	7½

BUTT WELD, EXTRA STRONG, PLAIN ENDS

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
1 to 1½	60½	49	1 to 1½	35½	21½
2 to 3	61½	50			

LAP WELD, EXTRA STRONG, PLAIN ENDS

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
2	52½	41	2	31½	18½
2½ to 4	56½	45	2½ to 4	34½	22½
4½ to 6	55½	44	4½ to 6	33½	21½
7 to 8	50½	37	7 to 8	24½	12½
9 to 12	45½	32	9 to 12	19½	7½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	13 75
Tin in 5-ton lots	29.50
Lead	4.75
Zinc	5.75

ST. LOUIS

Lead	4 85
Zinc	5.35

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	21.10	22.00	23 50
Copper wire (carload lots)	16.00	17 50	20.00
Brass sheets	16.25	20.00	20 75
Brass pipe	19.00	22.00	24 50
Solder (half and half) (case lots)	20.00	23.50	17 50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	14.25
Cleveland	16.00
Chicago	18.75

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel

Ingots and hot	41
Electrolytic	44

Monel Metal

Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots.......... 10.00

	Warehouse In Casks	Warehouse Broken Lots
New York	11.50	12.00
Cleveland	11.15	11.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	6.00
Chicago	6.00
Cleveland	7.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.00	$10.00
Copper, heavy, and wire	9.00	9.50	9.00
Copper, light, and bottoms	8.00	7.50	8.00
Lead, heavy	3.25	3.50	3.75
Lead, tea	2.00	2.50	2.75
Brass, heavy	6.00	5.50	9.00
Brass, light	4.50	4.00	5.00
No. 1 yellow brass turnings	5.00	4.50	5.00
Zinc	3.00	2.50	3.50

ALUMINUM—The following prices are spot from warehouse, cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.4	25.00@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	22.75
Chicago	20.50
Cleveland	22.50

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	41.00	35.00
Commercial	30.00	14.75	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

This market is very soft, and our quotations for the present are useful only as a guide.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	List	$2.25	1.60
Hot pressed hexagon	List	2.25	1.60
Cold punches hexagon	List	2.25	1.60
Cold punched square	List	2.25	1.60

Semi-finished nuts, 9/16 and smaller, sell at the following discounts from list price:

	Current
New York	60%
Chicago	50%
Cleveland	80%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in.	50-10%	60-10%	50%
1¼ and 1½ in. by 3 in. up to 12 in.	50%	50-5%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York...... $2.00 Cleveland...... $4.50 Chicago...... $4.00

For cast-iron washers, ¾ and larger, the base price per 100 lb. is as follows:
New York...... $4.50 Cleveland...... $3.75 Chicago...... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	40%	60%	40%
Larger and longer up to 1 in. by 30 in.	40%	50-10%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40%	10%
Chicago	net	net
New York	40%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel 7/16 and smaller	50%	60-10%	45%
Tinned	45%	60-10%	30%

Structural, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.65 Cleveland...$4.25 Chicago....$4.88 Pittsburgh..$3.70

Boiler, same sizes:
New York...$4.75 Cleveland...$4.35 Chicago....$4.98 Pittsburgh..$3.80

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	21.00	25.00	25.50
Brass	19.00	23.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in., inclusive in rounds, and ¼-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$7.50 per 100 lb.; New York prices is $7.50.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	7.50@10.00	12.00	14.25
Colored mixed	5.50@ 9.00	9.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.00
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville.

	Current
Prompt furnace	$3.00@$3.25
Prompt foundry	4.00@ 4.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current New York	Current Cleveland	Current Chicago
Raw in barrels (5 bbl. lots)	$0.80	$0.88	$0.87
5-gal. cans	.83*	1.03	1.12

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current Red Dry	Current Red In Oil	Current White Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.25
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount. Business is good in white lead.

R. I., Providence—B. Kaufman, 109 Bway., will build a 1 story garage and service station on Federal St. and Bway. Estimated cost, $6,500. Noted June 16.

R. I., Providence—Kaminsky & Levin, c/o H. M. Marshak, Archt., 312 Strand Bldg., are having plans prepared for the construction of a 1 story garage and service station on South Main, Gregory and South Water Sts. Estimated cost, $40,000.

R. I., Providence—A. J. Martin, 259 Plain St., will soon award the contract for the construction of a 1 story, 50 x 100 ft. garage and service station. Estimated cost, $30 000. Private plans. Noted June 16.

R. I., Providence—W. A. Mulry Co., 97 Empire St., has awarded the contract for the construction of a 1 story, 120 x 133 ft. garage on Elmwood Ave. Estimated cost $30,000. Noted April 21.

R. I., Providence—W. E. Phillips, 14 James St., plans to build a 1 story, 40 x 100 ft. garage and service station on James St. Estimated cost, $10,000. Private plans.

R. I., Providence—The Providence Ice Co., 17 Exchange St., plans to build a 1 story, 45 x 100 ft. garage and repair shop on Burnett and Greenwich Sts. Estimated cost, $15,000. Private plans.

Vt., Rutland—W. H. Williams has awarded the contract for the construction of a 1 story, 68 x 129 ft. service station. Estimated cost $50,000.

MIDDLE ATLANTIC STATES

D. C., Anacostia (Washington P.O.)—The Bureau of Yards and Docks, Navy Dept., Washington, D. C., has awarded the contract for the construction of a shop building at the Naval Air Station here. Estimated cost $31,345. Noted March 17.

D. C., Washington—The Aberinale Investment Co. is having plans prepared for the construction of a garage. Estimated cost $200,000. W. B. Wood, 816 Connecticut Ave., N.W., Archt.

N. Y., Coney Island—W. F. Mangels Co., West 8th St., manufacturer of mechanical amusement devices, plans to build a 90 x 200 ft. addition to its plant.

N. Y., New York (Borough of Manhattan)—The Henwood Bldg. Corp., c/o Dunnigan & Crumley, Archts. and Engrs., 394 East 150th St., will build a 1 story, 100 x 150 ft. garage on Henwood Pl. near Walton Ave. Estimated cost, $50,000.

N. Y., New York (Borough of Manhattan)—L. T. Phelan, c/o Dunnigan & Crumley, Archts. and Engrs., 394 East 150th St., will build a 1 story, 100x150 ft. garage on Burnside Ave., near Ryer Ave. Estimated cost $75,000.

N. Y., New York (Borough of Manhattan)—A. J. Schwanzler, c/o S. J. Kessler, Archt. and Engr., 529 Courtland Ave., will build a 1 story, 85 x 200 ft. and a 4 story, 85 x 100 ft. garage on 174th St. and Morris Ave. Estimated cost $120,000.

SOUTHERN STATES

Va., Hampton Roads—The Bureau of Yards and Docks, Navy Dept., Washington, D. C., has awarded the contract for the construction of a machine and carpenter shop here. Estimated cost $108,434. Noted June 30.

MIDDLE WEST STATES

O., Cleveland—The Hildebrandt Provision Co., 3616 Clark Ave., has had plans prepared for the construction of a 1 story, 66x100 ft. garage at 3600 Clark Ave. Estimated cost $60,000. Anders & Reimers, Erie Bldg., Archts.

O., Cleveland—S. Hovanatz, United Bank Bldg., will soon award the contract for the construction of a 2 story, 44 x 86 ft. garage on West 50th St. and Lorain Ave. Estimated cost $50,000. Hulet & Stanton, 3129 Scranton Rd., Archts.

O., Cleveland—The Republic Electric Mfg. Co., 1820 East 18th St., has awarded the contract for the construction of a 3 story, 47 x 57 ft. factory and office addition on East 18th St. and Chester Ave. Estimated cost $75,000.

Wis., Kaukauna—The P. H. Pagel Auto Co. will soon award the contract for the construction of a 1 story, 60 x 75 ft. garage. Estimated cost $40,000. H. O. Weldon, 10 South La Salle St., Chicago, Ill., Archt.

Wis., Milwaukee—A. Dietrich, c/o Rosman & Wierdsma, Archts., 424 Jefferson St., has awarded the contract for the construction of a 1 story, 60 x 120 ft. garage and repair shop on Lisbon Ave. Estimated cost $42,000.

Wis., Oshkosh—The Kaewer Auto Co., c/o Auler & Jensen, Archts., F. R. A. Bldg., is having plans prepared for the construction of a 1 story, 72 x 100 ft. garage on Main St. Estimated cost $50,000.

STATES WEST OF THE MISSISSIPPI

Ia., Des Moines—The Keith Furnace Co., c/o R. S. Keith, Court Ave., will receive bids until July 12 for the construction of a 1 and 2 story factory to include a foundry, etc., on East 26th St. and Dean Ave. Estimated cost $150,000. Boyd & Moors, 1020 Grand Ave., Archts. Noted Jan. 3.

Minn., St. Paul—The Twin City Motor Bus Co., 344 North Exchange St., will receive bids about July 1 for the construction of a 1 story, 120 x 150 ft. garage and office building on 5th near 7th St. Estimated cost $40,000. H. A. Sullwold, 643 Endicott Bldg., Archt.

Minn., Young America—Buegel & Mesenbring is having plans prepared for the construction of a 1 and ½ story, 50 x 150 ft. garage, here. Estimated cost $45,000. A. Plagens, New Ulm, Archt.

S. D., Redfield—The State Bd. of Correction of Charities, c/o F. W. Brown, Secy., Lead, will soon award the contract for the construction of a 1 story, 70 x 78 ft., service station. Estimated cost $90,000. C. H. Johnson, Capital Bank Bldg., Minneapolis, Minn., Archt.

WESTERN STATES

Cal., San Diego—The Bureau of Yards & Docks, Navy Dept., Washington, D. C., has awarded the contract for the construction of a machine shop, latrine toilet, fire engine house at the Naval Base Air Station here. Estimated cost $121,400.

CANADA

Ont., Brockville—G. W. Warwick, 111 King St., West, plans to rebuild 1 story garage on Home St., which was recently destroyed by fire. Estimated cost $15,000.

General Manufacturing

NEW ENGLAND STATES

Conn., Ansonia—The Ansonia O. & C. Co., 153 Main St., will soon award the contract for the construction of a 2 story, 75 x 240 ft. addition to its plant for the manufacture of web braids. Estimated cost, $125,000. Lockwood, Greene & Co., 101 Park Ave., New York City, Archts. and Engrs.

Mass., Everett—Briggs, Maroney Co., Inc., 85 Paris St., manufacturers of paint, has awarded the contract for the remodeling of a 3 story factory. Estimated cost $25,000. Noted Jan. 20.

Conn., Middletown—The Millbrook Dairy Co., 4 Main St., will soon award the contract for the construction of a 3 story, 50 x 60 ft. dairy plant, etc., on Church and Broad Sts. Estimated cost, $40,000. Buck & Sheldon, Inc., 60 Prospect St., Hartford, Archts. and Engrs. Noted May 26.

Mass., Springfield—C. P. Chase Co., 68 Birnie Ave., has awarded the contract for construction of a 3 story, 40 x 60 ft. factory and lumber mill.

N. H., Dover—P. Sherrell & Sons, Inc., has awarded the contract for the construction of a 1 story, 45 x 130 ft. and 25 x 105 ft. additions to its shoe factory. Estimated cost $25,000.

MIDDLE ATLANTIC STATES

N. Y., New York (Borough of Manhattan)—The Lorillard Tobacco Co., 119 West 40th St., is having plans prepared for the construction of a 3 story, 200 x 205 ft. factory on 73d St. and Ave. A. Estimated cost $150,000. Francisco & Jacobus, 511 5th Ave., Archts. and Engrs.

N. J., Trenton—The Huslander Engraving Co. is having plans prepared for the construction of a 3 story, 40 x 60 ft factory. Estimated cost $40,000. Fowler Seaman Co., Broad St. Bank Bldg., Archt.

Pa., Roanoke—The Amer. Viscose Co., Marcus Hook, is having preliminary plans prepared for the construction of a silk plant. Estimated cost $1,000,000. The Bollinger Co., 105 South 12th St., Philadelphia, Archt. and Engr.

MIDDLE WEST STATES

Ill., Aurora—The Miller Bryan Pierce Co., 225 River St., manufacturer of typewriter supplies, is having plans prepared for the construction of a 3 story, 60 x 150 ft., factory. Estimated cost $160,000. Lockwood Greene Co., 385 Dearborn St., Chicago, Archts.

Ind., Chesterton—The United States China Co. plans to build a 2 story, 100 x 300 ft. pottery plant to cost $100,000 and a 3 story, 50 x 50 ft. machinery building to cost $75,000. Private plans.

Ind., Indianapolis—F. D. Gardner Co., 221 East Maryland St., will soon award the contract for the construction of a 2 story, 80 x 180 ft. packing plant along the White River here. Estimated cost $75,000. Wanninwetsch & Co., 563 William St., Buffalo, N. Y., Archt.

O., Cleveland—The Empire Rolling Mills Co., Bessimer Ave., has awarded the contract for the construction of a 1 story, 81 x 172 ft. factory and warehouse. Estimated cost $75,000.

O., Cleveland—The Natl. Carpet Cleaning & Rug Mfg. Co., 1971 West 50th St., will soon award the contract for the construction of a 2 story, 40 x 123 ft. factory on West 50th St. and Lorain Ave. Estimated cost $75,000. Whitworth & Johnson, 413 B. of L. E. Bldg., Archts.

O., Kent—The Western Reserve Cotton Mills Co. is having plans prepared for the construction of a 3 story cotton mill. Estimated cost $300,000. Lockwood Green & Co., Hanna Bldg., Cleveland, O., Archts. and Engrs.

Wis., Milwaukee—The Milwaukee Sales & Investment Co., 425 East Water St., has awarded the contract for the construction of a 2 story, 50 x 100 ft. factory for the manufacture of films on Sycamore St. Estimated cost $40,000.

Wis., Neenah—G. Danke, Main St., has awarded the contract for the construction of a 2 story, 40 x 75 ft. creamery. Estimated cost $40,000. Noted June 2.

Wis., Neenah—The Jersild Knitting Co., 331 North Commercial St., has awarded the contract for the construction of an additional 50 x 200 ft. factory. Estimated cost, $42,000.

STATES WEST OF THE MISSISSIPPI

Mo., Clinton—The Terrill Tire & Rubber Co. will build a 2 story, 90 x 150 ft. tire and rubber factory near here. Estimated cost $25,000.

Mo., St. Louis—The Fleischmann Yeast Co., 1535 Market St., has awarded the contract for the construction of a 1 story, 75 x 170 ft. factory on Forest Park Blvd. and Bogle Ave. Estimated cost $50,000. Noted May 19.

Okla., Bartlesville—E. G. Hanson has awarded the contract for the construction of a mill building. Estimated cost $25,000. Noted June 9.

Okla.; Duncan—The Magnolia Petroleum Co. has awarded the contract for the construction of two 1 story, 40 x 260 ft. factories. Estimated cost, $100,000.

Tex., Taft—The Taft Packing Co. will soon award the contract for the construction of a 2 story, 65 x 115 ft. mill, fertilizer house and an addition to its boiler house. H. S. Green, 415 Euclid Ave., San Antonio, Archt.

CANADA

Ont., Beachville—The Beachville Cooperative Creamery plans to build a creamery on Main St. Estimated cost $50,000. G. J. Cook, Pres.

American Machinist

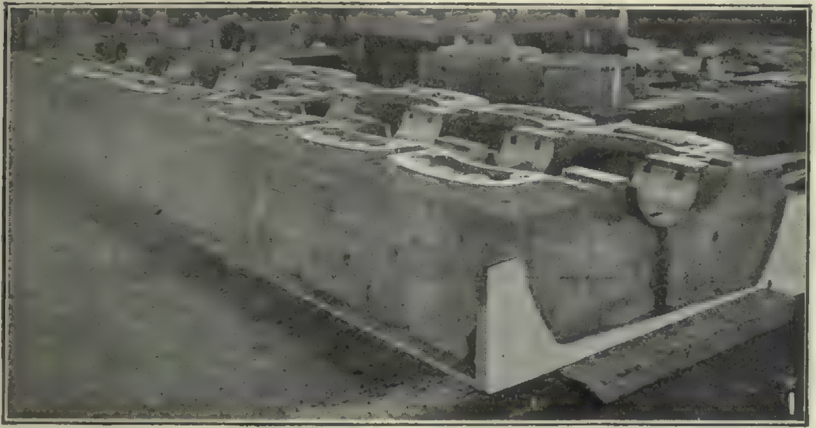
Volume 55 NEW YORK, JULY 14, 1921 Number 2

Building Diesel Engines on the Pacific Coast

How the Principal Parts of These Big Engines Are Machined—A Good System for Keeping Order in a Shop Handling Big Work

BY FRANK A. STANLEY

THE bedplate of a big Diesel engine, as made at the plant of the Dow Pump and Diesel Engine Co., Alameda, Cal., is shown in the halftone in Fig. 1. This bedplate is for a six-cylinder engine and when assembled will carry six A-frames of the type shown in Fig. 2. The bedplate is a single casting extending the full length of the engine and carrying the main bearings for the crankshaft. The illustration shows the large crankpits, one for each crank, and the oil reservoirs for the main bearings.



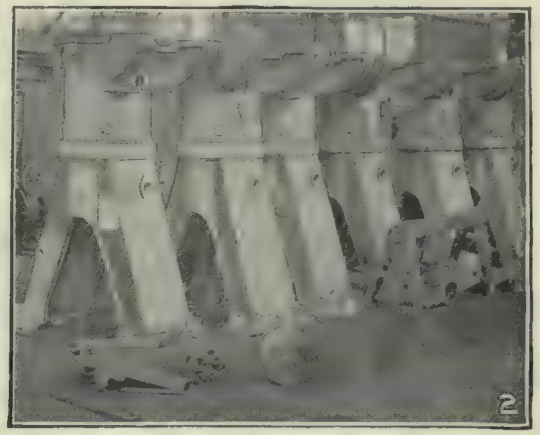


FIG. 1. BEDPLATE FOR 6-CYLINDER DIESEL ENGINE. FIG. 2. A-FRAMES FOR 6-CYCLE ENGINE

The main bearings are in the form of split shells, half in the bedplate and half in the cap. These bearing shells are shown in place in Fig. 1. The boring of the bedplate for the reception of the bearings is done in the big horizontal machine shown in Fig. 3, which has a large floor plate and suitable auxiliary tables for carrying the large castings. Another operation performed in the machine is the facing of a surface at the end of the bedplate for the fit of the air compressor which forms part of the engine unit, and which is driven from one end of the crankshaft. A milling cutter for such operations is shown lying in front of the work in Fig. 3.

Each A-frame is of cylindrical form, planed at the bottom to fit its respective seat on the top of the bedplate, and is bored at the top to receive the cylinder barrel which is forced into the frame chamber under pressure. It is surrounded by a water jacket cast in the frame.

MACHINING THE CRANKSHAFT BEARINGS

The main bearings or boxes for the crankshaft are the cast-iron half shells shown in Fig. 4. They are first bored out in the chucking machine or on a vertical mill, then put into the Gisholt machine and turned on the outside. Then they are lined with anti-friction metal and sent to the Gisholt machine, where they are bored to within a few thousandths of an inch of size. The bearing metal is, of course, peened thoroughly before the boring operations are performed. Following the boring, the boxes are placed in position in the bedplate with the caps and then scraped to fit the crankshaft.

The method of holding the work while turning and boring on the turret machine is illustrated in Fig. 5. The fixture used for boring consists of a circular casting doweled and bolted to the face of the big chuck. This fixture is bored out to form a seat for the boxes and with the large end of the box in place, four clamps are set up to hold the work fast.

The cylinder heads are of cylindrical form with passages for air, oil and exhaust, all surrounded by a water jacket. The heads carry the valves and valve-operating mechanism, including the camshaft supports. One of these heads is shown in position on a drill press in Fig. 6 for the drilling and reaming of a 2½-in. stud hole, for which operation two tools are used. The first is a multiple tooth-cutter similar to an end reamer, which bores out the hole to within ⅛ in. of size. This roughing tool is followed by a finishing reamer which finishes the hole to size.

TURNING THE CRANKSHAFT MAIN BEARINGS

The crankshaft is made of chrome nickel steel and is of the marine type, consisting of two forgings. One section is shown in the lathe in Fig. 7. The webs are drilled out in a previous process and the present view shows the set-up for turning the main bearings and flanges. The lathe headstock and tailstock are blocked up to give clearance for the throws, and a special tool-post is used to carry the turning tool at the proper height. The shaft is carried on centers and a clamp is placed over the flange at the chuck end to act as a dog against which a chuck jaw rests to serve as a driver.

A method of machining out the solid ends of the connecting rods is shown in Fig. 8. In this case the rod is milled out on a horizontal boring machine with a spiral reamer 1⅜ in. in diameter. There is a pilot at the outer end fitting a brass guide bushing in the outer spindle of the machine. The pilot and the hole in the bushing are tapered so that all possibility of chatter may be eliminated.

The work is secured to fixtures which hold the rod perfectly square with the table and spindle of the

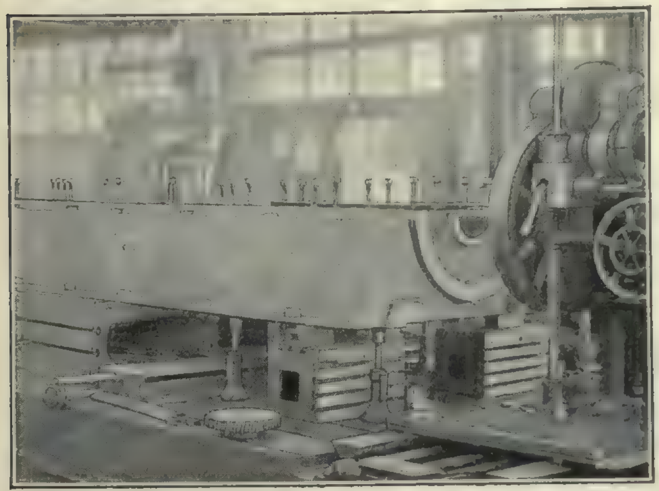


FIG. 3. MACHINE FOR BORING AND FACING BEDPLATE

FIG. 4. MAIN BEARING BOXES

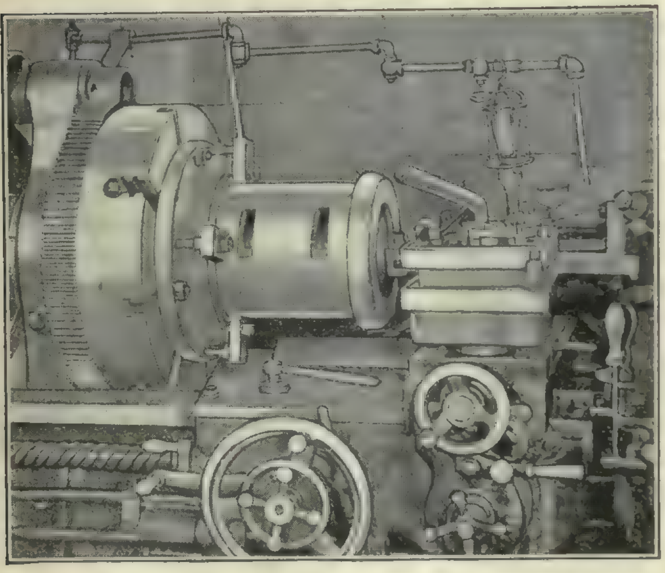


FIG. 5. BORING AND TURNING MAIN BEARING BOXES

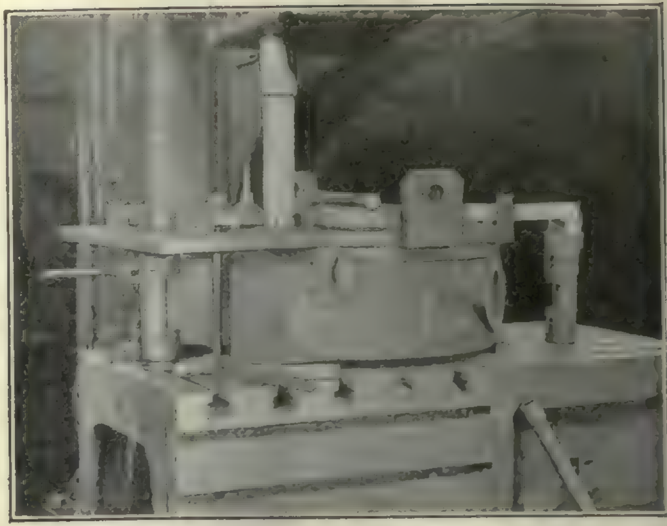


FIG. 6. BORING AND REAMING STUD HOLES IN CYLINDER HEAD

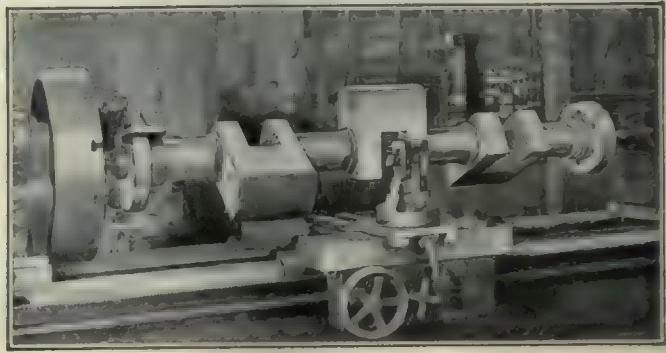


FIG. 7. TURNING CRANKSHAFT MAIN BEARINGS

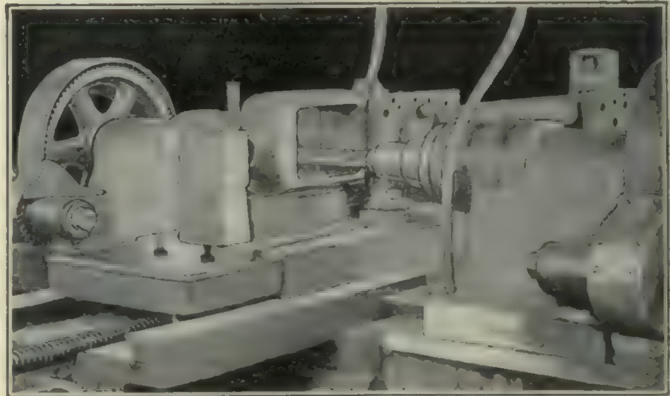
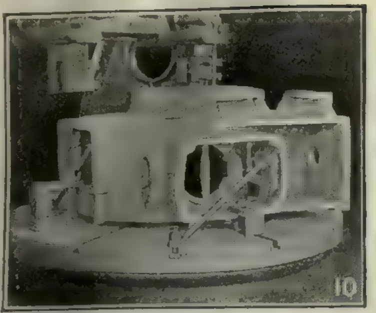
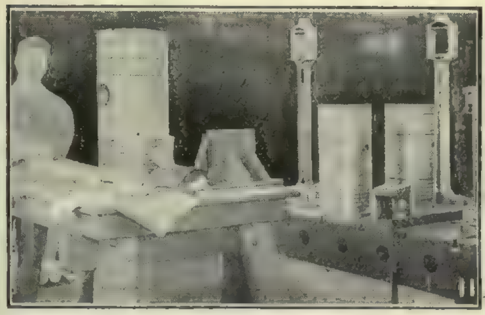


FIG. 8. MILLING OUT OPENING IN CONNECTING RODS

FIG. 9. FLOOR-LINE FOR KEEPING MATERIAL IN ORDER





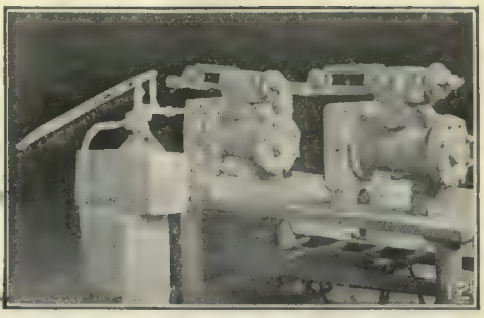


FIG. 10. BORING AND FACING AIR-COMPRESSOR CASING. FIG. 11. INSPECTION TOOLS. FIG. 12. EQUIPMENT FOR WATER-TESTING PUMP CASTINGS

machine. The hole has been opened out in the rod end by drilling out the metal and the milling cutter is used for finishing to the correct dimensions.

A convenient method of locating finished and semi-finished work going through the shop so that it will not be scattered around over indefinite areas and get in the way of other work and in the path of trucks is indicated by Fig. 9. Here heavy white lines are shown on the floor for the location of connecting rods near the machine on which they are milled out as described above. Similar lines are used at other points about the shop for other classes of work. The white lines distinctly outline the area where the rods are to be placed and furthermore indicate the position they shall rest in, with the strap end of one rod and the solid end of the next rod in the same direction. This also minimizes the possibility of bruising finished surfaces as compared with the indiscriminate placing of parts of this character.

The operation shown in Fig. 10 is the boring and facing of the casting that forms the casing for the air compressor used with this engine. This operation is done on the vertical boring and turning mill, the cut under way being the facing of the end where it joins the engine bedplate. The compressor is built to deliver air at a pressure of from 650 to 1,000 lb. per square inch for continuous service and is of the three-stage type, having four cylinders with inter-coolers between them. It supplies the air for atomizing the fuel oil and blowing it into the engine cylinders, this process taking place in the beginning of the third stroke of the cycle, at a time when the air pressure in the cylinder is about 500 lb. per square inch and when the temperature is about 1,000 deg. As the time of this period is only one-eightieth of a second, the air pressure required to perform the work must necessarily be uniform and considerably higher than the pressure in the cylinder. The cylinders of the air compressor are carried radially inside the casing shown in Fig. 10, each cylinder being fitted into an opening bored through the casing wall. One of the openings can be seen at the front of the casting on the boring mill table.

In setting up a job of this kind for boring, the holes for the cylinders must be centered by placing wood strips across the holes and testing to determine that all the openings will be central with the annular hub ring which is turned on the end of the casing to fit the similar surface on the end of the engine bedplate. With the casting properly positioned on the boring mill table, straps are applied to hold the work fast and struts are fitted obliquely from the table to the upper corners of the cored openings (as shown in Fig. 10) to take the thrust of the work and steady the job against vibration.

The view in Fig. 11 shows a number of pistons and rods undergoing inspection. The pistons are very long and are fitted with six rings each. They are tested with plugs, surface blocks, squares and indicators and the rods are also given a rigid inspection with suitable bench instruments.

Broaches are used for performing a number of operations in the shop, one being that of finish broaching the cams to size. These cams are bored out nearly to size, then placed in a broaching fixture which is provided with a ring holder to receive the cam, and with guides at top and bottom for the broach arbor or body. The broach proper is made with a taper hole from end to end which fits snugly on a taper body on the arbor, the taper fit being ⅛ in. per foot. The broach when in place on the taper also fits snugly against a shoulder on the upper end of the arbor. Thus the two members are coupled firmly together and the broach is forced steadily through the work when placed under the press.

Another interesting job of broaching is that of finishing the piston-pin holes. The hole is first bored perfectly square with the piston axis and nearly to size, so as to act as an accurate guide for the end of the broach, double-end cutters being used. The piston pin has two diameters, so the holes in the piston walls are of two diameters to correspond. The piston is therefore broached from opposite sides and alignment is assured by the piloting of the broach arbor through the hole.

The holes are thus held dead to size and the pins are ground alike. They are all forced in under 4 tons' pressure, the conditions of fit being uniform in all cases. A 10-ton press is employed for forcing in the pins.

A water-testing rig for pump castings is shown on the bench in Fig. 12. Water connections are easily made and a hand pump used to apply the required pressure.

Grinding with a Phantom Wheel

Difficulty of Grinding Thin Work Without Heating—Work Will Not Stand Heat and Pressure of Solid Wheel—Wheel Set at Angle Eliminates Much of the Pressure

By ELLSWORTH SHELDON
New England Editor, *American Machinist*

SOMETHING new in the way of grinding has been invented by Clarence L. Goodrich, assistant superintendent of the Pratt & Whitney shops in Hartford, Conn. The writer has had many and varied experiences with "wobbly" grinding wheels, but never before has he seen a wheel that wobbled so much, with such persistent regularity, and with such evident purpose to its mad career as does this so-called "phantom" or "swipe" wheel devised by Mr. Goodrich.

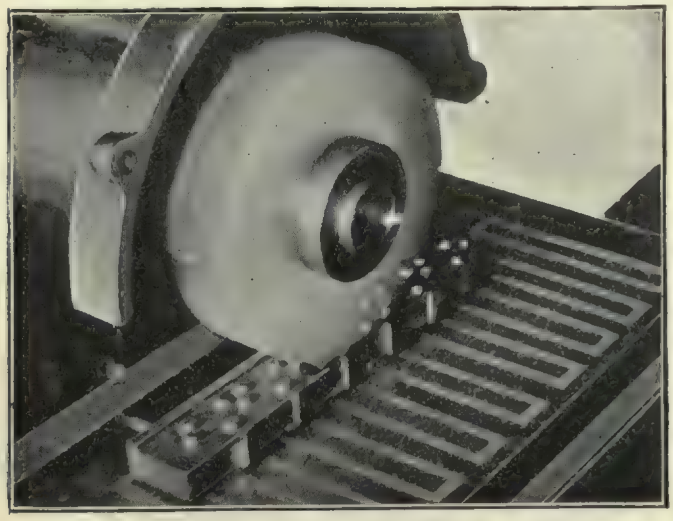


FIG. 1. THE "PHANTOM" WHEEL IN MOTION

The problem of grinding extremely thin pieces of hardened steel was up for solution in the above mentioned shop. Pieces 1 in. square and $\frac{1}{32}$ in. or less in thickness must be ground flat, smooth and parallel within very close limits. Though these pieces are finished by lapping, this latter is at best a slow operation and every "tenth" above the finish size that is not absolutely necessary to the finishing process adds its quota to the time and expense of production.

The thin pieces are, of course, not absolutely flat when they come from the hardening process to the grinding operation and would not lie still under the wheel unless packed; and packing each piece to grind first one side and then the other alternately would render the cost prohibitive even if it were possible mechanically. Then, too, so thin are some of the pieces that even the pull of the magnetic chuck would distort them; and magnetism seemed to be the most practical means of holding them.

To overcome the necessity for packing each piece, a three point bearing is provided. To preclude the possibility of distortion by reason of magnetic pull the points of contact are raised half an inch or more away from the surface of the magnetic chuck. This will serve to explain the presence of the device to be seen on the chuck in Fig. 1. Its body is of brass with pins of soft iron projecting slightly above the surface to provide a bearing for the work; the same pins passing through the brass body and extending below it, where they form feet upon which the jig rests and by which the magnetic flux is transmitted to the work.

As may be imagined, the holding power exerted in this way upon a thin piece of steel is slight, and being supported out of contact with cold metal except at the three bearing points, the heat generated by the grinding wheel might easily ruin the work by drawing the temper.

A solid wheel wide enough to cover the surface of the work would quickly sweep the pieces off the chuck, or, if means were provided to prevent this, would overheat them. A very narrow wheel that would enable the operator to avoid both these troubles would take a long time to traverse over the width of the pieces; besides being likely to induce distortion because of the slow progression of the "hot spot" across the work.

Many schemes were tried to avoid the known troubles without introducing unknown complications, but none were wholly successful until the "phantom" wheel, herewith described, was devised. All the parts necessary to its construction are shown in Fig. 2.

A standard grinding wheel 7 in. in diameter and about $\frac{1}{2}$ in. width of face was first mounted in the usual manner and dressed to the shape shown in the figure, leaving a very narrow face. A sleeve was then fitted with a pair of collars, one face of each collar being machined to form an angle of about 15 deg. with its axis. These collars are of necessity keyed to the sleeve so that they cannot change their relative position. A ring nut, with suitable holes to provide for the use of a spanner, completes the device.

The lead bushing of the grinding wheel is then dug out with a scraper to allow the wheel to tilt to an angle corresponding to that of the collars. Because of the firm grip on the wheel, washers of blotting paper being placed between each collar and the wheel, it was not found necessary to key the latter to the sleeve; though logically it should be so keyed, as any slippage from the position in which it is finally dressed would result disastrously if such slippage should occur while the wheel was running.

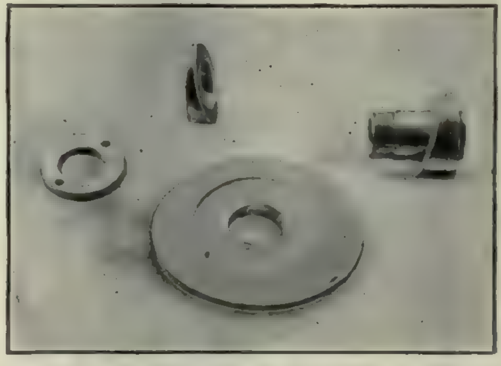


FIG. 2. PARTS OF THE PHANTOM WHEEL

The sleeve with wheel, collars and nut is a complete unit and may be handled on and off the machine as readily as an individual wheel, so long as the ring nut that holds the combination together is not loosened. The sleeve is held on the spindle of the grinding machine by the same nut that would hold the regular

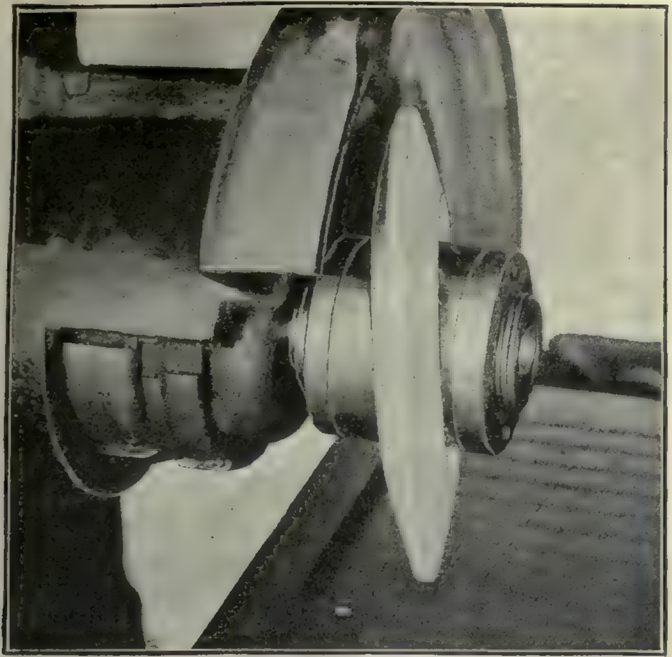


FIG. 3. THE WHEEL ON THE MACHINE

wheels; the outer end of the sleeve being counterbored to accommodate it.

The device is shown mounted on the grinding machine in Fig. 3 with the wheel stationary. This serves to give the observer an idea of the angular position. The cover of the wheel-guard was removed from this machine merely for the purpose of photographing the wheel. When the machine is in service this cover occupies its usual position and the wheel is almost completely enclosed.

When the combination of sleeve, angular faced collars and wheel is first mounted the periphery of the wheel will not run true; there will be two high and two low spots—in other words the wheel, though round of itself, will appear to be elliptical. To correct this condition the periphery must be redressed, and thereafter the ring nut that binds the parts together must not be slackened; for the wheel that now presents a truly circular periphery to the work is in fact elliptic, as may be seen in Fig. 4.

The departure from a true circle is hardly sufficient to be noticeable in the photograph, but the calipers, carefully set to the larger diameter, show the difference when applied to the smaller diameter. The actual difference amounts to about $\frac{3}{32}$ inch.

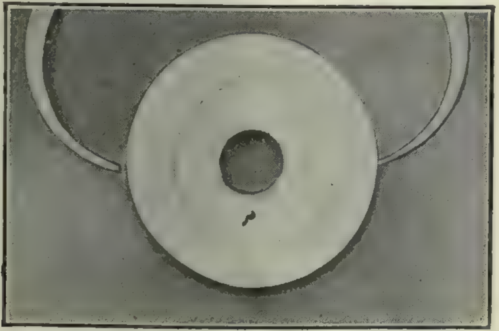


FIG. 4. SHOWING THE ELLIPTIC SHAPE

The grinding action of this wheel is in effect the same as that of a solid wheel of a width equal to the scope of gyration, but owing to the angular position occupied by it and the rapidity of its revolutions with respect to the forward movement of the table, the actual action may be represented as a series of contacts progressing back and forth across the work in a direction at right-angles to its lineal advance.

It was doubtless this stroke, across the work and back once in each revolution, that prompted its inventor to designate it "swipe" wheel. Its right to the title of "phantom" is more certain and is made clear by reference to Fig 1. When in motion the solid lines of the wheel disappear and, though the wheel is grinding with the apparent continuity of a solid wheel of 1 in. face and throwing sparks clear across the work, at no time is the work concealed from the operator's view and he is enabled to watch the progress of the grinding almost as readily as if no wheel was there.

Besides the visibility of the work the principal advantage gained by the use of a wheel in this manner is the fact that, because of the narrow surface in contact with the work at any time, comparatively little heat is generated and it is therefore possible to cover the entire surface of the work without side traverse and with little danger of drawing the temper. The wheel will not, of course, grind as rapidly as a full faced wheel of the same dimension would do upon work that is able to withstand the pressure of the latter and of sufficiently large volume to conduct the heat away from the surface, but in this case the limit of grinding speed and pressure is set by the work itself and even the phantom wheel may easily be forced beyond this limit.

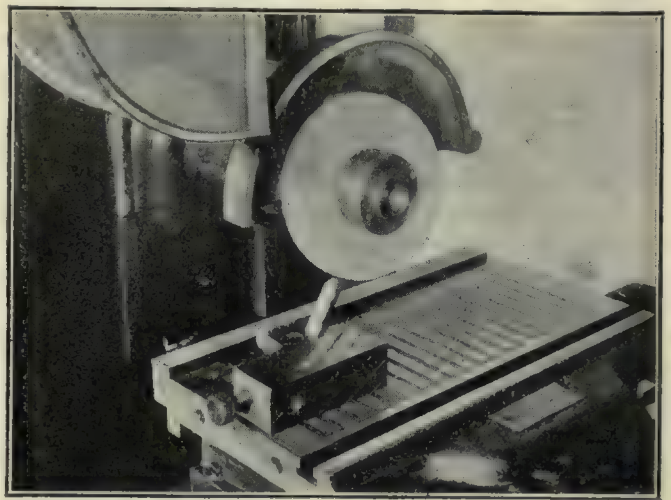


FIG. 5. POSITION OF THE DIAMOND IN DRESSING

In Fig. 5 is shown the method of dressing the wheel. If the machine were perfect—that is, if the wheel spindle were parallel in both vertical and horizontal planes with the travel of the table—the diamond in contact with the gyrating wheel in any position would produce a truly cylindrical shape, but if error existed, either of original construction or by reason of wear, the resultant contour of the wheel would depend upon the position of the diamond. Assuming error to exist in both planes, by placing the diamond at an angle of 45 deg. (midway between them) the error, if any, is a resultant of the two, and less than either.

[We are not entirely in agreement with Mr. Goodrich with respect to the desirability of setting the diamond in this position; but it is nevertheless an ingenious method of minimizing possible error, while if no error exists the position of the diamond is of no consequence. Ed.]

Design of Flat Springs

Importance of the "Spring Criterion"—Derivation of Formulas—Triangular-Shaped Flat Springs—Work and Resilience in Cantilever Springs

By JOSEPH KAYE WOOD
Engineer, Western Electric Co., Inc., A. T. & T. Co.

IN PREVIOUS articles by the author, on the subject of helical springs, the last being on page 854, Vol. 54, of the *American Machinist*, the new notion of "spring criterion," which is a symbolic expression containing all the dimensions of a helical spring, was shown to be a useful aid in the proper design of these springs. The maximum value which this criterion may have without stressing the material of the spring beyond the elastic limit is determined by the value of the "material index," another new term, which is defined as the ratio of the maximum safe fiber stress to the modulus of elasticity times a constant.

It can be shown that the value of the material index is the key to the whole matter of spring design, because by keeping its value in mind the spring criterion may be controlled accordingly. In this article it is intended to cover the meaning of these two new terms as applied to spring design in general, in the hope that it will simplify the method of attacking spring problems. Much of the ground covered will be elementary in order to secure logical arrangements of the principles involved.

Any mass of resilient material having a cross-sectional area small in comparison with its length may be made to perform useful work to an extent depending upon the elasticity and volume of the material. A force P which, if applied to a certain material gradually so as to stretch, bend or twist it from zero to F, uniformly, stores in the material as potential stress energy $\frac{P}{2}F$ units of work, where $\frac{P}{2}$ is the mean force applied. Upon the removal of the load or force P, the deformed material will return to its original state, and in doing so will have available for useful work the same amount of energy as put into it; namely, $\frac{P}{2}F$, which in terms of stress energy is equal to $\frac{K}{2}\frac{S^2}{E}\,al$ where S is the stress per unit of area, al the volume, E the modulus of elasticity and K a constant depending on the method of applying the load.

WORK AND RESILIENCE

The maximum amount of stress energy available for useful work or total resilience is obtained when S in the foregoing expression is just slightly less than the elastic limit of the material, equal to say $S_{max.}$, because any stress energy in excess of the elastic limit value is consumed for the most part in permanently destroying the resilient ability (returning to original state) of some or all of the "fibers" in the material.

Therefore, in order to prevent applying an amount of work which will exceed the total resilience of the particular volume of material in question, we may equate an expression of the work applied in terms of maximum allowable "load" per unit of area to an expression representing the total resilience, which, as we said before, is the maximum potential stress energy available for useful work. This will lead to an expression showing the maximum amount which a material of definite dimensions may be stretched, bended or twisted to secure total "resilience" and without exceeding the elastic limit. Thus, we have

Max. allowable work applied = Total Resilience

or,

$$\frac{P_{max.}\,F}{2} = K\,\frac{S^2_{max.}}{E}\,al \qquad (1)$$

This equation is represented graphically in Fig. 1, where a bar of resilient material is stretched its maximum safe amount.

METHODS OF LOADING

Now in order to substitute for $P_{max.}$ in terms of the maximum load per unit of area, which when the material is practically homogeneous and the elastic limit is not exceeded is equal to $S_{max.}$, we must consider separately the three general methods of loading, assuming that we have in each case a bar of material of the same volume al and length l.

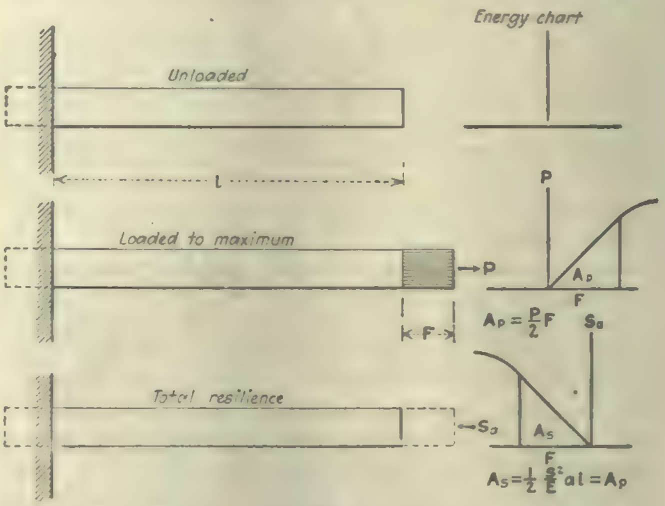


FIG. 1. WORK AND RESILIENCE IN A CANTILEVER SPRING

1. *Stretching (tension).*—When a load P is applied to a bar along its axis, as shown in Fig. 1, all the "fibers" are stretched an equal amount and in the same direction; and hence the load per fiber is the same throughout the entire cross-sectional area. Consequently, P is a summation of these equal loads and may be expressed by Sa where S is the summation of the equal fiber loads per unit of area.

Hook's law states that the amount of "stretch" or elongation is related as follows:

$$F = \frac{Pl}{AE} = \frac{Sl}{E}$$

The resilience is equal to

$$\frac{Sa}{2} \times \frac{Sl}{E} = \frac{1}{2}\frac{S}{E} \times al$$

Therefore, substituting maximum values of P and S and K equal to ½ in (1), we obtain

$$\frac{a\,S_{max.}}{2}\,F = \tfrac{1}{2}\,S^2_{max.}\,al$$

or

$$\frac{f}{l} = \frac{S_{max.}}{E}$$

$\frac{S_{max.}}{E}$ may be called the material index and $\frac{f}{l}$ the spring criterion.

It will be noted here that this expression has the same form exactly as Hook's law with the value of $\frac{S_{max.}}{E}$ fixed and $\frac{f}{l}$ variable. Also, the spring criterion is independent of the cross-sectional area. Furthermore, it is obvious that the spring criterion must always be less than the material index, hence we may rewrite this expression as follows:

$$\textit{(spring criterion)}\quad \frac{f}{l} < \frac{S_{max.}}{E}\quad \textit{(material index)} \qquad (2)$$

(2) Bending (Flexure $\approx$ tension and compression).

When flexure occurs in a bar of material, the fibers on the concave side are compressed and those on the convex side are stretched. The stretching and compressing decreases uniformly from both sides toward a neutral plane which passes through the center of gravity of the cross-sectional area, where the fibers are neither stretched nor compressed. A transverse load on the end of a bar of material fixed at the other end, i.e., cantilever bar, see Fig. 2, producing a moment of Pl at the fixed end, will stretch and compress the fibers at that section as explained above. The summation of the internal resisting moments of all the fibers is equal to $\frac{SI}{C}$, where S is the fiber stress on the extreme outer fibers on the concave and convex sides, I the moment of inertia of the cross-section, and C the distance from the neutral plane to the extreme outer fibers. Therefore, we may write the following expression, which is commonly known as the flexure formula:

$$\frac{SI}{C} = Pl \qquad (3)$$

The deflection of a bar of material due to a moment of Pl may be determined from the equation of the elastic curve, which for the cantilever is

$$EI\frac{d^2y}{dx^2} = Px \qquad (4)$$

This equation is only approximately accurate for moderate deflections, due to the fact that the horizontal projections of the curve δ_x are appreciably shorter than the lengths δ_s of the curve projected. Also, for very short lengths of material, the shear will produce appreciable deflections adding to the deflections due to bending. However, as stipulated before, very short lengths will not be considered here; hence shear deflection may be neglected without causing any serious error.

TRIANGULAR-SHAPED CANTILEVER SPRING

We are now ready to take up the various forms into which spring material is made in order to use it to the best advantage as resilient members in mechanisms. Hence, we will consider rectangular cross-sections of moment of inertia I equal to $\frac{bd^3}{12}$, in which the dimension d in the plane of bending is small compared to the other dimension b. The reason for this is that P in equation (4) increases at a greater rate than it does in (3) as d increases, thus cutting down the amount of allowable deflection.

By inspection of the flexure formula (3), it is obvious that S will vary from a maximum at the point of maximum moment, or at the fixed end, to zero at the point of maximum deflection, unless the cross-section is made to vary from maximum area at the fixed end to zero area at the point of maximum deflection. Thus, we may have uniform strength and maximum economy of material by varying b so as to have a triangular-shaped mass of constant thickness d.

Integrating (4) and determining the constants by the conditions that $\frac{dy}{dx} = 0$ when $x = 1$, and y is a maximum or F when x equals 0, we derive the following equation:

$$EIF = \frac{Pl^3}{3},$$

Which for a constant cross-section reduces to

$$F = \frac{4\,P\,l^3}{E\,b\,d^3} \qquad \textit{(see Fig. 2)} \qquad (5)$$

and for the most economical shape, that is, triangular of constant thickness d, reduces to

$$F = \frac{6\,P\,l^3}{E\,b_2\,d^3} \qquad \textit{(see Fig. 3)} \qquad (6)$$

where b_2 is the broad dimension at the fixed end. In practice, however, the apex of the triangular is cut off and the proper equation for the resulting trapezoidal form will now be deduced.

Referring to Fig. 3, it is quite obvious that the deflection corresponding to the load P will be equal to the deflection corresponding to each of the loads on the rectangular form $ABCD$ and the two triangular forms on the sides. Let P_1 equal the load necessary to produce a deflection F of the rectangular form and P_2 the load necessary to produce the same deflection F of the two triangular forms taken together. Also, let b_1 equal the minimum width and b_2 the maximum width. Then we have

$$F = \frac{4\,P_1 l^3}{E b_1 d^3}$$

or,

$$P_1 = \frac{F\,E\,b_1 d^3}{4\,l^3}$$

Also,

$$F = \frac{6\,P_2 l^3}{E\,(b_2 - b_1)\,d^3}$$

or,

$$P_2 = \frac{F\,E\,(b_2 - b_1)\,d^3}{6\,l^3}$$

Now, $P = P_1 + P_2$ for total mass;

Whence

$$\frac{F\,E\,b_1 d^3}{4\,l^3} + \frac{F\,E\,(b_2 - b_1)\,d^3}{6\,l^3},$$

or,

$$P = \frac{F\,E\,d^3}{l^3}\left(\frac{6\,b_1 + 4\,b_2 - 4\,b_1}{24}\right).$$

Whence,

$$F = \frac{12\,P\,l^3}{E\,d^3\,(b_1 + 2\,b_2)} \qquad (7)$$

Equation (7) is the general formula for material of constant thickness and symmetrically sloping sides, and which is loaded transversely at the free end, the other end being fixed. Making b_1 equal to b_2, which gives the flat rectangular form, reduces this equation to equation (5), and making b_1 equal to zero, which gives the triangular form, reduces the equation to equation (6), which apparently is a check.

The flexure formula (3) retains its original form for this general equation, the maximum b being substituted in every case. Hence, the flexure formula is

$$P = \frac{Sb_2d^2}{6\,l} \qquad (8)$$

The resilience for the general shape mentioned above is as follows:

$$\textit{Resilience} = \frac{S\,b_2d^2}{12\,l} \times \frac{12\,Pl^3}{Ed^3\,(b_1 + 2\,b_2)}$$

$$= \frac{Sb_2d^2}{12\,l} \times \frac{12\,S\,b_2d^2l^3}{6\,E\,d^3l\,(b_1 + 2b_2)}$$

$$\therefore \textit{Resilience} = \frac{S^2l\,d\,b^2{}_2}{6\,E\,(b_1 + 2\,b_2)}$$

Now, Maximum Allowable Work < Total Resilience

Hence, $\frac{Sb_2d^2}{12\,l}\,F < \frac{S^2\,l\,d\,b^2{}_2}{6\,E\,(b_1 + 2\,b_2)}$

Spring Criterion, $\left(\frac{b_1 + 2\,b_2}{2\,b_2}\right)\frac{d}{l^2}\,F < \frac{S}{E},$

Material Index (9)

The Spring Criterion, which contains all the principal dimensions of the material used and the desired deflection F, must not be greater than the Material Index. The value of the Material Index may be taken from formula (2), but it is better to determine it from an actual bending test of the grade of material in question. This formula should never be used to determine deflections but just simply to ascertain whether the material is being deflected beyond the safe amount or to find the value of the fiber stress. To determine deflections or loads, formula (8) should be used.

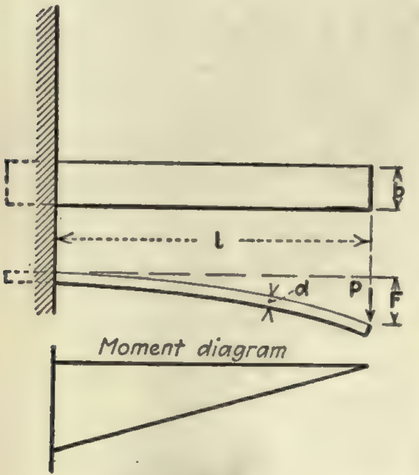


FIG. 2

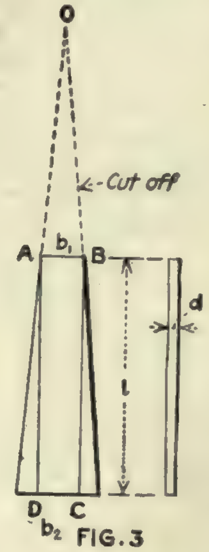


FIG. 3

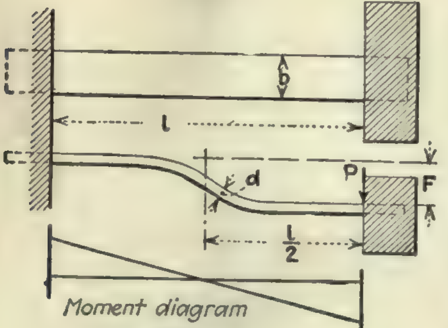


FIG. 4

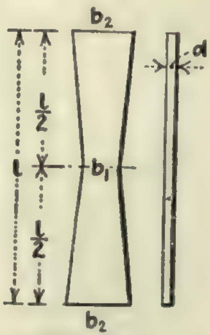


FIG. 5

FIG. 2. FLEXURE OF CANTILEVER SPRING. FIG. 3. SHAPE OF CANTILEVER SPRING. FIG. 4. FLEXURE OF CONSTRAINED CANTILEVER SPRING. FIG. 5. SHAPE OF DOUBLE CANTILEVER SPRING

The relation between the spring criterion and material index could have been derived very readily by substituting P of the flexure formula in the deflection formula; but its full meaning as brought out by using the total resilience principle, would no doubt have been lost.

By comparing formulas (9) and (2), it may be observed that by bending a volume of material we can obtain a higher maximum safe deflection than we can by stretching the same volume of material to its maximum safe length. Thus material loaded transversely is much more useful as a resilient member in mechanisms than if loaded axially. Such resilient members are called flat springs. There are other forms of flat springs which will be discussed later on, but the flat cantilever type covered by formulas (7) and (8) is the most common.

CONSTRAINED CANTILEVER TYPE OF SPRING

Now, if the free end of the cantilever form of spring be constrained, as shown in Fig. 4, the elastic curve will have an inflection point a distance of $\frac{l}{2}$ from either end of the spring. That is, the bending moment will be zero at this point. The bending moments at the extreme ends will be equal and maximum, as shown by the moment diagram. Therefore, the deflection of this spring due to a load P will be the sum of the deflections due to a load P of two identical springs of length $\frac{l}{2}$. Thus the deflection formula for this type of spring is derived as follows:

$$F = f_1 + f_2$$

$$\text{and } f_1 = f_2$$

$$\therefore F = 2f = \frac{2 \times 4\,P}{E\,b\,d^3}\left(\frac{l}{2}\right)^3$$

$$\therefore F = \frac{Pl^3}{Ebd^3} \qquad (10)$$

This formula may also be derived by integrating the general equation of the elastic curve (2) with the condition imposed that $\frac{dy}{dx} = 0$ when $x = \frac{l}{2}$.

To obtain the equation for the most economical spring of uniform strength, we may consider the spring as divided into two separate springs as we did before, which would infer that the two halves of the spring would be of triangular shape with the apexes meeting at the center, or a distant $\frac{l}{2}$ from either end. Thus, we would have the proper distribution of the material in order to obtain an equal value of S throughout the entire length of the spring, having zero cross-sectional area at the center where the moment is zero, and maximum cross-sectional area where the moment is maximum. But, as the zero section at the center would be impractical, we must obtain uniform strength and economy as near as possible by making the flat contour of the spring as shown in Fig. 5, where the "waist-line" dimension is designated by b_1 and the end dimensions by b_2. Of course, the thickness would be constant.

To obtain the deflection of this type of spring, we may proceed as we did in deriving formula (7) and (10), making $l = \frac{l}{2}$.

$$F = f_1 + f_2$$

$$f_1 = f_2 = \frac{12\,Pl^3}{Ed^3\,(b_1 + 2b_2)}$$

$$\therefore F = \frac{2 \times 12\,P}{Ed^3\,(b_1 + 2b_2)} \left(\frac{l}{2}\right)^3$$

$$\text{or } F = \frac{3\,Pl^3}{Ed^3\,(b_1 + 2b_2)} \qquad (11)$$

Formula (11) is the general equation for the constrained type of cantilever spring. We will now proceed to determine the spring criterion for this general type:

$$\textit{Resilience} = \frac{Sb_2d^2}{2 \times 6\,l} \times \frac{3\,Pl^3}{Ed^3\,(b_1 + 2b_2)}$$

$$= \frac{Sb_2d^2}{2 \times 6l} \times \frac{3\,Sb_2d^2l^3}{6\,Ed^3l\,(b_1 + 2\,b_2)}$$

$$= \frac{S^2b^2{}_2dl}{24E\,(b_1 + 2\,b_2)}$$

Now, *Maximum Allowable Work* < *Total Resilience*

$$\therefore \frac{Sb_2d^2}{2 \times 6l} \times F < \frac{l}{24} \times \frac{S^2}{E} \times \frac{b_2{}^2}{(b_1 + 2\,b_2)} \times dl$$

$$\frac{2\,(b_1 + 2\,b_2)}{b_2} \times \frac{d}{l_2} \times F < \frac{S}{E} \qquad (12)$$

$\frac{2\,(b_1 + 2\,b_2)}{b_2} \times \frac{d}{l^2} \times F$ is the Spring Criterion.

$\frac{S}{E}$ is the Material Index.

Machine-Tool Depreciation

By L. L. Thwing

A recent article on machine-shop accounting (page 730, Vol. 54, *American Machinist*) gives a list of percentages to be applied for straight line depreciation of various items of shop equipment. If these percentages are arrived at by a process of accounting expediency, and are intended to cover the most unfavorable conditions with a liberal factor of safety they may not be too high, but if they are advanced as an actual average of yearly depreciation I am entirely unable to make some of them square up with my experience with such problems. Is it, for example, the experience of *American Machinist* readers that standard machine tools are scrapped in ten years from the date of installation? That is what an annual depreciation of 10 per cent means. There may be some special purpose machines that have been scrapped because the owners did not think it best to wait for the next war on the small chance of using them; there may be other machines, such as automatic screw machines, which, on account of severe and continuous use, will wear out in ten years, but even in this unfavorable case, I believe that the average life of even an automatic screw machine is over ten years.

To go to the other extreme, what is ten years in the life of a planer? I have never seen a chain planer in actual operation, but I have in mind a screw planer about 48 in. x 36 in. x 12 ft., with 1844 cast on the crosstie, that is still in use for occasional jobs in a cotton mill machine shop, and there must be thousands of planers in daily use with the old-style flanged housings whether decorated with scroll work, angels, or left plain. These are not, of course, to be seriously considered as productive units, but there are a good many planers twenty years old that *are* entitled to be. Depreciation varies with conditions, and may be said to be a function of individual shop practice. Some shops—not as many as there ought to be—use dull times such as we are now passing through to repair their machinery, but the majority repair them when they break down, and not before. But even with all these variables and extremes, the fact remains that even today with all the abnormal war-time purchases of new equipment to lessen the average age of the machines, if you go into almost any shop that was flourishing before the war, you will find that the average age of the machine tools is nearer ten years than it is five. If machines wear out in ten years and are replaced by new ones, then the average age of the machine tools in any shop at any time is five years, and I do not believe this is a representative figure.

All published lists that I have ever seen gave an unnaturally high rate of depreciation to shafting, hangers and pulleys. Someone set a rate of depreciation of 10 to 15 per cent in the days when line shafts were not properly lined up in the first place, or if they were, they did not long stay so. Since that time our buildings have been made more rigid, our factor of safety on shaft sizes has been raised, and various other improvements made which must have increased the life of transmission machinery, but we still stick to the old rates. Can you imagine anything around the shop that depreciates more slowly than a pulley? To be sure some of them are put in storage when the machine which they drove is scrapped, but in any well regulated shop, the percentage of pulleys stored for future demands is very small. The before-mentioned list gives 15 per cent as the annual depreciation of shafting pulleys and hangers, and there can be found in various books even higher figures so there is no lack of authority, but is there any authority in experience for this figure? Can anyone by theory or practice show the wear of transmission to be 50 per cent more rapid than machinery?

In 1917 I appraised the machinery in a packing house not a stone's throw from the *American Machinist* building. The shafting in this plant was so old that it was in even inches and multiples of quarter inches. How old this would be I cannot say, but for a good many years shafting has come in sizes $\frac{1}{16}$ under even sizes. The demands on this equipment were not very severe, and they were troubled with breakage due to mis-alignment to a greater extent than is usual, but nevertheless this old equipment was standing up to the work very satisfactorily and what trouble there was was not due to age as much as it was to lack of maintenance.

The last item gives the annual depreciation of shop furniture such as bins, benches and trucks as 25 per cent, which means an average life of four years. I have in mind a machine department and an erection floor that were equipped with lineshafts, benches and racks in 1900, and I know that with trifling exceptions these are in use today and have been in constant use during the past 20 years.

These recommended depreciation rates have all the weight of authority that could be desired by an accountant, but they are so entirely at variance with such experience as I have had in the shop and as an appraisal engineer, that I cannot but question them. As I have indicated in a previous article there is a tendency, or possibly a necessity, among accountants to assume the responsibility for depreciation rates, when it is an engineer's problem, or better, a shop superintendent's problem.

Making Flather Lathe Parts Interchangeable

Each Part a Separate Unit—Jigs and Fixtures Eliminate Individual Fitting—All Parts Made to Gages—Perfect Alignment of Centers Assured

SPECIAL CORRESPONDENCE

THE Flather lathe is too well known to all who have to do with machine shops to warrant an extended description of it as a machine, but there are some methods practiced in its manufacture that are out of the ordinary and are worthy of notice.

In design it has been so standardized, and the tools and fixtures used in its construction so perfected, that practically all of the parts for any given size of lathe are interchangeable to the extent that it is practicable to take a part from one lathe, put it on another lathe of corresponding size, and have the mechanism work as freely and as accurately as if those parts were specially built to place.

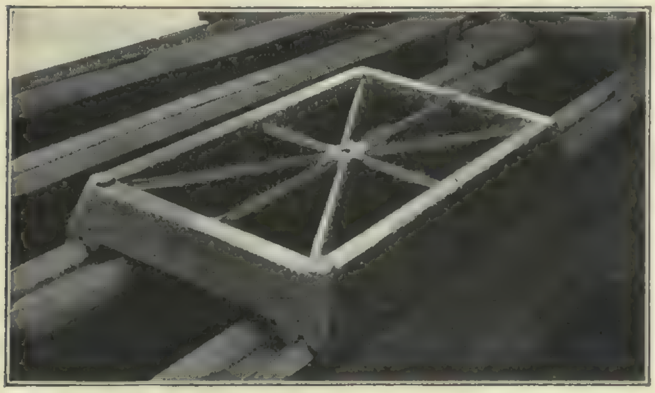


FIG. 1. SCRAPING PLATES FOR FITTING THE SHEARS

For each size of lathe bed there is a pair of scraping plates to which the shears and the saddles are fitted, and each plate has a master-plate by which the working plates may be checked and any departure from accuracy, whether by reason of legitimate wear or by misuse, noted and corrected.

By fitting the parts to these plates instead of to each other the builder is assured that they are all alike, and that any saddle may be used in conjunction with any lathe bed of corresponding size without the necessity for independent fitting. The master plates always remain in the toolroom and are not, therefore, subject to damage from handling; each plate being checked with the master-plate before being sent into the shop. One of the scraping plates is shown on a lathe bed in Fig. 1.

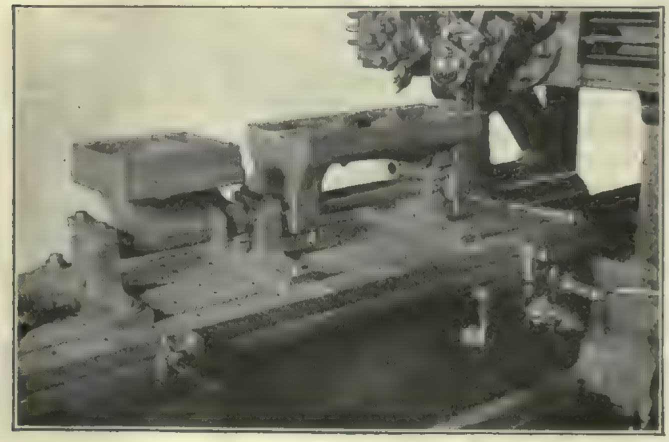
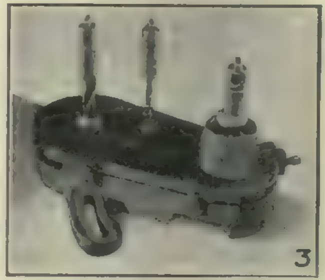


FIG. 2. PLANING UNDER-SURFACES OF HEADSTOCK AND TAILSTOCK

The headstock and tailstock of each lathe are completed and tested before the final cut is taken over the surfaces that rest on the lathe bed. The spindle bearings are of hard babbitt each scraped to its own spindle, and, being finished in advance of other operations that have to do with the location of the parts, become the locating points in subsequent operations.

A headstock and tailstock for a 16-in. lathe are shown in Fig. 2 in position upon the planer for the final operation. A planer is assigned to this particular job and used for no other purpose, so that there may be no possibility of error in the setting. The three V-blocks fitted to the planer table are planed in position and the mandrel upon which the parts are clamped by their own spindle bearings is ground true and is tested each time before using.

A separate mandrel is used for each size of lathe, with the shoulders so proportioned as to fit the bearings of the parts for which it is designed, and with three bearings of equal size at the points where the mandrel rests in the V-blocks, so that the headstock and tailstock are in the same position with respect to the planer table that they will later occupy in relation to the lathe bed; therefore there can be no question of faulty alignment.



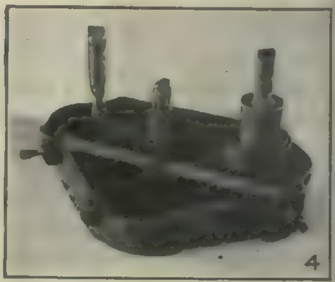


FIG. 3. JIG FOR DRILLING, REAMING AND COUNTERBORING THE SECTOR. FIG. 4. JIG FOR DRILLING THE GEAR COVER

By reason of the method used in the Flather lathe to secure the bearing caps to the housing, the spindle bearings may be firmly clamped to a mandrel that is the exact size of the journal on the spindle. The caps rest upon bushings of large diameter that are tapped into the caps, and the cap bolts pass through the centers of the bushings. Counterbored seats are provided in the housings in which the lower ends of the bushings bear, so that adjustment of the cap is taken care of by turning the bushings up or down as may be required; thus doing away with the necessity for using shims.

All holes in the headstock and tailstock for the attachment of accessory parts are drilled in jigs that are located from the spindle bearings, and all such parts are likewise jig-drilled so that any part may be used in connection with them without individual fitting. The smaller jigs are fitted with slip bushings so that drill-

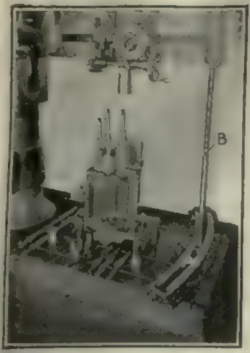
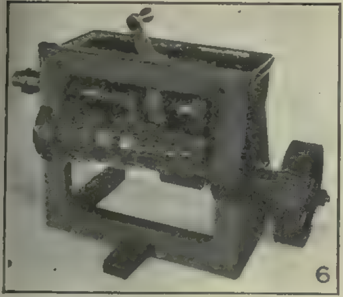


FIG. 5. BORING THE GEARBOX

ing, reaming, counterboring and tapping may be done without changing position; thus making it possible to do all machining operations upon a unit without loosening the holding clamps.

In Fig. 3, one of the smaller jigs is shown in place upon the swinging sector that carries the intermediate gear of the screw thread train, and in Fig. 4 is a similar jig for locating the holes in the gear cover.

The change gear box is a detachable unit secured to the lathe bed by bolts, and is made up independently of the lathe. In Fig. 5 may be seen the jig that locates the bearings for the three gear carrying shafts contained in the box. One shaft carries at its outer end the spur gear that constitutes one of the usual screw thread train upon the end of the headstock; corresponding to the "screw gear" that in the older form of lathe had to be changed every time it became necessary to "set up" to cut a thread. It is still necessary to change this gear to cut fractional threads not provided for in the box. The same shaft carries, within the box, a tumbler gear that is splined to the shaft and may be moved lengthwise of the shaft by means of the gear change lever in front. The second shaft carries the bank of gears into any one of which the tumbler gear may mesh to cut different pitches, and the third shaft carries the clutch gears that provide for the major changes; operated by the lever at the top of the box. This shaft connects directly with the leadscrew. Figs. 6 and 7 show rear and front views respectively of a standard gear box mounted upon a special stand for demonstration purposes.



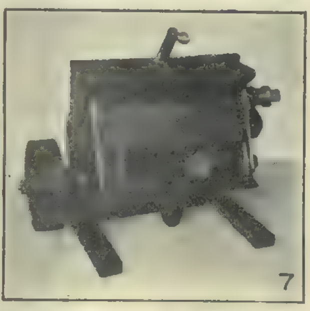


FIG. 6. REAR VIEW OF GEARBOX. FIG. 7. FRONT OF GEARBOX

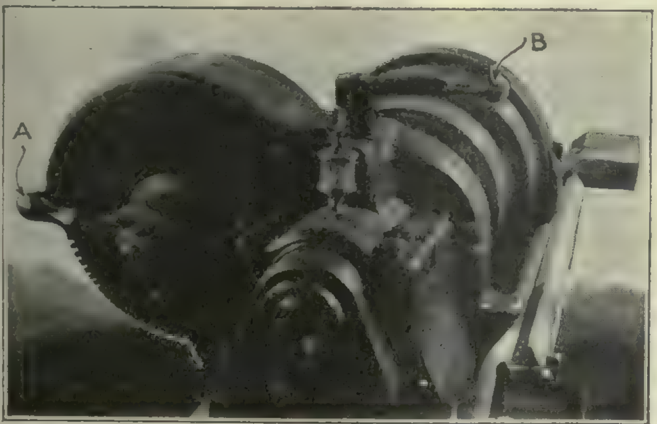


FIG. 8. THE TRIPLE-GEARED HEAD

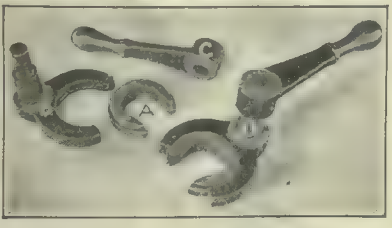


FIG. 9. DETAILS OF GEAR SHIFT LEVER.

The jig seen in Fig. 5 is reversible, so that both ends of a gear box may be finished at one setup, and slip bushings are provided for drills, rose-reamers, finishing reamers, counterbores, and facing cutters. The bolt that may be seen in the box in this picture is not a part of the jig, but is put in to act as a jackscrew to support the upper wing of the casting when the drills are at work. It is taken out before the reaming is done.

The machine used for most of the jig drilling is a standard radial drilling machine, on which special provision has been made for tying the outer end of the arm to the table to avoid the tendency to throw the tools out of line by reason of the deflection of the arm. The radius casting *A* is bolted to the table and the long T-head bolt *B* passes through the boss of an auxiliary saddle clamped to the arm of the machine. Locknuts upon this bolt above the saddle take the upward thrust caused by the drills.

A view of the double-geared head lathe is shown in Fig. 8. With the levers in the position indicated, the back-gears are out of service and the drive is direct from the cone to the spindle through the cone-locking-bolt in the main gear. By throwing the lever *A* forward the back-gears are brought into action.

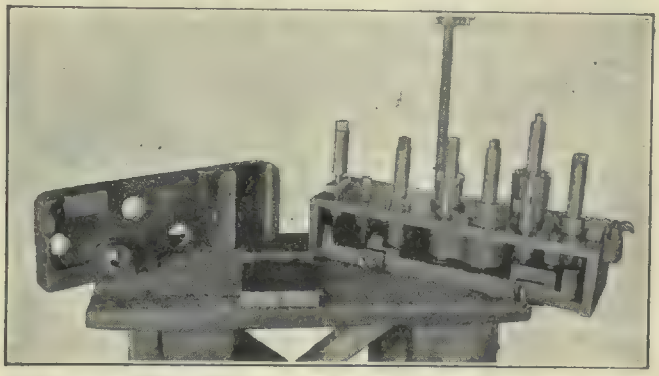


FIG. 10. TOOLS FOR MACHINING THE APRON

The place of the usual large gear on the back-gear quill is taken by a double gear that is splined to the quill; being free to move endwise of the quill. There are two gears of different diameters on the small end of the cone, into either of which the double gear may be made to mesh by sliding it lengthwise of the quill. This movement is accomplished by means of the lever *B*.

There are but three parts to the shift lever. In Fig. 9 part *A* is a yoke, the opening in which encloses the rim of the larger one of the double gears, allowing the gear to turn freely within it but without shake sideways. This yoke, in turn, fits the larger yoke *B*, being held from falling out by the tongue and groove, but free to turn within it. As the yoke *B* is more than half of a circle the part *A* cannot come out unless the opening in the latter is so turned as to coincide with the opening in part *B*. As the gear itself prevents the part *A* from turning when all the parts are assembled, part *A* is, perforce, obliged to remain in its allotted place, turning only enough to permit a slight rotative movement of part *B* when the lever is moved from side to side. The device is very simple and effective. The stud and the lever *C* complete the assembly and the whole is held in place by the gear cover. It can be assembled or taken apart without tools when the gear cover is removed. At *D* the various parts are shown assembled. Fig. 10 shows a jig for locating the holes in the apron of the carriage. This is a difficult part to make interchangeable, inasmuch as there are thirteen holes (irrespective of the holes for the bolts that attach the apron to the saddle) all of which are interdependent both in the horizontal and the vertical plane. Jigs for locating the apron and the gibs on the saddle are shown in Fig. 11. Any mechanic that has tackled the job of replacing the nut upon the crossfeed screw or the compound screw of a lathe will appreciate the difficulty of getting them to work freely without undue backlash, even when they are drilled and tapped in place upon the identical slide with which they are to be used. In this lathe these parts are made interchangeable so that a new nut may be put in place of one that has become worn or broken without any fitting being necessary.

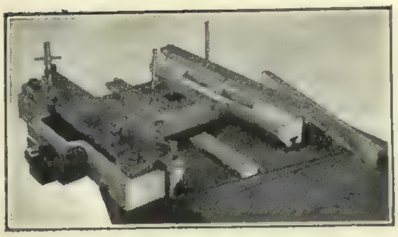


FIG. 11. LOCATING GIBS AND APRON ON SADDLE

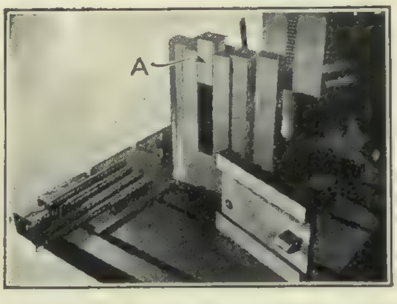


FIG. 12. JIG FOR DRILLING AND TAPPING CROSSFEED NUT

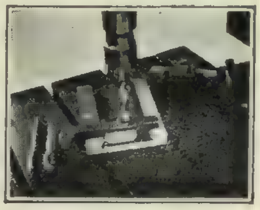


FIG. 13. JIG TO LOCATE NUT IN CROSS-SLIDE

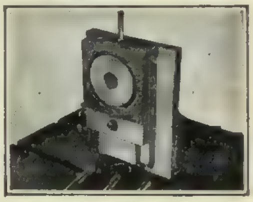


FIG. 14. DRILLING THE NUT FOR THE COMPOUND SLIDE

The jig for doing this work is shown in Fig. 12. In its main features it is like a section of the saddle with a carefully finished dovetail upon which the cross-slide fits, and is mortised into the face of a special angle plate which holds it truly vertical under the drill press. As the nuts are expected to interchange freely between one cross-slide and another, the locating of the nut in the casting is of first importance. The jig by means of which the locating hole is drilled, reamed, and counterbored is shown in Fig. 13. The locating point of the jig, as in all the others used in this connection, is that side of the dovetail that bears directly against the corresponding side of the saddle. Though variation is not expected or tolerated in these parts, if by any chance variation should exist it would be taken care of by the taper gib by which the work is held to the jig in subsequent operations.

After the nut is in place in the cross-slide, the latter is placed in position on the jig as shown in Fig. 14; the loose piece *A*, Fig. 12, coming out to allow the nut to clear. The cross-slide is then clamped to the jig by means of the taper gib inserted on the other side of the dovetail and the loose piece *A* reinserted. Part *A* is made a very close fit in the jig and is, in effect, the guide bushing that locates the holes. As shown in Fig. 12 it is partly withdrawn for the purpose of showing the construction.

The nut for the compound slide is located, drilled and tapped in similar jigs; all being a part of the same general series and operated in the same manner. Fig. 15 shows the jig for locating the nut; Fig. 16, for drilling and tapping the nut; and Fig. 17, for drilling, counterboring, and tapping the compound slide for the bushing that carries the compound screw. Fig. 18 shows the set up for drilling, reaming, counterboring and tapping the hole in the saddle for the sleeve that carries the crossfeed screw.

The leadscrew nut in the apron of a lathe is a detail that calls for careful and accurate workmanship, for it must be in exact alignment with the bearings of the leadscrew so that it will not cramp the screw when the carriage is brought near to either end of its travel. It must open and close freely, and when closed, must bear perfectly upon the screw. Inattention to these details will cause the lathe to cut an imperfect thread, a fatal defect in a modern high-class engine lathe. The leadscrew nut of a Flather lathe is cast from hard babbitt in a shell of cast iron. The casting is done in a jig, and though the nut is cast to form it is not cast to size, but enough metal is allowed so that the threads can be cut to size on the lathe itself. In Fig. 19 are shown the tools used and the manner of using them.

FIG. 15. LOCATING NUT FOR COMPOUND SLIDE

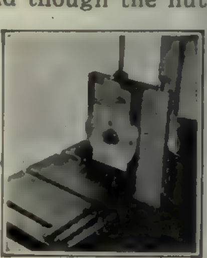


FIG. 16. DRILLING THE NUT IN THE CROSS-SLIDE

The bridge *A* is fitted to the shears of the lathe bed in the same way that the saddle of a carriage would be fitted, and, in place of the apron, carries a bracket which supports a guide bushing, the center line of which coincides with the position to be occupied by the leadscrew. The rear bearing bracket for the leadscrew has already been fitted to the lathe and when the bridge is moved as far to the right as this bracket will allow, the plug *B* must pass through both bracket and bushing without binding. The placing of the jig in position thus constitutes a check upon the work that has previously been done upon the lathe bed, for difficulty in entering the plug would show faulty alignment.

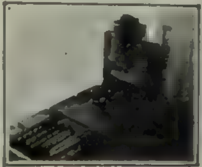


FIG. 17. DRILLING AND TAPPING FOR SLEEVE OF COMPOUND SCREW

After the alignment test the bridge is moved to the left a distance equal to the length, between bearings, of the extension tap-holder *C* which rests in the rear leadscrew bearing and the guide bushing in the jig. The jig thus supports the tap close to the cut, and as there is but very little material to remove, and that of a comparatively soft nature, the resulting nut is in exact alignment with the center-line of the screw.

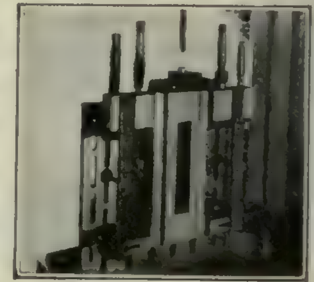


FIG. 18. JIG AND TOOLS FOR DRILLING, COUNTERBORING AND TAPPING THE SADDLE FOR SLEEVE OF CROSSFEED SCREW

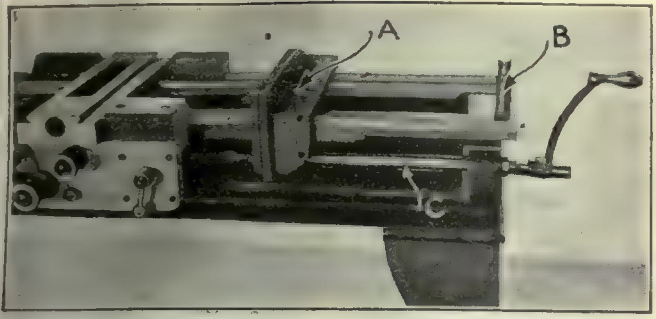
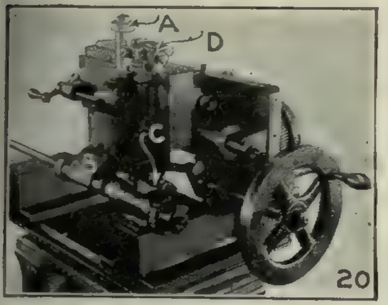


FIG. 19. RETAPPING THE LEADSCREW NUT

Practically all modern lathes have micrometer dials on crossfeed and compound screws, and the Flather is not an exception. Though hardly to be considered under the general heading of tools, jigs and fixtures, the little graduating machine shown in Figs. 20 and 21 is of considerable interest.



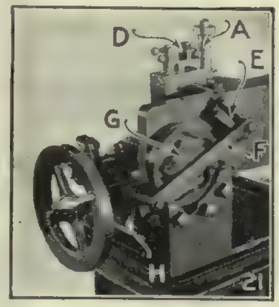


FIG. 20. FRONT VIEW OF GRADUATING MACHINE.
FIG. 21. REAR VIEW; SHOWING CAM MOVEMENT

The work to be graduated is placed on the upper end of the vertical spindle *A*, Fig. 20, and is held by a nut. There is also a spline for locating it, but a spline is a necessary part of a micrometer dial anyway; it is not required by the machine. The work spindle is turned by a worm and wheel located at *B*, the worm being actuated by the ratchet and pawl movement at *C*. The number of lines to the circle at the end of the work spindle is thus a resultant of the number of teeth on the ratchet; and the ratchet can easily be changed.

The ram *D* has a vertical movement derived through rack and pinion from the rocker at *E*, Fig. 21; and this movement is variable by changing the position of the stud in the rocker. Motion is transmitted through the rod *F* from the five-lobed face-cam *G*. The rock lever *H* has no function other than to support the outer end of the connecting rod against the downward thrust of the cam. One lobe of the cam is somewhat higher than the other four so that every fifth mark on the work is longer than the rest. The upper end of the ram *D* is fitted with a diminutive clapper-box that will hold any kind of a tool that is suitable to the work. The saddle carrying the work spindle is adjustable to and from the ram so that work of widely varying diameters may be accommodated. The worm is splined to its shaft and works between shoulders in the housing of the worm-wheel so that it requires no attention when making adjustments for diameter.

The machine, which is hardly larger than a good sized sewing machine, is turned by hand, and as all parts are positively geared together and there are no movements to make except to put on the work and turn the crank, the job is an excellent one for an inexperienced boy. There are no mistakes that he can make.

The Only Bolt Works in India

By B. H. Desebrock

Manager Machine Tool Sales, Pawling & Harnischfeger Co.

On page 904, Vol. 54, of the *American Machinist* is an article on the Bengal Bridge & Bolt Co., owned by Bannerjee Brothers of Calcutta, India, as being the only nut and bolt works in India. The statement contained in the article is not correct; and for your information we give you data on modern bolt and nut works erected in India during the last year.

In November, 1919, a company was formed, called the Indian Industrial Corporation, Ltd., of which the Soparivalla Brothers, wealthy grain exporters of Karachi, and Visham Narsi, the head of the Cutch Community in India, were the owners. The company has a capital of five lakhs of rupees, and in December, 1919, placed an order for a complete bolt and nut works, together with a large reclaiming mill.

Modern Plants and Equipment

The buildings, completed last November, are of reinforced concrete and are two in number, 100 ft. long by 40 ft. wide, each containing the most modern machinery of its kind in India. The reclaiming mill, bolt-heading machines and nut-making machines were purchased from the Ajax Manufacturing Co. of Cleveland, Ohio. The bolt-threading machines were manufactured by the Greenfield Tap & Die Corporation, Greenfield, Mass., the tapping machines for nuts by the Weigel Drill Co. of Peru, Ind., the lathes by the South Bend Manufacturing Co., South Bend, Ind., the pumps and boxing machinery by the C. H. & E. Mfg. Co., of Milwaukee, Wis., the forges by the Buffalo Forge Co., Buffalo, N. Y., and the double-door heating furnaces with oil-burning attachments were furnished by the W. S. Rockwell Co. of New York, N. Y.

The power for the entire nut and bolt-making plant is furnished by a 2-cylinder kerosene engine of 40-hp. manufactured by the Cook Motor Co. of Delaware, Ohio. The reclaiming mill is driven by a 100-hp. electric motor, the current for which is supplied by the Karachi Electric Supply Corporation. The works are situated in the Thöle Produce Yard and the grounds leased for a period of 50 years from the Karachi Port Trust. A special road was built by the Trust to the plant. It is worth while for anybody visiting Karachi to see this plant, because the design of the buildings is unique.

Wood Screws Also Made

It may be well to add that the first wood-screw manufacturing plant in India, Burma, and Ceylon is now being erected in Calcutta, the machinery having been delivered in February. The plant, which contains about 38 machines, has a daily output of 500 gross of commercial sizes of steel wood-screws. The machinery was supplied by the Asa S. Cook Co., Hartford, Conn.

Negotiations are under way at the present moment to place two more large screw plants in India for the same interests, one in Bombay and one in Madras, the output of the former to be 2,000 gross per day and of the latter 1,000 gross per day.

Mr. Moon, who has spent much time in India and who had entire charge of the designing, equipping and erecting of both of the plants just built, furnished the information for this article. He is in America at this time working on plans for other plants in India.

Roller Tools For Finishing Axle Journals

Roller Tool Used to Put Finish on Car and Locomotive Axles—Details of Construction and Method of Use

By J. V. HUNTER

IN LOCOMOTIVE shops axle journals are finished by a rolling process in the lathe after a truing cut has been made on the bearing. The finish produced is glassy smooth and indicates a densely compact skin-coat on the surface. What may be accomplished in the development of a roller-type of tool to do this work satisfactorily is shown by the different designs of tools that have been made in the Beech Grove shops of the Big Four Railroad Co., Indianapolis, Ind. These designs have been evolved in three successive steps as each of the preceding models showed its weak points in service. The tool now in use is proving highly satisfactory and the shop has standardized on this design.

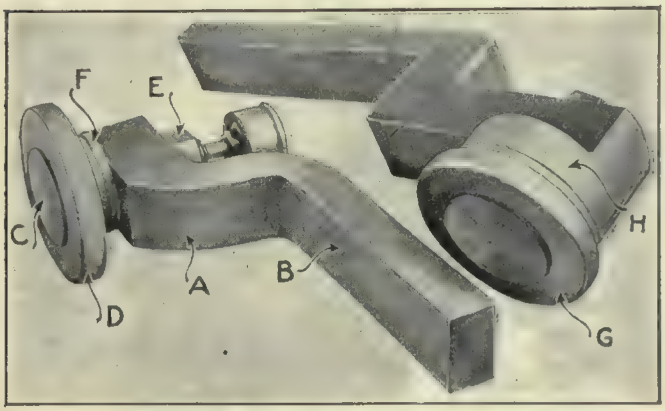


FIG. 1. EARLY TYPES OF ROLLER-TOOLS FOR AXLE JOURNALS

The original tool made for rolling axle journals is shown at *A*, Fig. 1. It has a forged steel shank *B*, drilled for the hollow pin *C* on which the roller *D* rotates. The pin has a large head to hold the roller and is held in the shank by the nut *E*. The side thrust of the roller is taken by a bronze washer *F*. A grease cup on the end of the pin is used to force lubricant into the bearing.

This tool did not stand up in service. The side-twist was so severe that the pin was soon worn out and the thrust washer cut to pieces. No amount of lubricant forced to the bearing would prevent it from quickly over-heating.

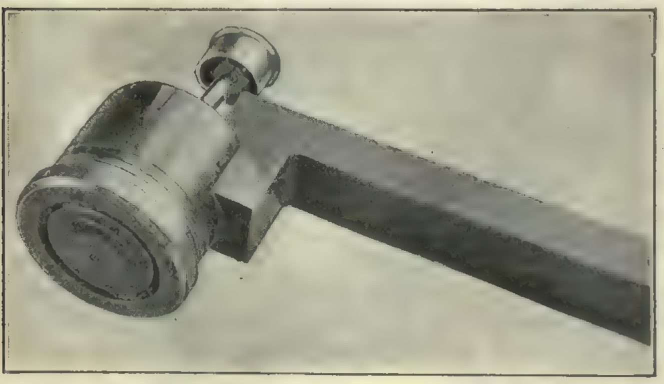


FIG. 2. LATEST TYPE OF TOOL WITH ROLLER AND BALL BEARINGS

The tool shown at *G*, Fig. 1 is the second design made with a view to overcoming the handicaps caused by the side-twist of the roller. In this tool the side-bearing shoulder was greatly enlarged, more than trebling the bearing surface. The shank was forged and finished with the enlarged head *H* so as to furnish means of distributing the side bearing pressure and a bronze washer between hardened steel plates was provided for thrust bearing. However, the pin used in the second tool is similar to that used in the first, the only change being to somewhat enlarge its diameter. The same means of lubrication were provided.

The second tool showed practically the same difficulties of operation that were encountered with the first. The thrusts were not distributed over sufficient area to prevent the surfaces from quickly overheating and cutting.

The third design of tool, shown in Fig. 2, has proved remarkably serviceable and has been adopted as the final approved form. The shank has an enlarged head and the design of the bearings is entirely different; a roller bearing is used for the radial load and two ball thrust bearings, one on each side of the roller, are used to carry the side-thrust load.

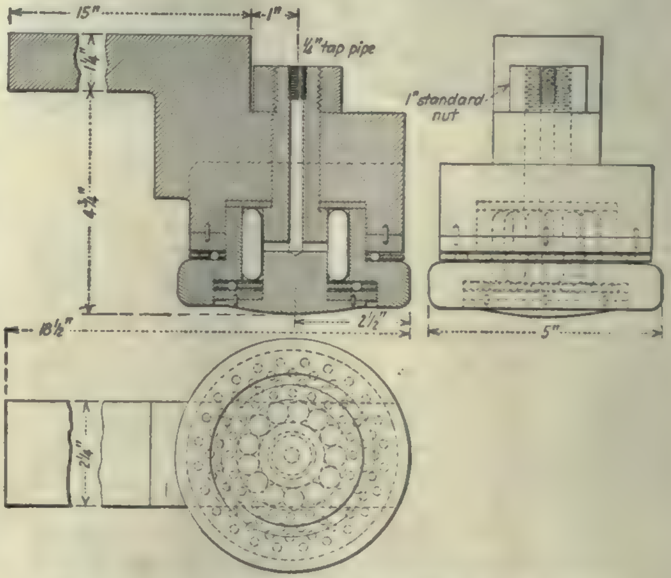


FIG. 3. DETAILS OF CONSTRUCTION OF LATEST TYPE OF TOOL

The construction of the tool is shown in detail in Fig. 3. The journal roller is made with a sleeve instead of being a plain disk and permits the use of longer rollers for the radial load. As the side-thrust has been found to be against the side of the pin head as well as against the tool shank, ball thrust bearings have been inserted in both locations. Both ball bearing retainers were made in the shop from brass disks drilled for $\frac{3}{16}$-in. balls, the larger for forty-eight and the smaller for forty balls. Hardened tool steel washers are used for thrust plates outside the ball thrust collars. As the roller is hardened tool steel, it is capable of taking the

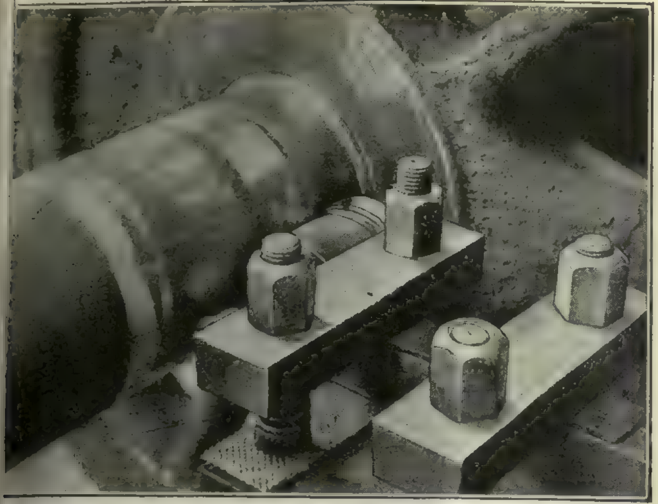


FIG. 4. ROLLER TOOL IN OPERATION

wear from the balls on its own surfaces. The pin is drilled so that lubricating grease can be forced into the roller bearing, from which point it naturally flows to both of the ball thrust-bearings.

That the bearing difficulties have apparently been effectually solved was shown by an examination of a tool after it had been in service for some time. The tool then showed no trace of heating and was producing a very satisfactory finish on the journals of a heavy driving wheel axle.

TOOL IN OPERATION

The latest type of tool is shown in operation in Fig. 4, being held in the tool post in the same manner as a regular turning tool. In this case the operation was started at the wheel hub and the tool is shown feeding toward the center of the axle. The feed maintained for the rolling operation is exactly the same as that used on the final turning cut; approximately $\frac{3}{64}$ in. The operator stated that only a very gentle pressure need be applied by the cross-slide screw in order to have the tool produce a good finish. He also said that unsatisfactory results could often be accounted for as having been caused by too great pressure on the work. The surface of the journal should be kept covered with a liberal coating of machine oil during the rolling operation, as the oil aids in obtaining a high finish. The roller-tool can be passed over the bearing several times if required, or until the marks left from turning have been entirely eliminated.

Unemployment Scores

Abstract from paper presented by Morris L. Cooke at the Cleveland meeting of the Taylor Society May 21, 1921.

That unemployment is not only an important factor in manufacturing costs, but is also an unnecessary economic waste of the first magnitude, was brought out by Morris L. Cooke, of Philadelphia, in a paper read before the recent meeting of the Taylor Society, in Cleveland. Mr. Cooke's paper is not a theoretical discussion; he cites facts and figures concerning the various phases of unemployment and practically demonstrates that the responsibility for higher costs, poorer workmanship and dissatisfaction among the workers rests with those employers who are incapable of managing so as to keep their workers busy the year round. The following are excerpts from Mr. Cooke's paper:

"The maximum relief from the evils attendant upon unemployment will come about through a localization of the problem within the individual manufacturing plant.

"The time seems to have arrived when we must pull our discussion of unemployment down out of the skies of speculative thought and interpret it in terms of actual everyday shop practice.

"My own impression is that the total of 'Unemployment without Employment'; i.e., the unemployment of what may be called jobless men, represents a relatively small percentage of the total. In some industries and especially in good times, it may easily represent an almost negligible part of the total unemployment. If this assumption proves even relatively near the truth, it will pay us to devote our most painstaking attention to the unemployment of men and women who can, very broadly speaking, be said to have jobs.

"And, of course, if we can assume that, let us say, 90 per cent of all the employment in the world is that suffered or enjoyed by those 'with jobs,' we have localized the responsibility in the first instance at least within the scope of the individual plant. And every employer is cited at the bar of public opinion to show cause why he is not guilty of contributory negligence in adding to the sum total of unemployment. In other words, the burden of proof is on every employer who lays any claim to industrial leadership to show that he has availed himself of every possible device for providing steady employment.

"But *self-interest* will more and more move manufacturers to undertake the detailed study of the unemployment problem as it becomes recognized that general industrial effectiveness, and more especially low costs, are altogether inconsistent with intermittency of employment.

"It is the testimony of the best managers the world over that as we learn to carry on a given class of work in better fashion the percentage of the skilled workers increases. In fact there is an abundance of evidence supporting the theory that when industry becomes truly scientific there will be no place for the unskilled. Hence we can safely conclude that the better the management the greater will be the financial sacrifice necessarily associated with lay-offs and dismissals.

"I believe we have now arrived at the time when the manufacturers who are to be the most prosperous in the long run will definitely decide on the size of the force required and hold to it. In almost every case this will mean a force smaller than the one now employed. Better methods and a decision to give steady employment to those employed almost invariably means an ultimate reduction in the normal force. Every effort should be made to effect this gradually through normal separations and not by 'firing' anybody. There is nothing here to preclude growth but it should be growth considered in the light of a steady, long-time demand for service.

"Another idea which while not current nevertheless appears to be inherent in effective manufacturing, suggests that idleness on the part of piece workers has as decided an effect on costs as idleness anywhere else. The employer does not appear to pay in any way for this type of idleness simply because he does not pay in direct wages. But he pays in unnecessarily high piece rates and in other more indirect ways. In an economic sense all idleness during predetermined hours of work is waste. Important as it is from a manufacturing standpoint to keep machines busy it is much more so to keep the workers busy."

Axles for Airplane Landing Gear

Large Airplanes Require Substantial Construction to Stand Shock of Landing—Alloy-Steel Tubing and Fittings Are Carefully Brazed and Soldered

SPECIAL CORRESPONDENCE

WE DO not always appreciate the development which is taking place in airplane construction unless some of the essential details are brought to our attention. In the increasing size and weight of planes it is very necessary to pay particular attention to the landing gear, as the stresses imposed by the landing of a heavy weight at high speed are considerable. Compared with the early planes which were of fairly light construction, the axles of the landing gear of a Martin twin-motored mail bombing plane seem extremely heavy, but experience has proved this to be necessary in order to secure the reliability which is so necessary both for the safety of the pilot and the continuity of the service.

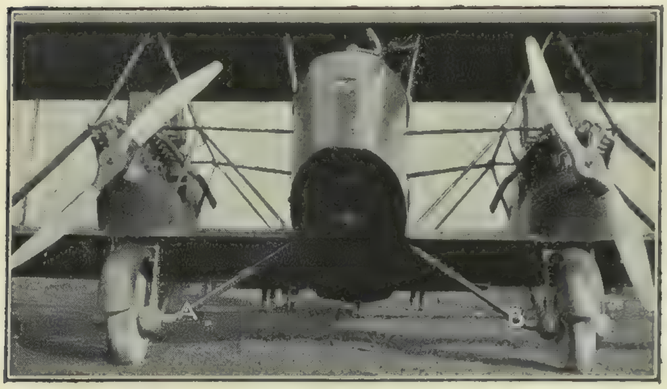


FIG. 1. THE AXLE IN POSITION

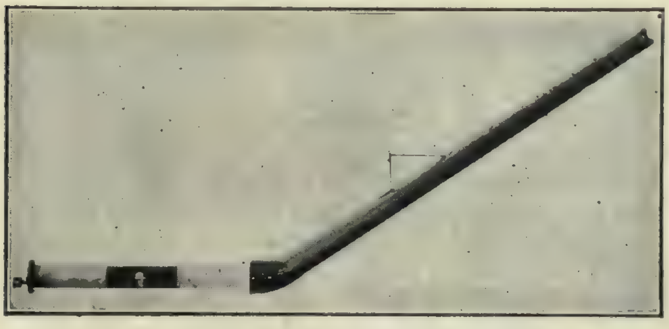


FIG. 2. ONE OF THE COMPLETED AXLES

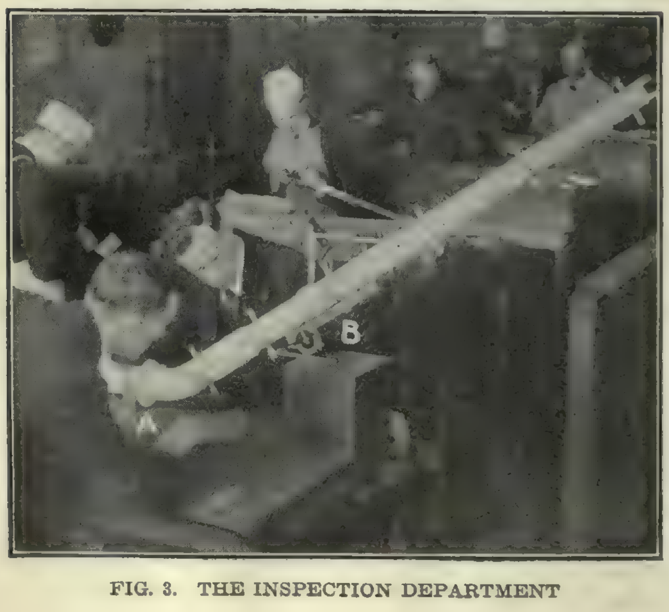


FIG. 3. THE INSPECTION DEPARTMENT

In Fig. 1 is shown a front view of one of these double motored bombing planes, the axles of the landing gear being shown at *A* and *B*. This is shown in further detail in Fig. 2, while Fig. 3 shows one of the axles being inspected after completion. This view shows the wheel end at *A* supported in a horizontal position by V-blocks, while the angle of the other end is being determined by the bevel protractor at *B*. It also shows further inspection operation on other parts.

Details of the axle are shown in Fig. 4, which is worth studying for a number of reasons. The axle consists primarily of a bent tube, as shown, and joined to a somewhat lighter tube which connects to the lower corner of the fuselage, as can be seen in Fig. 1. Fig. 4 gives the general dimensions and also shows the number of points to be brazed and soldered, as well as the rivets used to hold the various parts in position. The finished weight of each axle is 60 lb. 10 oz., which gives some idea of its substantial character.

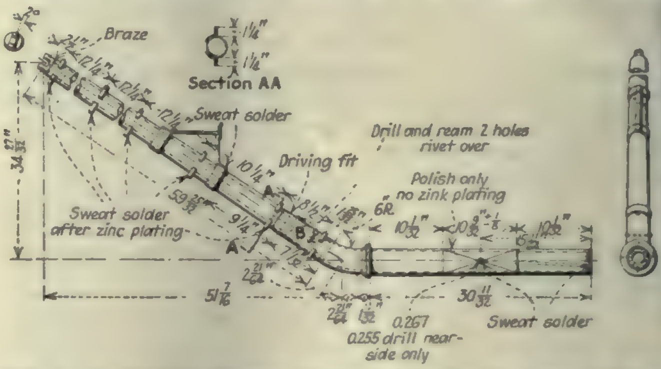


FIG. 4. DETAILS OF THE CONSTRUCTION OF THE AXLE

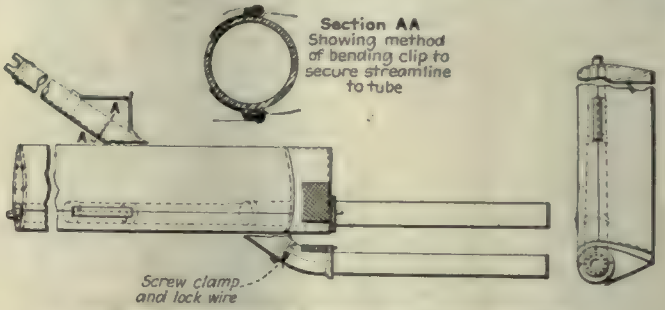
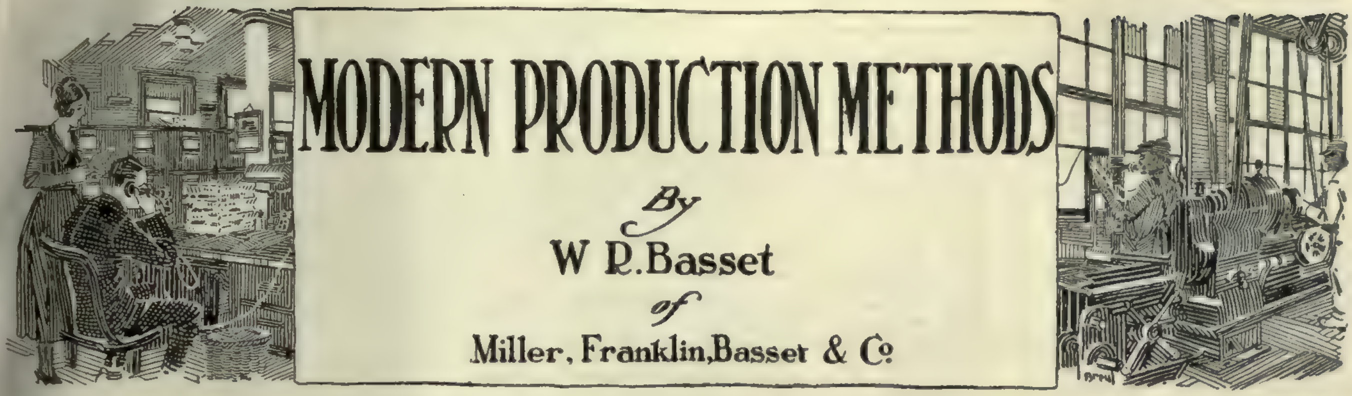

Section AA
Showing method of bending clip to secure streamline to tube
A
A
Screw clamp and lock wire

FIG. 5. HOW THE AXLE IS STREAMLINED

In both Figs. 3 and 4 are what appear to be pins through the axle tube. These, however, are metal strips on the outside for fastening the stream lining of the angular or "strut" portion of the axle. The shape of this steam lining is shown in Fig. 5, which also shows how the sheet metal is held in place by curling the clips as indicated in the cross-section view. The stream lining adds but 2¾ lb. to each axle and greatly reduces the air resistance as the plane flies at high speed.



MODERN PRODUCTION METHODS

By
W R. Basset
of
Miller, Franklin, Basset & Co

XVIII. Gathering the Final Costs

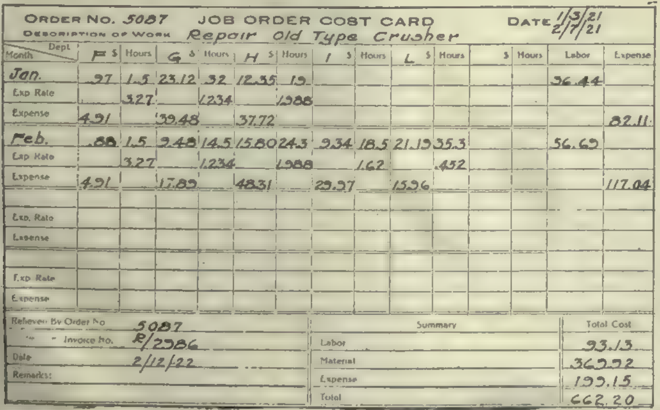
Finding of Total Cost Figures Only One Function of Cost-Accounting — Various Forms for Collecting Final Cost Items — The Ledger Accounts

MANUFACTURERS commonly look toward a figure representing the total cost of their product as the goal of cost finding. I have tried to make clear throughout these articles that nowadays that figure is comparatively unimportant, that it is purely historical, of some value in estimating future work, no doubt, but secondary to other ends which the cost system can be made to serve.

It is of little present value for the manufacturer to know when a job is done that it has cost him $4,190.27-3/7 as against the selling price of $4,000 which he quoted. It is much more important for him to know as work progresses that the cost is running too high, and why. That gives him control of the manufacturing operations in time to remedy inefficient methods, so that the final cost figure will be a pleasant one.

THE FINAL COST FIGURE

From the start of this series, we have been working toward the final cost figure; accumulating the amount of labor and material going into each part; building up the overhead expense, and devising a method by which the expense can be charged into each item of the product in the proper amount; and tying the cost figures into the general books so that there will be numerous checks on the accuracy of the costs. The methods for accomplishing these results have been so chosen as to give a constant and close control of manufacturing and to notify the executive if his costs are running too high.



ORDER NO. 5087 JOB ORDER COST CARD DATE 1/3/21 2/7/21
DESCRIPTION OF WORK Repair Old Type Crusher

Dept / Month	F $	Hours	G $	Hours	H $	Hours	I $	Hours	L $	Hours	$	Hours	Labor	Expense
Jan.	.97	1.5	23.12	32	12.35	19							36.44	
Exp Rate		327		1234		1988								
Expense	4.91		39.48		37.72									82.11
Feb.	.88	1.5	9.48	14.5	15.80	24.3	9.34	18.5	21.19	35.3			56.69	
Exp Rate		327		1234		1988		1.62		.452				
Expense	4.91		17.89		48.31		29.37		15.96					117.04
Exp. Rate														
Expense														
Exp Rate														
Expense														

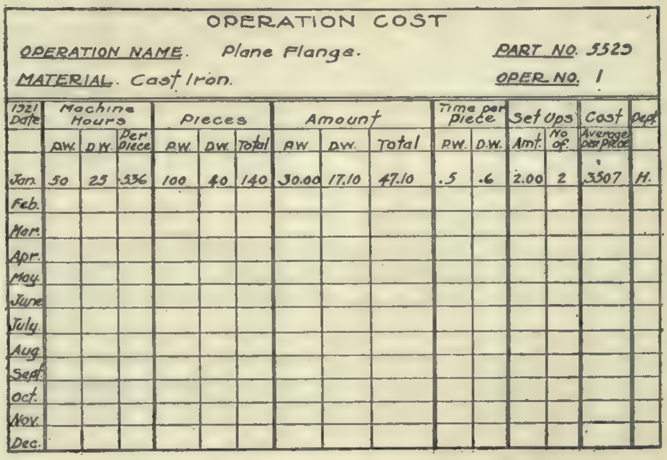
Relieved By Order No 5087
" " Invoice No. R/2386
Date 2/12/22
Remarks:

Summary	Total Cost
Labor	93.13
Material	369.92
Expense	199.15
Total	662.20

FIG. 85. JOB ORDER COST CARD

Specifically, we have now developed figures to show: (1) The material chargeable to each part; (2) The direct labor chargeable to each part; (3) The proportion of overhead to be charged.

In order to determine the total or final cost of a part, we have only to gather these figures. The labor has been recorded on the service cards; the material on the requisitions; and the normal expense rates have been developed and deviations from them shown on the expense analysis.



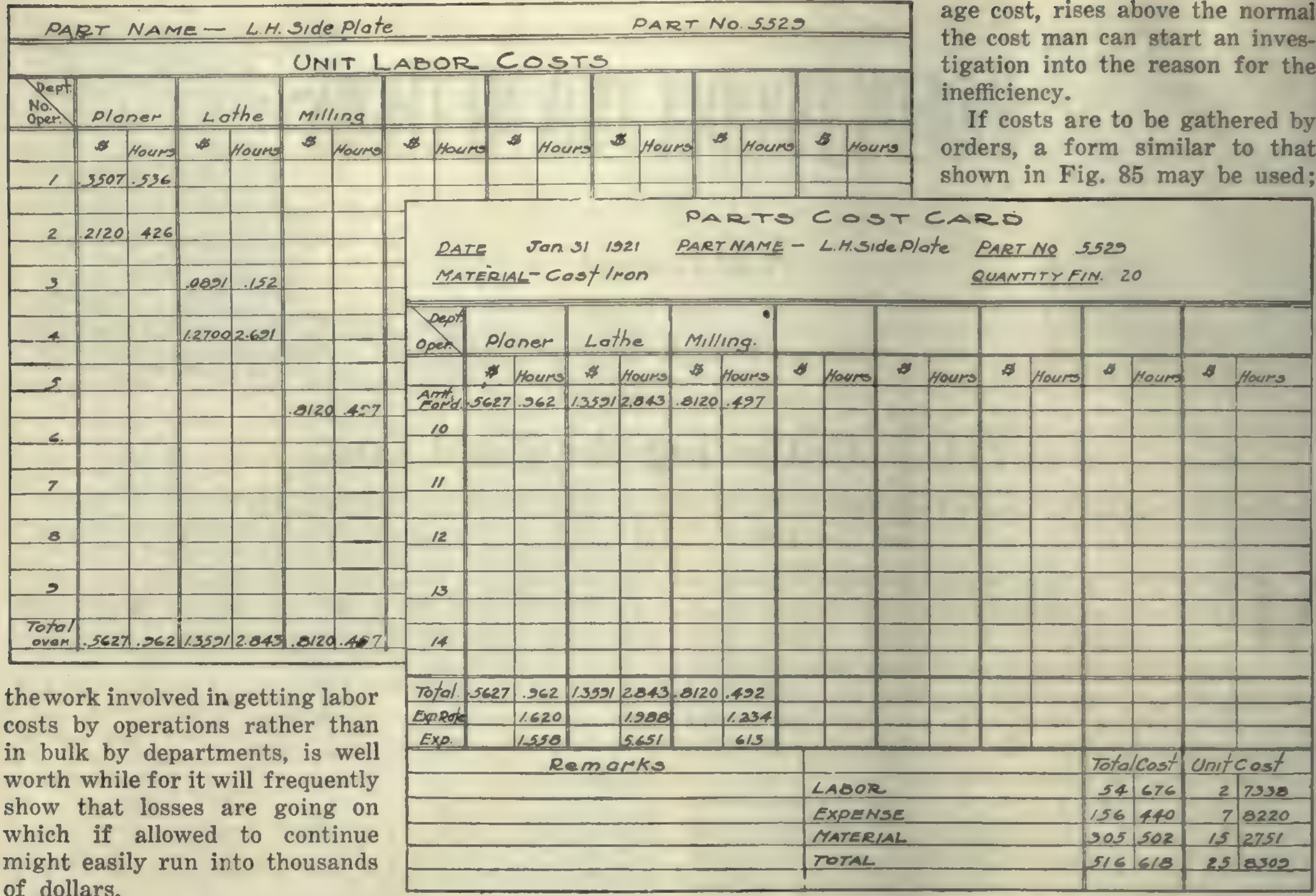
OPERATION COST

OPERATION NAME. Plane Flange. PART NO. 5523
MATERIAL. Cast Iron. OPER. NO. 1

1921 Date	Machine Hours			Pieces			Amount			Time per Piece		Set Ups		Cost	Dept
	P.W.	D.W.	Per Piece	P.W.	D.W.	Total	P.W.	D.W.	Total	P.W.	D.W.	Amt.	No of.	Average per Piece	
Jan.	50	25	.536	100	40	140	30.00	17.10	47.10	.5	.6	2.00	2	.3507	H.
Feb.															
Mar.															
Apr.															
May.															
June															
July.															
Aug.															
Sept.															
Oct.															
Nov.															
Dec.															

FIG. 86. OPERATION COST CARD

The direct labor cost may be gathered (1) by operation, or (2) by departments. The first method is preferable as it gives closer control, and shows more accurately the shop efficiency. Exceedingly inefficient manufacturing may be buried from sight indefinitely if the direct labor for an entire department is reported. For example, the departmental labor may be less than expected—thus making the executive feel falsely secure—although this result may be produced, not by skillful management of the whole department, but by having an extremely dexterous workman on one operation whose low labor cost offsets the high cost of a poor workman in the same department. If the labor is reported by operations, the true conditions become at once apparent and steps can be taken to correct the inefficiency. This is another instance where good judgment must determine the degree of detail with which costs are gathered. In some phases of cost finding, it is possible to spend a great deal of money going into detail which brings no return. In this case, however,



PART NAME — L.H. Side Plate PART No. 5529

UNIT LABOR COSTS

Dept. / No. Oper.	Planer		Lathe		Milling											
	$	Hours	$	Hours	$	Hours	$	Hours	$	Hours	$	Hours	$	Hours	$	Hours
1	.3507	.536														
2	.2120	426														
3			.0891	.152												
4			1.2700	2.691												
5					.8120	.497										
6.																
7																
8																
9																
Total over	.5627	.962	1.3591	2.843	.8120	.497										

PARTS COST CARD

DATE Jan. 31 1921 PART NAME — L.H. Side Plate PART No 5529
MATERIAL — Cast Iron QUANTITY FIN. 20

Dept. / Oper.	Planer		Lathe		Milling.											
	$	Hours	$	Hours	$	Hours	$	Hours	$	Hours	$	Hours	$	Hours	$	Hours
Am't. Forw'd.	.5627	.962	1.3591	2.843	.8120	.497										
10																
11																
12																
13																
14																
Total.	.5627	.962	1.3591	2.843	.8120	.492										
Exp. Rate		1.620		1.988		1.234										
Exp.		1.558		5.651		613										

Remarks		Total Cost		Unit Cost	
	LABOR	54	676	2	7338
	EXPENSE	156	440	7	8220
	MATERIAL	305	502	15	2751
	TOTAL	516	618	25	8309

FIG. 87. PARTS COST CARD

the work involved in getting labor costs by operations rather than in bulk by departments, is well worth while for it will frequently show that losses are going on which if allowed to continue might easily run into thousands of dollars.

In an earlier section we mentioned that the productive service cards, when an operation is completed, are sent to the central cost department. Here they are priced and sorted, first to part number and then to operation number, and are so filed until the end of the month. In this file, there is a card for each operation on each part, with a master card set up either by part or order number.

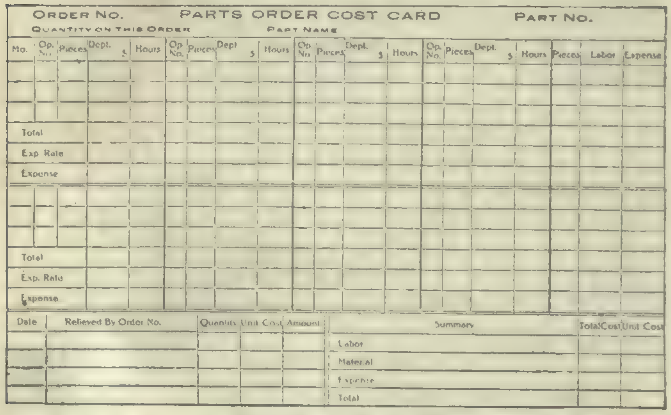
Here it becomes necessary to decide for each shop whether the costs shall be gathered by parts or by orders. If the shop is largely on job work, where a given part may go through only a few times in a year, it is ordinarily best to gather costs by orders; that is, by jobs. It is only in the repetitive shop where certain parts are made in considerable quantities, that good use can be made of part costs by operations. On repetitive work, the cost man can watch his costs month by month, and if the time taken per piece, or the average cost, rises above the normal the cost man can start an investigation into the reason for the inefficiency.

If costs are to be gathered by orders, a form similar to that shown in Fig. 85 may be used; if by operations, the form shown in Fig. 86 is recommended.

At the end of the month, the service cards for each operation on each part are totalled and the results posted to whichever of these two forms it is decided to use. From these cards it is easy to calculate the average labor cost per piece for that operation for the month.

It is now possible to check again the accuracy of our costs. This is done by totalling the productive labor posted to the cards, shown in Fig. 85 or Fig. 86, during the month. This total should be the same as the amount of productive labor which has been transferred from the payroll account to the goods in process account.

The service cards from the toolroom are kept in a

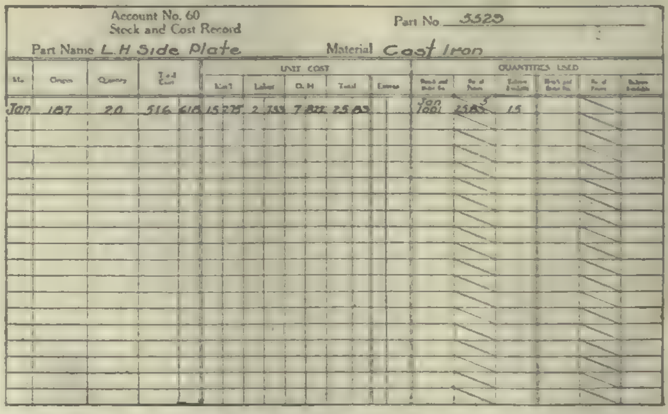


ORDER NO. PARTS ORDER COST CARD PART NO.
QUANTITY ON THIS ORDER PART NAME

Mo.	Op. No.	Pieces	Dept. $	Hours	Op. No.	Pieces	Dept. $	Hours	Op. No.	Pieces	Dept. $	Hours	Op. No.	Pieces	Dept. $	Hours	Pieces	Labor	Expense
Total																			
Exp Rate																			
Expense																			
Total																			
Exp. Rate																			
Expense																			

Date	Relieved By Order No.	Quantity	Unit Cost	Amount	Summary	Total Cost	Unit Cost
					Labor		
					Material		
					Expense		
					Total		

FIG. 88. PARTS ORDER COST CARD FOR USE IN A JOBBING SHOP

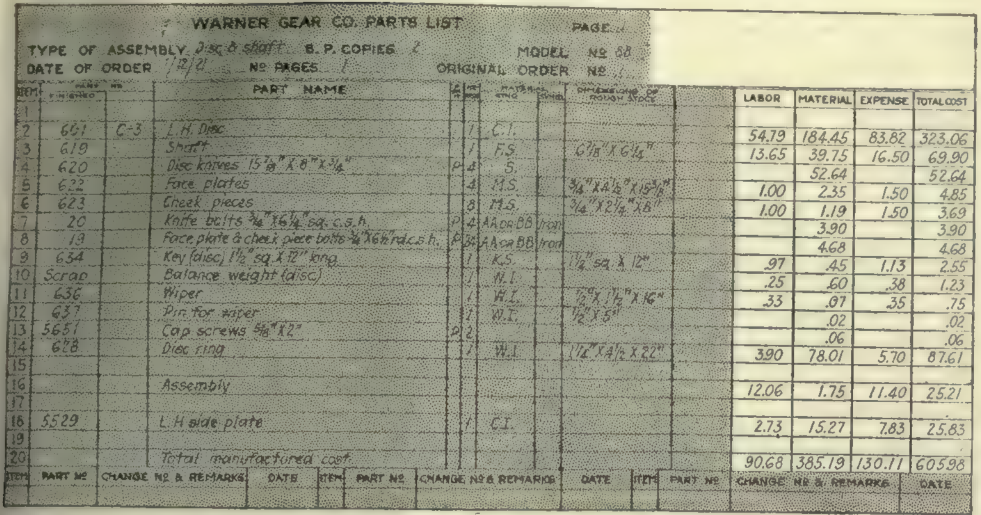


Account No. 60
Stock and Cost Record
Part No. 5529
Part Name L.H Side Plate Material Cast Iron

UNIT COST QUANTITIES USED

Jan 187 20 516 618 15 275 2 733 7 822 25 83 Jan 1921 25 83 15

FIG. 89. SPECIAL INVENTORY CARD FOR CHARGING OUT FINISHED PARTS



WARNER GEAR CO. PARTS LIST PAGE 1

TYPE OF ASSEMBLY Disc & shaft B. P. COPIES 2 MODEL No 88

DATE OF ORDER 1/12/21 No PAGES 1 ORIGINAL ORDER No 1

ITEM	PART NO FINISHED	NO	PART NAME		NO	MATERIAL STND	SYMBOL	DIMENSIONS OF ROUGH STOCK	LABOR	MATERIAL	EXPENSE	TOTAL COST
1												
2	661	C-3	L.H. Disc		1	C.I.			54.79	184.45	83.82	323.06
3	619		Shaft		1	F.S.		6⅛" X 6¼"	13.65	39.75	16.50	69.90
4	620		Disc knives 15⅞" X 8" X ¾"	P	4	S.				52.64		52.64
5	622		Face plates		4	M.S.		¾" X 4½" X 15⅝"	1.00	2.35	1.50	4.85
6	623		Cheek pieces		8	M.S.		¾" X 2¼" X 8"	1.00	1.19	1.50	3.69
7	20		Knife bolts ¾" X 6¼" sq. c.s.h.	P	4	AA or BB	Iron			3.90		3.90
8	19		Face plate & cheek piece bolts ¾" X 6½" rd. c.s.h.	P	32	AA or BB	Iron			4.68		4.68
9	634		Key (disc) 1½" sq. X 12" long		1	K.S.		1½" sq. X 12"	.97	.45	1.13	2.55
10	Scrap		Balance weight (disc)		1	W.I.			.25	.60	.38	1.23
11	636		Wiper		1	W.I.		½" X 1½" X 16"	.33	.07	.35	.75
12	637		Pin for wiper		1	W.I.		½" X 5"		.02		.02
13	5651		Cap screws ⅝" X 2"	P	2					.06		.06
14	628		Disc ring		1	W.I.		1¼" X 4½ X 22"	3.90	78.01	5.70	87.61
15												
16			Assembly						12.06	1.75	11.40	25.21
17												
18	5529		L.H side plate		1	C.I.			2.73	15.27	7.83	25.83
19												
20			Total manufactured cost						90.68	385.19	130.11	605.98

ITEM	PART NO	CHANGE NO & REMARKS	DATE	ITEM	PART NO	CHANGE NO & REMARKS	DATE	ITEM	PART NO	CHANGE NO & REMARKS	DATE

FIG. 90. PARTS LIST USED IN COST-FINDING

separate file arranged according to the departments which have used the toolroom service. It is from this record that we secure the distribution of the toolroom labor charge.

A glance at the cards shown in Figs. 85 and 86 will show that we have entered not only the labor cost, but the number of machine hours required by the piece. This is needed for the next step, which consists of gathering the three elements of cost on the parts cost card, Fig. 87, as set up for each month. To this card we post, under the correct departments, the labor cost per piece and the machine hours used per piece. The total of the labor charges for all departments gives the labor cost for a single piece. We determine the charge for expense by totalling the machine hours shown for each department

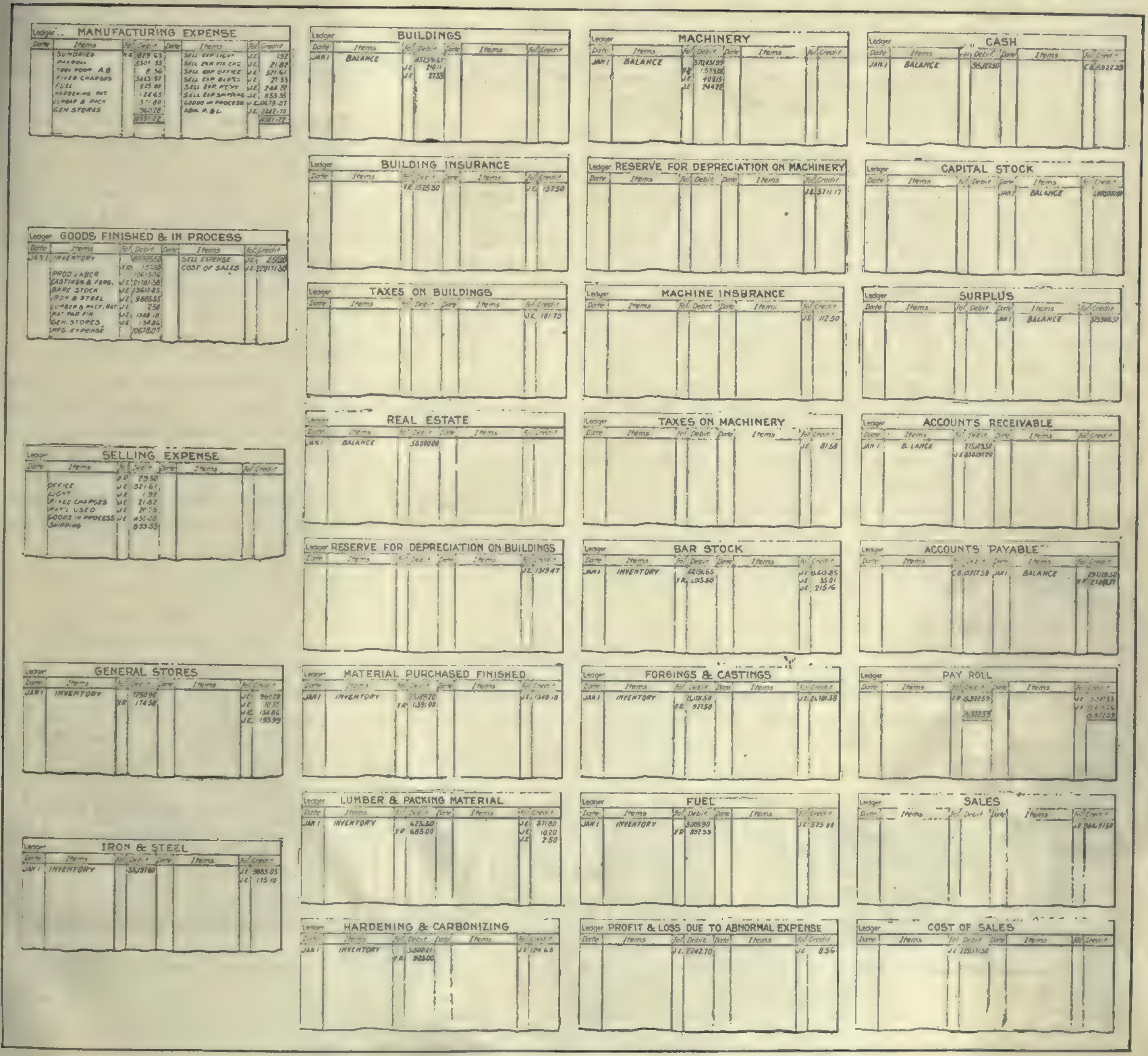

MANUFACTURING EXPENSE
BUILDINGS
MACHINERY
CASH
BUILDING INSURANCE
RESERVE FOR DEPRECIATION ON MACHINERY
CAPITAL STOCK
GOODS FINISHED & IN PROCESS
TAXES ON BUILDINGS
MACHINE INSURANCE
SURPLUS
REAL ESTATE
TAXES ON MACHINERY
ACCOUNTS RECEIVABLE
SELLING EXPENSE
RESERVE FOR DEPRECIATION ON BUILDINGS
BAR STOCK
ACCOUNTS PAYABLE
GENERAL STORES
MATERIAL PURCHASED FINISHED
FORGINGS & CASTINGS
PAY ROLL
LUMBER & PACKING MATERIAL
FUEL
SALES
IRON & STEEL
HARDENING & CARBONIZING
PROFIT & LOSS DUE TO ABNORMAL EXPENSE
COST OF SALES
Ledger
Date
Items
Fol.
Debit
Credit
JAN 1
BALANCE
INVENTORY

FIG. 91. LEDGER ACCOUNTS WITH SALES ENTRIES RECORDED

and extending them by the standard hour rate for its department. The next step is to determine the total value of the material which has been requisitioned for this part during the month, and dividing the total by the number of parts requisitioned. This gives an average price per piece for material. In the lower right-hand corner of the parts cost card, the cost of labor, expense and material per part is shown and the total cost, in this case, $25.8309 is arrived at as the total cost for a single piece. Multiplying this figure by the number of parts finished, which is 20, we get a cost for the total number of these parts which have been finished during the month, of $516,618.

THE UNIT COST

This method of gathering parts costs is best adapted to shops which are producing the same parts over and over, and where, therefore, it is important to develop the unit cost and from that find the total cost for all parts made in a month.

The form shown in Fig. 88 can be used to somewhat better advantage in shops which operate more along jobbing lines. Here it is important to know the total cost of all of one kind of part made on an order, rather than the unit cost. So on this card we gather the cost of all of the parts of a single kind made on one order, and if wanted, divide this total by the number made to get the unit cost.

CHARGING OUT MATERIAL

In Part XV, we described the method of charging out material on the "exhaustion of lot" basis. The same method is used in charging out finished parts, as they are needed for assembly, into the completed product. To simplify charging out on this basis, a special form of inventory card, similar to that shown in Fig. 89 is needed. On this card is shown the month, the order number, quantity made during the month, the labor material and expense per piece on that order, and the total money value. Provision is made to show the amount withdrawn from stock and a balance figure to show how many pieces are still left in stock. This makes it simple to charge out the finished parts at their correct price. In the jobbing shop it is not likely that finished parts will be carried in stock. The form shown in Fig. 89 is therefore dispensed with and the parts order cost card, shown in Fig. 88, is used for the same purpose.

We are now ready to build up the final assembly costs. Rather than multiply the number of forms needed for conducting a company's business, we prefer to use a single form for several purposes when that is possible. For example, in building up the assembly costs, we use a copy of the parts list, which has its original use in the planning of production. The form was shown and described in Part IV. In order to illustrate its use in cost-finding, it is reproduced herewith in Fig. 90 with the proper cost figures entered thereon.

The four columns which were in black in the original parts list appear in white after the form has been photographed. These columns are headed "labor," "material," "expense" and "total." The items of cost are entered in these four columns from the finished parts inventory card or the parts order cost card, extended by the number of parts that are required in the assembly. The totals of each of these columns will give us the material, labor and expense cost for all of the parts in the assembly, but do not include the cost of assembling them. However, we have in the cost department a parts operation card for the assembling operation, showing the labor and expense. Adding this to the total cost of the parts, we get the total manufacturing cost of an assembly.

TOTAL COST OF ASSEMBLY SOLD

To this can be added the proper percentage of selling expense, thus getting the total cost of the assembly sold. Usually, however, the selling expense is not so simple a matter. The more approved methods of building it up will be treated at greater length in the next article.

Our next step is to apply these manufacturing costs to the sales which we have made during the month, so that we may later develop our manufacturing profit and loss statement. The cost department is furnished with a copy of each invoice for goods sold, showing the order number and type of assembly. By referring to the files of completed costs, the cost department allocates to each invoice the manufacturing costs of the items covered by it.

THE MANUFACTURING PROFIT AND LOSS

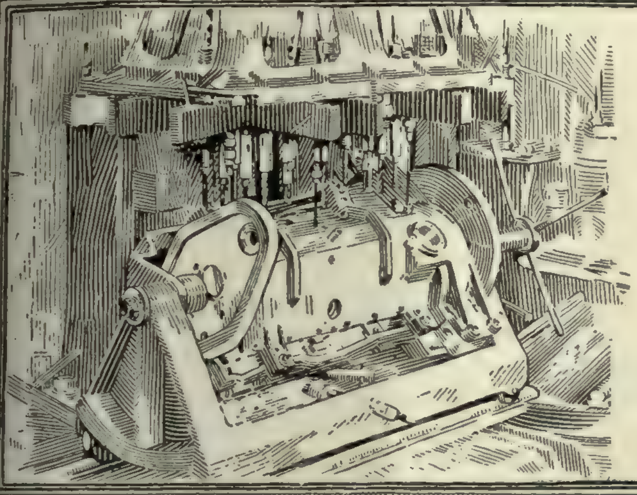
If it is desired to know the profit and loss by lines, the invoices are sorted into classes of product and their sales price and cost totalled. The difference between the two amounts, as shown by the invoices, is the manufacturing profit or loss.

The following journal entries are needed in order to carry the cost of sales for the month and the value of sales for the month to the ledger.

JOURNAL ENTRIES

	Dr.	Cr.
Accounts receivable	$350,197.50	
Sales		$350,197.50
Cost of sales	229,171.30	
Goods finished and in process		229,171.30

In figure 91 are shown the ledger accounts as they appear when these entries have been made. As in previous articles this step has been taken to show the appearance of the books at this point in the work.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Albert A. Dowd Engineering Co., New York City

Drill Jig Design Concluded—Roll-Over Jigs—Trunnion Jigs—Double Trunnion Jig—A Difficult Drilling Problem—Trunnion Jig Used Progressively

A PIECE of work may require drilling from several sides and it may be of such a size that the jig cannot be handled easily. The conditions may not warrant the use of an indexing or trunnion jig and yet the production required may make it necessary to design a fixture that can be operated conveniently and rapidly. When a jig approaches a size 8 or 10 in. square and it is necessary to drill holes from several sides it is often desirable to make provision for rolling over so that the operator will not be obliged to lift the jig or drop it on each side in succession. Several methods of applying "roll-overs" are shown in Fig. 101. *A* is a cast form which is made as a part of the jig itself, the corners *B* and *C* being rounded to permit rolling the jig over on either of these sides. A flat portion is provided at *C* to assist in loading so that the jig will not be wobbling from side to side when the piece is being locked in position.

D shows a roll-over of practically the same form except that it is made as a separate piece which can be applied to the jig body by means of screws *E*. A third form, shown at *F*, is probably the most useful and cheapest of all the varieties illustrated. It is made from a steel strip bent to the shape shown and screwed to the body of the jig by means of two or more screws *G*. There is very little to be said in regard to the design of roll-overs and the illustrations given are sufficient to cover practically all cases. The points which should be borne in mind are that the roll-over must be so constructed that it will operate easily and at the same time not interfere with any extensions or lugs on the jig or interfere with loading in any way.

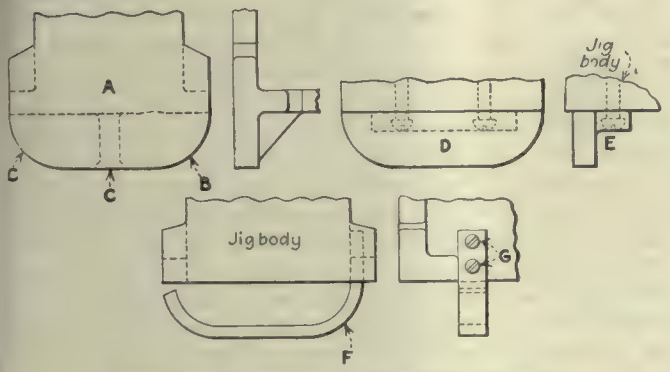


FIG. 101. DESIGNS FOR ROLL-OVERS

In Fig. 102 is shown an outline example of a roll-over jig of simple construction embodying the principles just mentioned. The work *A* is located on a central stud *B* and by a nut and C-washer *C*. The requirements of the work are that it must be drilled from the direction indicated by the two arrows. The bushings are shown at *D*, *E*, *F* and *G*. When being loaded the jig rests on the table on the flat portions *H* and *K*. It will be seen that it can be readily rolled over on the curved surfaces *L* and *M*.

Design of Trunnion Jigs

The tool designer should now have a very good idea of jig construction so that he should be able to decide when a trunnion or indexing jig is necessary. We will give here a word of caution in regard to the consideration of the machine capacity on which the trunnion jig is to be used. Be sure to select a machine of sufficient size so that there will be no difficulty in indexing the jig. Another matter which should be thought of is the balance of the trunnion when it is loaded. In all cases the pivot points on which the jig swings should be approximately at the center of gravity of the cradle when it has been loaded with the work. This brings up another point which should be taken into consideration, namely, the material from which the work is made. For example, large castings may be made of a light metal, such as aluminum, or a heavy metal, such as cast-iron.

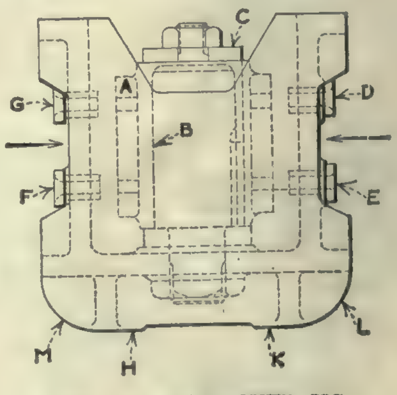


FIG. 102. ROLL-OVER JIG

In the design of very large trunnion jigs gearing is occasionally used to revolve the work. The gearing

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For the authors' forthcoming book. All rights reserved.

is operated by means of a crank which may be either fastened permanently to the fixture or made so that it can be slipped off when not in use. The placing of the work in the jig is an important point that should not be neglected and every provision should be made so that the operator can load the work without a great amount of difficulty.

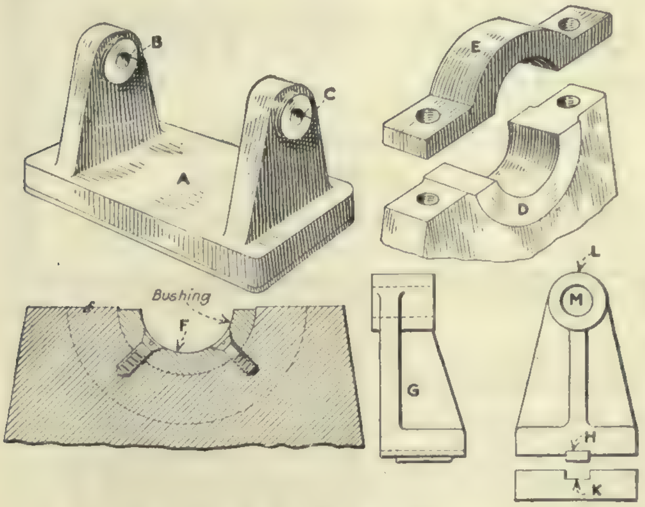


FIG. 103. TRUNNION DETAILS

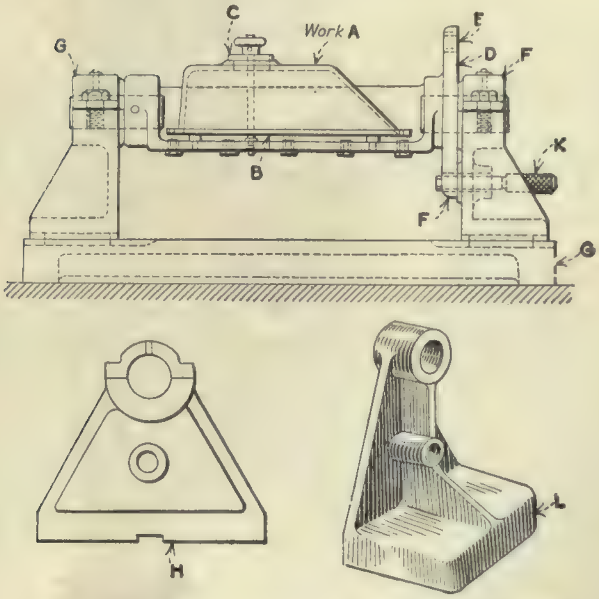


FIG. 104. OPEN TRUNNION JIG WITH CRADLE

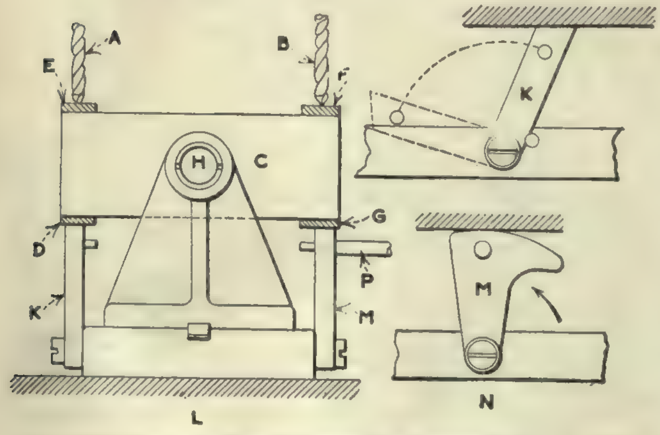


FIG. 105. UNUSUAL TYPE OF TRUNNION JIG

There are several well-defined types of trunnion jigs as follows: Open or cradle type, in which the work is loaded into a receiving cradle and clamped in place, after which the jig is indexed so that the work can be drilled from the opposite side; closed or box type, in which the work is drilled from several sides in succession; the double trunnion type, a rather common form, built when it is desired to revolve the work in two directions in order to drill it from the ends as well as from the sides.

DETAILS OF TRUNNIONS

In Fig. 103 are shown some details of trunnions in common use. Form *A* is a simple type having two trunnion bearings at *B* and *C*, the base and the two trunnion bearings being cast in one piece. This type is used where removable plugs act as shafts on which the jig swings. In rare cases the shaft may extend through both holes. The use of this form is limited by the nature of the work and it possesses some disadvantages in that it must be replaced entirely in case any part of it should be broken. It can be used sometimes to advantage where a cheap method of construction is desired. The holes at *B* and *C* can be rebored and supplied with bushings when they become worn; or they may be supplied with bushings in the shaft base which would improve the construction somewhat.

The bearing shown at *D* is a common form with a cap *E*. It may be cast iron or furnished with half bushings as indicated at *F*. The bushings may be made of bronze or steel or they may be babbitted. All bearings on trunnion jigs should be made of generous proportions with plenty of stock allowed for reboring.

An excellent way to design trunnion bearings is shown at *G*. The general form of the bracket indicated can be followed in many cases. Attention is called to the tongue *H* and the groove *K* for aligning the two brackets when they are assembled on the base *K*. In proportioning a bracket of this kind it is well to make the thickness of the hub *L* not less than half the diameter of the hole *M*, and it is usually better to exceed these proportions slightly in order to make the construction more reliable and to provide for emergency.

TRUNNION JIG WITH CRADLE

In Fig. 104 is shown a very good example of an open trunnion jig with a cradle. The work *A* is a large casting which has been previously finished on the side *B* and is to be drilled from the same side. It would be difficult to load the work in an upside-down position if a plain jig were used. We see here the reason for the trunnion design as it is evident that the work can be readily placed in the cradle and can be clamped by a method similar to that indicated at *C*. The jig cradle is of cast iron with an index flange at *D* in which the bushings *E* and *F* are located. The trunnion is located so as to distribute the weight of the cradle and the work equally and thus make the indexing easy. The trunnions are supported in bearings *F* and *G*, which have removable caps. Following the procedure shown in Fig. 103 the base *G* is grooved so that the two brackets carrying the trunnions will be in alignment. An end view of the bracket used is shown at *H*. The index pin *K* is of the removable type. It may be attached to the jig with a piece of closet chain. Another form of bracket which can sometimes be used is shown at *L*. This form is not as strong as that shown at *H* but for light work it will give satisfaction. The trunnion jig described is very simple, yet of a form which is frequently used. A more elaborate method of indexing can be used if desired.

TRUNNION JIG WITH A PECULIAR INDEX AND CLAMPING DEVICE

The example shown in Fig. 105 is diagramatic only and is rather unusual in the principle of indexing and clamping. When drilling the work at *A* and *B* considerable pressure would be exerted by the drills at some distance from the center on which the jig is supported and it would ordinarily require a large index plate to give the accuracy required. Assuming that the work can be drilled from two sides only, the indexing portion or box in which the work is held as shown at *C* can be provided with hardened and ground parts at *D*, *E*, *F* and *G*. These parts must be accurately located in relation to the center *H*.

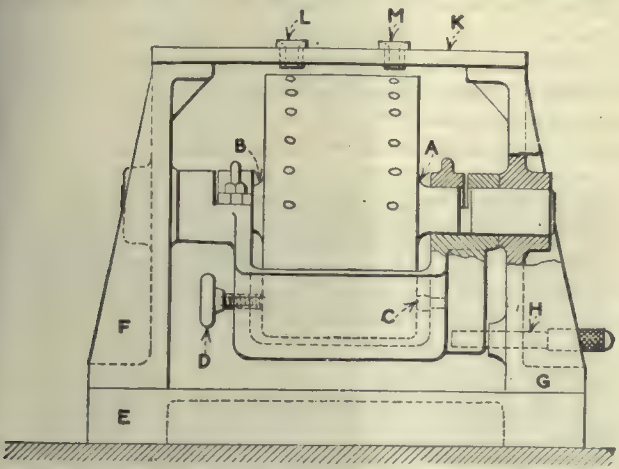


FIG. 106. TRUNNION JIG FOR CAM DRUM

At one side of swinging support *K*, shown in detail at *L*, bears against the underside of the hardened plate *D*. On the other side the cam lever *M* is used. When it is desired to index the fixture the two levers *k* and *m* are thrown out of the way. After indexing support *K* is thrown up into position and the cam lever is operated by means of the handle *P* thus forming an accurate index and locking the entire mechanism securely. The supporting latches and cams must be of sufficient size to give the necessary stability to the structure. An example of a good trunnion jig for a large cast-iron drum which has a series of holes half way around the outside is shown in Fig. 106. The work is located by means of the finished hubs *A* and *B*, which rest in bearings as shown and are clamped by means of hinges and leaf clamps. The work is located sidewise by being forced against the stop *C* by the thumbscrew *D*.

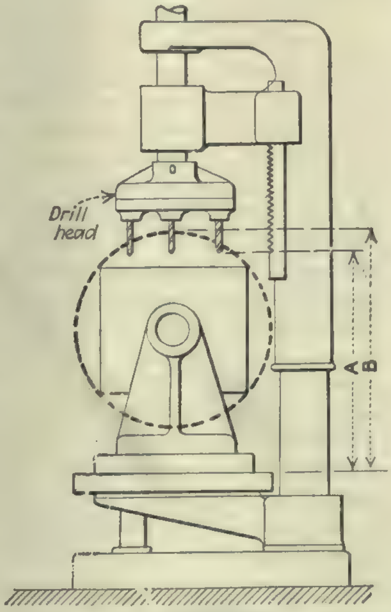


FIG. 107. TRUNNION JIG REQUIRING A SLIDING MOVEMENT WHEN INDEXING

The index part of this jig is in the form of a cradle. The base of the casting *E* supports the trunnion brackets *F* and *G*, in the latter of which the index pin *H* is located. A connecting plate *K* carries the two bushings *L* and *M*. In locating the work in the jig the cradle is revolved about 45 deg. from the position shown which permits the work to be rolled into position without difficulty.

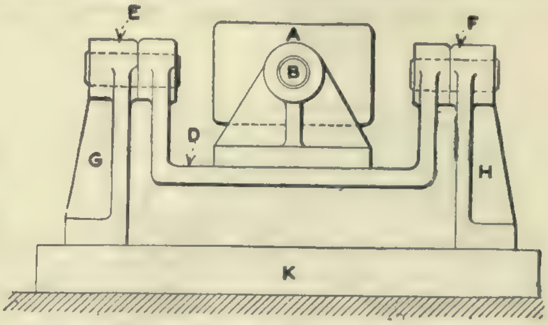


FIG. 108. PRINCIPLES OF DOUBLE TRUNNION JIG

TRUNNION JIGS REQUIRING A SLIGHT MOVEMENT WHEN INDEXING

Fig. 107 illustrates the trouble which may be caused by not carefully considering the machine on which the work is to be produced. When indexing, the jig will throw the patch indicated by the dotted circle, which would mean that it would strike the drills. The minimum height above the table to which the drill head can be raised is indicated at *A* while the clearance necessary to swing the jig is shown at *B*.

One method of remedying the difficulty would be to provide a slide that would permit the jig to be moved out into the position shown by the dotted lines. Interference might take place in some other point, for example on the face of the column, in which case the same remedy would prove efficacious.

The diagram shown in Fig. 108 is given in order to illustrate the principles of a double trunnion jig and is not by any means intended to illustrate an actual working jig of this character. The work can be mounted in the indexing member *A*, supported in trunnions at *B* and provided with a suitable indexing device so that it can be swung around in the direction indicated by the arrows. The bracket *C* is mounted on a cradle *D* which in turn is carried by trunnions *E* and *F*. This also is provided with an indexing mechanism in one or the other of the brackets *G* or *H*.

A great deal of care must be taken in the design of double trunnion jigs but before designing it at all it is well to give a great deal of thought as to whether or not it is advisable to design such a cumbersome mechan-

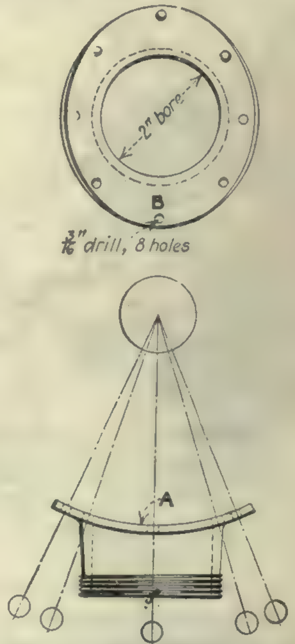


FIG. 109. EXAMPLE OF A DIFFICULT DRILLING PROBLEM

ism. Generally speaking it is better to avoid using a device of this kind whenever possible. The principles which have been mentioned in the general description of trunnion jigs can be applied with equal favor to the double trunnion type, but it must be remembered that there are movements in each direction to take care of, and there is considerable danger of interference when indexing from one position to another. However, there are a number of double trunnion jigs in use here and there throughout the country which have given satisfaction.

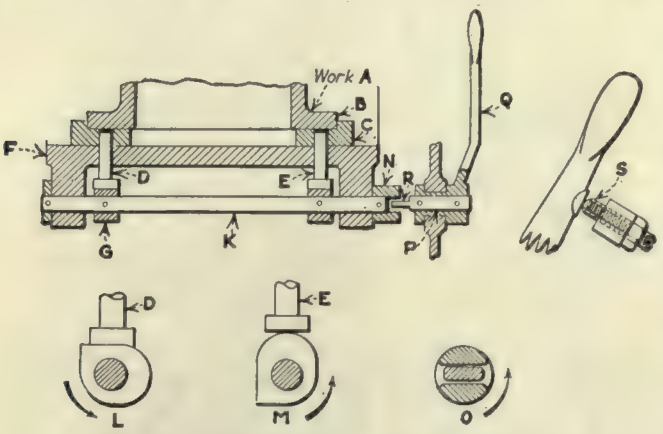


FIG. 110. EJECTOR FOR A LARGE CASTING

A Difficult Drilling Problem

The work shown at *A* in Fig. 109 is a gasoline tank filler flange which must be drilled with eight $\frac{3}{16}$-in. holes *B*. The second view indicates the accuracy required. It is suggested that the tool designer use this example for practice and design, a trunnion, cradle or indexing jig in which the various holes can be drilled.

It is a difficult piece of work to handle efficiently and it will serve as a very good brain stimulus to the tool designer. He should be able after a review of the various points and examples given under indexing and trunnion jigs to design a creditable jig for this piece of work. It is practically impossible to design a roll-over jig or a jig with feet at various angles for this piece of work due to the close approach to each other of the various angles.

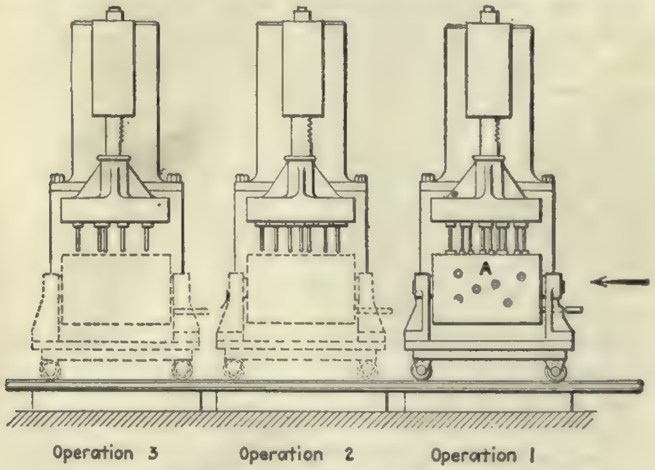


FIG. 111. TRUNNION JIG USED PROGRESSIVELY

A condition frequently found when locating a piece of work which has been previously machined is shown in Fig. 110. The work *A* is located by the outside of the flange *B* in a locating ring *C*. Therefore if the casting is of large size, it may be difficult to remove the work from the ring after it has been drilled.

In order to assist in the removal two pins *D* and *E* are placed opposite each other in the indexing member *F*. These two pins are acted upon by the cams *G* and *H* which are pinned to the shaft *K*. They are locked when in position shown at *L* and take the position shown at *M* when in action.

It will be seen that if the member *F* is the indexing member it is necessary to provide a means of operating the ejectors from outside the swinging member. This is done by pinning a collar *N* to the end of the shaft and cutting a slot across this collar as shown at *O*. The pin *P*, controlled by the lever *Q*, is flatted at *R* so that it loosely fits the slot in the collar *N*. When the jig is indexed this slot and pin will come into alignment so that the pin can be revolved by means of the lever thus raising the ejector pins and forcing the work up out of the seat. A suitable stop such as that indicated at *S* is suggested in order that the lever may always regain a certain position to make the engagement of the pin with the slot absolute.

Trunnion Jig Used Progressively

Let us assume that a piece of work, held in the trunnion jig at *A* in Fig. 111, is to be drilled from three sides in sequence. It is possible to mount the trunnion jig on wheels and to provide a track on which the jig can be rolled, so that it will come successively under the spindles of the three single spindle machines equipped with multiple heads. It may be found advisable to provide suitable stops for the positions of the jigs. Arrangements of this kind would be made only when high production was desired.

The use of the trunnion jig for progressive machining is very common in the modern automobile shop, however, for drililng cylinder and crankcase castings. Frequently as many as half a dozen different operations are performed on as many machines, the jig passing along the track from one machine to the next as the successive operations are performed.

A Correction

We are indebted to G. M. Bartlett, secretary of the committee on Steel Roller Chains, S. A. E., for corrections of some errors which occurred in the preliminary report of the Standards Committee. Mr. Bartlett's letter, which is self-explanatory, follows:

"I notice in looking over your report of the Chain Division of the Standards Committee, of the Society of Automotive Engineers, page 1,052, Vol. 54, that there are several errors which affect the construction of the proposed tooth form and cutters in a vital way, and I take the liberty of calling your attention to the same. The errors occurred in the preliminary pamphlet of the S. A. E. Standards Committee, but will be corrected by them before further publication.

"In column 2, line 10, the division sign (÷) should be changed to the plus (+) sign.

"In the same column, sixth line from the bottom, 14.1 should be changed to 14.07.

On page 1,053, in the formula for *W*, *N* should be changed to *n*.

"In the formula for *xz*, at the end of the article, $\frac{90^\circ}{M}$ should be changed to $\frac{9^\circ}{M}$."

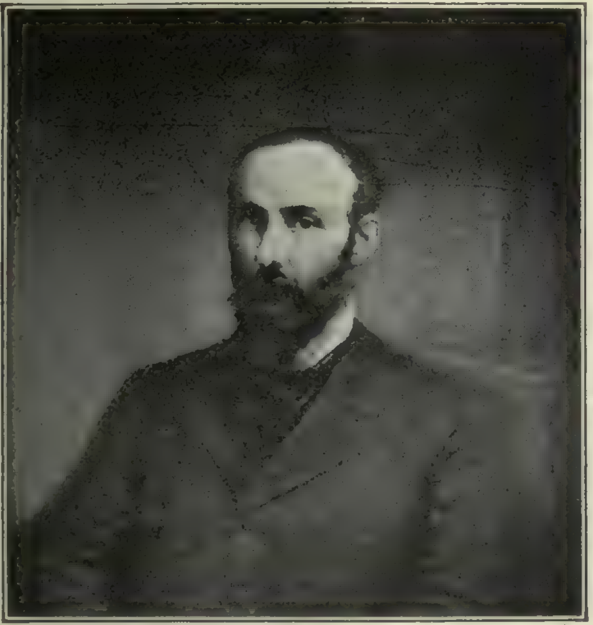
Evolution of the Split Pulley

The Old Method of Driving the Pulley on Over the End of the Shaft—How the Invention of the Split Pulley Came About

BY HARRY BOTSFORD

THE uselessness of machines apart from their source of power, and the uselessness of engines apart from the mechanical agents that convert power into productiveness, is responsible for one of the most interesting stories of American industrial progress.

Many of the greatest changes in power transmission that have taken place in the past four decades have occurred at Mishawaka, Indiana, and most of these innovations were due to Wallace H. Dodge (dead these many years), who was a man of vision and who worked out ways and means of solving some of the most difficult problems of the age in power transmission.


WALLACE H. DODGE, INVENTOR OF THE SPLIT WOOD PULLEY

What happened back in the early "eighties" when a new lathe or machine arrived at a factory? Before the new machine could be installed there were necessary a number of time-taking, back-breaking operations that were unpleasant to every member of the organization involved.

Belts must be removed, hangers taken apart, couplings parted, the main shaft must be taken down, and at last the new pulley must be driven by sledges into place. Then the process was reversed and finally the new machine was linked up with power. The process was a time thief and as a rule such installations were made only on holidays and at night. All in all—judged from even the inefficient standards of that day—the whole operation was inefficient throughout.

This was the situation at the time the real history of efficient power transmission actually begins. This date may be said to be July 10, 1881, when Wallace H. Dodge calmly watched his sawmill and machine shop burn to the ground as the result of lightning. It was his birthday, and a very unpleasant one at that.

Dodge was a thinker, and investigation proves him to be one of the early conservationists, for his mill utilized small odds and ends of lumber that were usually thrown on the scrap heap where eventually they would be burned. These small pieces of lumber he used effectively in the manufacture of mallets, file handles, bucksaws, and window screens.

Before the debris of the small mill was cold, Dodge began planning a way to start business again. He went out and borrowed every cent he could find and started at once to rebuild.

Old wooden pulleys salvaged from the ruins proved a great nuisance, for each pulley—true to type—would fit only one size of shaft and not the size of the new shafting.

New pulleys were needed and the exchequer of the company was practically exhausted. Dodge and his superintendent, George Phillion, discussed the problem and at last decided to make their own pulleys and to make them of wood and to *split* them in the middle. Momentous decision! They had the wood, the only hitch was how to join the two parts together again.

With this idea in view, the first pulleys were built. They were made in layers of broad, flat rings, each ring composed of segments strongly glued together. Placing these rings, one on top of the other and with glue between layers, they formed a hollow cylinder.

This roughed-out rim they now sawed into two semicircular halves and fitted across the diameter of each a thick board, dovetailing it into the rim. Bringing the two halves together, they centered the pulley and bored the hole, always a little smaller than the shafting, with the idea of clamping the hub so terrifically tight that it would stick forever—or at least, so they hoped! The pulley was then completed by reaming out the rim, surfacing the face, and finishing the whole contrivance. The pulley now would be ready to install on a shaft without taking down shaftings, hangers, belts, couplings or other pulleys.

It was now found that the new type of pulley worked excellently at first but in a short time began to slip around the shaft. Then Dodge and Phillion tried wrapping the shaft with paper. This served only as a temporary check and rapidly disintegrated as soon as a few drops of oil became absorbed by the paper.

However, they worked stubbornly on, and finally hit upon the plan of separating the two flat arms about a quarter of an inch, all the while keeping the edges of the rim in contact. Then when the clamps were tightened at the hub, a good purchase would be secured; and the pulley would cling to the shaft like grim death. Working out these principles, the pulley worked efficiently.

From a commercial point of view the manufacture of pulleys in the early '80's was highly inefficient. There were—and still are—forty different sizes of commercial shafting, with a range of twenty-seven hundred different sizes in face and diameter of what may be termed the common pulley. Inasmuch as any of these twenty-seven hundred pulleys is susceptible to forty different borings, it will be seen that had any mill supply house carried a complete stock, they would have been forced to carry 108,000 pulleys, all different. Conse-

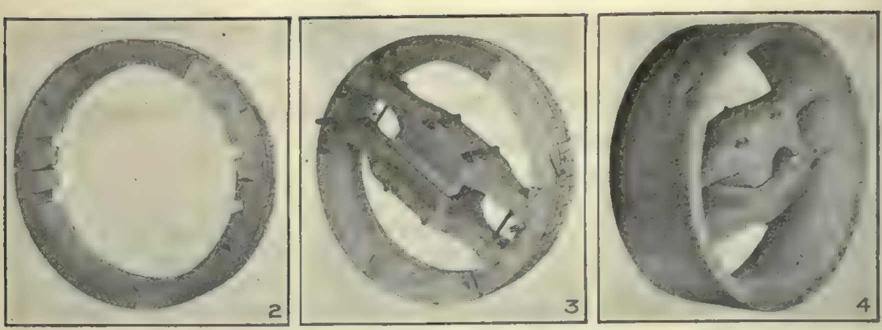


FIG. 2. PULLEY AFTER BEING SAWED IN TWO. NOTE HOW SAWING IS DONE, PRECLUDING POSSIBILITY OF MATCHING WRONG SIDES. FIG. 3. SHOWING METHOD OF FITTING ARMS TO RIM. FIG. 4. A COMPLETED PULLEY SHOWING HOW COMPRESSION IS SECURED ON SHAFT

quently delays were always in evidence when orders for pulleys came in.

Prime necessity now became the mother of a second vitally necessary invention, for by this time Wallace H. Dodge was firmly convinced that his split pulley had every commercial advantage over the inefficient solid pulley in common use.

As his idea developed he hit upon a scheme of employing a split bushing of wood—a simple idea as we think of it now, but at that time it was radically new.

Here is how the idea worked out: Forty little sleeves of wood of the same diameter were turned perfectly round and the hole in each bored to a different size, then they were split. Meantime a standard bore had been established for the wood split pulley, to which all pulleys must conform. The bushing was to act simply as a mediator between the pulley and the various sizes of shafting. The two inventions of Dodge and Phillion marked the first important developments in the construction of the pulley since the days of the pyramids, and gave evidence of the greatest idea in the mechanical transmission of power since steam was first harnessed to a jackshaft. Roughly summarized it was this: instead of 108,000 pulleys—2,700 pulleys and forty bushings.

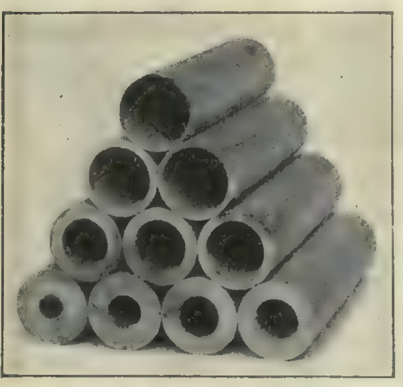


FIG. 5. THE WOODEN BUSHINGS WHICH SOLVED THE BORE PROBLEM

Dodge filed applications for patents on both his ideas and at once started manufacturing pulleys along the lines described. The letters patent were granted on the fourth of July, 1882.

One would naturally come to the conclusion that the adoption of the new pulley with all of its manifest and indisputable features would be rapid, but as a matter of fact Dodge had a rather serious time for a number of years in marketing his product. As an example of the ultra-conservatism of those rays a single memorable experience in marketing may be narrated.

In the year 1884 Dodge shipped two carloads of his pulleys to the great fair—the Cotton Centennial held at New Orleans.

Arriving there Dodge approached the official in charge of Machinery Hall and asked for permission to attach several of his pulleys to the line shafting. The permission was not granted and the official even waxed sarcastic at the very thought of a pulley held to a shaft only by compression. In fact he as much as said that he doubted seriously if anyone would ever permit one of the pulleys to be fastened to a counter-shaft, let alone a line shaft.

Dodge, however, refused to be discouraged and circulated among cotton manufacturers trying to interest them in his pulleys, but without any success. At last there came a real opportunity—putting a driving pulley on the main shaft of a unit driving a pony planer. The exhibitor was up against a problem—placing a solid pulley on the shaft would mean that his entire shafting would have to come down and that much valuable time would be lost. At this critical and psychological moment, Dodge heard of the situation and hurried to the scene to persuade the owner to permit him to install a split wood pulley. The man reluctantly assented and the installation was made in a very short time.

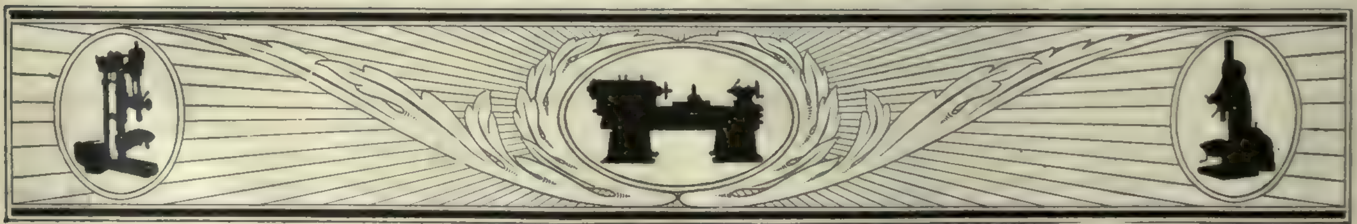
The new pulley worked well, as Dodge knew it would, and that afternoon Dodge found the official in charge who had refused him permission to install a pulley on the line shaft, and showed him the split wood pulley in operation. The official admitted that the pulley was efficient in every sense and gave Dodge the entree to install his pulleys on any shaft in the exhibition.

HIGHEST AWARD AT THE CENTENNIAL

Two interesting sidelights are thrown on this experience when it is known that the man who had the planer exhibit afterward took the Chicago agency for Dodge and sold thousands of pulleys. The other fact worthy of mention is that the pulley exhibited by Dodge won the highest award and special certificate.

The wood split pulley is commonplace to look on—to all appearance it has no romance attached to its evolution but in reality its progress as an efficient hard-working and necessary agent in the economical transmission of power is full of interest and industrial romance.

Truly the valiant spirit and ingenuity of Wallace H. Dodge are deserving of much credit from the industrial world which he served so well in giving it the split wood pulley.



A Bonus System That Teaches Thrift

Special Correspondence

Among the many systems devised for the purpose of bringing the working force of a factory into closer touch with the management, thereby gaining the loyalty and interest of the operatives, teaching them some of the difficulties encountered in their behalf by the employer, and keeping them satisfied and on the job, one devised by H. A. Sevigne, general manager of the National Wrapping Machine Co. of Nashua, N. H., is worthy of attention. The product of this firm, though not a machine tool, involves the use of the same kind of machinery and processes and employs the same class of workmen.

This company has, in recent years, been subject to the common difficulty of holding its men and has found it necessary to put in practice some scheme of relief. If the men could be made to see that their employers were their friends and co-workers instead of their natural enemies; that conditions of which they were wont to complain were as likely to be their own fault as the fault of their employers; and that there was nothing to be gained by continually changing from one job to another, the hardest part of the job would have been accomplished. It was to this end that the system was installed.

As no system of bonus payment, however generous, can long exist upon any foundation other than square dealing and considerate treatment, the first requisite to any system is a shop wherein the conditions affecting a workman's comfort and convenience are properly regulated. This asset the company already had; the shop being clean, light and comfortable, with proper tools supplied and work so arranged that each man could do his part without being subjected to annoying inconveniences and unnecessary delay.

A competent trained nurse is regularly employed whose duty it is not only to render first aid in case of injury or sickness at the factory, but to look after the physical welfare of the families of the operatives as well. If any employee is absent from his accustomed place without previous intimation of intended absence, and communication cannot readily be established by telephone, the nurse is promptly sent by automobile to the home of the absentee and if he or any member of his household is sick she remains until a physician is summoned and regular attendance provided for. Not only is this service without cost to the employee, but, within reasonable limits, he suffers no loss of time for his unavoidable absence from the factory.

The workmen also receive a cash reward awarded upon a system of percentages that are determined by the workmen's own conduct with respect to his work, his care in maintaining agreeable shop conditions, and his consideration for his fellow employees. Such points as promptitude in reporting for work and faithfulness in attendance; skill and accuracy in production; tidiness in appearance, both in respect to person and in manner of carrying on work; reliability and general deportment; are considered by the committee in making an award.

Profane and boisterous conduct, inattention to work, spoiled parts and similar evils arising from carelessness or lack of interest will materially count against him; while careful workmanship, increased productive capacity and suggestions for the improvement of product or processes will be counted in his favor.

The value of the points upon which a man's rating is based is relative. As the product of the company is a standard machine, distributed all over the world and with a considerable demand for parts, all of which must be interchangeable, skill and accuracy count for more than speed of production. There are only two grades of workmanship: a piece is either a perfect part—or scrap.

Upon the introduction of the system something over a year ago, each man's rating was established at 75 per cent and each man added to the force is started at the same figure. At the end of each month the committee considers the record of every employee and changes his rating in accordance with its judgment.

A large blackboard located in a conspicuous position bears each man's name and rating, and the findings of the committee are entered upon this board so that all employees may know the standing of the entire force. All entries up to and including 94 per cent are entered in white chalk; above that figure the entries are in red, and any man holding a red figure for a period of six consecutive months is entitled to a reward. If an employee reaches 100 per cent for any six months period his bonus is doubled; and that this figure is not unattainable is amply attested by the fact that several employees regularly carry the 100 per cent mark.

When an award is made the amount, though in cash, is not given directly to the man; instead he is taken to the bank where he is properly introduced, the money deposited to his credit and he is given the pass-book with instructions how to use it and, incidentally, as to the advantages and desirability of a private banking account. If for any reason the man desires to use the money he is advised against drawing upon the account, as the company stands ready through the bank to make him a loan against his personal note, taking the book as security.

The system thus not only encourages loyalty and faithful service, but teaches many who would not otherwise come in contact with it the working of the banking system and the advantages to be derived from having a personal account. It encourages thrift and at least starts the workman upon the road to prosperity.

The committee that determines the award consists of three members, two of which are elected monthly by the workmen themselves. Mr. Sevigne reserves the right to be at all times the third member but has thus far never exercised his voting privilege; nor does he even attend the meetings of the committee unless his presence is requested. The only other restriction placed upon the voting power of the employees, placed by themselves, is that one member of the committee shall be a foreman and the other a workman, and that no one man shall serve two consecutive months.

The findings of the committee, though reached by the employees themselves, are as a rule more favorable to the firm than to the men, and upon the few occasions when the executive member has been requested to settle a difference between the two employee members he has invariably decided in favor of the workman.

The system is applicable by subdivision to shops of any size and, by the establishment of suitable points upon which to base the rating, to any class of work. Its sponsors do not claim that it is perfect but it has so far worked out to the mutual advantage of employer and employee. It has practically eliminated labor turnover and greatly reduced personal friction within the force.

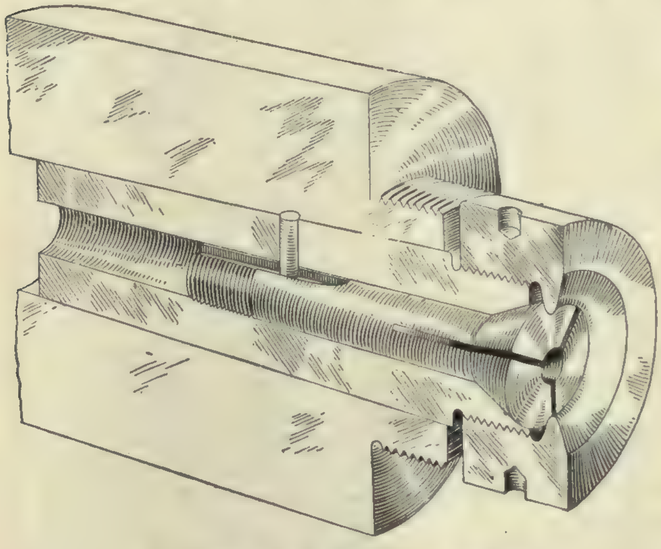
Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Using Small Spring Collets in a Large Lathe

By John E. Hoagland

While working in a toolroom during the war where the equipment was very poor I made up this device to be able to do small work in a large lathe. We had one bench-lathe and two sets of collets for it, but none of the larger lathes was fitted with drawback chucks.


AN IMPROVISED DRAW-IN CHUCK

The lathe spindle was first bored out to a suitable taper and the large taper collet made to fit it. The collet was then hardened and the hole ground 0.002 in. larger than the spring collets. The taper in the front end was ground after the collet was placed in the spindle, to make sure that it would run true. A ring nut on the threaded end of the large collet served to tighten the spring collets on the work.

Gages for Chisel Shanks

By Neil McDougall

The article by A. J. Schwartz on page 423, vol. 54, of the *American Machinist* is interesting to us because of the fact that the Hull Division Toolroom, Navy Yard, Puget Sound, has just gone through the same experience as that related in his article. We also, for a time, had fitted the chisels to a hammer which someone had said was correct and we also got along with "fairly good results."

With a working force that required about 1,500 chisels and calking tools and 945 scaling and chipping hammers in addition to 1,365 riveting hammers, drills and other pneumatic tools, methods which gave only "fairly good results" were not good enough. A careful study of conditions together with a number of experiments resulted in the adoption of a system of "Go" and "No Go" gages, as shown. The gage shown in Fig. 2 is for the round shanks with two different diameters; the gage shown in Fig. 1 is for chisels and calking tools with round straight shanks and a diameter of 0.680 in. Both of these gages allow a tolerance of plus or minus 0.001 in., which agrees with Navy Specifications 40-B-4. The notch shown on the side is used to gage the length on which a tolerance of plus or minus 1/32 in. is allowed. The hexagon shank is practically obsolete in this yard.

The hammer bushings or nozzles are gaged with the gages shown in Figs. 3 and 4. The "Go" end is plus 0.001 in. which is just large enough to receive the largest allowable chisel shank. The "No Go" end has a plus diameter of 0.003 in. This is the maximum tolerance allowed on a new nozzle. In addition to the above we use the "No Go" gage shown in Fig. 5, which is 0.010 in. oversize on all dimensions. This gage is used to determine when a nozzle has worn beyond economical use. Any nozzle which admits this gage is removed and replaced with a new one. All gages are hardened and ground to size..

In connection with the chisel and calking tool shanks the tool repair room is provided with a special grinding attachment by which these shanks can be ground to size very rapidly and at small expense, scarcely any measuring being necessary other than to gage about

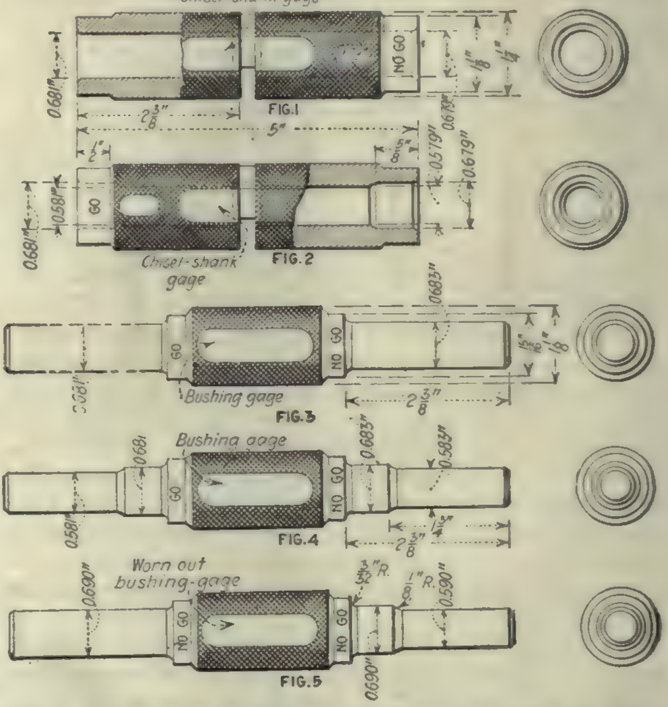


FIG. 1. GAGE FOR ROUND STRAIGHT-SHANK TOOLS. FIG. 2. GAGE FOR SHANKS FOR TWO DIAMETERS. FIGS. 3 AND 4. GAGES FOR HAMMER NOZZLES OR BUSHINGS. FIG. 5. WORN-OUT BUSHING GAGE

every fifth or sixth tool. With this grinding attachment a helper or handyman can grind chisel shanks to the required size at the rate of about three a minute.

Mr. Schwartz takes exception to the tolerance of only 0.001 in. on chisel shanks. His reference to an allowance of over 0.01 in. between the maximum shank and the minimum socket is not clear. Navy specifications 40-T-2 covering pneumatic tools do not specify any particular dimensions for hammer bushings other than to say that they shall fit the chisel shanks shown. The chisel shanks shown are identical with those shown in Navy Specifications 40-B-4. None of the pneumatic tool manufacturers' catalogs which have come to our notice makes any mention of the diameters of the hammer bushings further than to show the chisel shanks which they are intended to fit. The dimensions they give of the chisel shanks shown are the standard dimensions only; no tolerance of either a plus or a minus is mentioned. It is admitted that with the practice now in force by chisel blank manufacturers, chisel blanks within the limit mentioned cannot be obtained; however, it is believed that a general demand for blanks within such limits would result in chisels being produced to meet the demand.

To many, these limits will appear to be unnecessarily or unreasonably close, as suggested by Mr. Schwartz. However, our experience has shown that these limits are both practical and economical: practical in that tools can be held to such limits at very little if any more expense than when a greater tolerance is allowed; economical in that the results obtained by the workmen using the hammers and the small percentage of broken chisels and calking tools as compared with the old system amply repay the little expense incurred.

Horsepower Chart for Spur Gears

By Earll R. Muddiman

The ways to determine the pitch of a gear when the horsepower, number of teeth and revolutions per minute are given are either by tables, a chart or—trial and error.

The most accurate and compact of these methods would be a chart. With this in mind the horsepower of spur-gear chart was designed to cover practically all ordinary commercial requirements.

The chart is plotted from the Lewis formula as given at the top, where f is the static fiber stress (8,000 lb. per square inch for cast iron and 20,00 lb. per square inch for cast steel); V the velocity in feet per minute; b the face (equal to $3p$ for 15 deg. involute and cycloidal teeth and $2\frac{1}{2}p$ for 20 deg. involute teeth); p the circular pitch, and y the Lewis form-factor which is slightly modified.

The right-hand wing has a horsepower alignment chart for cast-steel and cast-iron gears respectively for the 45-deg. elements which are plotted against the y factors, given in terms of the number of teeth, the top values being for standard teeth and the bottom values being safe for stub teeth.

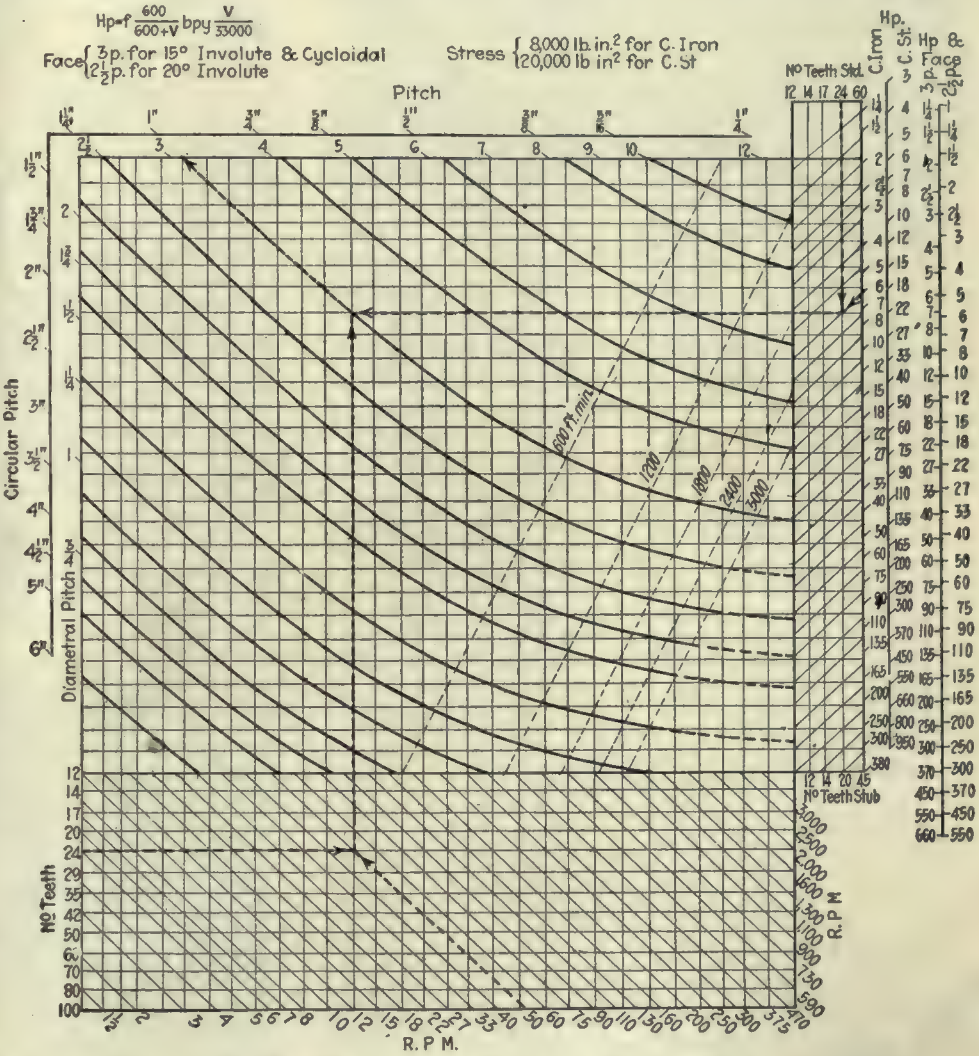


CHART FOR FINDING HORSEPOWER OF GEARS

The intersection of these two factors will determine the abscissæ for the main chart. The lower wing has the revolutions per minute plotted against the number of teeth giving the ordinate for the main chart. The main chart has a pitch alignment chart for circular and diametral pitch which are plotted against the abscissæ and ordinates from the two wings. The speed of the pitch circle in feet per minute is also plotted across the main chart. The horsepower and face chart is an auxiliary chart for converting the horsepower of a gear having a face equal to $3p$ to one having a face equal to $2\frac{1}{2}p$ or vice versa.

The dotted lines give the process for determining the pitch of a 24-tooth gear, standard 15 deg. involute or cycloid teeth with a face equal to $3p$ (or 20-deg. standard involute with face $= 2\frac{1}{2}p$) making 50 r.p.m. and transmitting 6 hp. for a cast-iron gear. The answer is 1 in. circular or approximately 3 pitch diametrical.

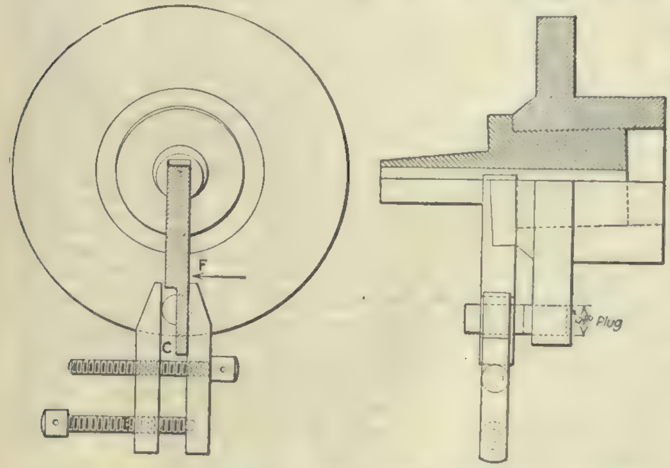
Holding a Tightly Fitting Piece Against Turning While Pressing It Into Place

By Walter Strow

The writer recently had a broach guide, as shown in the sketch, to press into an adapter that had previously been bored, and it was necessary to maintain the slot parallel with the center line on which the table in the flange was laid out to within very close limits. As every toolmaker knows, no matter how accurately the piece is started, by the time it reaches its final position it will be twisted a little one way or the other, and as in this case the fit was very tight, it would have been impossible to swing it back again without breaking the piece or distorting the slot.

To insure the final accuracy of the job a ⅝-in. plug was carefully flatted at one end to exactly half its diameter and driven in the outer hole. A piece of flat stock accurately fitting the slot was also flatted at one end to correspond.

Entering the guide in the bored hole a little way, the flat stock was tapped into the slot and swung around until the flat side came in contact with the flat on the plug, and firmly clamped. The guide was then pressed home and when the job was tested it was found to be well within the required limits.



HOLDING A ROUND PIECE FROM TWISTING WHILE PRESSING IT INTO PLACE

The simple little trick may be found advantageous by some other fellow on similar work.

Facing Forming Dies With Stellite

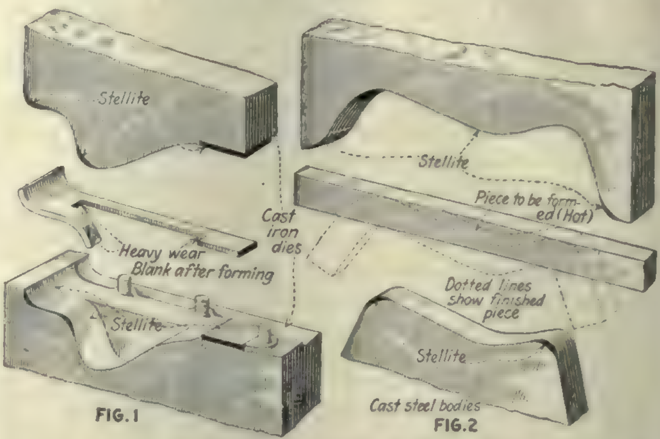
By Wilfred L. Clark

I have read a lot about welding tips of stellite on cutting tools by the oxy-acetylene and other processes, but have never come across anything about using the same material for facing the dies used for forming heavy pieces, so I am sending you herewith a couple of sketches showing how we used stellite for that purpose.

In Fig. 1 are shown the tools for forming railroad anchor springs, the piece being shown between the dies. The piece is of hard spring steel 2 x $\frac{5}{16}$ x 8 in., and is blanked and formed hot.

The forming dies are of cast iron, and the plain chilled iron tools without stellite facing would last only two days. After building them up as shown in the sketch they will run for six months: or until the heat causes them to crack.

The blanking dies are of high-speed steel and will go down pretty fast on the corners and throat. When built up with stellite at the points of greatest wear they will run for a week or more, with a production of 800 pieces per hour.



FIGS. 1 AND 2. FORMING DIES FACED WITH STELLITE

Fig. 2 shows the first operation on a Henggi anchor spring. This is made of hard spring steel 1½ x ⅞ in. formed hot on tool steel dies faced with stellite. The production is 500 pieces per hour and the dies will run for weeks without care. The second operation is to fold the ends in until the piece resembles a figure "3," and the only way we could get the tools to stand for this operation at all was to face them with stellite.

Both these jobs would have been failures if we had not discovered this way out, as the maintenance expense was altogether too high when using tool steel dies and renewing them every week.

A Boring Attachment Used on an Automatic Cutting Machine

By S. H. Carbis

We have for some time been machining each year from five to ten such castings as are shown in Figs. 1 and 2.

Fig. 1 shows an iron casting 37¼ in. in diameter with twelve holes equally spaced on a diameter of 28¾ in.; these holes are 5½ in. in diameter, ⅞ in. long, with a spacing tolerance of 0.002 in. It had been our custom to do these castings on a horizontal boring mill, where it took about 35 hr. for each casting.

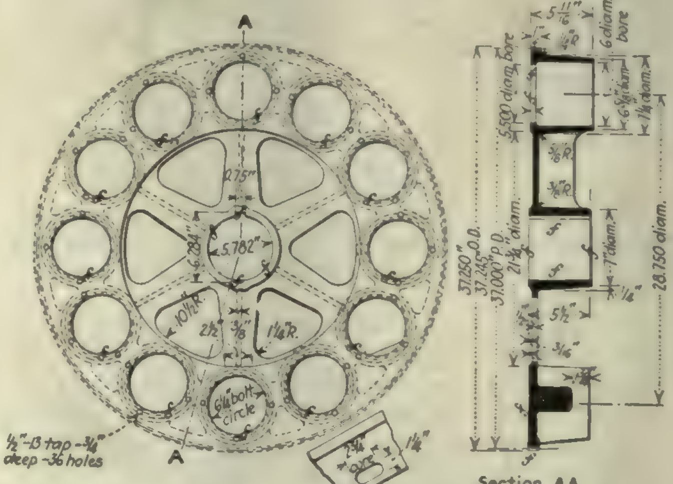


FIG. 1. ONE OF THE CASTINGS TO BE BORED

Fig. 2 shows another iron casting, 37 in. in diameter, with twelve holes equally spaced on a diameter of 28¾ in. The holes are 1.874 in. diameter and 3¾ in. long These castings were also machined in the horizontal mill with 24 hr. allowed for each. It may be well to explain that we did not make a jig for the work because we never had enough castings in a year to make it pay.

This year we received an order for fifty machines, which would require fifty each of these castings, so it was essential that we speed up, especially as thirty machines were to be completed four months from receipt of order.

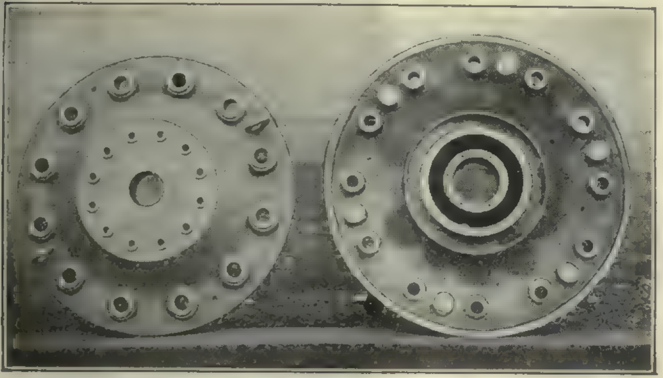


FIG. 2. A CASTING THAT IS DRILLED BEFORE BORING, AND THE DRILL JIG USED

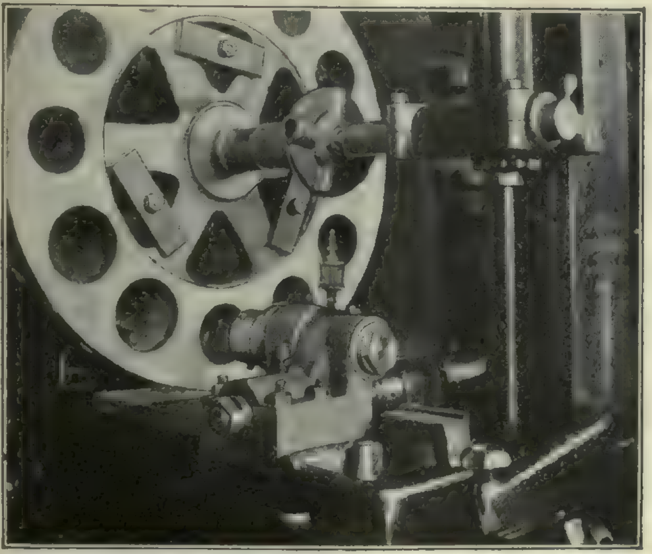


FIG. 3. THE CASTING AND BORING ATTACHMENT IN PLACE

We have a Newark automatic gear-cutting machine and decided to use the automatic indexing feature. Fig. 3 shows the casting in Fig. 1 in position on the machine and the attachment we made for boring the holes. Fig. 4 shows the details of this attachment, in which the staggered boring tools for roughing and the reamer for finishing can be seen. We removed ¾ in. of stock from the diameter with the boring tools and finished each hole in one operation.

We set the machine as for cutting a twelve-tooth gear and set the forward and reverse feed for the length we needed, put an apprentice on the job and told him to go ahead. We were greatly pleased to find only 0.0004 in. error where we were allowed 0.002 in. The castings were each finished in 2 hr. and 40 min., with an apprentice, where it formerly took a high-priced mechanic 35 hr. on the horizontal boring mill.

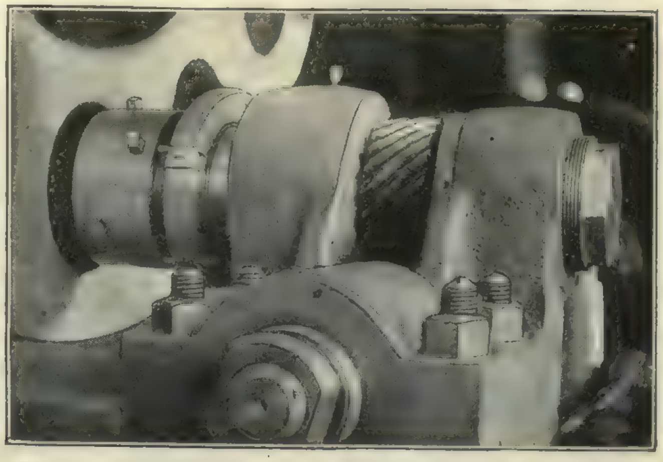


FIG. 4. CLOSE UP VIEW OF THE BORING ATTACHMENT

In the first set-up we completed five castings or sixty holes before the reamer required resharpening. We then reground the reamer, leaving less clearance than before, and completed nine castings or 108 holes before grinding was necessary.

The casting shown at the right in Fig. 2 is now drilled in a drilling machine, using the jig shown at the left; then it is bored to size on the gear-cutting machine. The jig was also made on the gear-cutting machine. This casting is now machined complete in 3 hr. and 50 min. It is quite light and work cannot be forced without springing it.

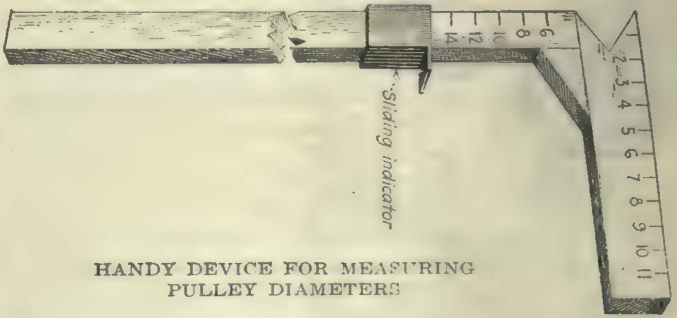
This attachment has not only paid for itself but has almost paid for the gear-cutting machine. New uses develop every few days and owing to the extreme accuracy and automatic operation we feel that the machine and attachment are well worth while even if the machine was never used for gear cutting.

A Pulley Measuring Pole

By H. W. Johnson

The measuring pole shown in the accompanying cut may be made of any light wood. The handle is long enough to enable a man standing on the floor to reach and measure pulleys on the line shaft. The sliding indicator is made of hard sheet brass, bent so that the friction will hold it in place, yet allow it to be pushed along without undue resistance.

Before taking a measurement the indicator is pushed up near the top of the pole. The lip of the slide is hooked under the rim of the pulley and the pole is pushed up until the V-notch fits easily around the shaft. The pole can now be taken down and the pulley diameter read off the vertical scale. This scale is figured to read diameters directly. The face width is read from the horizontal scale. This scale is also useful for measuring belt widths and to test the face of pulleys for crown.



HANDY DEVICE FOR MEASURING PULLEY DIAMETERS

IN THIS ISSUE

THE constantly-increasing use of the internal combustion engine in marine service has developed another (and extremely interesting) angle of the machine-building industry. An article by Frank A. Stanley in which he describes the methods used in machining and assembling these big power units is given first place in this number. He also explains how the parts are kept in order during their progress through the shop, which is an important item in a shop handling heavy machinery on a production basis.

The problem of grinding thin pieces of steel without drawing the temper is one that every all-round mechanic has been confronted with sometime in his career. Ellsworth Sheldon presents a real answer to the problem in "Grinding with a Phantom Wheel," page 44. The "wobbly" grinding wheel is made to wobble a definite amount and for a definite purpose, which will be very interesting to those who have grinding problems of their own.

"The Design of Flat Springs," on page 46, will need no introduction to those who have read the previous articles on spring design by Joseph Kaye Wood. The value of the formulas and the information concerning the results obtained will be appreciated by other engineers working along the same lines.

The tools and methods used in the production of a modern machine tool are described in detail in "Making Flather Lathe Parts Interchangeable," on page 50. Each part must be machined and fitted with a degree of accuracy that will not only make it possible to assemble any part to any machine, but that will also insure the assembled product being up to the standards required of machine tools which are to be used in high-speed production. How this accuracy is obtained is explained in detail, supplemented with descriptions of the jigs and fixtures used.

One process that is probably used more in railroad shops than in any others, is that of finishing cylindrical pieces (such as piston rods and axle journals) by "rolling" them. The description of this process by J. V. Hunter in "Roller Tools for Axle Journals" on page 54 explains in detail the latest types of tools used in this operation, and should be interesting not only to railroad mechanics, but also to those who are not so familiar with this method of putting a smooth finish on work of this nature.

As the business of manufacturing airplanes settles into its place as a necessary and important industry, the interest in airplane design and manufacture increases. "Axles for Airplane Landing Gear," on page 56, gives details of the construction of an axle for a Martin plane, and is a forerunner of a number of articles along this line.

W. R. Bassett goes into the subject of cost-finding on page 57 of this issue, and not only tells how costs are gathered, but also shows how the records are kept. Forms for keeping records of both material and operation costs are given, with instructions for their use. The importance of knowing the cost of every element entering a manufacturing process has been recognized by every successful manufacturer with the result that cost-finding has become virtually a science.

The design of drill jigs is concluded in the current installment of "Tool Engineering," on page 61. Roll-over jigs and trunnion jigs are described and illustrated in detail. The use of gearing for turning large trunnion jigs is also explained. While both roll-over and trunnion jigs are intended to make it possible to operate on several sides of a piece of work at a single setting, each has its own place and function.

An interesting article on the "Evolution of the Split Pulley," by Harry Botsford, will be found on page 65. How Wallace H. Dodge invented the split pulley as a make-shift, and the importance of this "make-shift" to industry today, makes an interesting story.

Among the "Ideas From Practical Men" are several shop-kinks of unusual merit. John E. Hoagland tells how to use small spring collets in a large lathe. Neil McDougall supplements a previous article on gages for chisel shanks with descriptions and drawings of gages used at the Puget Sound Navy Yard. The horsepower chart for spur gears will undoubtedly find a place in the designer's handbook; information of this nature is extremely valuable. Wilfred L. Clark shows how one shop builds up worn forming tools with stellite, thus keeping the cost of production down to a manufacturing basis.

Coming Features

The thirteenth installment of the Tool Engineering series will be a part of our next issue. It is the first of several articles devoted to the design of milling fixtures.

We are to launch a new series next week called "Organization and Management of the Small Shop." A particularly good feature of this series is that the author, Elmer W. Leach, is writing largely from his own experience. It is a good series and we want all who have the faintest idea that they may need it to start in on the first installment.

There will be another Rolls-Royce article by Colvin, entitled, "Some Unusual Features of the Rolls-Royce Car."

Another of the group dealing with shop design is scheduled. It describes the high and low bay type of machine shop of the Foote-Burt Co., Cleveland, Ohio.

The railroad article will be by Stanley. It deals with miscellaneous railroad shop tools and methods.

The second of the series, "Manufacturing with Special Machines vs. Standard Equipment," will be in our next issue.

EDITORIALS

Who Will Survive?

DURING the days of booming demand, when there were more buyers than sellers, we lost sight of the old law of the survival of the fittest. There was no question of survival, only of filling orders.

Too many do not seem to realize that the old law is now back on the job. They seem to feel that all they have to do is to sit by and wait, borrowing money to tide them over if need be, until the buyers flock around their doors once more. But these "waiters" are doomed to disappointment. The days of good business are on the way to those who *go out and bring them back*, not to those who stay at home and wait for them to come of their own accord.

Even now there is more business than many realize —but it goes to those who hustle for it, and they are not proclaiming its source to their competitors.

Now is the time to look the situation squarely in the face, to ask yourself whether you really mean to stay in business or not. If you do, get busy—don't wait for things to turn up. They won't—you've got to turn them up.

If your machines have a right to survive, they must be economically sound for the user. They must produce more and better work per dollar invested than the average machine of their class.

If you *know* they can do this, you must hammer the facts into the men who ought to be using them. You can't do this by sitting down and waiting for times to improve. You've got to get your selling talk across *now*, and *make* them improve. For, though many are not buying now, they are studying new equipment and making up their minds as to what they want. Unless they know all the good points of your machine now, the other fellow is practically sure of the order when it is placed.

Those who hang on in the hope of business revival and do nothing to revive it, are doing an injustice to themselves and to the industry. Even if they survive they will be so far behind that dividends will be a minus quantity for many years. In fairness to their stockholders, to themselves and to the industry, it would be better to quit now. Some of these are bound to be forced out anyhow and it is far better to retire while there is still a balance on the right side.

This isn't pessimism—it's just plain sense. We are full of optimism for the men who get out and hustle for business in the face of discouragement. They are bound to win. But the kind of optimism which is content to look at Pollyanna mottoes and wait for something to turn up, is doomed to disappointment.

Now is the time to see that every man who needs your machines knows what they will do and why he ought to have them. The harvest may not come as quickly as usual or as soon as we would like. But it will come if we sow the seed. If we do not sow now the crops will be garnered by those who had the courage to sow and cultivate, even in a bad season.

Volume Versus Value

MOST of us these days are watching with anxious eyes the descending curve of business on the charts issued by the various statistical and economic bureaus. It is not a very encouraging picture as it stands. But how many of us are discounting the fact that many of the figures which are averaged to get the curve depend on dollar values rather than on volume of goods turned?

Most of the index numbers are of necessity based on raw material and wholesale figures because they are the only ones easily available and it is a matter of common knowledge that most commodity prices have dropped nearly to or below pre-war levels. As a matter of fact the volume of business being transacted in pounds or tons or numbers or whatever physical unit is employed, is far greater than the business curves indicate. One has only to study the steadily increasing number of freight cars loaded and the constantly diminishing number of surplus cars to realize the truth of this statement.

Analysis of these figures shows that the rates of change are very similar to the ones that existed in 1919 when business was starting its upward swing. There is little likelihood that the business boom that started in 1919 will be repeated but the similarity of the freight car loading figures is at least encouraging.

Taking a Lesson from "Bicycle Days"

BACK in the early days of the bicycle boom, with wheels selling at $150 each and behind on orders, the conditions were very much as they were a year ago in the automobile business. One far-sighted business expert examined the books of a large concern and advised that the price be cut in half. The financiers regarded him as a fit subject for the asylum. The demand was here, why not work it to the limit? For, boiled down, the law of supply and demand means "get yours while the getting is good."

A few of the directors saw the expert's side of the problem. The $75 left a fair margin of profit and such a price would have prevented the mad rush to build bicycles at every cross-roads shop. But the plan was not approved and the bicycle industry went on the rocks so far as the great majority of the shops was concerned.

With such an example the present-day builders of automobiles, washing machines and machinery of various kinds, should see the path which the various industries have followed. The demand lured too many into the game and all of them could not survive. It is little less than a business crime to use good capital, so badly needed in other lines, in a vain endeavor to save concerns which are doomed to failure. Many should learn by past experience and quit while there is still something left.

Shop Equipment News

Betts 13-Ft. Movable-Side-Rail Planer

A metal-working planer with one side head mounted on a vertical rail that can be moved relative to the table is shown in Fig. 1. The advantage of the arrangement is that work of different widths can be accommodated in the machine, and yet both side heads put in use without any undue overhang of either one. The machine has recently been built by the Betts Machine Co., Rochester, N. Y., and installed in the plant of the Erie Foundry Co., Erie, Pa., chiefly for work on steel castings for steam hammers. It has a capacity of 13 ft. 2 in. between the housings, 8 ft. 2 in. under the crossrail, and a planing length of 20 ft., although the machine can be furnished in any desired length.

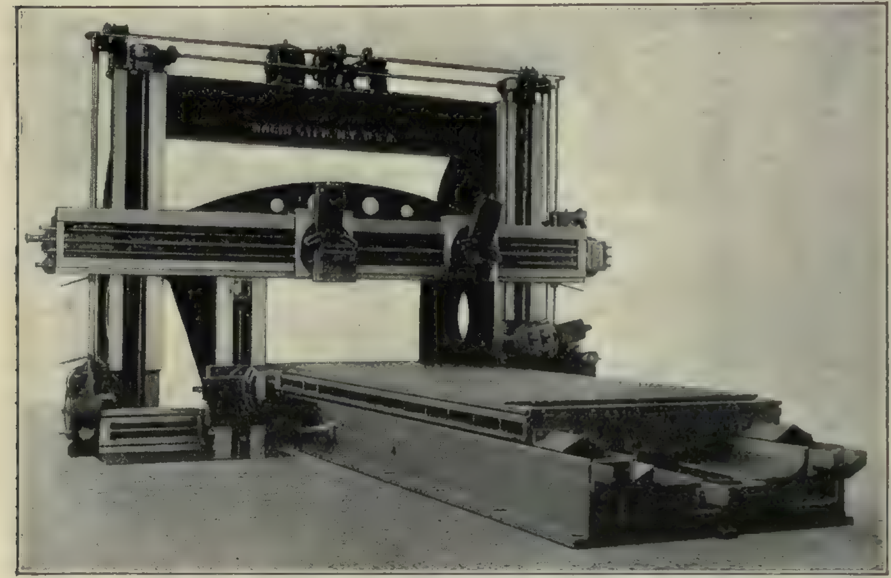


FIG. 1. BETTS 13-FT. MOVABLE-SIDE-RAIL PLANER

The center of the table is offset from the center of the machine. The side head on the right-hand housing will take care of work requiring only one side head, without the necessity of extending its slide beyond a point where it does not receive proper support.

The left-hand side head, shown in Fig. 2, is carried on a movable steel member or rail which has its bearing at the top on the crossrail, and at the bottom on the foot of the upright. This member has a sliding fit on the under side of the crossrail and can quickly be moved in and out either by hand or by power. When it is in position it can be clamped to the crossrail, as well as to the foot of the upright, on which it has a wide bearing. Since the movable member is held to the bottom of the crossrail, it will move up and down with the crossrail whenever the latter is adjusted for different heights, only requiring that the two clamps which hold the base member against the foot of the housing be loosened.

When the side rail is in its extreme outer position, it is flush with the side of the housing, and in this position the table will accommodate work the full width between the housings; and when it is moved along to the right as far as it will go, it is against the side of the table. Both side heads are in line with the rail heads, so that no extra travel is required when taking cuts with the rail heads and side heads at the same time. Since the rail which carries the side head has an easily controlled lateral movement, the operator can bring his side tool up to the work without excessive overhang of the toolslide; and thereby is enabled to take a heavier cut than would be possible with overhanging toolslides. The construction can be applied to either the right, or left-hand side head, or both, if desired.

All four heads are equipped with patented feed and power rapid traverse arrangements. The feeds are entirely independent of each other in all directions. Thus the operator can take a cut with either one or both side heads, while at the same time he can move the crossrail heads quickly along the crossrail by the power rapid traverse. The power rapid traverse to the heads, as well as to the side rail, is operated through a double friction clutch by means of conveniently located levers; no shafts or idle gears run in this mechanism when the power rapid traverse is not in use. The feed and traverse movement is said to be fool proof.

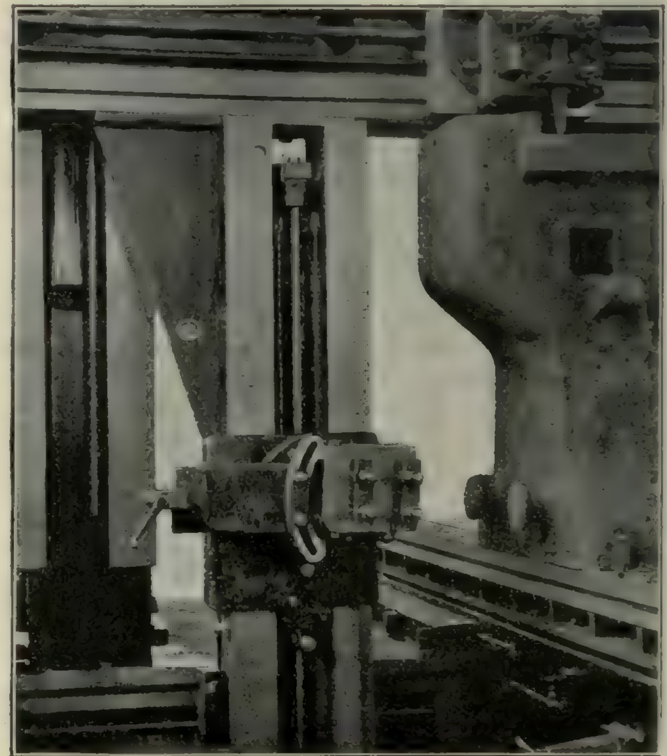


FIG. 2. ARRANGEMENT OF MOVABLE SIDE RAIL

The driving power on the machine illustrated is furnished by a 75-hp. reversing motor, giving cutter speeds of 20 to 40 ft. per minute and return speeds of 40 to 80 ft. per minute. The same motor which raises and lowers the crossrail also furnishes the power for the rapid traversing of the heads. The table is of the double-plate box-type construction, heavily ribbed, and is driven through steel gears and a steel rack. In cleaning, the chips are removed from the side of the table. The construction is said to be very substantial, and the method of control pliable.

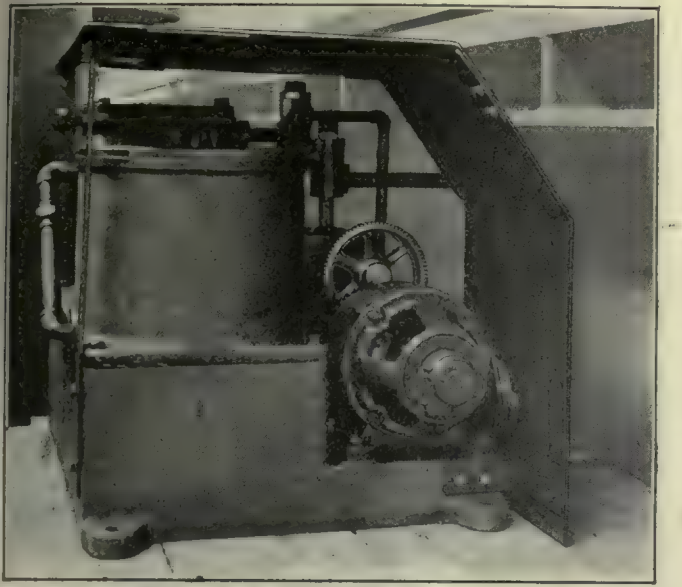


FIG. 3. FORCED-FEED LUBRICATING MECHANISM

Forced feed lubrication is provided for the table tracks, as well as for the driving gears and driving shaft bearings. The oil is filtered by a Bowser oil-filter system, shown in Fig. 3 and located at the rear.

It is said that the planer can do practically all of the work usually handled on an open-side, extension or convertible planer; and that it can work economically because all four cutting tools can be used to take heavy cuts simultaneously.

Lehman 22- and 24-in. Cone-Head Lathe

The Lehmann Machine Co., St. Louis, Mo., has recently placed on the market a three-step-cone, double-back-geared engine lathe in 22- and 24-in. sizes, the illustration showing the 22-in. machine.

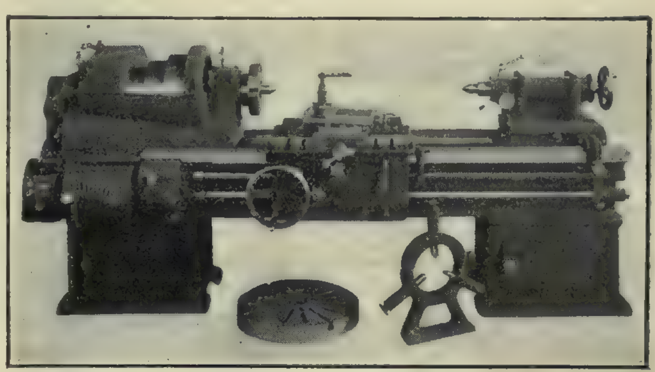
The bed has chilled ways and is braced by large cross-ribs. The V's are large, and have a total angle of 90 deg. The inside front way is flat. A rack is cast in the center of the bed for engaging the pawl on the tailstock, thus avoiding the necessity of pulling the clamping bolts so tight to secure the tailstock

The headstock casting is carried from the front to the rear box on a line with the center of the spindle, tying the bearings rigidly together and serving as a guard for the belt. A geometrical progression of nine spindle speeds is provided in the head. The spindle is made of steel and hardened. The nose is provided with bearings for faceplates and chuck plates, both behind and in front of the threaded portion. The hardened spindle running in hard bronze bearings gives a very low coefficient of friction and long life to the bearings, it is said.

The tailstock is clamped to the bed by four bolts brought up to the top of the barrel, for the convenience of the operator. Its spindle is large in diameter and is provided with an improved locking device, which is said to securely hold the spindle without throwing it out of alignment.

The carriage has a wide bridge and is provided with an oil trough which returns the cutting lubricant inside the V's. Wipers fastened to the carriage keep the V's lubricated and clean. The apron has a central oiling system and a removable front plate, so that the mechanism is accessible without removing the whole apron from the carriage. The apron is of box form and provides a double support for all studs and a double bearing for all running shafts. A safety device prevents engagement of the feed rod and the lead screw at the same time. The compound rest is of large diameter and is graduated up to 90 degrees.

The quick-change feed mechanism is said to be designed so as to simplify the construction and to double the range with the addition of only two gears. A cone of gears with the ordinary type of sliding rocker arm is employed; but the rocker has two central driving gears of different ratios, each with an intermediate gear which engages the cone of gears. For cutting odd threads and worms a swinging quadrant permits the use of special and compound gears. The whole quick-change mechanism is a unit contained within a housing that can be entirely removed in a few minutes. A central and independent oiling system lubricates the bearings in the box and rocker.



LEHMEN 22-IN. CONE-DRIVEN, DOUBLE-BACK-GEARED LATHE

The feed rod is not running when thread cutting, and the lead screw is inoperative when the feed rod is employed. An adjustable collar on the feed rod serves as an automatic stop for the carriage feed and also as a safety. The lead screw is of high-carbon steel with a two-pitch Acme thread. It is provided on both ends with ball-thrust bearings, which reduce the gear strain and the friction. The thread indicator is attached to the carriage and may be disengaged when not in use. This device permits both pulleys on the countershaft to be run forward. When cutting threads, the carriage may be quickly run back by hand and the half nut re-engaged at the correct point by reference to the dial on the indicator.

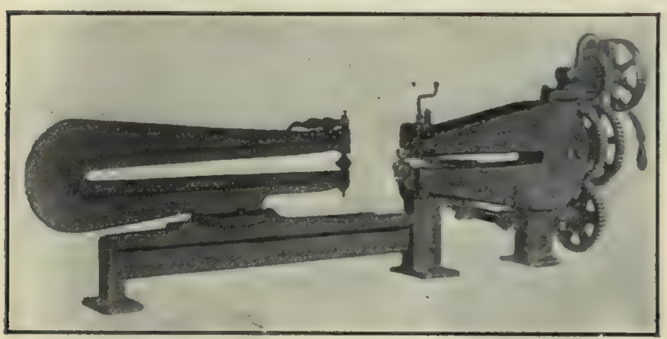
A micrometer carriage stop can be furnished when desired. The steady rest has alloy steel plugs, and all adjustments and locks are made with star handles, no wrench being necessary. It can be reversed on the bed so that the tool may be run up close from either side.

The back gears and the friction gears in the apron are made of semi-steel and the apron reverse gear of phosphor-bronze. All other gears are of steel. The feed gear on the end of the spindle is driven through a shear pin, to prevent breakage of parts of the feed mechanism. All gears are covered so as to give safety to the operator and protection from dirt.

Niagara No. 13-B Ring and Circle Shear

The illustration shows the No. 13-B deep-throat ring and circle shear recently placed on the market by the Niagara Machine and Tool Works, Buffalo, N. Y., for work on light material. The machine not only cuts outside circles, as do most circle shears, but also internal circles or holes, owing to the inclined position of the lower shaft and cutter. It is also suitable for cutting reverse curves within certain limits fixed by the construction.

The cutters are made of a special quality of tool steel hardened and ground. Adjustment is provided for taking up wear on the cutters and for suiting the thickness of the material to be cut. The upper cutter can be raised and lowered to penetrate the stock, so that the cut can be started in any part of the sheet, and not only on the edge. The slitting gage, applied to the cutting head, is readily adjustable for strips of various widths and it enables the accurate cutting of similar strips.



NIAGARA NO. 13-B RING AND CIRCLE SHEAR

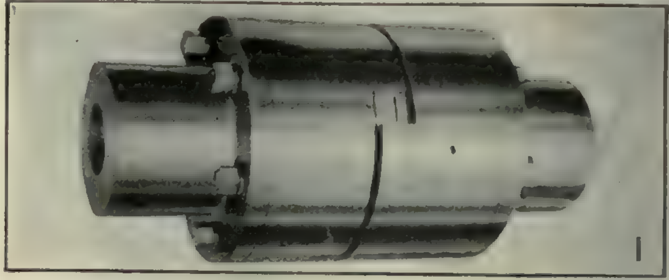
Specifications: Capacity to cut: thickness, 20-gage soft steel; diameter of circle from square blank, 3½ to 42 in. Distance from throat of cutting head: to frame, 18 in.; to gage, 9 in. Pulleys: size, 9 x 1¾ in.; speed, 100 r.p.m. Depth of throat of circle arm, 30 in. Diameter of cutters, 1⅝ in. Weight, 430 lb.

The circle arm has a throat of sufficient depth to permit of cutting from square blanks the largest circles for which the machine is rated. The circle arm can be readily moved and fastened the proper distance from the cutters, according to the diameters to be cut. A scale graduated in sixteenths of an inch is marked on the support of the circle arm. The proper position of the blank between the clamping disks is determined by a swinging gage and the cutters. An eccentric device is used for clamping, enabling the easy and rapid fastening of the work.

The gears and pinions are well protected by metal guards. A clutch, actuated by a hand lever, permits of stopping the motion quickly at any point. The machine is regularly furnished for bench use, but high legs can be furnished if desired. By the use of two universal joints in the lower shaft, the shaft can be placed in an inclined position and a deep cutting throat used, without the necessity for making the cutting head extremely heavy and adapted to floor use only, as in the case with most shears having the capacity for plates of the size handled.

Karge "Cushion" Couplings, Pulleys, Gears and Clutch

The Karge-Baker Corporation, Phoenix, N. Y., has recently placed on the market a flexible "cushion" coupling made in a variety of forms to adapt it to various uses. In Fig. 1 is shown the type FL coupling, which is fitted with flanged ends carrying hubs to fit the shafts being connected. The plain type L coupling does not have the flanged ends, but the shafts are keyed into the body of the coupling. The use of the detachable ends, however, facilitates the adapting of the coupling to shafts of different sizes.



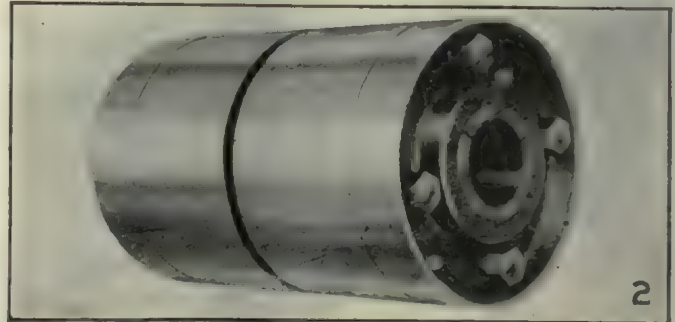


FIG. 1. KARGE "CUSHION" FLANGED COUPLING, TYPE FL
FIG. 2. KARGE COMPRESSION-GRIP COUPLING, TYPE CL

The coupling is adapted to the connection of rotating shafts transmitting power, and it not only corrects for parallel and angular misalignment and permits armature float, allowing each shaft to run freely in its own bearings, but it also cushions the drive and absorbs the shocks occurring between the two shafts. A helical steel spring of square section is fitted in the coupling, the drive being transmitted through it. The cushioning feature allows for a relative rotation between the two ends of the coupling of 30 to 40 deg. in either direction, at which point the shoulders on the casings strike and

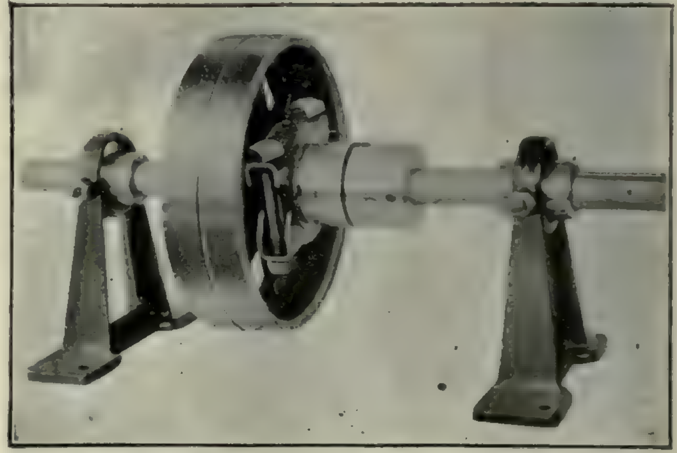
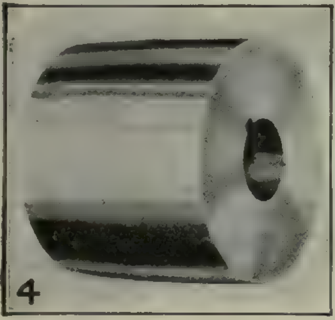


FIG. 3. KARGE COUPLING APPLIED TO PULLEY

give a positive drive. The torsional strength of the coupling is said to be greater than that of the shafts which it is intended to connect.

The standard type L coupling is made in sizes to transmit from ¼ to 160 hp. at speeds from 1,800 to 100 r.p.m., respectively. A factor of safety of 4 is used. The bores vary from ¼ to 5 in. in diameter, and the weights from about 6 oz. to 385 lb. The flanged coupling is made to transmit from 6 to 64 hp. It can be furnished with bores from ¾ to 4⅜ in. in diameter, and it weighs from 7½ to 187 pounds.

The coupling can be furnished with ends of the type shown in Fig. 2 for obtaining the grip on the shafts by means of compression only. By tightening the screws, the end hub is driven up so as to close the split cone bearing in its center. Thus the coupling can be very easily installed on the shafts. This type CL coupling is made to fit shafts from 11/16 to 3 in. in diameter, and for horsepowers from 6 to 64.



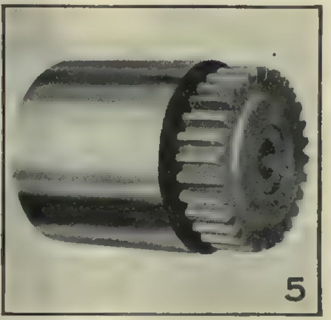


FIG. 4. KARGE "CUSHION" MOTOR PULLEY
FIG. 5. GEAR ATTACHED TO KARGE COUPLING

In order to cushion the shock of starting a shaft by means of a belt on a pulley, the cushion coupling is made with a bushing on which a pulley can be mounted, as shown in Fig. 3. Bushings can be furnished to fit any standard pressed-steel or cast-iron pulley. One end of the cushion coupling is connected to the shaft and the other to the pulley bushing, so that the power is delivered through the spring of the coupling. The standard sizes of the coupling are adaptable to this use.

Fig. 4 shows the cushion pulley intended for application to motors where a small diameter is necessary. The cushioning mechanism, such as previously described, is inclosed within the pulley, and it permits of a torsional movement of the pulley rim of from 40 to 60 deg. This cushioning absorbs the shock of starting, and prevents surges from injuring either the motor or the machine being driven. A compressed fiber sleeve is fitted on the face of the pulley. The pulley can be furnished in diameters of from 2 to 30 in. and face widths of 2 to 16 inches.

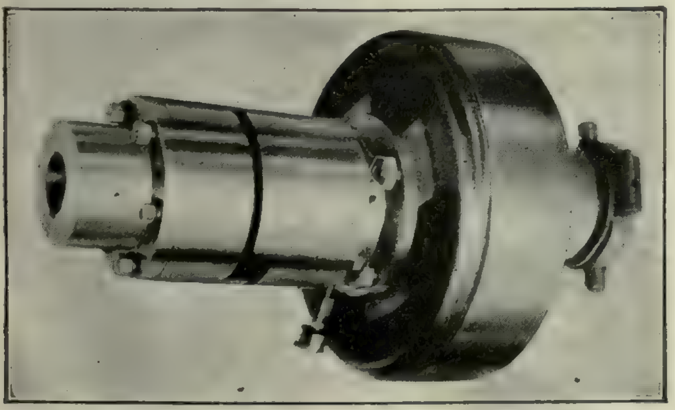


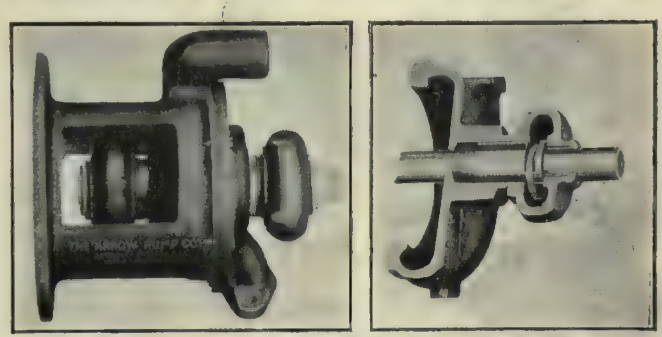
FIG. 6. KARGE COUPLING AND FRICTION CLUTCH

A similar device for absorbing the shocks in gear trains is also made, being constructed both as a pinion and as the hub for a ring gear. The device is said to prevent undue shock to the teeth and to cause noiseless running of them. The pinion can be furnished in diameters of from 2 to 30 in., and in face widths from 2 to 10 in. Fig. 5 shows a coupling with a gear connected to one end of it, the other end being secured to the shaft.

The cushion coupling is shown connected to a friction clutch in Fig. 6, this construction being intended for use where it is necessary to connect and disconnect a machine from a constantly turning shaft. To engage the clutch, two arms are forced outward by the axial movement of a conical bushing, thus forcing the two shoes outward against the inside of the periphery of the driving plate. The cushion coupling absorbs shocks due to both starting and running. A range of sizes of clutches suitable to use with the different sizes of couplings is made.

Packing Gland for Arrow Pumps

The Arrow Pump Co., with general offices in the Buhl Building, Detroit, Mich., is prepared to manufacture different types of rotary pumps in which are incorporated the company's own design of self-lubricating packing glands. It is claimed that the construction eliminates leaky glands and scored shafts due to improper lubrication at the glands. The cut-away view on the right side of the accompanying illustration shows in detail an example of the construction. The gland is applicable to any device requiring the packing of a rotating shaft.



ARROW CENTRIFUGAL PUMP AND TYPE OF PACKING GLAND USED

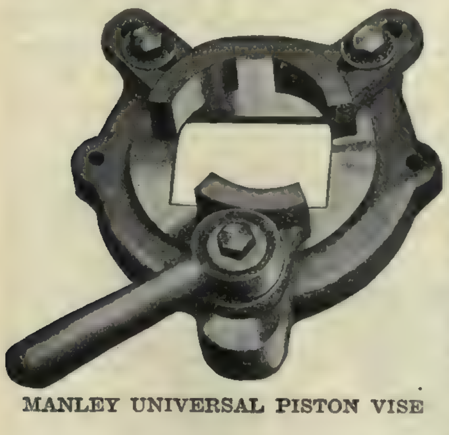
The packing gland is so arranged in combination with an adjustment nut and oil reservoir as to permit of the use of a ring oiling device. A constant and positive flow of oil is thus supplied to the gland and to the bearing which is a part of the construction. In this way the shaft is supported close up to the load, which eliminates the long overhang that exists where the shaft load is carried in out-board bearings. Deflection of the shaft is prevented and the seal of the packing is therefore undisturbed. It is said to be the constant disturbance of the packing by deflection in improperly supported shafts that causes leaking glands. Soft, resilient packing is not used, as metallic packing affords all the resiliency necessary to completely seal without scoring the shaft.

The method of lubrication keeps a film of oil constantly between the packing and the rotating shaft, as well as in the bearings. The packing is thus not subjected to severe wear and for this reason, coupled with its not being disturbed, will hold its seal for long periods without adjustments, it is claimed. At the left side of the illustration is shown a centrifugal pump intended for circulating water on an automotive engine and fitted with a gland such as just described on each end of the shaft. Lubricant and other centrifugal pumps are in development.

Manley Universal Piston Vise

The Manley Manufacturing Co., York, Pa., has recently placed on the market the vise shown in the illustration, for holding automotive pistons while working on them, as when replacing the rings or wristpins or tightening the connecting-rod bolts. The device is said to be adaptable to all sizes of automobile pistons, hence is called "universal." It is intended for attachment to a work bench.

The vise grips the piston by means of three jaws, the inside bearing surfaces of which are circular arcs. It is stated that by this construction the piston is not damaged, as it is apt to be when held in a two-jaw vise, even though that vise have rounded bearing surfaces. In order to set the vise to fit a piston, the three jaws are brought up to touch the piston, which is stood near the center of the vise, and then the capscrews in the jaws are tightened. The front jaw is fitted with an eccentric operated by means of a small lever, so that the piston can be quickly released and clamped when once the jaws have been adjusted to fit it.



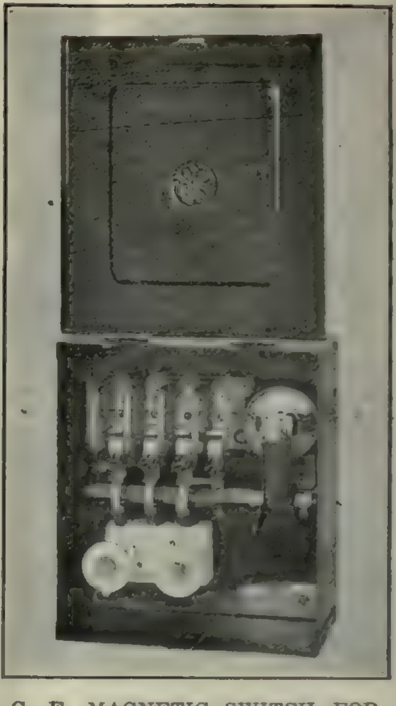
MANLEY UNIVERSAL PISTON VISE

The square hole in the center of the vise is for use when the connecting rod is attached to the piston that is placed in the vise, as the rod can be allowed to hang through the hole. The vise holds pistons from 2 11/16 to 5 5/16 in. in diameter. It is made of cast iron and weighs 15 pounds.

G. E. Inclosed Magnetic Starting Switch

An inclosed magnetic starting switch for small alternating-current motors, known as the C.R.-7005-A-2 switch has recently been developed by the General Electric Co., Schenectady, N. Y. It is for use with motors of from 3 hp. and 110 volts up to 5 hp. and 220, 440 and 550 volts. The switch is suitable for use with momentary contact start and stop push-button stations, or snap switches, float switches, pressure governors and thermostats.

The apparatus consists of an operating magnet, contactor, and protective plugs, all mounted on a sheet-steel base and inclosed in a case with a cover hinged at the top. The accompanying figure shows the cover raised. The operating magnet is wound for full-line potential, is water-proofed, and easily removable from the front. The contacts are heavy copper, backed by helical springs which hold them tightly in place, and make them capable of very frequent service for a long time. The protective device is in the form of two removable inverse-time-element protective plugs, which safeguard the motor against overloads ordinarily met in service. When used with momentary contact push-button stations, these switches provide undervoltage protection, as the motor cannot be restarted when stopped by voltage failure, until the start button has been pressed. When used with snap switches, float switches and the like they furnish under-voltage release, permitting motors to restart immediately on the return of voltage.

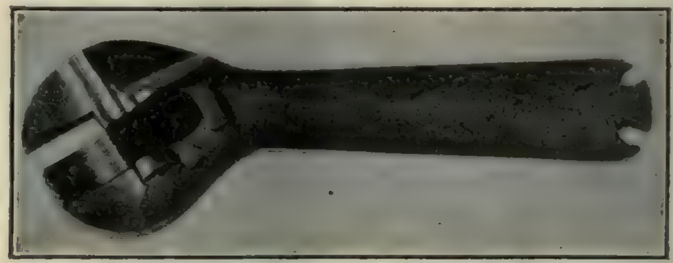


G. E. MAGNETIC SWITCH FOR STARTING A. C. MOTORS

The switch is easy to install, being provided with three knockout holes at the top and two at each side for 3/4-in. conduit. It has holes for mounting screws in the back plate. All parts are easy of inspection, and renewal of vital parts is a simple matter, owing to their accessibility and design, it is said.

Huber & Dubs Adjustable Wrench

A wrench which is adjustable for nuts of various sizes has been put on the market by Messrs. Huber & Dubs, of Zurich, Switzerland. The body and jaws are made in one piece of drop-forged steel. Between the jaw, as shown by the accompanying illustration, are placed a number of thin oblong plates 0.032 in. in thickness. These plates move on hinges, and can be turned back singly from their position between the jaws. In each position, they are rigidly held in place by a spring plate screwed to the body.



HUBER & DUBS ADJUSTABLE WRENCH

The wrench is at present made in one size only, the jaw opening being adjustable from 1/2 to 1 in. The spanner shown is very flat, and is mainly intended for flat nuts, such as are used on bicycles. It can, however, be produced in any desired thickness. The thin metal plates are made of hardened steel, and the spring and the plates are easily renewable. The chief claim is that the wrench maintains a constant distance between the jaws better than screw-adjustable wrenches.

NEWS SECTION

Some Information on the Market in Finland

The following letter has been received by the Barnes Drill Co., Rockford, Ill., from a member of the A. B. Machinery Co., at Abo, Finland.

"The writer has now been here since September, and all the time in the most intimate contact with the market, but the impression of the conditions here, especially of what pertains to the market for American products, is that they have changed from bad to worse. It does not take much to come to this conclusion as only the exchange situation has to be considered in order to get a clear view of the situation. The first of September the value of one dollar was 38 finmarks, today the value of the dollar is 51.50, in other words the purchasing value of our currency in America is so small that American products cannot be placed in the market here under present conditions.

"It is the writer's impression that the reports now circulating in America, as well as those issued by the American government, based upon the consular reports, and the reports issued by the banks of America, are based upon the sudden improvement in our currency which took place during November and the early part of December last year, when the value of one dollar relative to the finmark dropped from 51.50 to 27 within a period of 45 days. Since then there has been a decline in the value of our currency that today's value is lower than it was Nov. 30, when the earlier low record was reached.

"For a house such as ours, specializing in American machine tools of quality, there is hardly anything doing, our work being principally preparatory work for the future which we believe will come sometime with new possibilities for American products. When such a change will take place it is impossible to foretell with any degree of certainty, and we believe that the change actually will be brought about by American financiers, who at the present time are governing the gold supply of the world. Some scheme will be developed for the equalization of the exchange, as it is important also for American industry to have its exports up to par, which cannot be done before the exchange of the European countries has improved considerably."

◆

Southern Steel Mills Showing Signs of Better Times

The 84-inch plate mill at the Bessemer plant of the Tennessee company is now in operation.

Other finishing mill operations include the blooming and rail mill at Ensley and the bar and structural mill at Fairfield.

The car plant is in operation at the works of the Chickasaw Shipbuilding and Car Co., which is also making parts for the ships that are being turned out at the Chickasaw yards in Mobile.

The Tennessee company is operating five blast furnaces on basic iron for use in the steel mills.

The Ensley and Fairfield steel mills are on a 50 per cent base and the operations of the past several weeks are enlarged this week by the running of the plate mill at Bessemer.

Among other rail orders the Tennessee company is executing one of 10,000 tons for the Alaskan railroads. This moves down the Warrior river to Mobile, thence to Seward, Alaska, by Isthmian Steamship company vessels.

Industrial Conference at Harrisburg

An Industrial Relations Conference, authorized by Governor William C. Sproul of Pennsylvania, is being arranged by Dr. Clifford B. Connelley, Commissioner of the Department of Labor and Industry, Commonwealth of Pennsylvania, to be held at Harrisburg, Pennsylvania, Oct. 24 to 27.

This conference will include the features of the Welfare and Efficiency Conferences and Safety Congresses of other years. The main topics to be discussed will include Industrial Waste, Industrial Co-operation, Industrial Publicity, Industrial Education, Women and Children in Industry and the Medical Supervision of Industry.

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Japan Does Not Favor Adoption of the Metric System in That Country

The Kingdom of Japan, which heretofore has had its own system of weights and measures, recently decided to change to the metric system in order to have uniformity with other parts of the world. There was a division of opinion in Japan. Some people advocated adoption of the metric system, while others urged the English system in order to come into line with America, Great Britain and the British Colonies, which are admittedly the greatest industrial nations of the world. The following remarks are paraphrased from a communication from a very well informed correspondent in Japan, a citizen of that country:

"Japan is a peculiar country. At present it has no distinct system of weights and measures and no definite standards, different kinds of weights and measures being intermingled throughout the country. Among practical and industrial engineers the English system was generally adopted and with much convenience. But among theoretical engineers the metric system was mostly used. Teachers in the schools taught both systems and so on.

"In the recent discussions the practical men urged the English system, especially 'an improved English system,' government officials and professors in the Imperial University agreed as to the advisability of this. However, the special committee on weights and measures appointed by the government decided to adopt the metric system and finally the measures were passed by the two houses—Peers and Commons. The majority of this special committee consisted of old men and of men who had been educated chiefly in Germany, and who almost worshipped everything German. This was influential in leading to the decision.

LAW WILL NOT BE EFFECTIVE

"Although, however, it will be attempted to make the metric system compulsory in Japan and the law so provides, it is doubtful whether such a result will happen.

"Almost everything in this world develops from actual necessity. In the long run the most useful system will survive. If the leading nations of the world, which are America and Great Britain, to which Japan owes most of her civilization, business methods, etc., decide to retain the English system of weights and measures with some improvement, it is certain that Japan will continue to use the English system out of considerations of actual necessity, without regard to the law, which will be practically ineffective."

Prof. Greene to Head Princeton Engineering School

Prof. Arthur M. Greene, of Rensselaer Polytechnic Institute, has accepted the call of the trustees of Princeton University to become dean of the engineering school and professor of mechanical engineering. He will take up his new duties in September, 1922. Prof. Greene is a graduate of the University of Pennsylvania and also holds an honorary degree of D.Sc. conferred in 1916. He has taught mechanical engineering at Drexel Institute, at the Universities of Pennsylvania and Missouri and at Rensselaer, and has been prominent in the American Society of Mechanical Engineers as manager and vice-president, and at the present time is chairman of the Research Committee.

Princeton has given an undergraduate course in civil engineering and a graduate course in electrical engineering for many years. Next fall undergraduate courses in mechanical, electrical, mining and chemical engineering will be added to the curriculum. A four-year course will lead to the degree of bachelor of science in engineering and is designed to meet the needs of the student who does not expect to practice the profession of engineering but wishes the engineering training to fit him for business or manufacturing. For those who decide to follow engineering as a profession an additional year of special work in the chosen branch will bring the engineer's degree. The establishment of the new courses has been largely due to the untiring efforts of certain of Princeton's engineering alumni through the graduate body known as the Princeton Engineering Association.

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Three More Courses in Boxing and Crating

The ready response of the industries to the recent training course of instruction in boxing and crating, conducted at the Forest Products Laboratory, Madison, Wis., has prompted the directors to arrange another series of such courses. These will take place on the following dates: July 25 to 30; Sept. 26 to Oct. 1; Nov. 7 to 12.

Further information on this subject can be had by addressing a request to the laboratory.

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The Real Salesman

One who has a steady eye, a steady nerve, a steady tongue and steady habits.

One who understands men who can make himself understood by men.

One who turns up with a smile and still smiles if he is turned down.

One who strives to out-think the buyer rather than to out-talk him.

One who is silent when he has nothing to say and also when the buyer has something to say.

One who takes a firm interest in the firm's interests.

One who knows that he is looking out for his own interests by looking out for his customer's interest.

One who keeps his work, his temper and his friends.

One who wins respect by being respectable and respectful.

One who can be courteous in the face of discourtesy.

One who has self-confidence but does not show it.

One who is loved by his fellowmen.

—Bates Company.

Business Conditions as the Big Banks of the Country See Them

Review and Outlook of the Peoples National Bank of Pittsburgh

"General activity in the industrial life of the Pittsburgh District showed a slight reactionary movement last week, moving down a point in average of production and employment of labor, but with conditions clearing for a more definite upward trend in the future. Building trades are slower and blast furnace operations contracted a little, while coal mining failed to maintain its upward trend due to slack buying in the markets outside of lake trade. Glass factories, potteries and smaller industries are gaining in momentum but machinery industry is slowing down to a point where much idleness now exists especially in Pittsburgh's immediate territory and in other great centers.

LABOR DECLINES WAGE CUT

A strike of building trades in Pittsburgh is rather expected at the end of the current month as the workmen are declining to accept any reduction in wage rates. This will materially stifle improvements until settled.

The abolishment of overtime rates of pay by the Republic Iron and Steel Co. affects several thousand men in Youngstown and makes uniform this rule of work in the steel industry. The eight-hour day continues but all overtime possible will be at the regular rate. Very little of this is possible at this time.

The depression in the machinery trade has hit Pittsburgh severely, including the great works at East Pittsburgh, and at West Homestead, where thousands of men have been temporarily laid off.

Building costs are so high that several who braved the risk are expressing disgust with the results in Pittsburgh. This is especially the case in the dwelling house projects. Where labor unions rule, costs have been in excess of generous estimates. Efficient labor has gained however. In heavier construction work, union labor has been bidding against itself in getting work under scale rates. This is the best sign of a weakening of the stubborn organizations which are now delaying all building enterprises.

A GREAT DIFFICULTY

In entering on any discussion of our present commercial situation it would be foolish not to acknowledge frankly that we are in the midst of great economic difficulties. But it is infinitely more foolish for anyone to think we will not grow out of this situation.

We have gone through a post-war, speculative boom, stimulated by a world vacuum in commodities. We are suffering both from the aftermath of the boom and from the war destruction, with its consequent reaction upon us of the greatly lowered standards of living in Europe. In some ways the situation is even more difficult than that following the Civil War, because to-day our economic machinery is more intricate and less easy to adjust, and we are not dealing with a domestic situation as then, but with a situation in which the whole world is implicated.

We have much upon which to congratulate ourselves. Our difficulties are infinitely less than those of Europe; we have weathered the danger point of a great crisis; our financial system has proved its strength; and for the first time we have passed safely through a commodity crisis without monetary panic. Our people have abundant food and abundant clothing. We are at least warmly housed, even though crowded. We possess in the high intelligence, high courage, and high ideals for our people ample reserves of economic, social and political strength. We possess a great sense of neighborliness that has had fine manifestation in these difficult months in help given each other for weathering the storm. We have had a remarkably small ratio of failures.

INEQUALITIES IN PROGRESS OF READJUSTMENTS

It is almost banal to say that we have many readjustments to complete. Part of the bitterness of the situation arises from the inequalities in the progress of these readjustments in different walks of life and in different branches of industry. Nothing is more indicative of this lack of alignment in the march of readjustment than the study of recent commodity and labor indexes as they compare with a 100 pre-war base:

Farm prices (crops)	115
Farm prices (animals)	123
Wholesale food	150
Retail food	156
Railway receipts per ton-mile	166
Lighting	207
Building materials	212
House furnishings	275
New York Industrial Commission wage index	212
Department of Labor, hourly union wage index	199

Much of this readjustment can be accomplished only with time and patience. Economies of hard times produce savings and greater endeavor. Shrinkage in values yield more free capital. These savings in turn fertilize the soil for upward progress. There are many impediments to the smooth movement of readjustment that everyone can enumerate, and everyone will set a different value and importance upon each of them. From all quarters of our domestic field we have daily given as impediments to recovery—badly adjusted railway rates, excessive and badly adjusted taxes, insufficient tariff, high wages, high profits, high interest, restriction on effort by labor, and a dozen others, while our domestic recuperation is sadly interlocked with the recovery of Europe.

EQUALITY OF SERVICE

There is slow and only partial realization by some bankers, directors of public utilities, manufacturers, and distributors, both employers and employees included, of the fact that we must approach a parity of levels in profits, prices, and wages in different industries. Some groups are able to put up stronger resistance to reduction of economic levels than others. For instance, this resistance against lower levels in the services and commodities that the farmer must buy in the face of his very much lower returns is already digging a grave of unemployment for the other industries which helped to bring about this condition.

No greater lesson can be brought home to our people than that we must not only get but give *quid pro quo* in service. No particular economic fraction of our population can long continue securing undue advantage without disaster to itself and the community. Our whole economic and moral problem—indeed, our safety, our satisfaction, and our happiness—are balanced upon our practice of this basic truth in business dealings.

There are many encouraging signs in this readjustment. Many manufacturers and wholesalers are making cuts in their inventories that equal or exceed the increases which they obtained when we were on the upgrade. They are passing their savings in raw material and labor on to the next stop in distribution. Economically, the retailer is of necessity the last of the chain to make readjustment, and in some localities and some lines he has been less responsive to the necessity of this readjustment than the situation calls for. The processes of competition work very sharply and promptly upon the manufacturer and wholesaler because the buyers are comparatively few and very wise. They do not so react upon the retailer because the public at large is not so wise and is too inert to do that shopping around for the best bargains which is necessary to set up the processes of competition.

Labor shows a willingness to make reductions in wages in many directions, and I believe is willing to face even further reductions if its sacrifices can be demonstratively handed on in general reduction of final price levels, so that the cost of living travels in step. Labor is growing in efficiency, and shows a willingness to remove the objectionable limitations, an effort that grew up in some industries during the war.

It is entirely possible for us to maintain our high standards of living if we can secure equitable readjustments all along the line. But we must face the fact that if we are to hold to our higher standard of living and to maintain employment of our people against the competition of the living standards of Europe, lowered for a whole generation, we must do it with greater efficiency, and by harder work.

A Few Sidelights on the Middle-West from the National City Bank of Chicago

The country is in the midst of the drastic readjustemnt which everyone knew would come sooner or later, but which was scarcely expected in its present intensity at this time. It is not a pleasant ordeal, but the comforting thought is that we shall be the better for it and that through systematic deflation, general business will be re-established upon a safe and sound footing. Absence of buying in some industries even at the reduced price levels shows that the public is not convinced yet that the movement will not go further. All prices are to a greater or lesser extent being readjusted which means that price inequalities are being straightened out and that the country is developing a price level at which it will resume business in earnest. When this level is established—and we are approaching it more closely every day—the basis will be laid for sustained revival in general trade.

COST OF LIVING HAS COME DOWN

All living costs and the expense of doing business are being lowered in response to an insistent demand for the abandonment of war schedules. The figures of the National Industrial Conference Board show that within a year the cost of living has come down 20 per cent, although it is still 61.9 per cent above the level of 1914. Food prices within twelve months have been lowered 33.8 per cent, fuel and light 7.2 per cent and shelter 8.2 per cent. The country is still desperately in need of new houses and apartments for rentals are burdensome everywhere. Investigation shows that rentals consume from 15 per cent to 20 per cent of the average wage earner's income and that there is little chance of reducing them until capital and labor get together and a well defined program for community building is carried out. This is very important, for history shows that social disorders increase when workers are improperly housed and living conditions at industrial centers become intolerable. In those sections which have maintained the war scale of wages, relatively little real work is being done, for the one thing certain is that the country cannot erect houses at the average scale of war costs. The nation is desperately in need of dwelling accommodations and the sooner the requirements are met the better it will be for all concerned, including even those workers who have resisted wage cuts most vigorously.

GREAT TAX BURDEN

Although the services of several thousand government employees have been dispensed with the preliminary estimates show that during the new fiscal year beginning this month every man, woman and child in the United States may be taxed $60 for the expense of conducting the Federal Government. This is quite apart, of course, from the demands of local, state and county taxation, and shows how enormously the cost of government has increased since the World War began. An honest effort is being made to curtail these outlays, but it is evident that the procedure will be slow and that for several years to come the cost of government will figure largely in the cost of living. Other nations are much worse off than we are, but there is reason to believe that much good will come ultimately from the efforts of various government officers and public spirited citizens to lessen the outlays for armament and military purposes. The public outlays will be increased to some extent by the disposition of the Legislatures and public bodies to vote immense sums for road-building campaigns and other improvements calculated to give employment to many of the 4,000,000 or 5,000,000 workers in this country without anything to do.

Time to "Cash" the Present—Credit Structure Stronger—Need for a Demand for Goods—European Situation

In an address before the American Institute of Banking at Minneapolis, Francis H. Sisson, vice-president of the Guaranty Trust Company of New York, said in part:

"For more than a year the American people have been discounting the future. The time has arrived when they should begin to 'cash' the present. There is ample evidence to indicate that many of the readjustments which we have undergone in the last twelve months have practically been completed, and, although there will inevitably be further readjustment in other directions we are rapidly succeeding in laying a foundation for the revival of business on a sane, sound and stable basis.

SYMPTOMS RATHER THAN CAUSES

"One of the most significant and fundamental indices of that fact is the improved credit situation. But the conditions which underlie and influence the credit situation are so complicated that many business men, and others, quite naturally, are likely to overlook or misunderstand the essential factors and perhaps attach too much importance to less vital but more spectacular features; thereby, frequently being led to seek a remedy for symptoms, rather than causes. That state of mind unquestionably accounts for several of the alleged economic panaceas which have been conceived since the Armistice, and some of which been tried, notably the emergency tariff for the 'benefit' of our agricultural interests.

"Consequently it is imperative for us to concentrate our attention on the essential, fundamental factors in the business situation and to interpret them as correctly as we can in the light of past experience and the present juxtaposition of various elements. For that reason the condition of credit is of especial interest, particularly now, and should be studied by the business man not merely from the viewpoint of supply and demand and rates but also for the purpose of ascertaining basic principles and underlying causes. Such a study today will inevitably lead to reassurance and confidence.

CHANGE IN BASIS OF CREDIT STRUCTURE

"There is a very important development in the credit situation which should be noted. I refer to the fact that during the last twelve months there has been a decided shift in the basis of our credit structure from Government obligations to business paper. In other words there has been a very marked reduction in the discounts at the Federal Reserve banks secured by Government obligations.

"It is gratifying to observe also that, whereas in 1919 only slightly more than $700,000,000 was extended by Reserve banks on agricultural and livestock paper, in 1920 more than $1,980,000,000 was granted on that kind of paper. The farmers, in brief, are better financed than they have ever been, notwithstanding that they have not been as freely supplied with credit as some of them desired for the purpose of trying to suspend the operation of irresistible economic laws by artificially sustaining prices for their products in a universally falling market. And that is one of the most encouraging indications in the present situation.

THOROUGH LIQUIDATION ESSENTIAL

"We are witnessing the repetition of a familiar experience in the accumulation of bank reserves coincident with retarded business activity. Such conditions ordinarily precede a period of declining interest rates, which in turn tend to stimulate borrowings for productive purposes. This reaction is not altogether automatic, however, for the cost of borrowed money is but one of several elements in the general cost of producing goods. It should not be expected that the decline in interest rates which has been recorded will suffice of itself to relieve business of the depression through which it is now passing. And it is better that the liquidation should be thorough than that a premature, partial revival, which could not be sustained, should engender false hopes respecting an immediate return of general prosperity.

"Let us not forget that a bank rate cannot create capital and credit. Only productivity and saving can do so.

GREATEST OBSTACLE TO BUSINESS REVIVAL

"Notwithstanding that there is still considerable 'frozen' credit in this country the principal economic problem is not the credit situation, although many, especially in agricultural districts, appear to think so. The chief obstacle to a general revival of business is the difficulty of developing an adequate demand for goods.

"Superficial consideration of that problem would suggest that the solution would lie wholly in the readjustment of prices. But lower prices in many lines have not aided materially in stimulating buying. As a matter of fact, in some instances, paradoxical thought it may seem, the lower the price, the less buying there has been. This curious antithesis has been due, of course, to the belief generally entertained that pracically all commodity prices were certain to recede even more than they have, which has tended, naturally, to prolong the so-called buyers' strike.

PRICE FLUCTUATIONS

"It would be well, however, for the public to study recent price trends and their underlying factors, for many significant developments are occurring. For instance, the wholesale prices of several basic commodities; namely, wheat, corn, cotton, sugar, rubber, copper, lead, pig iron, petroleum and timber, increased 2½ per cent last month. That advance marked the end of a steady decline in the prices of these commodities from their peak on June 1, 1920, which represented a fall of more than 54 per cent. It is interesting to note that the highest price of rubber in the period following the Armistice was only 1 per cent above that of July 1, 1914, and on June 1 of this year the price of rubber was 70 per cent below the pre-war price. On that date, too, copper was 2 per cent cheaper than on July 1, 1914; cotton was 3 per cent cheaper, and hides 35 per cent cheaper.

"While there is great unevenness in price levels and some commodities must undergo further liquidation it is equally true that other prices have depreciated too much and are now beginning to ascend to their rightful level. It is essential for the public to realize that the turn has arrived in the prices of some commodities.

"Many buyers seem to be pursuing a hand-to-mouth purchasing policy in the hope that prices generally will recede to the pre-war level. Apparently they fail to understand that it is of little consequence at what level prices are stabilized so long as they are stabilized, which is the important object. And stabilization will come when there is proper adjustment of various commodity prices one to another and between costs of production and distribution of commodities and their prices to consumers.

"That which would help this country most of all at present would be a national movement to buy, 'not until it hurts,' but until it helps.

MORE LIQUIDATION OF RAILROAD COSTS NEEDED

"Following the recent announcement of the Railroad Labor Board authorizing a reduction of wages of railroad employees on about 100 roads and amounting to approximately 12 per cent, effective July 1, there has been considerable agitation for an immediate horizontal reduction in freight and passenger rates. Such a reduction would be extremely advantageous to the economic welfare of the country, of course, if it were possible without further jeopardizing the finances and credit of the carriers and precipitating receiverships—to the very decided economic detriment of the country.

"The situation now, however, with many commodity prices dropping sharply, is different. The problem is to bring about a rate readjustment by which lower rates will be provided for commodities that cannot be handled at the present rate levels, and not to effect a horizontal rate reduction which will take away from the railroads all that they hope to save through the forthcoming wage reduction and economies made possible by the abrogation of the national agreements.

"Furthermore, it must not be overlooked that considerable progress has already been made in rate readjustments on the commodity basis, and that thousands of proposed changes, agreed to by railroads and shippers, have been submitted to the Interstate Commerce Commission for its approval.

HALF OUR PEOPLE DIRECTLY OR INDIRECTLY INTERESTED

"Aside from the very vital bearing that the betterment of railroad finances and credit would have on the general economic situation there is another very important consideration; namely, that approximately 50,000,000 Americans are the indirect owners of our railroads through the investment of their savings in railroad securities. And, therefore, they should be keenly interested in the welfare of the railroads, because that in some degree affects their own welfare. They themselves want fair treatment; consequently they should insist that the railroads be given like treatment. And they should realize that there must be further reduction in railroad operating costs before there can be justifiable general reductions in railroad rates.

BETTERMENT OF EUROPEAN SITUATION IMPERATIVE

"While we can better our economic condition materially through putting our own house in order we cannot achieve the full measure of prosperity that is possible for us until there is decided improvement in the European situation. Try as we may to circumvent that stubborn fact we are gradually coming to understand, through painful, but let us hope gainful, experience that if the remainder of the world is economically dependent upon us to a larger extent than any other country we are likewise economically dependent upon the remainder of the world to a larger extent than we have heretofore realized.

"In this connection it is very significant to note recent changes in our foreign trade. It may surprise some of us to learn that in April of this year our export trade valued at pre-war prices, was approximately equivalent to that of April, 1913. But our imports, similarly measured, were about 60 per cent. in excess of those of April, 1913.

"Asia, as well as South America, developed trade balances against the United States in April. The number of prinicipal countries holding such balances increased from seven in march to a dozen or more in April.

Switzerland, Central America, Brazil, Chile, Uruguay, China, British India, the Dutch East Indies, the Philippine Islands, British South Africa and Egypt all had favorable balances during April. Japan reversed a March debit of $5,500,000 to an April credit of $11,500,000.

NOT MERELY OF LONG CREDITS

"Our problem is not merely to extend long-term credits sufficient to get our surplus products out of this country, but also, and rather, to aid in re-establishing the industries of other countries so that these countries can rehabilitate their general economic condition as quickly as possible. We prosper most when they are most prosperous, because their needs are greater, if not more urgent, and can be satisfied through greater purchasing power. Consequently, we should export capital, as well as goods; machinery, as well as raw materials; American methods, as well as American merchandise.

"Fortunately, Europe is no longer going hungry. The rationing of food has been abandoned among two-thirds of the population. And, according to information received by the Department of Commerce, with the forthcoming harvest it is expected that the economic recovery of Europe will have proceeded so far, both in local production and ability to provide the full amount of needed imports, that the rationing of food can be abandoned in all countries, except possibly Austria. Coal rationing has ceased in every country except Germany, Italy, Poland, Austria and Hungary.

"The clothing situation alone has failed to keep pace with the improvement of the other basic necessities. Imports of textiles have been insufficient to meet the urgent demand for an adequate amount of wearing apparel, and larger imports of textiles by Europe are sure to follow—which should help materially in moving our vast surplus cotton out of warehouses and in reviving our textile industry.

Idle Freight Cars Decreasing Says Railway Association

A further decline in the number of surplus freight cars is shown by reports just received from the railroads throughout the United States by the Car Service Division of the American Railway Association.

On June 15, according to these reports, the number of cars in excess of current freight requirements was 381,746, which was a decrease of 7,780 cars compared with that on June 8. Of the total surplus, 159,448 consisted of coal cars which was, however, a reduction of 2,587 compared with the number of idle coal cars on June 8. There were also 143,935 surplus box cars on the latter date but this was a decrease of 3,721 in about a week.

Reports also showed increased demand for stock as well as automobile and furniture cars, there being a decrease in the number of surplus stock cars of 778 since June 8 and nearly 400 for the latter type of cars.

Business Conditions in England

By Our London Correspondent

The "on with the dance, let joy be unconfined" method of conducting affairs has received more than one rude shock of late. The estimate of unemployed varies somewhat with the political and economic views of the estimator, but on the lowest figure out-of-works cannot be many less than 4,000,000 persons. Through ordinary causes more than 2,000,000 persons are on the lists. The miners' dispute accounts for more than another million, and a dispute in the cotton industry embroils more than a half million. In addition the threatened and not altogether improbable stoppage of engineering workpeople has been estimated, perhaps not too optimistically, as likely to involve about one and one-half million workers of all kinds. The effect of this want of employment on overseas trading will be clear. According to the latest returns the value of British exports last month—£43,088,418—was actually lower than the value in the same month of 1913; consequently, even if prices are now no more than double pre-war standards it follows that in quantities only half the pre-war exports are being sent away. In money values exports last month were more than £76,000,000 below the figures for 1920. Comparing the first five months of this year with the same period of last year the imports are about 379½ million pounds lower and total exports about 263½ million pounds lower also. Last month's imports were valued at £86,308,308 and re-exports (exports of foreign and colonial merchandise) at £7,231,836. It must not be thought that the decline in exports is due solely or even mainly to the long-continued coal dispute. It has been manifest for a number of months and the same applies also to imports. Taking engineering only the unemployment figures showed a marked and continuous rise, month by month, before the opening of the coal dispute. The work market, or at any rate Great Britain's share, has been steadily fading and, while settlement of the various disputes now in progress will certainly remove a serious handicap, this will not itself form a complete remedy for the present troubles.

GOVERNMENT FINANCES

The whole financial position is a matter for serious thought for, to judge by the figures so far available, no budget surplus can accrue. The government is attempting cuts in all directions, and the government-sponsored act by which farmers were guaranteed prices for wheat, etc., will be repealed, though only about six months old. It almost necessarily follows that wages of agricultural laborers must decline, for with removal of guaranteed prices goes the minimum wage as fixed by wage boards. Not to give a list, in many trades, reductions in wages are threatened or have already been effected.

Part, but part only, of the bill arising from the coal troubles has been presented, the cost of mobilization, etc., of the reserve and defence force being about six million pounds, while the transport arrangements, importation of coal, bounties, etc., cost more than six and a half millions, and the extra cost of railways—due, it is true, in part to the ordinary depression—will amount to about nine millions. In addition, if the terms are accepted, the coal mining industry is to be subsidized to the amount of ten millions. The post office loss of three and a half million pounds arising rather from the telegraph and telephone services than the ordinary postal service (the latter make a profit) will about be met, according to an official estimate, by increased postage charges. So that the pre-war halfpenny postcard costs 1½d. for postal purchases, postage on foreign, but not colonial or American letters, is raised from 2½d. to 3d.; other charges are increased and part of the loss is to be prevented by the stoppage of Sunday delivery and collection of letters. But the value of technical trade journals as missionaries of business has been so well impressed on the postmaster-general that he withdrew the proposal to increase postage rates of printed matter sent abroad. A council of business men has been formed to help the postal officials in an advisory capacity.

UNEMPLOYMENT FUNDS GONE

The unemployment funds of the trade unions have been depleted by circumstances, though the exact position is naturally only known to trade union authorities. The position of the national unemployment scheme is notorious. A war surplus of twenty millions has been used up and most of the ten millions borrowed; fresh borrowing from the treasury must therefore be made. The scheme in short has collapsed. It has therefore been decided to increase the payments, men, for example, paying 7d. per week and employers 8d. per week and the state a fourth. Similarly the benefits are to be reduced, that is, to 15s. a week for men, 12s. for women and proportionately for younger workers. The waiting period is to be increased from three days to six, but on the other hand, in view of the serious want of employment thought likely to continue, the benefit period is to be extended by six weeks. At present nearly 25 per cent of the insured persons are out of work and benefit is being paid to the tune of say £2,000,000 weekly, with contributions of about one-third of a million pounds. Leaving out of account the coal industry, apparently it is the pottery and earthenware industry that in the immediate past has been suffering most from want of employment, for; as stated officially, 75 per cent of the people in these trades are unemployed, with 57 per cent in the case of the iron, steel and tin-plate trades, and 35 per cent in the glass industry. Much the same order applies where short-time working is also included in the estimate; but the linen, cotton, jute, etc., bolts and nuts, etc., industries then take—the bad—precedence of glass.

LABOR STILL OBSTINATE

While trouble is still possible all round, the labor position may nevertheless clear very quickly. In the cotton industry the two sides have agreed to terms, which, however, at the moment need ratification, and in the coal fields, though the results of the ballot so far made public are not too promising, it is likely that the dispute may be stopped. The engineering strike or lockout, whichever way it may be represented, has not yet eventuated. During negotiations extending over three months the workmen's representatives have clearly been fighting a delaying action. Now at the last moment, on the intervention of the Minister of Labor, the employers have modified their terms by spreading the reductions over a longer period and allowing the trade unions a further fortnight in which to ballot. In due course the 12½ per cent (time) and 7½ per cent (piece) Ministry of Munitions' bonus will be withdrawn, the three stages stretching out to the first full pay day in September next. Next 3s. a week will come off time rates and 7½ per cent off piece rates at the first pay day in October, 3s. then coming off whenever the official cost of living index number reaches an excess value of 115 per cent, *i.e.*, 215 as against 100 pre-war, but not earlier than the first pay day in November.

OPTIMISM IN BUSINESS

Meanwhile in the last few days certain business men, particularly those of the smaller order, have taken a more optimistic view of the general position. Few can mention any real ground for their view, but some base their ideas on the lighter labor position and some even on the hope of reduced taxation. Perhaps the fine weather might be noted. In engineering and in fact generally speaking, much will depend on the price at which coal can be produced and sold. Reference to the amount of coal needed to produce steel will show the interdependence of industries, a fact which is often overlooked, though it is of importance when German finished steel bars are sold at £11 a ton and gas strip at £12 10s. a ton delivered in the Birmingham district, as reported at the last meeting of the London iron and steel exchange. Business in pig iron is described as practically at a standstill "owing to the exhaustion of stocks of foundry iron, though a limited quantity of forge quality still offers." Apparently there are many inquiries for manufactured iron and steel, but reduced cost of production is needed before they can be transformed into orders. Wages in the iron and steel industry steadily and rapidly decline, being based on a sliding scale and varying somewhat with the price obtained.

NEW BUSINESS

Very little in the way of new engineering contracts has been recorded of late, but Metropolitan-Vickers, Ltd., Trafford Park, are to supply turbo-alternators to the value of about £300,000 to the city of Melbourne, and it is understood that the order for the switchgear has gone to America. Inability to complete a contract within the time limit has more than once led to cancellation recently, the firm of Robert Stephenson & Co. mentioning this in connection with locomotives they ought to have supplied. Trade is in fact very dull and the British Engineers' Association is issuing a statement to the effect that "in spite of the strenuous efforts of directors and managers engineering firms are quite unable to secure the volume of business required to replace the orders executed during the last six months, or now rapidly approaching completion." They point to the need for lower prices within the purchasing power of the customer, this applying, they add, even to the home market. A settlement of the coal dispute is not thought in itself sufficient, and "it cannot be too clearly and widely understood that the engineering industry has no chance of recovery unless and until a substantial reduction has been made in the costs of production. This is a problem to be solved, and failing its solution other considerations will be of little more than academic interest." The coal dispute, carrying with it the cancellation of a number of trains has, together with the reduction in prices, helped certain of the motor car firms, though the industry as a whole can hardly be described as happy. Still several firms have been fairly engaged of late, and it is felt that the future of the British motor car industry will lie more in the direction of the lighter and cheaper car. This relative activity has had some effect on the market for small tools; here prices have been reduced and stocks valued on a lower basis.

MACHINE TOOLS VERY QUIET

Nothing can be said regarding the machine tool trade itself; it is at the moment one of the least promising sections of British engineering.

Looking at this portion of the overseas trading figures, the machine-tool imports have naturally declined during 1921, but during the same period even now are higher than in 1913, the weights as officially given being 1,969 tons and 1,655 tons, as against 5,732 tons in 1920. The value per ton has increased from about £90 in 1913 to about £240 this year. In exports Great Britain has so far done better, sending away 11,113 tons against 7,285 tons in 1913, and a slightly lower amount in 1920. The value has risen from about £60 to about £145 to the ton. The re-exports of machine tools are not heavy, 125 tons during the current year; the value is about £225 per ton, or rather less then the unit value for the imports, and in fact showing only a relatively small increase on pre-war values.

PRICE TRENDS

The rate of decline in wholesale prices has slackened of late, in fact, according to one estmate (there are several) the bottom has been reached, if only temporarily. But the Board of Trade index number for the past month is 204.7, showing a drop of four points. Retail prices have lagged behind wholesale prices for some considerable time, a fact that has been the subject of bitter comment on the part of wholesalers, who assert that retailers throw practically all the sacrifice on the wholesale side. It seems clear that the cost of living might be lowered somewhat but for the shopkeeper element. New figures are almost due—the last available gave the value at 219.

Aerial Mail Service Between Bahamas and Florida

According to Consul Lathrop an act has already passed its first reading in the Bahama House or Assembly by which certain concessions are given to the Bermuda and West Atlantic Aviation Co., a British limited company with registered offices in London. A subsidiary of £5,000 per year is provided in the decree for the purpose of carrying mails between Nassau, Bahama, and Miami, Fla. It is expected that the hangar and repair shops constructed by the company will be open to the airplanes of all nations on reasonable terms, although at present the bill provides for this only by inference.

The Australian Federal Postmaster General's Department is conferring with the Air Council with reference to the practicability of establishing an aerial mail service for Australia.

The Business Barometer

The Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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The thirtieth of June marked the end of a half year during which business men have been worrying and apprehensive. Let us see whether the worry and apprehension have been warranted.

In the six months ending Dec. 31, 1920, commodities declined almost precipitately. Wheat, corn, oats and flour, pork, lard, beef and butter, tea, coffee and sugar, wool and silk, cotton, cottonseed oil and print cloths, iron, steel and copper, lead, tin and silver, hides, leather and rubber were, upon the average, 40 per cent lower at the end of 1920 than they were a year ago.

The average decline in the same articles since last New Years has been only 18 per cent, or less than half the depreciation registered in the previous half year. Cotton and hides, leather and copper, oats and corn, coffee and tea are now down to prewar prices and wheat, flour, steel and iron are the only staples on the list that are substantially above the quotations of June, 1914.

The record of the security markets is not dissimilar. The stocks of ten representative industrial corporations that had declined an average of 39 per cent during the six months ending Dec. 31, 1920, fell only 10 per cent in the last half year and ten railroad stocks that showed an average decline of 16 per cent during the last six months of 1920 were but 5 per cent lower on June 30 this year than they were at the end of the previous year.

In other words, taking securities and commodities together the average decline of say 11 per cent during the last six months is about one third of that recorded in the previous half year and many of these securities are now below prewar quotations while not a few of the commodities are quoted at less than they could have been bought for in June, 1914. A schedule of the commodities, securities and prices upon which the foregoing statements are based will be sent upon request. It is too long to be printed.

Viewing the record of the entire twelve months it is indeed remarkable that a decline which has cut values nearly in half could have occurred without causing a single bank or mercantile failure of the first magnitude, but as bearing upon the immediate future it is more important to observe that the speed of the decline has been so much slackened during the last six months that we are perhaps justified in assuming that its end is near.

A study of the periodicity of price movements shows that the declines have been much more abrupt than the advances and that while the mean line of human progress is steadily upward it is successively crossed and recrossed by the line of demand, which varies as people are economical or extravagant, but is rarely more than 10 per cent above or below the normal.

Certainly the developments of the week do not indicate that there is anything very seriously wrong at present and while the losses some sustained and wrote off at the end of last year may have made them feel sore but few bones have been broken and there is, I submit, but little in the record of the last six months to justify the pessimism so generally felt and expressed.

In talking about this unnecessary surrender to gloom Thomas A. Edison said the other day: "I have been through five depressions in my business life. They are all alike. This latest one is exactly like all the rest. The men who, if business fell off 66 per cent, increased their selling effort by 75 per cent managed to pull through as if there was no depression and the efforts of such men tended to shorten the periods of depression."

Mr. Edison's figures are wrong. Business never falls off 66 per cent, but his faith in the stimulating power of human energy is sound and inspiring, and those who have been waiting for the tide to turn as they laid upon their oars will, I fear, soon find themselves outdistanced unless they commence rowing again.

My reasons for this opinion are as follows:

First; the growing ease of money and the increasing bank reserves which, as I have so often pointed out, are prerequisites of business activity.

Second; the tone of the stock market, which registering as it does the collective opinion of acute and trained observers, is distinctly firmer and substantially higher.

Third; the advance in bonds, which shows that investors are recovering confidence and indicates that hoarded capital will shortly be seeking employment.

Fourth; the Government report on the cotton crop, which puts the reduction in acreage at 28 per cent and connotes a hitherto unattainable degree of co-operation among the Southern farmers, by virtue of which they will in the future be able to control the price of cotton, thereby assuring reasonable prosperity to the South.

Fifth; the manifest improvement in the railroad situation evidenced by a very substantial increase in net earnings for May.

Sixth; the remarkable increase in savings bank deposits in New York and Chicago during the past six months.

Seventh; the generally improved position of the public utility companies in the United States as a result of the general advance in street car fares and public service charges that has been authorized.

Eighth; the increase in building activity that is reported from all over the country and the general belief that there is a large potential demand for steel that will make itself felt when prices are reduced.

Ninth; the good distributive trade that is reported in most wholesale staple markets and a retail trade in essentials whose volume as indicated by its money value is as large as last year.

Tenth; the manifestly better feeling in England that has followed the settlement of the coal strike and the pourparlers now being held in Dublin and London from which a permanent solution of the troublesone Irish problem is expected.

As against this impressive array of the encouraging there is to be put:

The prospect of a long fight in Congress over a tariff measure that is in many respects objectionable and may seriously curtail our foreign trade.

The possible passage of a bill donating a bonus of from two to five billions to those who served in the war.

The delay of Congress in attacking the problem of taxation and diminishing the burden with which enterprise is now unfairly handicapped.

The political and economic complications in which Obregon has involved himself in Mexico and the possibility that he will shortly be unseated.

The acute financial distress in Cuba and the resulting tie-up of American capital there.

It is, however, to be noted that all of these troubles except the Cuban crisis are *in futuro* and are therefore preventable if we work hard enough. The passage of the bonus bill, which would make it necessary to issue two or three billions more bonds is the thing most to be feared. Everyone who believes that it will involve an unwarranted raid on the Treasury and lead to an orgy of extravagance ought to oppose it with all the influence he can command.

If and when it is finally killed there will be less difficulty in persuading Congress to revise the tax laws intelligently and minimize the obstacles to foreign trade that the tariff is certain to create. This is about all that can be hoped for but if through the united use of their influence the business men of this country can induce Congress to act with reasonable economic intelligence there is reason to expect that American business will thrive again as it has in the past despite the burdens which the war has imposed. Relatively they are not as heavy as those that we assumed in fighting the Civil War in 1861-5. Our national wealth in 1860 was estimated at 16 billions and the war left us with a national debt of 2⅓ billions. Our national wealth today is variously estimated at from 300 to 500 billions and our debt at 24 billions. In 1865 the country was divided and the South was impoverished. Now it is united and there has been no impairment of our productive power anywhere. The comparison should be an antidote to pessimism.

In detail the news of the week contains little that calls for particular comment. The reserve ratio of the Federal Reserve Banks is 60 as compared with 60.8 per cent a week ago. The change is not significant. The gold reserves continue to pile up. They have gained $16,000,000 during the week. Bank clearings, as reported by Bradstreet, are only 12.6 per cent below those of a year ago, from which an actual increase in the volume of business passing is to be inferred. The statistics indicate a decrease in the number of those who are said to be unemployed but I am inclined to believe that most of the unemployment is voluntary and that the idleness of those who are not working is largely due to their unwillingness to accept the wages or the jobs offered. In other words they have become somewhat epicurean in their taste for work and the corrective of a little adversity will do them no harm.

The crops promise well despite seasonal reports of damage. Trade reports are generally encouraging and the commercial barometer if it is not higher is at least steady and indicative of fair weather.

◆

Extend Credits or Lose Export Trade

The commercial prosperity of the United States depends in no small degree on the eventual readjustment of the country's foreign trade relation according to the viewpoint of American delegates attending the meeting of the International Chamber of Commerce in London.

This opinion is expressed in an economic summary to be delivered by the Americans at the meeting signed by the American National Committee, of which A. C. Bedford, chairman of the Standard Oil Company of New Jersey and American vice-president of the International Chamber, is the chairman.

"The United States," says the report, "is one of the chief sufferers from the partial dislocation of the trade of the world, and unless she is prepared to extend credits on a large scale must look forward to a great decrease of her export trade, which will react unfavorably upon industrial conditions and retard her recovery from the present depression.

"At the same time the fact that the war has changed her status from that of a debtor to that of a creditor nation shows that she must also be prepared to receive imports in larger volume than formerly, and such an increase may react unfavorably on certain lines of trade.

"This problem of the readjustment of foreign trade relations is one of the most important developments that have resulted from the World War, and upon her successs in solving it the commercial prosperity of the United States during the next few years will in no small degree depend."

In a part of the report devoted to the financial situation in the United States the committee pictures the situation caused by the rapid fall in prices and says:

"Although definite progress has been made in the liquidation of frozen credits and therefore in the direction of easier money the process of readjustment is not complete. It has turned out that many business concerns are more seriously involved than was at first supposed; and as facts of this nature become more fully developed the conclusion is frequently drawn that the credit situation instead of improving has steadily grown worse.

"Such an inference is unwarranted and is based on a confusion between bank credit and private credit. The strain on the banks probably passed its peak last autumn when it became evident that seasonal and other demands would be met without serious difficulty. But individual embarrassments and bankruptcies steadily grew in number in the fall and winter and in some cases their full extent was not fully realized.

In connection with the present remarkable movement of gold to the United States, the committee declared that wisely handled, the increasing gold reserves can be made a factor of safety, but if they lead to a new period of credit inflation they will bring a day of reckoning as severe as through which the country has just passed.

Notes on the Polish Oil Industry

Przeglgad Naftowy (Petroleum Review) for April, 1921, publishes the following data concerning oil products shipped from Polish refineries during 1920, these being in addition to 3,740 carloads of crude oil which were exported:

Products	Domestic Consumption, Cubic Meters	Exports, Cubic Meters	Total, Cubic Meters
Gasoline	502,776	223,589	726,365
Kerosene	867,773	577,098	1,444,871
Gas oil	200,035	368,017	568,052
Lubricants	454,232	356,425	810,657
Paraffin	87,497	92,939	180,436
Other products	466,626	378,042	844,668
Total	2,578,939	1,996,110	4,575,049

This year's (1921) production of alcohol in Poland will be about 40,000,000 liters, of which 30,000,000 liters will be exportable. Last year's alcohol production was only 10,000,000 liters (1 liter = 0.264 gallon).

◆

Chinese to Construct Short Rail Lines

According to an official report on Chinese railways, the total cost of the entire government property December 31, 1919, amounted to $491,577,322 Mex. Of this amount $485,100,154 was the cost of road and equipment; $521,366 was the cost of other physical property, such as land, mills, or mines, not part of the operated railways though having been paid for out of the sums represented by mortgage bonds, government investment and similar capital liabilities; and $5,955,802 was the cost of non-physical assets, which consists of stocks and bonds of other companies, the purchase price of rights and similar intangible property. The cost of road and equipment per kilometer 0.62 miles of line in the system was $81,144 Mex. If the average price of the silver dollar is taken as equal to 75 cents of United States gold currency, the cost of the Chinese Government Railways per kilometer of line would amount to $60,000, which is rather high, probably owing to the fact that much of the materials and most of the equipment used were purchased abroad. The Ministry of Communications is planning the construction of short railroads in several directions. The Peking-Hankow line is to be connected with the Peking-Pukow railway by a branch running from Tsingchow to Shihchiachuang. The administration of the Peking-Hankow Railway has also submitted specifications to the government for the building of a number of highways as feeders for the main line. On the Peking-Mukden Railway a second line of rails is to be laid between Shangaikuan on the west and the Tangshan coal mines. The distance is about 120 miles and the estimated cost of the work is about $5,000,000 Mex. The Yu Tung section of the Peking-Hankow Railway will also be double tracked. Further north, the Peking-Suiyan line is to be extended in a westerly direction to the important trading center of Paotaocheng across the Mongolia border. The Suiyan-Paotao line, the extension into inner Mongolia of the Peking-Suiyan Railway was to be opened for traffic in April. The new section ends at Paotaochang, near the Yellow River. The estimate of expenses in connection with labor and the purchase of materials is stated to be $5,127,300 Mex.

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J. L. Gough Heads Chicago Machinery Concern

The National Machinery Sales Co., machinery dealers, of Chicago, whose Illinois incorporation we briefly noted some weeks ago, has, we learn, opened headquarters at 28 North Desplaines St. in that city. The organization has been completed by the election of James L. Gough as president and treasurer; James J. Sheridan as secretary; and George D. Benson as assistant secretary.

These gentlemen are all well known to the machine-tool trade, Mr. Gough having been until recently president of the Federal Machinery Sales Co., of Chicago. He has been in the machine-tool business for more than twenty-five years; Mr. Sheridan is a well-known Chicago lawyer and banker, having been vice-president of the Federal company. Mr. Benson was a salesman with the same company.

The new company will begin an extensive selling program at once, dealing with machine tools and accessories. Export, as well as import trade will be handled.

Rand, American Engineer, Gets British Honors

Cable advices to the national headquarters of the American Society of Mechanical Engineers, in New York City, announce the election as honorary member of the Iron and Steel Institute of Great Britain, of Charles F. Rand, chairman of the executive board of Engineering Foundation and one of the leaders of post-war research in American industry.

Mr. Rand, a prominent mning engineer, is a director and a past president of the American Institute of Mining and Metallurgical Engineers. He is also a past president of the United Engineering Society of New York.

Mr. Rand is honorary secretary of the John Fritz Medal Board of Award which in London last week bestowed the John Fritz Medal, for achievement in applied science, on Sir Robert Hadfield. Mr. Rand is now in England as secretary of the engineering mission of thirteen which formally presented the American award to Sir Robert. On July 8, at Paris, the John Fritz Medal for 1922 was presented to Eugene Schneider, head of the famous Crèusot Works.

In 1914 Mr. Rand was decorated by King Alfonso XIII with the Grand Cross of Knight Commander (Comendador con Placa) of the Order of Isabella Catolica for distinguished services to Spain and to mining.

Mr. Rand holds membership in the American Iron and Steel Institute, the Iron and Steel Institute of Great Britain, National Research Council and American Society for Testing Materials. He is identified with the construction of railways and the opening and operation of iron mines in Cuba, besides being largely interested in mines of manganese and copper ores.

The award to Mr. Rand is the second that has been given to American engineers recently. Professor Robert Peele of the School of Mines of Columbia University having been elected to honorary membership in the Institution of Mining and metallurgy, of London.

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Patent Bill to Be Reconsidered by War Department

So that a further report may be submitted by the Secretary of War, the Stanley patent bill, providing that foreigners shall manufacture within two years any article they patent in this country, has been allowed by the Senate to go over for further consideration. Frederick P. Fish of Boston, a patent attorney of national reputation, takes the position that the legislation would set up a bad policy and establish a dangerous precedent. In view of the objections from such an authority, Senator Stanley expressed perfect willingness to await until the Secretary of War could reply to Mr. Fish's arguments.

Senator Stanley declared, however, that he is thoroughly convinced of the necessity of the legislation. He thinks the only effect it can have is to protect the Ordnance Department in a great number of patents that have been perfected by American engineers upon American ordnance. These same inventions, Senator Stanley says, which the Americans used during the war and are now using but which they did not patent, have been patented by foreigners and sold to the Krupps or other foreign concerns, with the result that we cannot use our own patents for our own defense. Senator Stanley also pointed out that the United States is the only country in the world that has no such legislation.

In the course of his remarks, Senator Stanley said that he is strongly of the opinion that the junking of patents should be prevented. He declared that this is one of the most fecund sources of corruption and of monopoly. He called attention, however, to the fact that nothing of that kind was attempted in this bill.

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Penn R.R. to Take Over Vandalia Shops

On account of the general business depression and the probable later merger of the Vandalia shops with the Pennsylvania system, the extensive building program at Terre Haute, which was to have taken place this year, will be abandoned, according to Frank H. Worthington, superintendent of the St. Louis division. It was planned to build up the division in the way of new and more extensive car shops and facilities for repairing cars and locomotives, but these plans will be discarded for an indefinite period.

Proposed British Empire Air Mails

Interesting developments are foreshadowed in the scheme which has been submitted to the English Government by the Agent-General of Tasmania. The plan which has been provisionally approved by the promoters is to form an Imperial Air Company which would take advantage of the government offer of airships, plant, and other material now in possession of the British government, and inaugurate air services between Great Britain and Egypt, India, South Africa, Australia and New Zealand. The capital of the company has been fixed at £1,500,000, of which half would be issued, and would, it is hoped, be taken up as regards 50 per cent, by Dominion governments, the remaining 50 per cent being subscribed by the general public. The share of Great Britain would be the free gift of the airships and material. It is anticipated that it would be possible to arrange a time-table of services between Great Britain and India of five days, of the same period for South Africa, with a ten to twelve days' service to Australia and New Zealand.

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Combination of French Iron and Steel Interests

Much newspaper comment has been caused by announcements which have appeared from time to time recently in the French trade journals relative to a fusion of interests of three large French iron and steel companies. The "Forges et Aciéries du Nord et de l'Est," the "Usines Métallurgiques de la Basse-Loire," and the "Société des Forges et Aciéries du Nord et de Lorraine" united to form a new company, but such action on their part did not bring about a fusion of the companies, each of them retaining its own administration.

The first company has obtained the approval of its stockholders to constitute in a single group certain iron and steel plants which were in the occupied region of France and were wholly or partially destroyed by the Germans. To rebuild and put into working order these plants new capital is necessary.

Another instance of such temporary alliances has been seen in the recent combined issue of shares for the reconstruction of the coal mines in the devastated regions of the Pas-de-Calais and the North, in which all the important coal companies are participating and all of which will receive a share of the capital subscribed.

The "Forges et Aciéries du Nord et de l'Est" propose to utilize a portion of the extra capital which they are issuing for subscription to purchase additional interest in the North et Lorraine Co. and to buy a certain number of shares in their associate company, the "Basse-Loire."

It has been pointed out that by such an association of interest they will better be able to distribute their products throughout France and abroad, owing to the various plants being located in the northern, eastern and western sections of France. The companies in question likewise have large interests in coal and iron-ore mines and will thus be, to a great extent, independent and self-supporting as far as raw materials are concerned.

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Belting and Aluminum in India

The increasing number of factories and mills in India, especially cotton and jute, will demand constantly increasing amounts of leather belting. This should be carefully and properly introduced, with due consideration of the inefficiency of the Indian mechanic and the climatic conditions prevailing. The most successful belting is that made of high-grade leather, cemented with waterprofing compounds to protect it from the hot, moist climate. As many buyers, however, can not pay the price for waterproofed belting, there is a market for various grades.

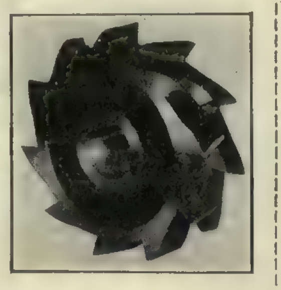
A plan is under consideration for the construction of a plant on the western coast of India to produce about 2,500 tons a year of aluminum from bauxite by the use of electricity. It is proposed to generate about 20,000 kilowatts by the construction of a large reservoir to collect and store the annual rainfall and the flow of a small stream, with a head of about 1,700 feet. Considerable quantities of aluminum are now being imported for the manufacture of cooking and other utensils, and it is thought that there will be a good market for the product and demand for any surplus power generated.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

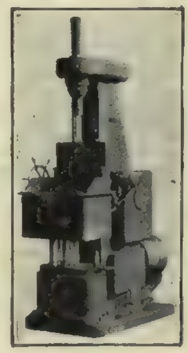
Cutter, Milling, "Herringbone"
Bridgeport Cutter Works, 50 Remer St., Bridgeport, Conn.
"American Machinist," April 7, 1921

The cutter has, as its name would indicate, a double-opposed helical form of tooth, though the helices do not meet at the center, as would a true herringbone. The cutter is made in two parts, permanently joined together. It can be furnished in all diameters from 2¼ to 8 in., and in any width from 1/16 to 1½ in. The material used is a standard brand of high-speed tool steel.



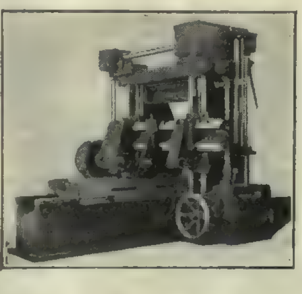
Drilling Machine, Multiple, Inverted-Spindle
Defiance Machine Works, Defiance, Ohio.
"American Machinist," April 14, 1921

The chief feature of the machine is the fact that the spindles feed upward into the bottom of the work, thus permitting the chips to fall out of the hole and the work to rest on the face in which the holes are being drilled. The base and column are a single box-form casting. The mechanism is constructed in units, each inclosed in a compartment. The running parts are throughly lubricated. The machine can be built with any number of spindles required by merely changing the spindle head. Dust and chips are excluded from the spindle bearings by the use of sleeves and a settling chamber. Quick-clamping work fixtures of any type can be furnished. Belt drive may be used, or a motor can be mounted at the back of the column and connected by means of a silent chain.



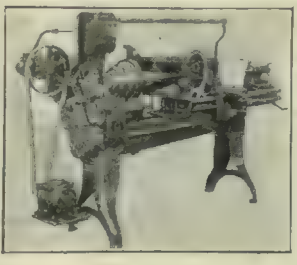
Milling Machine, Planer-Type
Becker Milling Machine Co., Hyde Park, Mass.
"American Machinist," April 14, 1921

This planer-type milling machine has a crossrail adjustable for height. The machine shown has a horizontal spindle, although vertical-spindle machines can be furnished, two heads being placed on the rail if desired. The machine is built in sizes from 24 to 48 in. in width and in standard lengths up to 20 ft. The length of the bed is 1⅔ times the working surface of the table. The machine is driven by a 20-hp. motor running at 1,200 r.p.m. and mounted, together with the speed box, on the upper beam. In the speed box are sliding gears giving eight changes of speed. The longitudinal feed of the table is through a cast-iron rack and steel worm, which runs in an oil bath. The table has a power-driven rapid traverse.



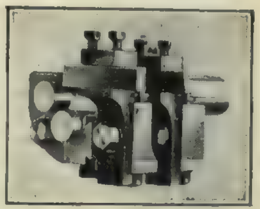
Boring Attachment, (Re-), Cylinder
Barnes Drill Co., 814-830 Chestnut St., Rockford, Ill.
"American Machinist," April 14, 1921

This attachment is intended for use in connection with the sliding-extension gap lathe made by the company. It accommodates any size or type of cylinder. It consists of an angle bracket to be clamped on the carriage of the lathe, a 2½-in. diameter boring bar with a Morse taper shank to fit the spindle of the lathe, a high-speed steel cutter, and a draw-bolt to go through the spindle. It is said that after setting up the job, less than five minutes is required to take a cut through a 4-in. cylinder.



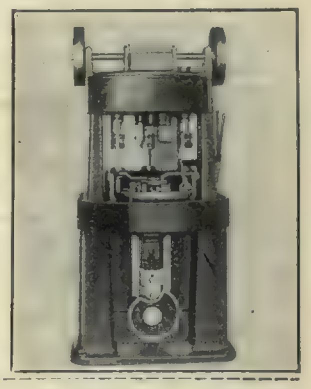
Box Tools, Tangent-Cut
P. H. Biggs Machine Co., Cleveland, Ohio.
"American Machinist," April 7, 1921

The Model C box tool is shown in the illustration. The tools are intended to facilitate high-speed production of screw products or other parts which are machined in turret lathes. They are made entirely of steel, and are hardened throughout. The outstanding features of these tools are said to be the angular manner of setting the bits, and the fact that they may be removed, sharpened and replaced without disturbing the original adjustments. The tools are furnished in four sizes for turning from 1/16 to 1⅝ in. in diameter. All tools of a given size are made with parts interchangeable.



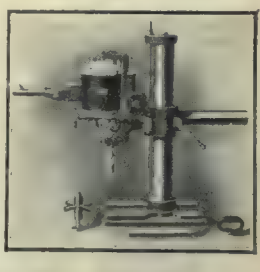
Boring Machine, Multiple-Spindle, Vertical
Manufacturers' Consulting Engineers, McCarthy Bldg., Syracuse, N. Y.
"American Machinist," April 14, 1921

The machine is intended for production work, being adapted to the handling of a single part, such as a cylinder of an automobile engine or a connecting rod, the latter case being illustrated. If it is desired to machine different parts on the same machine, it is necessary to change the head of the machine, the rotary fixture and the cam. The spindles rotate only and are fixed in a vertical position. The rotary fixture and the work are fed upward to the cutting tools by means of the cam. One idle position of the rotary fixture is allowed, so that the loading and unloading are done while the machine is working.



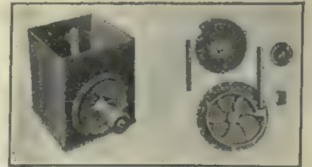
Drill Stand, Radial, No. 3
Hisey-Wolf Machine Co., Cincinnati, Ohio.
"American Machinist," Apr. 14, 1921.

The stand is intended for the holding of the portable electric drills made by the concern. It is known as the No. 3 and is made in two styles, the NN and the NNA. It holds a portable drill of either the single- or two-speed type and having a capacity of 1¼ in. Since the stand enables the use of the portable electric drill for precision work it greatly increases the scope of usefulness of the tool. The column is made of steel tubing. There is a horizontal adjustment of the head of about 12 in., an operating radius of 20 in. being obtained. The vertical adjustment of the head is 20 in., and the feed motion about 9 in. The head in which the drill is mounted can be swung to any angle.



Pump and Agitator, Soluble-Oil, Lafayette
Fruchey Machine Co., 454 East Lafayette Ave., Detroit, Mich.
"American Machinist," April 14, 1921

The pump proper consists of a rotor on a ⅝-in. shaft, running between two plates. The suction of the pump tends to force the rotor shaft against the hardened steel button which acts as a thrust washer. The inlet is through five holes in the cover plate, and the outlet is through a vertical pipe. The pump is always charged with the oil or cutting fluid, which is said to eliminate loss of prime. The agitation is effected by the break in the vanes next to the hub. The pump is self-lubricating, since all parts run in the oil. The tank, which can be furnished in any size desired, is made of 16-gage galvanized iron.



Clip, paste on 3 x 5-in. cards and file as desired

Information Wanted on Industrial Research Laboratories

Research facilities and the development activities of American industries are to be described in the forthcoming revision of *Bulletin of the National Research Council*, No. 2, "Research laboratories in industrial establishments of the United States of America." Only 300 such laboratories were listed in the first edition but it is hoped that several hundred new names will appear in the revision and that a more nearly complete reference list will thus become available. The general demand for the first edition of the bulletin shows the wide interest in this subject and the importance of having every laboratory which devotes even a portion of its time to research properly listed.

The council requests information from directors of research who have not already supplied it. The following data are wanted: Name and address of firm and address of laboratory; name of director of research; number on laboratory staff (classified as chemists, engineers, bacteriologists, etc.); approximate proportion of time spent on research; chief lines of research, unusual features of equipment; research laboratory space; date of organization of research laboratory and annual expenditure for research. Confidential information is not desired.

It is also requested that librarians in the service of the industries please bring this notice to the attention of the proper officials in their organizations.

This material should be furnished as promptly as possible to the Research Information Service, National Research Council, 1701 Massachusetts Ave., Washington, D. C.

Corliss Engine in Service Twenty Years

After nearly twenty years of uninterrupted service the five hundred horse power Corliss engine at the Clayton Cotton mills, Raleigh, N. C., was shut down for good, the mill having been equipped with electric power throughout.

The steam was first turned on this engine in August, 1901. For nearly 20 years it has turned the spindles and the wheels of the mill every working day. The first year a box melted out on the engine and it stopped for two and one half hours. Since that time it has never stopped for as much as half an hour at one time on account of the engine.

This is said to be a wonderful record for an engine. Some engineers may be inclined to doubt this but superintendent A. Sam White, who has been with it from the beginning, is willing to vouch for the statement.

India to Produce Liquid Fuel

The foundation stone of the series of plants for the production of liquid fuel, which are being erected by the Carbon Products (Ltd.) of Bombay was laid at Vikroli, about 14 miles from Bombay in April, 1921. This is a help in solving for India and promises to help in solving the problem of fuel shortage and the importation of motor spirit, fuel oil and lubricating oil from distant countries and to give a supply from Indian materials at a cheaper rate than formerly. The first unit will produce 2,000 gallons daily, as well as 50 tons of semicoke and gas. It is expected that the first building will soon be ready and that by the end of October genuine swadeshi products will be on the market. The works are situated both on rail and road, occupying about six acres of land.

Business Items

The Zina Goodell machine and garage business of Salem, Mass., has been combined with the Fallon Machine Co., of Lynn, Mass. The new company will keep the name of Zina Goodell and will operate in the Salem plant, where all the Fallon equipment has been moved.

The Elwood Foundry and Machine Co., Elwood City, Pa., has been incorporated with $75,000 capital stock, by C. W. Carbeau and others.

The Reliance Boiler Works, Pittsburgh, Pa., is being organized by William Oleon, H. C. Feldstein and R. M. Collins, to manufacture steam boilers, tanks, etc.

The National Recording Pump Co., Dayton, Ohio, has been incorporated with $50,000 capital stock, by William T. Hatmaker, S. W. Burnham and others.

The Western Pipe and Steel Co., Chicago, Ill., has been incorporated with $100,000 capital, by Frederick Corrigan, to manufacture steel pipe and other iron and steel products.

The North Shore Machine Co., Lynn, Mass., has been incorporated and will begin at once to manufacture special machinery.

The Dolman Manufacturing Co., Springfield, Mass., has been incorporated. Small tools and special machines will be manufactured. The directors are C. C. Jackson, C. F. Spellman and B. S. Siegel.

The Seamweld Equipment Co., Milwaukee, Wis., has been organized to manufacture welding machines, etc., with $50,000 stock. The incorporators include Harry W. Marsh, Peter C. McNulty and others.

The New Britain Machine Co., of New Britain, Conn., has recently received an order from the government for about $100,000 worth of 6-in. sights to be used on naval guns.

The Albany Engineering Works, Berkeley, Cal., is to build an extension to its present plant. A machine shop and foundry are planned.

The Martin Machinery Corporation, of Chicago, Ill., has been awarded the contract for constructing the steel towers for suspending the lines of the Arkansas Light and Power Co., over the White River.

The Robbins Machine Co., Portland, Ore., has been incorporated with a capital stock of $50,000. The directors are G. P. Robbins, L. E. Crouch and Geraldine Robbins.

The United States Screw and Stamping Co., Worcester, Mass., has been incorporated to manufacture machinery. Directors named are H. Beland, R. L. Whittemore, H. B. Gibbs, C. R. White and J. C. Ware, all of Worcester.

The Dawn Manufacturing Co., Bridgeport, Conn., has been incorporated with a capital stock of $50,000. The company will build washing machines and electrical appliances. J. A. Dickerman, H. V. Leckis and G. Leckis form the partnership.

The Excel Tool, Die and Machine Corporation, Buffalo, N. Y., has been incorporated with $50,000 capital, by R. A. Anderson, C. O. Falk and J. A. Winlund, to manufacture machinery, tools, etc.

The B. L. Schmidt Co., of Davenport, Iowa, manufacturer of cylinder grinding machines, has been purchased by the Bettendorf Co., also of Davenport. The combination will continue to manufacture automobile cylinder grinding machines.

The Nut-Lock Washer Co. has been incorporated at Evansville, Ind., to manufacture nut-lock washers, etc. Directors named include F. B. McLaughlin, John C. Greer and Frank P. Fuchs.

The Hydro-Appliances, Ltd., Port Robinson, Ontario, Canada, has secured the plant of the Dominion Cannare and after suitable machinery has been installed will manufacture electric machinery.

The Peerless Safety Can and Device Manufacturing Co., Chicago, has been incorporated with $150,000 capital, by Richard Abram, Robert White and B. F. Allnutt, to manufacture automotive equipment, metal cans, etc.

The San Francisco offices of Pawling & Harnischfeger Co. has been moved to 32 Beale St., Milwaukee, Wis. R. M. Taylor is district manager in charge.

The Wallace Governor Co., Chicago, Ill., has been organized and incorporated with a capital stock of $100,000. Henry J. and Charles Aaron are mentioned as directors. The company will engage in the machine and foundry business.

The Paragon Foundry Co., Chicago, Ill., is having plans drawn for a foundry, 100 x 200, to cost about $50,000.

The Prest-O-Electric Devices Co., Hartford, Conn., has been incorporated with a capital stock of $500,000, to build machinery. A. W. Britton and R. K. Thistle, of New Jersey, and S. B. Howard, of New York, are named as directors.

The Jeffrey Manufacturing Co., builders of mining machinery, has located its general offices at 30 Church St., New York City. Harold B. Wood is district manager in charge.

The Auto Gear and Axle Co., Newark, N. J., has been organized and incorporated to manufacture axles and other automobile parts. Edmund Van Buren, Abraham Weisinger and Robert Kerben are the directors.

Trundel & McAdams, Ltd., Ottawa, Ont., Canada, has been incorporated. The company will manufacture and deal in machinery, tools, forgings and general plant equipment.

The Dominion Reliable Machinery Co., Ltd., Toronto, Canada, has been organized and incorporated with a capital stock of $60,000. Machinery tools and equipment will be manufactured.

New Publications

The Engineering Index 1920. 586 pages, 6½ x 9¼ in. Published by the American Society of Mechanical Engineers.

This is the second volume of the index to be published by the American Society of Mechanical Engineers, and is somewhat larger than before. Approximately 14,000 items are listed which refer to articles in some 700 publications. These have been culled by reviewers from over 1,200 periodicals, reports and publications which are regularly received by the engineering societies library. There is little to be said in reviewing such a book as only the individual reader can know how much or how little is of value to him personally. As with all indexing, much depends upon the point of view of the indexer. No library is complete without a copy for reference.

Sheet Metal Drafting. By Ellsworth M. Longfield, head, sheet-metal dept., Boston Trade School. Prepared in the extension division of the University of Wisconsin. Two hundred and thirty-six 6 x 9-in. pages, with 344 drawings. Published by the McGraw-Hill Book Co. Inc., 370 Seventh Ave., New York,

This volume was prepared especially for correspondence-study instruction in the extension division of the University of Wisconsin, and should be excellent as a text book for vocational, evening and part-time schools. It furnishes a systematic course of study in the principles of sheet-metal pattern drafting, each chapter discussing a different principle and containing the necessary drawings to make it thoroughly understandable. Each chapter also contains one or more practical problems with which the student may prove his mastery of the information.

An ideal scope of the work can be gained form the chapter headings, which follow: Rectilinear Figures; Wired Cylinders; Cylinders Cut by Planes; Intersecting Cylinders; Cones of Revolution; Intersecting Rectangular Prisms; Planning for Quantity Production; Sections Formed by Cutting Planes: Frustrums of Rectangular Pyramids; Combinations of Various Solids; Frustrums of Cones; Return and Face Miters; Triangulation of Scalene Cones; Triangulation of Transition Pieces; Developments by Sections; Developed and Extended Sections.

Engineering Instruments and Meters. By Edgar A. Griffiths. Three hundred sixty 6⅝ x 9⅜-in. pages; 348 line drawings and photographs. Published by D. Van Nostrand Co., 8 Warren St., New York, N. Y.

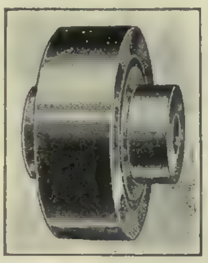
A comprehensive treatise on the basic principles involved in the design of instruments for the measurements of the fundamental quantities of mechanical science. The author has described in detail most of the modern instruments of measurement, with the object of enabling the reader to apply the principles to the design of instruments for his particular purposes. The scope of the work is very broad, taking in all classes of gages from the common snap gage to the aerodynamic balance. The operation of many well-known instruments is described, thus serving to guide the reader in selecting the instrument best suited to his problem. The following chapter headings will serve to indicate the extent of the field covered and the order of presentation: The Measurement of Length; The Measurement of Screw Threads; Measurement of Area; Measurement of Volume; Measurement of Velocity; Measurement of Force and the Comparison of Masses; Measurement of Work; Measurement of Temperature.

Personnel Relations in Industry. By A. M. Simons, author of "Social Forces in American History," formerly lecturer on personnel relations in the extension department of the University of Wisconsin, and manager personnel department of the Leffingwell Ream Co. Cloth covers, 6 x 9 in., 330 pages. Published by the Ronald Press Co., New York, N. Y.

Condensed-Clipping Index of Equipment

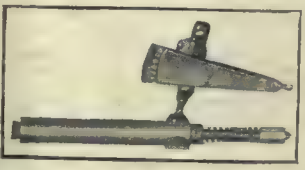
Patented Aug. 20, 1918

Coupling, Flexible, "Kantilever Spring"
Brown Engineering Co., Reading, Pa.
"American Machinist," March 31, 1921



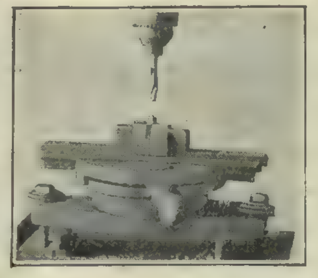
This flexible end-to-end shaft coupling is intended for use in power transmission. No leather, rope or rubber is used in the coupling, it being made entirely of metal. The coupling is completely inclosed and the interior parts run in oil. The inner member carries laminated leaf springs placed radially and fitted into grooves in the rim of the coupling. The springs bear on the rim at their outer ends, the sides of the grooves being tapered so that the springs can bend as the load is applied. Both angular misalignment and parallel misalignment are corrected. The springs act also as shock absorbers. The coupling is made in a range of sizes from 3 to 25½ in. in outside diameter, and for shaft sizes as large as 10 in. The weights vary from 3 to 1,580 pounds.

Center Tester
Ideal Tool Co., Rochester, N. Y., Manufacturer.
Johnson & Miller, 42 Murray St., New York, N. Y., Sales Agent.
"American Machinist," April 7, 1921



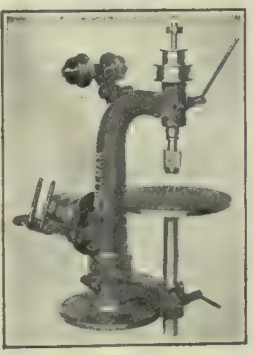
The device is used in connection with the test indicator made by the same concern. Its purpose is chiefly to aid in locating punch marks in line with the center of a machine spindle, either with the work stationary or revolving. The tester consists of a holder through which passes a rod carrying a center point and free to move through the holder. The holder is held in the machine spindle, and the center point is placed in the punch mark. Either the work or the spindle is then turned, the floating cone holding the center rod permitting the center point to move in case the punch mark be not directly in line with the spindle. The collar near the point presses on the contact point of the indicator, the deflection being shown in thousands of an inch on the scale.

Fixture, Drilling and Tapping, Quick-Acting
Waldon Tool and Metal Manufacturing Co., 13 Ferry St., Norwich, Conn.
"American Machinist," April 7, 1921



The fixture is shown mounted on a small drilling machine and the two jaws used in holding the work and the handle which operates them can be seen. The jaws are operated by a cam plate with a slot so arranged as to give a rapid motion until the jaws are almost in contact with the work, and then to increase the gripping power so as to hold the work firmly. The fixture has a large hole through the center so that the work drops through as soon as the jaws are opened. It is provided with a removal arm for carrying drill bushings.

Drilling Machine, Bench, High-Speed
Pullman Ventilator and Manufacturing Co., York, Pa.
"American Machinist," April 7, 1921

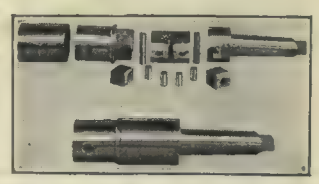


The drill is rated as having a capacity of 12 in., and it takes drill bits from No. 0 to ⅜ in. in diameter, being intended for high-speed work on small parts. The machine can be furnished with a chuck, as shown in the illustration, or with the spindle end bored for a No. 1 Morse taper. A two-step cone allows of variation in the speed. Weight, 85 lb.

Rivet-Heating Machine, Electric, G. E.
General Electric Co., Schenectady, N. Y.
"American Machinist," April 7, 1921

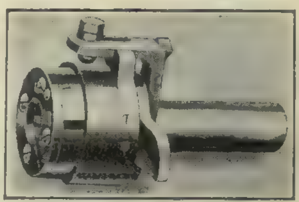
The heating unit consists of an air-cooled transformer with a single-turn short-circuited secondary, in which the rivets to be heated form a part of the secondary circuit. The primary winding is designed for 220, 440 or 550 volt single-phase circuits of 40, 50 or 60 cycles. The primary winding is connected to a drum controller, so that six different voltages can be obtained on the secondary. Adjustment of the rate of heating to accommodate different sizes of rivets can be made by setting the handle on the controller, the adjustments being made without danger to the operator, as the control apparatus is wholly enclosed.

Chuck, Universal
Cincinnati Engineering Tool Co., 4659 Spring Grove Ave., Cincinnati, Ohio.
"American Machinist," April 7, 1921



The device can be supplied in three sizes and with any style of special shank or socket. It was developed for use with all types of boring and reaming fixtures, either of the vertical or horizontal type, that require a double support for the tool. It is said to overcome all errors due to faulty alignment with the spindle of the machine base or table, or of the fixture. All parts are made of alloy steel and hardened and ground. The universal joint is full-floating, and is very short, considering the movement that it allows. There are no projecting parts.

Die Head for B. & S. Automatic Screw Machine, "H & G."
Eastern Machine Screw Corporation, New Haven, Conn.
"American Machinist," April 7, 1921



The die head is intended for use on Brown & Sharpe automatic screw machines. The main feature of the head is in the provision for holding it from revolving while cutting. An extension of the shell engages both sides of the overhanging arm attached to the body. The operation of the trip lever is sensitive enough for cutting very fine threads. The adjustment for length of thread is made by a screw which brings the tripping button to the proper point. It is claimed that the thread can be cut to a shoulder or to a given point with great precision, and that by a simple adjustment the depth of cut can be controlled to within 0.0005 inch.

Toolholder, Spring, Miner
Miner-Fuller Co., Plainville, Conn.
"American Machinist," April 7, 1921

The toolholder is recessed in the front end for the section which carries the toolbit, this section being attached to a spring-neck as shown. This construction allows the tool to spring back and forth, but prevents any side motion. A full-length toolbit can be used, and the holder can be employed as a solid holder if desired. The shank is heat-treated, and the spring neck is of tempered tool steel. The holder takes a 5/16-in. square tool bit. The shank is 9/16 x 1⅛ x 7 inches.

Clip, paste on 3 x 5-in. cards and file as desired

This book is a valuable addition to existing literature on management and labor. It deals with general principles, with the object of furthering the process of classifying facts and pointing out some of the scientific laws that have been brought to light. Human nature has been made its basic characteristic. It is evident that a great amount of work has been expended upon getting together the facts set forth and giving them careful analysis. The material from which the book resulted was organized for presentation to classes of the extension department of the University of Wisconsin, and was later rewritten.

A number of the chapter headings are: Sources of Labor Supply; Mental and Trade Tests; Interesting Labor in Industry; the Wage Relation; Labor Turnover; Democracy in Industry; Forms of Joint Management.

Acceptances, Trade and Bankers'. By Park Mathewson, counselor on Business. Finance management; vice-president of the Business Bourse, New York. Cloth covers, 5 x 8in., 343 pages, illustrations of various forms of trade acceptances. Published by D. Appleton & Co., New York, N. Y.

A book that should be of great value to the business executive and his assistants. It explains acceptance principles and procedure as demonstrated in actual use in the United States and foreign countries. The three parts of the book are devoted to: Acceptance Theory, Procedure and Practice; Rulings and Opinions of Counsel of the Federal Reserve Board on Acceptance Procedure; and Data for Trade Acceptance Campaigning. Some of the chapter headings that indicate the scope of the work are: The Theory of Acceptance Payment; What Is a Trade Acceptance?; General Methods of Collecting or Discounting Acceptances Through the Banks: Sound Accounting Methods for Handling Trade Acceptances by Seller and Buyer; Investigations by Questionnaire of Trade Acceptances; Rulings of the Federal Reserve Board; What Can the Trade Acceptance Do for the American Business Man?; Making Clear to the Buyer the Advantages of Trade Acceptances.

The Work of Railway Carmen. By Edmond K. Hogan; published by the Railway Employees Department, American Federation of Labor, Chicago, Ill.

This booklet of nearly 200 pages was prepared as a refutation of the claim that the building and repairing of railway car does not require mechanical skill and experience. It does this by showing in detail just what the work is and it is illuminating even to those who are more or less familiar with railroad work. The author is to be congratulated on the painstaking care with which he has undertaken his task and the result is a distinct contribution to the vocational literature of the country.

Beginning with a general survey of the work, he takes up the details of both wooden and steel cars and then subdivides it into sections such as upholstering, cabinet work, welding, millwrighting, patternmaking, painting, lettering, etc. These include both rough work and fine, such as inlaying, silvering of mirrors, silver plating and similar highly skilled jobs. The automatic air brake also forms a part of the carman's duties as well as the repairing of all sorts of damage done to car bodies and trucks by collisions and other accidents.

The book is well illustrated to show the nature of damages in cars, the different types of cars and vestibules, the action of the air brake, etc. As a textbook for railway car repairs it is far ahead of anything which has been published previously. Railway apprentice schools can do no better than to use this for instruction purposes and the mechanical world is indebted to the author for his labors.

The Dynamics of the Airplane. By Kenneth P. Williams, Ph. D., Associate Professor of Mathematics, Indiana University; Vol. 21, Mathematical Monographs, Edited by Mansfield Merriman and Robert S. Woodward. Cloth board covers, 6 x 9 in., 128 pages, 50 figures. Published by John Wiley & Sons, Inc., New York, N. Y.

The book is intended for students of mathematics and physics who are attracted by the dynamical aspect of aviation. It does not attempt a complete treatment of the subject, but takes up certain interesting and vital problems connected with flight. Although the items considered are logically and completely developed, the treatment in the text is for the most part elementary, as only the last chapter demands of the student familiarity with the more advanced dynamical methods. The work is quite broad in scope, and should give to the student a clear understanding of the nature of the mathematical problems encountered in the design, construction and operation of the airplane.

The chapter headings are as follows: The Plane and Cambered Surface; Straight Horizontal Flight; Descent and Ascent; Circular Flight; The Propeller; Performance; Stability and Controllability; and Stability.

Personals

Hubert S. Wynkoop has been appointed by President Berresford, of the American Institute of Electrical Engineers, to represent the institute in co-operating with the Building Codes Committee of the Department of Commerce.

Elbert C. Fischer has been appointed plant engineer at the Picatinny Arsenal, Dover, N. J.

S. A. Dinsmore has been appointed Chicago representative of the Standard Gauge Steel Co., Beaver Falls, Pa. He succeeds Richard O'Connor.

E. J. Wagner has been elected secretary of the Standard Gauge Steel Co., Beaver Falls, Pa. He is also in charge of sales.

Leo E. Rush, who is associated with the American Road Machinery Co., Inc., is now located at Groton, N. Y.

Edward L. Dillon, until recently located in the St. Louis office of Fairbanks, Morse Co., is now in the Dallas, Tex., office of that company.

J. MacFerran Taylor has joined the sales force of Pawling & Harnischfeger, Milwaukee, Wis., and is attached to the San Francisco office.

Eugene A. Leinroth is now with the Albro-Clem Elevator Co., Cleveland, Ohio. He was formerly with the Chicago Pneumatic Tool Co., Philadelphia, Pa.

Harry W. Anderson, formerly with the Templar Motors Corporation, Lakewood, Ohio, is now general sales manager for the Duesenberg Automobile and Motors Co., Inc., Indianapolis, Ind.

A. L. Jones, Jr., has been transferred from the Deane Works of the Worthington Pump and Machinery Corporation at Holyoke, Mass., to its Kansas City office.

Obituary

James Prentice Snedden, general superintendent of the Babcock & Wilcox Co., died on June 11.

Trade Catalogs

Deoxidine. American Chemical Paint Co., Philadelphia, Pa. Bulletin No. 10, giving directions for using this material in preparing steel for painting.

Karge Couplings. Karge-Baker Corporation, Phoenix, N. Y. A 11 x 14-in. catalog illustrating and describing a line of couplings for shafting, pulleys, bushings and other assemblies.

Boston Gears. Boston Gear Works, Quincy, Mass. Catalog G-1, giving complete information of a line of gears said to number 1,500 sizes.

Sullivan Dry Vacuum Pumps. Sullivan Machinery Co., Chicago, Ill. Bulletin No. 78-A, covering two styles, "WG-61" and "WA-61," single cylinder, steam and belt-driven vacuum pumps. Each type is fully illustrated.

Electric Traveling Grab Bucket Cranes. Northern Engineering Works, Detroit, Mich. Bulletin No. 520-B, a well-made-up booklet covering a line of cranes for various uses. Each type is illustrated "at work."

Baker Industrial Tractors. The Baker R & L Co., Cleveland, Ohio. Bulletin No. 10 showing some of the uses of Baker tractors in shops, yards and docks.

Sullivan Turbinair Hoist. Sullivan Machinery Co., Chicago, Ill. Bulletin No. 76 illustrating and describing the latest model Turbinair Hoist, a small but powerful hoisting engine for mines, quarries, yards and shops.

Auto Transformer Starter. Cutler-Hammer Manufacturing Co., Milwaukee, Wis. An elaborate five-color circular, known as Bulletin No. 9141, which describes a new auto-transformer starter for squirrel-cage motors.

Excavator Cranes. Pawling & Harnischfeger Co., Milwaukee, Wis. Bulletin No. 6X describing the latest addition to a line of excavating machinery as manufactured by this company. This is known as Excavator-Crane No. 206 and is a full-revolving, portable crane and excavator which can be put to many uses.

Pilot Brand Tools. Consolidated Tool Works, Inc., 296 Broadway, New York. Catalog "B," twenty 9½ x 11½-in. pages, describing with illustrations and specifications a line of hacksaws, planers, hand drills, breast drills, calipers, micrometers and wrenches.

Pamphlets Received

Hours and Earnings in Anthracite and Bituminous Coal Mining: Bulletin No. 279 of the Bureau of Labor Statistics, U. S. Department of Labor, Washington, D. C. This reports shows the earnings and hours of labor of coal mine employees. Figures are presented for bituminous mine employees in 1919, and for anthracite mine employees in 1919 and 1920. Many tables showing these figures are included. Nearly all the coal fields in the United States are represented in the statistics.

The Open or the Closed Shop? A twenty-four page pamphlet, written by Walter Drew, Counsel to the National Erectors' Association, of New York, and published by the National Association of Manufacturers. This is an intelligent and impartial discussion of a vital industrial question and Mr. Drew handles it in an able manner. The views of labor leaders, financiers, jurists and others are analyzed.

The Settlement of Our Export Balance: Irving National Bank, New York. This pamphlet is the forty-seventh of a series published by the Irving National Bank as a contribution to public thought upon questions relating to national prosperity. This one is written by Lewis E. Pierson, chairman of the board, and is an excellent dissertation on the conditions in the export market today. Mr. Pierson analyzes the effects of the war on our foreign trade and offers some refreshing suggestions on this much discussed question.

Safe Practices: National Safety Council, Chicago, Ill. This is one of a series of lectures in loose-leaf form covering various subjects pertaining to safety in industry. This one deals with the prevention of skin troubles from cutting oils and emulsions.

Effects on Concrete of Immersion in Boiling Water and Oven Drying. By W. J. Schlick, Engineering Experiment Station, Ames, Iowa. Bulletin No. 59 of the Iowa State College of Agriculture and Mechanic Arts. This bulletin covers a series of experiments to determine the effects of immersion and drying on the strength of concrete. The conclusions are set forth in a clear and concise way and tables and graphs are provided to guide the reader.

Forthcoming Meetings

The third annual convention and exhibition of the American Society for Steel Treating will be held in the Manufacturers Building, State Fair Grounds, Indianapolis, Ind., during the week of September 19 to 24 inclusive.

A joint meeting of the American Society of Mechanical Engineers, the Society of Automotive Engineers and the Army Ordnance Association will be held at Aberdeen, Md., Friday, October 7.

NEW *and* ENLARGED

Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Del., Wilmington—Du Pont Eng. Co.:
Two 16 in. shapers.
One 28 in. sliding head drill press.
One 16 in. x 10 ft. south bend lathe with four step cone, back geared, etc.
One pipe cutting and threading machine.
One 24 in. crescent jointer with safety head.
One No. 3 universal saw table.
One band saw.
One combination wet and dry grinder.
One planer.
One No. 2 economy hack saw.
One pattern makers lathe.
One iron grindstone with adjustable tool rest.
One post borer with table 8 x 24 in.

N. Y., Angola—Evans Center Garage, J. Bingemheimer, owner — milling machine, drill press and lathe.

N. Y., New York—The American Lithographic Co., 52 East 19th St.—one Ames bench lathe, complete.

N. Y., New York—J. Heinricks, 948 Bway., manufacturer of copperware—one 60 in. lathe, 10 or 12 ft. long.

N. Y., New York—Irving Press, 121 East 31st St.—14 in. high sensitive drill.

Pa., Philadelphia—Bureau of Water, 796 City Hall, F. H. Caven, dir.—wrist pin turning machine.

N. C., Statesville—J. C. Steele & Sons, Manufacturers of brick making and clay working machinery. C. M. Steele, Purch. Agt.—one 34 in sliding head, back geared drill press. (New or nearly new.)

Va., Richmond—R. S. Gilson's Ford Repair Shop, 1811 West Broad St.—one small power lathe, drill press and emory wheel stand.

Va., Richmond—McMullen & Benton, 1649 West Broad St.—one small power lathe for auto repairs.

W. Va., Blaefield—The Bailey Lumber Co. Inc., Lock Box 336, Manufacturers of building materials, etc., E. L. Bailey, Pres.—
One triple endless bed drum sander.
One 6 in. moulder.
One 8 in. moulder.
Two self-fed rip saws.
One single-edge tenoning machine with copes.
One sash and door clamp.
One hollow chisel mortiser.
One chain mortiser.
One 30 in. cabinet surfacer.
One sash and door sticker with boring attachments.
One swing cut-off saw.

Ill., Christopher—The Bd. Educ., care of L. D. Putnam—manual training equipment.

O., Cincinnati—The Norton Broadway Machinery Co., 236-238 Bway., W. D. Norton, Purch Agt.—
Bulldozer, medium size.
No. 3 Miller plain automatic gear cutter for repair shop.
Heald Cylinder grinder, water lubricated.
Hydraulic press.
Landis crank shaft.
Shear to cut 1½ in. round.
Shear to cut 2½ in. round.

Wis., Milwaukee—W. Schoof, Green Tire Rd.—garage equipment including drill press and lathe.

Wis., Milwaukee—M. Wald, 185 4th St., manufacturer of auto radiators—drill presses.

Wis., Wausau—The Marathon Electric Mfg. Co., Plummer Island—buffing lathes.

Ia., Des Moines—The Keith Furnace Co., 200 Court Ave., R. S. Keith, Pres.—machine for grinding furnace fronts, either a grinding machine or a lathe equipped with grinding tools, tumbling machine, small hand cranes and large overhead power crane.

Kan., Wichita—The Bd. Educ.— manual training equipment for proposed high school.

Ont., Harriston—McLaren's Garage—garage equipment.

Que., Iberville—Rapid Tool Co. Ltd., A. Leelair Purch. Agt.—complete equipment for tool shop and foundry.

Que., Montreal—The Catholic School Comn., 36 St. Catherine St., E.—$15,000 worth of manual training equipment.

Que., Montreal—N. Leonard, 2238 St. Lawrence St.—welding machine, vice and small lathe for garage and repair shop.

Machinery Wanted

Va., Norfolk—The Interstate Equipment Corp., Debree Ave.—Set of flanging or bending clamps, 8 to 10 ft. long, suitable for boiler work.

Va., Stuart—J. D. Blackard Stave & Cooperage Co., Inc., Manufacturers of barrels, crates, etc., W. G. Blackard, Secy. and Treas.—8 to 10 in. jointer one with removable head that can be used as tongue and groove machine and jointer, preferable self-feed rip saw, suitable for making lath and a hand drum sander one with drum and disc, preferable. (Used.)

W. Va., Princeton—The Micijah Pocahontas Coal Co., L. R. Taylor, Pres.—mining machinery, including cutting machines, rotary converter and coal cleaning and screening machinery.

Mich. Detroit — Hinkley Motors Corp., 3420 West Fort St.—assembling equipment and traveling crane for plant at Ecorse.

Mich., Hancock—The Peoples' Fuel Co.—coal crane.

O., Cleveland—C. Preschley, 8501 Clark Ave.—universal wood-working machine.

O., Piqua—The Orr Felt & Blanket Co.—mattress and blanket manufacturing machinery.

Wis., Neenah—The Valley Paper Mills, care of G. W. Burnside, 305 Caroline St.—traveling crane.

Wis., New Prospect—(R. D. Campbellsport)—H. Koch—sawmill machinery including belting and shafting.

Wis., New Richmond—The Liberty Loan Cheese & Butter Assn—cheese-making machinery.

Que., Asbestos—The Canadian John Manuele Co., St. James St., Montreal—equipment for proposed asbestos plant.

Que., Quebec—Ignaco Bilodeau Ltd., St. Joseph St.—complete equipment for the manufacture of concrete blocks.

Ont., Haileyburg—The Haileyburg Brick & Tile Co., A. J. Murphy, Ottawa, Purch. Agt.—complete equipment.

Ont., Wallaceburg—W. McLean, Box 454 and A. Philips, Box 126—Universal woodworker and a handle making machine.

Metal Working Shops

NEW ENGLAND STATES

Conn., Hartford — B. Aronofsky, 609 Windsor Ave., has awarded the contract for the construction of a 1 story, 50 x 100 ft. garage on Windsor Ave. Estimated cost, $15,000.

Conn., Hartford—T. R. Forestiere, Charter Oak Pl., will build a 2 story, 24 x 50 ft. garage and a 12 x 50 ft. addition to his bottling plant. Estimated cost, $18,000. Noted April 14.

Conn., Hartford—S. Maislen, 356 Windsor Ave., will soon award the contract for the construction of a 1 story, 50 x 80 ft. garage on High St. Estimatd cost, $15,000. Dunkelberger & Gelman, 721 Main St., Archts.

Mass., Springfield — Chaplin & Chaplin, 374 Main St., will build a 1 story, 50 x 110 ft. garage on White St. Estimated cost, $20,000.

MIDDLE ATLANTIC STATES

N. J., Orange — A. P. Nucciarone, 206 Central Ave., will soon award the contract for the construction of a 1 story, 32 x 60 ft. structural iron foundry at 45 Hickory St. Estimated cost $15,000.

N. Y., Brooklyn—The Radella Co. Inc., c/o Burke & Olsen, 32 Court St., will build a 1 story, 200 x 200 ft. garage on Empire Blvd. and Cedar Pl. Estimated cost, $65,000.

N. Y., New York—The 119 West 145th St. Garage Corp., c/o L. A. Sheniart, Archt., 194 Bowery, will build a 1 story, 100 x 175 ft. garage. Estimated cost, $75,000.

THE WEEKLY PRICE GUIDE

This Week's Market

More price declines are noted this week than in the preceding four. On July 5, Bethlehem's lower steel schedule went into effect, and on the following morning the U. S. Steel Corporation followed suit. The principal independents are adhering to the new prices, which are: Bars, $1.90; shapes and plates, $2; sheet bar, $5 per ton; billets, 4 x 4, $33; slabs, $34; tin plate, $5.75. The dealers have responded by dropping their prices for the second time in two weeks. This latest decrease amounts to 20c. per 100 lb. on beams, channels angles and tees.

Not much change in the metal market, although New York shows a slight falling off in copper and tin and in the products of these metals.

The market for shop supplies has been weak for some weeks, and now we show a new list of quotations for New York.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.80
Northern Basic	25.50
Southern Ohio No. 2	25.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	32.26
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75	27.26
Virginia No. 2	*27.00
Basic	†25.00
Grey Forge	24.40
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern, sil 2.25@2.75	28.67
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	24.96
Basic	23.46
Bessemer	24.96

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$3.03	$2.89	$3.23
Soft steel bars	3.03	2.79	3.13
Soft steel bar shapes	3.03	3.48	3.13
Soft steel bands	3.63	6.25	
Tank plates	3.03	2.89	3.23

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.20
Warehouse, New York, delivered	3.13
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
Blue Annealed				
No. 10	3.10	3.68	3.85	4.13
No. 12	3.15	3.73	3.90	4.18
No. 14	3.20	3.78	3.95	4.23
No. 16	3.30	3.88	4.05	4.23
Black				
Nos. 17 and 21	3.75	4.30	4.30	5.20
Nos. 22 and 24	3.85	4.35	4.35	5.25
No. 25 and 26	3.90	4.40	4.40	5.30
No. 28	4.00	4.50	4.50	5.40
Galvanized				
No. 10 and 11	4.00	4.50	4.50	5.70
No. 12 to 14	4.10	4.60	4.60	5.80
Nos. 17 and 21	4.40	4.90	4.90	6.10
Nos. 22 and 24	4.55	5.05	5.05	6.25
No. 26	4.70	5.20	5.20	6.30
No. 28	5.00	5.50	5.50	6.40

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb.	$4.73	$4.63	$4.00
Flats, squares and hexagons, per 100 lb.	5.23	4.63	4.50

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	55%
Cleveland	55%
Chicago	50%

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b New York: 3/32, 8½c. per lb.: ⅛, 8c.; 5/32 to ¼, 7¾c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	5.50	7.00	8.25
Spring steel (light)	8.00	7.00	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.20
Hoop steel	4.03	3.49	3.[illegible]
Cold rolled strip steel	7.50	8.25	7.90
Floor plates	5.00	3.09	5.78

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of April 13, 1921:

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
BUTT WELD					
1 to 3	62½	50	¾	33½	18½
			1 to 1½	35½	20½
LAP WELD					
2	54½	41	2	30½	16½
2½ to 6	58½	45	2½ to 4	34½	22½
7 to 12	54½	44	4½ to 6	33½	21½
13 and 14	45	37	7 to 8	24½	12½
15	42½	32	9 to 12	19½	7½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	60½	49	1 to 1½	35½	21½
2 to 3	61½	50			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	52½	41	2	31½	18½
2½ to 4	56½	45	2½ to 4	34½	22½
4½ to 6	55½	44	4½ to 6	33½	21½
7 to 8	50½	37	7 to 8	24½	12½
9 to 12	45½	32	9 to 12	19½	7½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20-5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	13@13½
Tin in 5-ton lots	29.25
Lead	4.75
Zinc	5.75
ST. LOUIS	
Lead	4.85
Zinc	5.35

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	20.75	22.00	23.50
Copper wire (carload lots)	15.50	16.50	19.50
Brass sheets	15.75	20.00	10.75
Brass pipe	18.50	22.00	23.50
Solder (half and half) (case lots)	20.00	23.50	16.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	14.25
Cleveland	16.00
Chicago	18.00

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel

Ingots and hot	41
Electrolytic	44

Monel Metal

Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots........ 10.00

	Warehouse	
	In Casks	Broken Lots
New York	11.50	12.00
Cleveland	11.15	11.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	6.00
Chicago	6.00
Cleveland	7.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	9.50	9.50	$10.00
Copper, heavy, and wire	9.00	9.00	9.00
Copper, light, and bottoms	7.50	7.06	8.00
Lead, heavy	3.25	3.50	3.75
Lead, tea	2.00	2.50	2.75
Brass, heavy	5.00	5.00	9.00
Brass, light	4.50	4.00	5.00
No. 1 yellow brass turnings	5.00	4.00	5.00
Zinc	3.00	2.50	3.50

ALUMINUM—The following prices are spot from warehouse, cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.4	25.00@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	19.50
Chicago	23.00
Cleveland	22.00

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	41.00	35.00
Commercial	30.00	14.75	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

This market is very soft, and our quotations for the present are useful only as a guide.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	2.00	$2.25	1.60
Hot pressed hexagon	2.00	2.25	1.60
Cold punches hexagon	1.50	2.25	1.60
Cold punched square	1.50	2.25	1.60

Semi-finished nuts, $\frac{9}{16}$ and smaller, sell at the following discounts from list price:

	Current
New York	75%
Chicago	50%
Cleveland	80%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in.	50%	60-10%	50%
1⅛ and 1¼ in. by 3 in. up to 12 in.	40%	50-5%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York...... $3.00 Cleveland...... $4.50 Chicago....... $4.00
For cast-iron washers, ½ and larger, the base price per 100 lb. is as follows:
New York...... $4.25 Cleveland...... $3.75 Chicago....... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	40%	60%	40%
Larger and longer up to 1 in. by 30 in.	40%	50-10%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40%	10%
Chicago	net	net
New York	40%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel $\frac{7}{16}$ and smaller	50-10%	60-10%	45%
Tinned	50-10%	60-10%	30%

Structural, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.40 Cleveland...$4.25 Chicago....$4.88 Pittsburgh..$3.70
Boiler, same sizes:
New York...$4.50 Cleveland...$4.35 Chicago....$4.98 Pittsburgh..$3.80

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	18.00	24.00	25.50
Brass	16.00	22.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in., inclusive in rounds, and ¼-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$7.50 per 100 lb.; New York prices is $7.50.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	7.50@10.00	12.00	14.25
Colored mixed	5.50@ 9.00	9.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.00
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$2.75@ $3.00
Prompt foundry	4.00@ 4.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.76	$0.86	$0.84
5-gal. cans	.83*	1.00	1.09

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.25
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount. Business is good in white lead.

N. Y., Yonkers—S. Fleischter, 144 Hawthorne Ave., is having plans prepared for the construction of a 1 story, 65 x 100 ft. garage at 150 Hawthorne Ave. Estimated cost, $20,000. C. A. Bartley, 30 Fairview St., Archt.

N. Y., Rochester — The Mayor Coating Machine Co., 205-213 St. Paul St., will build a 1 story, 125 x 231 ft. factory on Scottsville Rd. Noted June 20.

Pa., Pittsburgh — The Crane Co., 836 South Michigan Ave., is building 1 and 2 story, 192 x 292 ft. pipe shops.

MIDDLE WEST STATES

Ill., Oak Park—Hart & Whetston, 5 North La Salle St., Chicago, have awarded the contract for the construction of a 1 story, 55 x 125 ft. garage on Lombard Ave. and Madison St., here. Estimated cost, $40,000.

Ind., Elkhart—The Pendergast Fence Co., Stillwater, Minn., had plans prepared for the construction of a 1 story factory, here. Estimated cost $25,000. Private plans.

Mich., Ecorse—The Hinkley Motors Corp., 3420 West Fort St., Detroit, has had plans prepared for the construction of a 1 story, 250 x 340 ft. factory and office on Cicotte Ave., here. A. Kahn, 1000 Marquette Bldg., Detroit, Archt.

O., Cleveland — P. M. Platten, Engineers Bldg., has awarded the contract for the construction of a 1 story 43 x 137 ft. commercial building and garage on East 133d St. and Miles Ave. Estimated cost, $40,000. Private plans.

STATES WEST OF THE MISSISSIPPI

Colo., Colo. Springs — The J. C. Jarrett Motor & Finance Co., recently incorporated with $250,000 capital stock, plans to build a factory at 933 Hayes St.

Ia., Des Moines—The Keith Furnace Co., 326 Southwest 11h St., will soon award the contract for the construction of a 1 and 2 story 80 x 100 ft. foundry and machine shop and a 40 x 150 ft. tin and register building, etc. Estimated cost, $250,000. Boyd & Moore, 314 Securities Bldg., Archts.

Kan., Wichita — F. L. Wright, 310 Schweiter Bldg., plans to build a 1 story. 50 x 140 ft. garage. Estimated cost $35,000. Architect not selected.

Minn., Minneapolis — The Kremer Motor Co., 1518 Hennepin Ave., has awarded the contract for the construction of a 2 story, 50 x 150 ft. garage at 1411 Yale Pl. Estimated cost, $45,000. P. E. Crosier, 916 New York Life Bldg., Archt. Noted May 5.

Mo., St. Louis—C. M. Burnmeister, 4101 North 21st St., will soon award the contract for the construction of a 1 story, 60 x 120 ft. garage on 21st St. and Angelica Ave. Estimated cost $30,000. Private plans.

Mo., Mexico—The Hoxsey Shroot Motor Co. will build a 1 story, 47 x 175 ft. garage. Estimated cost $15,000.

WESTERN STATES

Tex., San Antonio — The Morgan-Woodward Auto Co., 1202 South Flores St., has awarded the contract for the construction of a 140 x 305 ft. garage. Estimated cost $50,000.

CANADA

Ont., Harriston—McLaren's Garage plans to rebuild garage which was recently destroyed by fire. Estimated cost, $20,000.

Ont., Toronto—G. Hilbert, 195 Jarvis St., is having plans prepared for the consruction of a 2 story, 50 x 60 ft. garage on Shuter St. Estimated cost, $15,000. J. Hunt Stanford, 67 Yonge Arcade, Archt

Que., Iberville—The Rapid Tool Co. Ltd. will soon receive bids for the construction of a 78 x 100 ft. tool shop on Principle St. Estimated cost, $110,000.

General Manufacturing

NEW ENGLAND STATES

Conn., Stamford — Cohn & Abranis, 545 Main St., have awarded the contract for the construction of a 1 story ice cream and candy manufacturing plant on Beckley Ave. cost, $10,000.

Conn., Stratford—H. T. Saunders, Linden Ave., has awarded the contract for the construction of a 1 story, 40 x 55 ft. and 20 x 30 ft. laundry on Ferry Blvd. Estimated Estimated cost, $10,000.

MIDDLE ATLANTIC STATES

N. Y., Brooklyn—The Erie Dyeing and Processing Co., 2765 East 55th St., Cleveland, O., has awarded the contract for the construction of a 1 story dyeing plant on Nassau Ave. near East 14th St. Estimated cost $150,000. Noted June 23.

N. Y., Syracuse—The Onondaga Pottery Co., 1858 West Fayette St., had plans prepared for the construction of a pottery plant. Estimated cost $500,000. G. L. Noble, Union Bldg., Engr.

N. J., Passaic — The Passaic Worsted Spinning Co, 9th St., will build a 4 story, 36 x 69 ft. factory on 8th St. Estimated cost $35,000.

Pa., Phoenixville—The Watco Knitting Co. is having preliminary plans prepared for the construction of a 3 story, 36 x 80 ft. addition on Bridge St. J. V. Poley, Royersford, Archt.

Ill., Chicago—The Northern Bank Note Co., 538 South Clark St., has had plans prepared for the construction of a 3 story, 120 x 260 ft. printing plant at 2334 South Racine Ave. Estimated cost, $200,000. H. C. Miller, 112 West Adams St., Archt.

Pa., Scranton—The Times Printing Co., 809 Linden St., has awarded the contract for altering its 2 story printing plant. Estimated cost $30,000.

Pa., Clifton Heights—The Kent Mills, manufacturers of woolen goods, is building a 4 story, 37 x 120 ft. mill. Estimated cost $100,000.

MIDDLE WEST STATES

O., Piqua—The Orr Felt and Blanket Co. has awarded the contract for the construction of a 4 story, 100 x 200 ft. factory. Estimated cost, $185,000.

O., Coventry—C. Palmer, 7 South Forge St., Akron, plans to build a match factory, here. Estimated cost $1,000,000.

O., Kent—The Western Reserve Cotton Mills Co., care of O. M. Mason, is having plans prepared for the construction of a 3 story cotton mill. Estimated cost, $300,000.

Ill., Rock Island—Sturtevant & Baker, 1514 7th Ave., plans to build a 2 story ice cream factory. Estimated cost, $200,000. Architect not selected.

Ill., Niles (Chicago P. O.)—St. Hedwigs Industrial School for Girls, will soon award the contract for the construction of a 2 and a 3 story infirmary and printery. Estimated cost, $160,000. E. Brielmaier & Sons, 432 Bway, Milwaukee, Archt.

Mich., Detroit—E. H. Jones, 2128 Penobscot Bldg., is having plans prepared for the construction of an 8 story, 38 x 60 ft. merchantile shop on Madison Ave. Estimated cost, $200,000. C. H. Crane, Huron Bldg., Archt.

STATES WEST OF THE MISSISSIPPI

Okla., Oklahoma City—The Curtis Booth & Bentley Co., 701 Main St., plans to build a 2 story planing mill. Estimated cost $500,000. Architect not selected.

Mo., St. Louis—The Woodward & Fierman Printing Co., 309 North 3rd St., plans to build a 2 and 3 story plant on Tower Grove along tracks of Missouri Pacific R.R. Estimated cost, $1,000,000. Architect not selected.

Mo., Webb City—The Lock Joint Pipe Co., care of Missouri Pacific R.R. Co., plans to build a 1 story cement pipe factory. Estimated cost, $150,000. Architect not selected.

Ia., Clinton—The Chicago & Northwestern R.R., 399 West Jackson Blvd., Chicago, Ill., plans to build an artificial ice plant. Estimated cost, $50,000. Private plans.

CANADA

Que., Asbestos—The Canadian John Manuele Co., St. James St., Montreal, will receive bids about July 15 for the construction of an asbestos factory here. Estimated cost, $350,000.

Man., Winnipeg—The Winnipeg School Bd., will receive bids until July 26 for the construction of a 3 story, 265 x 318 ft., school building including manual training shops, etc., on the corner of Alverstone and Wellington Sts. Estimated cost, $1,000,000. J. N. Semmens, 508 Great West Perm Bldg., Archt.

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American Machinist

Volume 55 NEW YORK, JULY 21, 1921 Number 3

Organization and Management of the Small Shop

The Necessity of Organization in the Management of the Small Shop—How One Small Shop Started and Won a Battle Against Odds

By ELMER W. LEACH

THE necessity of organization in the management of the small shop has prompted me to select that phrasing only after considerable thought, because it has a very definite suggestion in its wording which I wish to have clearly understood at the outset. And this is it, that a small shop, no matter how very, very small it may be, can have and must have an organization and a management just the same as any million dollar corporation, if it is to be operated profitably and successfully.

There are some short-sighted persons who go into the manufacturing business on a limited scale with the original conviction that because their plant falls into that class known as "small shops," it is not necessary to keep a set of books, to make any special or methodical attempt to sell their goods, or to watch purchases, production, profits and the hundred and one other things that really must be watched; in fact, they seem to believe that their business will continue from one month to the next and from one profit to a larger one without any conscientious and concerted planning and striving toward bigger things.

How quickly such people are disillusioned. We read of some great captain of industry who has amassed a tremendous fortune. We read about the wonderful organization of which he is the head, and of the extensive system of production units and sales departments which he has established in every corner of the world. There is an irresistible tendency to say to ourselves. "Fortunate fellow, he was born under a lucky star."

But there is no luck about it, and I have never known any instance where the stars entered into the factors determining such a man's success. Back of every story of individual accomplishment which may have been brought to your attention is another story that the outside world does not so often learn, a story of a gigantic effort that ninety-nine other men may have declared to be physically impossible, but which the one man was big enough and bold enough to attempt.

HARD WORK NECESSARY

There are certain elements entirely beyond your control which will affect your business so as to bring unhoped for successes or unexpected set-backs and misfortunes, but no business man has ever trusted to the element of luck in forming his plans and policies. No business man has ever attributed any material portion of his success to luck. And so we should not do our industrial leaders the injustice of presuming that their accomplishments have been possible through anything but real, honest hard work; and work with a very definite purpose and object in view.

Those who are contemplating organizing a small manufacturing business or those who may already have begun such an undertaking will do well to recall that "The path of life is not flowing with milk and honey, nor is it strewn with roses and violets." It is a hard, true rule that you get out of life in proportion to what you put into it, which is also true of business. Your success in business will be directly proportionate to your effort toward success, and it will come only when you work for it, and only as you earn it.

LORD, SAVE US FROM OUR FRIENDS!

Do I discourage you? That is quite opposite to my desire. There will be any number of other persons to do that when you announce your intention to enter business. They will examine your product and tell you the idea is not new. They will say there is something similar on the market in much simpler form at a much smaller price. They will declare that it will take thousands of dollars in advertising to create a demand for your goods and that when you have done so some large corporation will cut in on your market with methods of competition against which your little enterprise can never hope to survive.

By the dozens, supposedly sincere friends have come to every man of courage and vision and predicted embarassing failure within a few months; they have proved the utter impossibility of his plan.

But we heard the same type of prophets explain why the French could not prevent the Germans from entering Paris on September first in 1914. I read of one gentleman who, through a very unusual and yet possible mix-up by a marriage to a lady whose daughter had at the same time married his own father, was able to prove seriously that he was his own grandfather!

THE VALUE OF REAL FRIENDS

One is fortunate indeed if he has friends who can give really intelligent information which will help him in analyzing his problems and arriving at decisions; and it is entirely possible that your first intentions and plans may be too pretentious or too inconsistent with reasonable probabilities. In that event, you should be glad if some one brings to your attention facts which you had overlooked by not appreciating their bearing on your problem. Never refuse to listen to advice, but do not accept it blindly as sound even though it may be offered in all sincerity.

Some people say that the business world is overcrowded and that there are no opportunities today such as were open to Henry Ford or to Thomas Edison when they were young men.

It is true that Henry Ford developed the idea of an inexpensive automobile and Thomas Edison the incandescent light, the talking machine and other ideas; they took basic ideas which had not been presented to the world before even in a crude way and developed them into what are now two of our largest industries. And there are other men who have taken ideas from their conception and carried them through to practical form and successful application and development; but that does not necessarily mean that the field is overcrowded or that the possibilities are exhausted.

No, the field of business is still bigger than the biggest man who has ever entered it. New machines, new products, new processes are being offered to the world every day of every year; and some place in that ever-increasing complexity of our industrial development there is a definite corner for the that idea which you may have hesitated to submit to the competition of the commercial market.

Whether it be an improvement on some product already in use or an entirely new article; whether it be a hammer of new shape or a new style of monotype; in other words, whether it be large or small, simple or complex, modest or pretentious; if it is practical, if it can be manufactured economically, and if it has a permanent and substantial market, then do not let ten thousand pessimistic advisors deter you from developing your idea.

SUCCESS AND HARD WORK

Your success is certain. It is merely dependent upon how hard you are willing to work for it and how earnestly you enter into the accomplishment of your ambition.

The World War did some strange things with the minds of men. Some men, from the bigness and vastness of it all, lost all belief in the possibility of individual effort accomplishing anything worth while or receiving any deserved reward. Having been one small part of a gigantic machine (in which individuality really was entirely destroyed) they returned to civilian pursuits and found it impossible to remold themselves so as to fit into the civilian world where different conditions obtained.

Then there were others who entered the service with patriotic ambitions and a desire to have an active combatant part in the actual crushing of the enemy. For some reason, however (usually because of qualifications which made them more valuable on this side of the water or at least away from the battle zones) they were withheld from participation in the real fighting, and were kept throughout the period of the war at some dull and uninteresting task which seemed to them quite unimportant and unnecessary.

Such men, in most cases, returned to civilian life thoroughly disgusted with thier experience and with the emotions which had prompted them to enlist in the service of the flag. It will take some of them a long while to realize that they had just as real and just as praiseworthy a part in bringing about the final victory as though they had gone into battle and done their bit with rifle and bayonet.

But there were also countless men who enlisted in the service of their country with the same determination to advance that had characterized them before. The bigness of that thing of which they were a part only served to awaken in them a restlessness which, on return to civilian life, developed into a real dissatisfaction over conditions with which they had formerly been content. Those young men were not willing to back into the same old channels.

They were not to be satisfied with the same old job under the same old conditions and terms. They had a new conception of the relative importance of the world's goods; and they resolved to extend that red-blooded spirit which had carried them along to victory and let it permeate into their business activities and help them win new battles and gain new objectives in a different sort of struggle.

It was such emotions that brought me back from the biggest army in the world and put me into the smallest shop in the world.

My definite intention to organize a small shop was formed while I was still in the service. Previous to entering the army I had spent my entire working life of five years at a single plant. I had started in with this company as a draftsman at fifteen cents an hour. That work gave me a good detailed knowledge of its products from the mechanical standpoint.

Later on, in order that I might have actual practical experience to tie up with my drafting work, I donned overalls, bought a tin dinner-pail and went into the factory, working at various times in the machine shop, the pattern department, the assembly floor, the electroplating shop, the foundry—in fact there was not a single department of that plant in which I was not given an opportunity to "learn the ropes."

All this time I was being given a thorough training in various departments of a modern manufacturing plant, in the various phases of business practise. I was learning the problems of business from every angle.

Later on it was my enjoyable privilege to represent this company on the road from Seattle to New York and from Duluth to San Antonio, getting the outside viewpoint which one can never receive inside the plant. This work gave me a combination of opinions which enabled me to look more broad-mindedly at the problems of our sales and production departments. It is the actual, personal contact with a firm's distributors which permits one to grasp the true marketing policies that can be most effective.

At still later times the positions of assistant sales manager and lastly advertising manager were given me to fill, rounding out in that last capacity a business education covering a period of five years which one could not obtain in five times five years in our most highly specialized business universities.

I do not mean to discount the value of a business education. I received a university training, and use portions of that training in my daily experiences. But one can never get in his schooling that practical element, that responsibility of dollars and cents, which he must recognize when he enters business, whether for himself or in the employ of others. The best training for a business career is in the business world itself.

Positions such as I held and education such as I received really permit a man to say to himself with confidence, "I know my business thoroughly." And unless you can say that to yourself about the field in which you are about to enter it is not yet time for you to trust your future and your capital to the dangers of mismanagement through lack of knowledge.

While I was in the service I was approached by a gentleman who had taken out several patents pertaining to the kind of machinery with which I was familiar.

He was a practical inventor; not the "bug-house" variety, but a technical man capable of originating ideas and with the knowledge of factory methods to manage the developing of those ideas in their practical form.

THE THREE ELEMENTS OF A MANUFACTURING BUSINESS

His machines possessed unquestionable merit, so that I had in them the first requisite for a manufacturing business—a product. I had had personal contact with jobbers in thirty states through whom such equipment could be sold, and there was the second necessary element—the market.

But neither of us had the third very essential requirement—the capital; so that our main problem was a financial one. It is one thing to create a marketable idea, but it is quite another thing to interest some outside influences to the extent of obtaining sufficient capital to organize a going manufacturing business that can produce your products at a profit.

Fortunately, however, we were able to raise five thousand dollars with which we rented a small building, purchased equipment, made patterns and jigs and announced to the trade the presence of a "world-beater."

In placing a new article on the market one has two main problems—one is production and the other is marketing.

The first can be solved to a large extent with pencil and paper by men with sufficient technical knowledge. A man who has successfully managed a large wartime ordnance plant can study a small, simple machine such as our first one was and predetermine what its approximate cost will be and what equipment will be needed to build it. So it is not always very difficult to answer the question, "Can we build it?"

The writer will always believe that the more important question of the two is, "Can we sell it?" The first question is answered by ourselves but the second is largely dependent on the public, or on that portion of the public which may constitute possible prospects for your goods.

And you can never say with certainty what someone else will do. You will pardon me, I am sure, for reviving a past feud so often but I do like to draw illustrations from our late friend, the former Kaiser. Poor Bill couldn't say with certainty what the Doughboys would do if they landed in France. And because he couldn't prevent them from landing in France in tremendous numbers and because he couldn't control their activities after they landed in the way he wanted to, a disastrous monkey wrench was thrown into the transmission of his war machine, making it a mighty unprofitable and unhealthy business venture to be connected with.

RESPONSIBILITY FOR FAILURE

Many a small business has been founded on reasonable possibilities and been backed by all necessary enthusiasm, effort and capital, and yet it has gone down to failure because its owners did not consider "the other fellow," and analyze the probable actions which he might follow.

Many a plant has been built and equipped for the manufacture of a certain product only to remain idle because the goods could not be marketed. That is the most disheartening kind of failure. One is tempted to place the blame for such a failure on the buying market, and yet that is not the correct disposition of responsibility for lack of success at all.

The blame, the sole blame, rests on the man or men who did not investigate the market for their goods and acquaint themselves with its probabilities and its limitations before concerning themselves about the details of the design and construction of their product.

We started actual production of but a single machine, a simple product that retailed at only twelve dollars. We knew before we ever established that price that we could produce it in quantities to sell profitably at that figure.

But this was our sales problem. There were about a dozen of these machines in our own city that had been in use for one or two years. Outside of our own "home town," however, our product was not known and the name of our company never heard of. The company with whom I had been previously connected had three machines on the market accomplishing the same purpose. There were thousands of these machines giving satisfactory service in shops in every section of the country; in fact, in every country bordering on the seven seas. Two other companies in the country also made machines similar in purpose, and all these other machines were backed by successful performance over a period of years and by large corporate organizations.

In addition to those conditions the design of our machine made it necessary that we sacrifice part of our profit (that is, the profit we had figured there would be that first year) or place our list prices actually higher than those of any of these other companies with whose products the trade was well acquainted.

We chose the latter. We established our higher price, and offered our machine to the market on the basis that it was better in quality, design, construction and ease of operation.

Our locally situated competitor had about five hundred jobbing accounts throughout the country which he had obtained through twelve years of effort. In less than one year we had one hundred and twenty-five of those concerns handling our equipment which had by that time developed from a single machine into a comprehensive line of seven machines!

Those jobbers were scattered in the four corners of the country; in fact, at the end of that first year we had one account in Canada and two in England. And this with unheard-of, higher priced machines in a market already occupied by firms with an established reputation for producing quality products.

Our first piece of advertising matter did not go into the mails until three months after we had organized; our first machine was not shipped from our shop until three months after we had opened our doors and begun operation. And yet, in the remaining nine months of that year we established ourselves on a profitable production basis and showed one-fourth as many accounts as our other local company had built up in twelve years. There, I believe, was an accomplishment of which any small shop owner could well be proud. And remember that it was done on quality and not on price.

It does not take many words to tell of the accomplishment of that first year. But the success was earned by hard, hard work and only after discouragements which brought us more than once face to face with the question as to whether or not it was worth while to stay in the fight any longer.

There comes a time in every business when it is much easier to quit than to keep on. Such a time came to us exactly on Christmas Day (of which more later on), on what God had intended to be a merry Christmas. But we chose to keep on though it was the harder course to take, and out of it all came a success that was well worth the struggle.

The work of that organization is by no means completed. The shop is now much larger, and today's successes bigger in many ways than those of the earlier history. The writer is not now actively engaged with his original "small shop" although he is still in very close personal touch with its problems and its policies. He has since seen fit to devote his time to other larger organizations, but he shall always believe that his biggest individual accomplishment was the organization and management of a small shop.

That was the experience which made me see the need of a help for other men who might be steering themselves into a similar channel. The store of technical literature is conspicuously lacking in practical assistance for "the little fellow." Books on factory management and sales management do not present those problems in such a way that the information can really be used by a man just establishing a small manufacturing business. More often than not they leave one so "snowed under" with a mass of systems so clearly too elaborate for his needs that the most likely result is a thorough misunderstanding of the true value of "sensible system."

The writer plans to present a reasonable mixture of theory and practice. However, everything that is offered you is the fruit of actual, personal experience. It is not guesswork. The methods explained and the suggestions offered have all stood the test of practical performance in a small shop. They are written from the viewpoint of the small shop owner with a hope that they may provide information which will help guide small manufacturing concerns safely through the first days and early struggles to the final successes which are always waiting as a reward for effort.

The Selection of Apprentices—Discussion

By F. P. Adelbert

Under the above title on page 455, Vol. 54, A. W. Forbes writes his views on an ideal apprentice system. It is not very surprising that "he has not had the nerve to try them in his own shop" though it appears extremely doubtful if his plan would attract a great many prospective mechanics, for he does not seem to make much allowance for the boys' point of view.

He would have the boy consider the apprenticeship as attractive as a college education and expects to divert the boys from college to the shops.

Now, a boy who goes to college, or at least the one who would be a prospective mechanic, does so with certain ideals in mind. He or his parents expect, for the sacrifice of time and money, to derive definite results such as a broad foundation for future great advances, and incidentally to gain a very definite distinction as a graduate of a certain school. Can Mr. Forbes honestly say that his shop or any other that he has in mind would give an equal foundation for advance or equal distinctions to a graduate of their apprentice course? Until it does so, not in theory but in actual practice, it is idle to expect the boy and his parents to make equal sacrifice, if both ways are open to him.

Neither can the shop offer the attractive atmosphere of the college. One has only to picture a comparison of the college boy as presented in "movies," literature and advertising to see that the average prospective college student or one of equal mentality is not going to be diverted to a suit of overalls and eight hours a day in a shop environment.

At the apprentice age the boy's parents must think for him, and their thinking is largely influenced by their judgment of the shops they work in and the men at their head. If good apprentices cannot be had it is because their fathers who work in our factories have formed the conclusion that the returns are not worth the demands. We can only change this by offering greater inducements to the immediate generation of apprentices. If the next generation of fathers are caught young enough and properly educated, Mr. Forbes' plan might work out.

Transmission Formulas for Balata and Fabric Belts

By W. F. Schaphorst

The writer has developed the following formula for Balata belts. It is based on a well-known table as published by a prominent belt manufacturer:

$$W = \frac{H}{0.000158\, ND\, (P-1)}$$

where W = width of belt in inches;
H = horsepower to be transmitted;
N = number of revolutions per minute;
D = diameter of pulley in inches;
P = number of plies.

This formula is usable for Balata belts of 3, 4, 5, 6, 7, 8, 9 or 10 ply.

The rules as ordinarily given for fabric belts made up in plies are something like this: "A 4-ply stitched canvas belt is equivalent to a single leather belt; 8-ply is equivalent to a double leather belt," and so forth. After knowing the equivalent we have to hunt up our rules of thumb for leather belts before being able to decide on a width necessary for a given drive.

The writer has hashed over these rules and equivalents and has hit upon a formula that gives a direct answer without mentioning leather at all. The formula herewith applies to most ordinary belts made up in plies such as rubber and stitched canvas.

$$\frac{WS}{\frac{2640}{P} + 136} = H$$

where W = width of belt in inches;
S = speed of belt in feet per minute;
P = number of plies;
H = horsepower.

For example, what horsepower may be transmitted by a 10-ply canvas belt, whose width is 6 in. and whose speed is 4,000 ft. per minute?

Substituting in the formula, we get $H = 60$.

Changed into its other forms for the determination of W, S or P, we have:

$$W = \frac{H}{S}\left(\frac{2640}{P} + 136\right);$$

$$S = \frac{H}{W}\left(\frac{2640}{P} + 136\right);$$

and

$$P = \frac{2640}{\frac{WS}{H} - 136}.$$

Some Unusual Features of the Rolls-Royce Car

Power Transmitted Through Large Ball Joint—Bracing Used at Rear End of Chassis—Axle and Torque Tubes Made of Steel Forgings

BY FRED H. COLVIN
Editor, *American Machinist*

SOME details of the design of the Rolls-Royce car are rather unusual in automobile practice and involve different construction which in turn requires special machining methods. Fig. 1 shows the rear end of a Rolls-Royce chassis in which the cross tube can be seen at *A*. The two brackets *B* and *C* support the trunnions of the internal control sphere which is shown in various stages of completion in Fig. 2. Surrounding this is the external control sphere *D*, Fig. 1. With the inner control sphere held firmly in place the outer control sphere, which is of bronze, forms the floating connection with the rear axle through the torque tubes *E* and *F*. The torque tubes, the differential housing *G* and the rear axle tubes *H* and *I* are all of forged steel and with the exception of the differential housings are machined all over, so as to insure uniform thickness and lightness of weight with adequate strength.

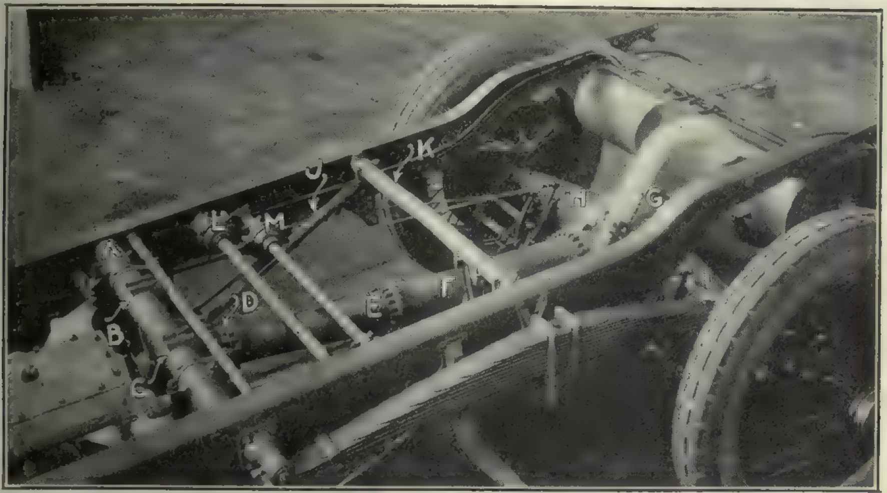


FIG. 1. CONSTRUCTION OF THE REAR END OF THE CHASSIS

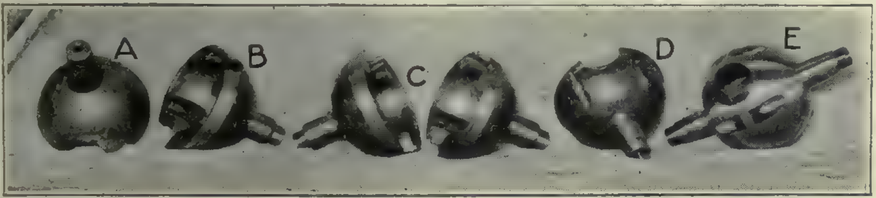


FIG. 2. THE INTERNAL CONTROL SPHERE IN DIFFERENT STAGES

This view also shows the bracing at the rear end of the chassis such as at *J* and the crossbrace *K*. Cases *L* and *M* contain small geared differentials on the brake shaft so as to equalize the pressure exerted on the brake drum. Wire cable is used instead of brake rods so as to avoid any tendency to rattle. Another noticeable feature is the use of square-headed bolts, although hexagon nuts are most universally used.

In Fig. 2 is shown the internal sphere in several of its stages. It is a drop forging which is heat-treated so as to show from 170 to 228 by Brinell test, after which it is sandblasted. The first operation is to drill the hole in the stem, as at *A*, and next to rough-turn the flange and stem, as at *B*. The flange, stem and the step are then rough turned and the edge recessed and bored as shown at *C*. Then the four bolt holes are drilled, after which the recess for the bolt head is cut on a milling machine as can be seen at *D*. Then the bore and stem are finished after which the threads are milled on the end as shown at *E*. Turning the sphere is shown in Fig. 3, where the special attachment mounted on the lathe carriage may be seen. Fig. 3 also shows the large micrometer, set for measuring the diameter of the sphere, and some of the other gages used. This operation is followed by grinding the outside of the sphere in the fixture shown in Fig. 4.

The external control sphere is a bronze casting which is machined in the usual way, the final grinding of the internal spherical surface being shown in Fig. 5. The grinding is done on a Heald cylinder grinder after all the other machining operations have been finished. The bolts by which this sphere is fastened to the front torque tubes are recessed in the body and the space over the heads filled with white metal as can be seen at *A*. The white metal filling is machined at the same time the internal surface of the sphere is bored and is also ground with the bronze. The white metal filling effectually prevents the bolts from loosening and also adds to the bearing surface of the sphere.

The rear-axle housing consists of a differential case in halves having a tapered tube on each end to carry the brake rigging as well as the axle bearing. Since the

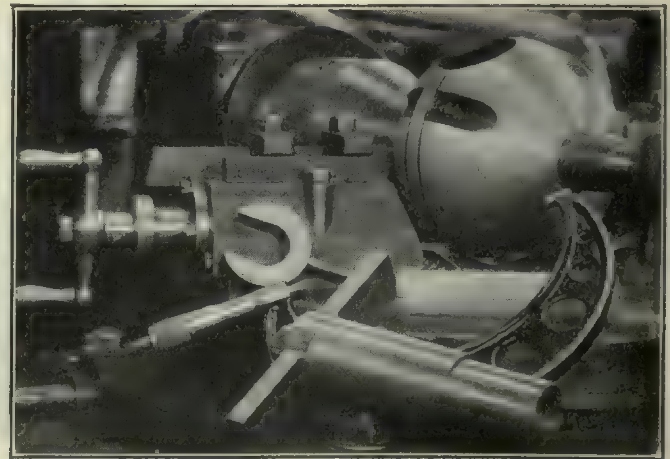


FIG. 3. TURNING OUTSIDE OF CONTROL SPHERE

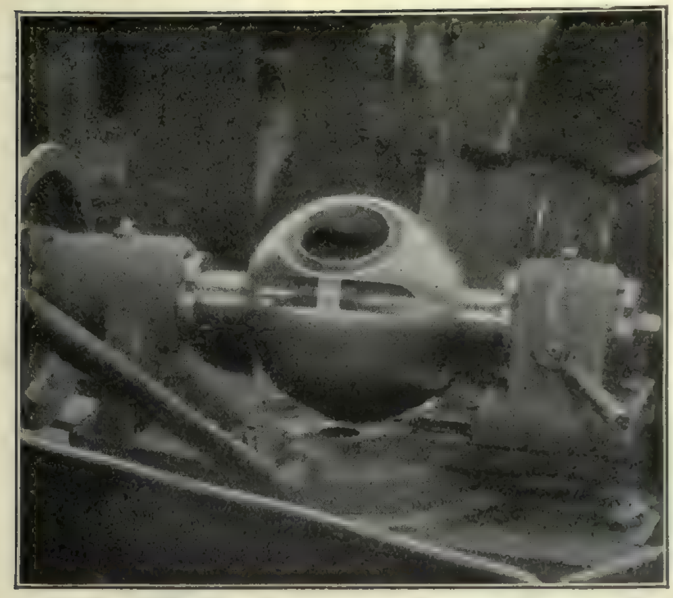


FIG. 4. GRINDING THE INTERNAL CONTROL SPHERE

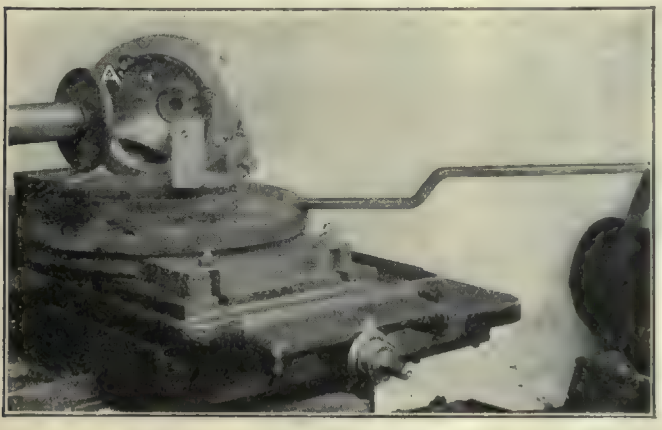


FIG. 5. GRINDING THE EXTERNAL CONTROL SPHERE

housing parts are all forgings, no castings or sheet-metal work enter into the construction of these essential parts of the car. Each torque tube is tapered and has a flange on each end for bolting it to its adjoining member.

These torque tube forgings are rough-turned and bored by the forge shop so that the first operation in the Rolls-Royce plant is to heat-treat them so they will test from 255 to 277 Brinell. They are then sandblasted and the test pieces examined for strength and quality, after which the flanges are turned and faced and the parallel portions of the outside turned.

The axle tubes are finish turned in the Lo-swing lathe as shown in Fig. 6. The tube is driven by the large end flange *A* by means of the bolts shown, the small end being supported by a suitable center. Multiple tooling is used, the taper turning being controlled by the former *B*. The former is fixed to the lathe and remains stationary while the tools travel along the incline guided by rollers as at *C*, which are kept in contact by suitable springs. This method gives the desired form to the tube and makes an economical and uniform method of machining the outside.

BORING THE TAPER

The inside of the axle tube is finished with a special boring bar similar to the one shown in Fig. 7. This particular bar is for the front portion of the torque tube, but the method of use is similar in both cases. After the flanges of the rear torque tube are turned and faced, three locating holes are next drilled in the small flange for handling the tube in the turning and boring operations. Boring the taper is shown in Fig. 7. Here the tube is centered by a chucking flange *A* and held in position by the three clamps shown. The bearing ring *B* runs in the jaws of the steady-rest and supports the outer end of the tube. Suitable pins in the driving plate *A* prevent the tube from slipping under the cut.

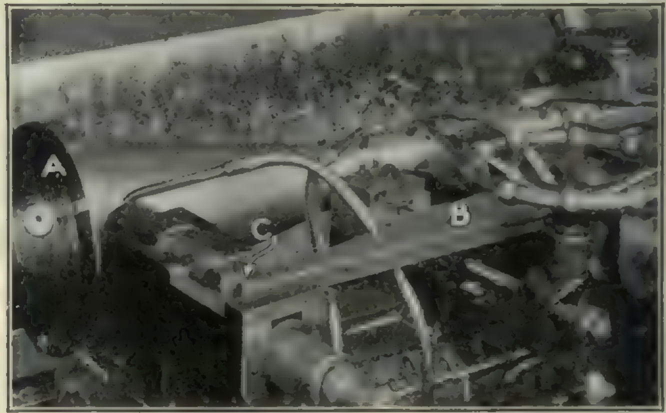


FIG. 6. TURNING A REAR-AXLE TUBE

The boring is done by a small toolblock mounted in the under side of the large tapered bar *C* and fed by suitable gearing from the lathe carriage mechanism on which the boring fixture is mounted. Motion is secured from the crossfeed, through suitable gearing to the shaft *D* which in turn drives the screw controlling the tool carrying block in the bar *C*. In operation the bar is run inside the tube to be bored a sufficient distance to give the desired amount of cut and the feed started. For increasing the depth of cut it is only necessary to move the carriage forward and lock it in a new position for the succeeding cuts.

It will be understood that the increase in the depth of the cut will be equal to the tangent of the taper angle of the boring bar multiplied by the longitudinal movement of the carriage.

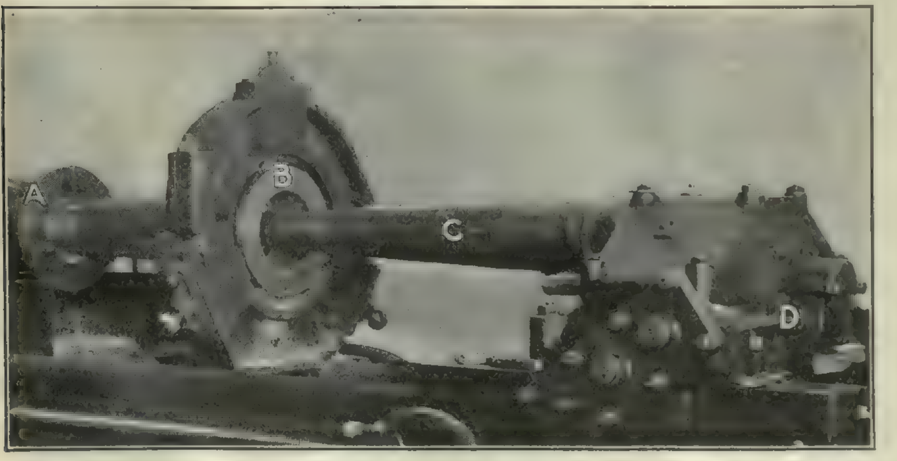


FIG. 7. BORING A TORQUE TUBE

Miscellaneous Railroad Shop Tools and Methods

An Excellent Method for Guiding Taps and Reamers—An Inexpensive High Speed Steel Reamer—Fixture for Plumbing Crankpins—Repairing a Cylinder

BY FRANK A. STANLEY

AN INTERESTING set of taps and appliances used in connection with radial stay operations are illustrated by the line drawings herewith. Fig. shows the taper reamer for crown sheets; the taper ap for crown sheets is represented by Fig. 2. The taper tap in Fig. 3 is for the outside wrapper sheet. A stop gage for crown sheet reamer and tap is illustrated in Fig. 4. A handy split nut for quick action on tap extension guides is shown in Fig. 5; and a set of extension guides themselves are seen in Fig. 6.

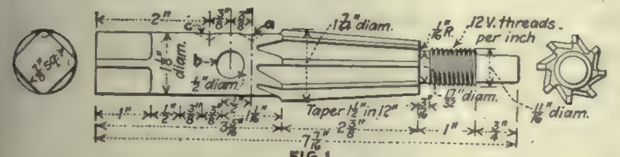


FIG. 1

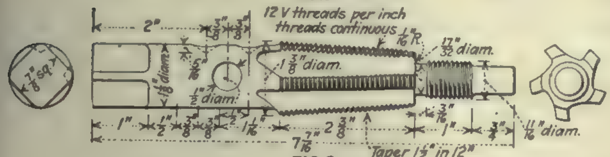
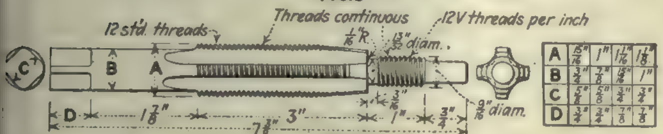


FIG. 2



A	15/16"	1"	1 1/16"	1 1/8"
B	3/4"	7/8"	15/16"	1"
C	5/8"	5/8"	3/4"	3/4"
D	3/4"	3/4"	7/8"	7/8"

FIG. 3

FIG. 1. TAPER REAMER FOR CROWN SHEET. FIG. 2. TAPER TAP FOR CROWN SHEET. FIG. 3. TAPER TAP FOR OUTSIDE WRAPPER SHEET

The method of applying these tools in reaming and tapping is illustrated in Fig. 7.

Referring first to the crown sheet reamer Fig. 1: This tool will be seen to be provided with a pilot and threaded portion at the leading end and the shank is shown with three setscrew seats for three definite positions for the stop collar shown in Fig. 4. The three position holes are marked *a*, *b* and *c*, in Fig. 1, and there are three numbered positions stamped on the shank showing as 1, 2 and 3, the difference in stop gage position from one hole to the next being ⅜ in.

If a new hole is being reamed out for tapping, the stop gage is placed in position No. 1, and when later on the work is repaired and re-reamed, instead of reaming out to an indefinite point, the stop gage is placed in position No. 2 and again the hole is reamed to an exact known diameter. When the hole is eventually reamed out for the third time, the stop gage is placed in position No. 3 for the final or largest hole that will be permitted in the work.

Thus the hole is reamed three times before it reaches its maximum allowable size. The position of the reamer in the sheet is shown at 1 in Fig. 7. The stop gage is shown in its first position and the pilot end of the reamer is shown entered into place in the extension guide *A*. There are three guides in the set, designated at *A*, *B* and *C* (see Fig. 6). The end of the reamer screws into the hole in the end of the extension, forming a solid firm joint, and as the body of the extension fits through the hole in the outer sheet, the alignment of the reamed hole with the crown sheet hole is thus assured.

Now consider the taper tapping operation following the reaming process: The tap is also provided with three positive positions for the stop gage and the application of the gage to the first position on the tap is seen clearly at 2 in Fig. 7. The use of the extension guide *A* is here again seen, tap and guide extension being coupled in the same manner as the reamer and guide.

BUSHING AN ENLARGED HOLE

It will be noticed that the extension is shown passing through a bushing in the outer sheet. This is included to show the method of bushing down an enlarged

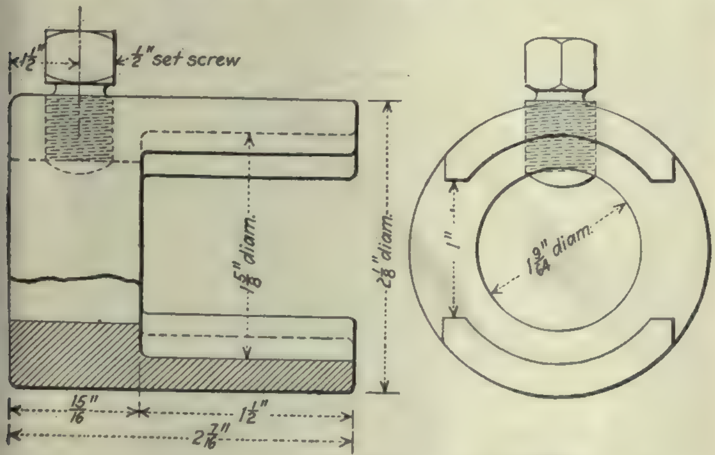


FIG. 4

FIG. 4. STOP GAGE FOR REAMER TAP.

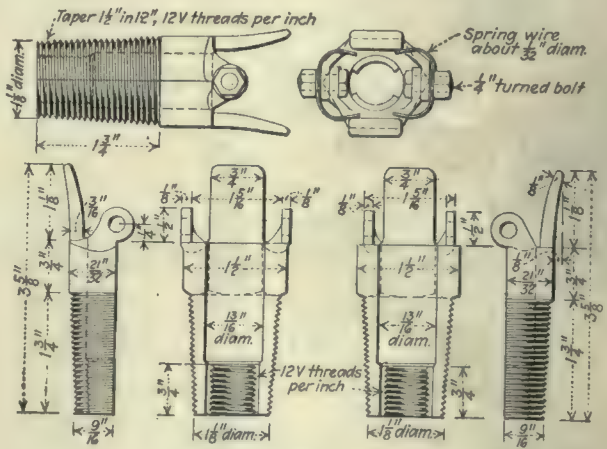
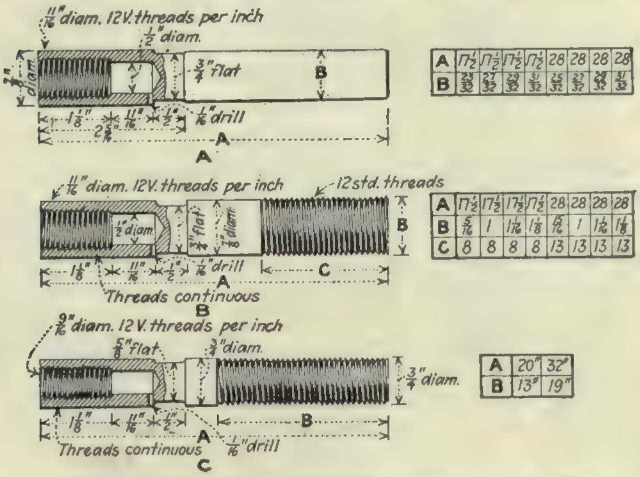


FIG. 5

FIG. 5. SPLIT NUT FOR TAP EXTENSION GUIDE

hole. The largest stay used is 1⅛ in. and the largest bushing permissible is 1⅛ in. In bushing a hole as in No. 2, Fig. 7, the bushing is made of the same taper as the tap and screwed in to stay. Then the reamer guide can be used through the bushing as though it were the original hole, and the bushing tapped the same way. In tapping the wrapper or outside sheet, the tap used has a Whitworth thread as noted in Fig. 3, and if a hole in the sheet is bushed as referred to above, the bushing is also threaded Whitworth standard. This form of thread gives a greater area and stronger section between adjacent holes in the sheet than is possible with other forms of thread.



A	17½	17½	17½	17½	28	28	28	28
B	25/32	27/32	29/32	31/32	25/32	27/32	29/32	31/32

A	17½	17½	17½	17½	28	28	28	28
B	15/16	1	1 1/16	1⅛	15/16	1	1 1/16	1⅛
C	8	8	8	8	13	13	13	13

A	20"	32"
B	13"	19"

FIG. 6. TAP AND REAMER EXTENSION GUIDES

The threads on the tap and on the pilot for connecting with the extension guide are continuous. Thus, when either tap is used as in positions Nos. 3 or 4, Fig. 7, with a threaded extension guide, as guide *C* or *B*, perfect continuity of threads is assured between the tapped holes in the two sheets.

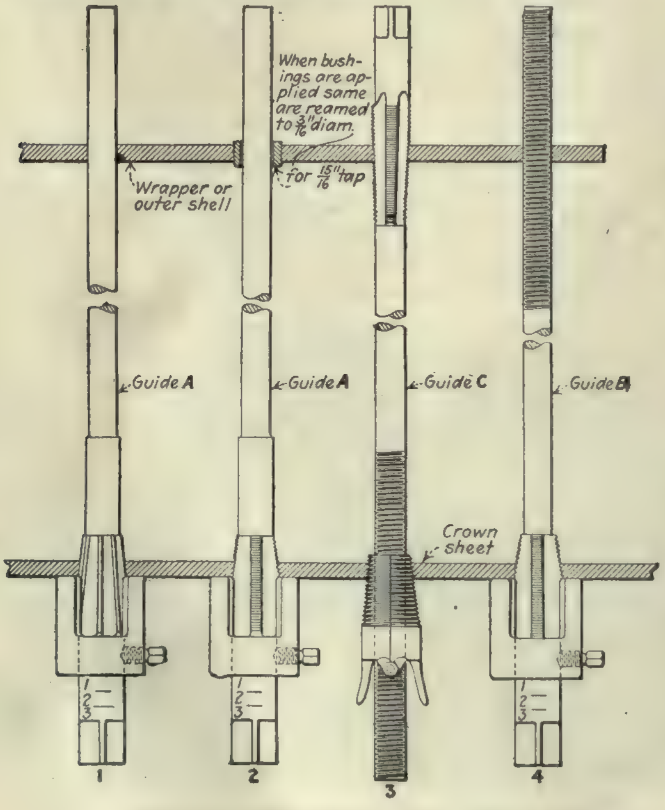
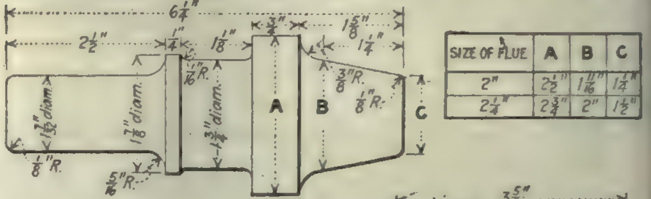


FIG. 7. METHOD OF REAMING AND TAPPING HOLES

Application No. 3 in Fig. 7 shows the method of tapping the outer shell after the crown sheet has been tapped, in which the split nut for the tap extension guide is used. To secure continuity of threads between the hole to be tapped and the hole already tapped the following method is applied:

The split nut, Fig. 5, is made with outside and inside threads even. The two parts of the nut are pivoted on two short studs and normally held closed by means of two torsion springs. In applying the nut as in Fig. 7 (see No. 3 position), the nut is opened by the pressure of the fingers on the projecting ears behind the pivot and slipped on over the tap extension guide *C*, which has been passed through the holes in the crown and outer sheets. After reaching the tapped hole in the crown sheet the nut is allowed to close on the thread on the extension guide and is then screwed into the tapped hole as seen at No. 3, Fig. 7.



SIZE OF FLUE	A	B	C
2"	2½"	1 11/16"	1¼"
2¼"	2¾"	2"	1½"

FIG.8

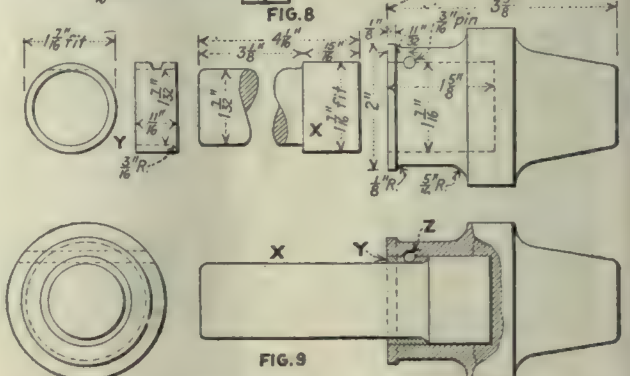


FIG.9

FIG. 8. SOLID BELLING TOOL. FIG. 9. ASSEMBLED BELLING TOOL

The tap for the outer shell is then screwed into the other end of the extension guide and this brings its threads into correct relation to the threaded guide end in the nut in the crown sheet. The hole in the outer sheet is now tapped out, the threaded guide extension *C* serving as a lead screw to help pull the tap into the work and at the same time assure continuous threads between the two sheets.

TAPPING THE CROWN SHEET

If the hole in the outer shell has been tapped first and a hole is to be tapped in the crown sheet, the method of application is as represented at No. 4, Fig. 7. For this process extension guide *B* is used. The taper tap for the crown sheet is screwed into the extension guide and the stop gage applied to the tap as at No. 4. The threaded end of the extension guide *B* is already run into the tapped hole in the outer sheet, and serves as a lead screw so that the thread in the crown sheet hole will be continuous with the thread in the outer sheet hole.

BELLING TOOLS FOR FLUES

The drawings, Figs. 8 and 9, show two forms of belling tools used for bell-mouthing flue ends before beading. The original construction of the tool is represented by Fig. 8. This is a solid one-piece affair made of tool steel. After this tool has been used for a time it may break in the shank at a point just behind the head, and the method then is to fit up the old head with a new shank according to the drawing in Fig. 9. This head is bored out to receive the enlarged end of a new shank *X*, which is held in place by a soft steel bushing *Y* which is pushed in behind the shoulder on the shank. The bushing is further secured by a small crosspin *Z* in a hole drilled half in the bushing and half in the belling head.

Complete dimensions are given on the detail drawings for both the solid belling tool and the built up construction which constitutes the replacement form.

INSERTED BLADE REAMERS

Two inexpensive reamers with inserted blades of high-speed steel are illustrated in the halftone, Fig. 10. These reamers are made in various sizes but on the same principle of construction, namely, with bodies of machine steel milled with slots of suitable width to receive standard thickness of high-speed steel stock. The high-speed steel bars are ground on the sides just enough to clean up, cut into lengths for the reamer blades, and these blades are then driven into the slots in the reamer body. Then the reamer is ground to size and the blades relieved as desired.

A shallow half-round groove is milled at the front of every slot before driving the blades in, allowing chip space and at the same time allowing the reamer blades to be set in deeply where they will be properly backed up.

VALVE SETTING FRAME

One form of frame for setting valves is shown in Fig. 11. This device is applied particularly to Walschaert's valve gear, but similar constructions are used for other forms of gearing.

The frame consists of a telescopic arrangement made up of light but stiff bars of metal which may be extended or contracted for adjustment as required. The outer ends of the members are provided with bearing bushings and plugs to allow the device to be hung up on crankpin and valve gear connection, thus taking the place of the actual gear itself. So, if an engine on the floor has the side motion and gearing stripped down but is otherwise ready for valve setting, this dummy device can be applied and the work of setting valves carried along without waiting for the gear to be put in place.

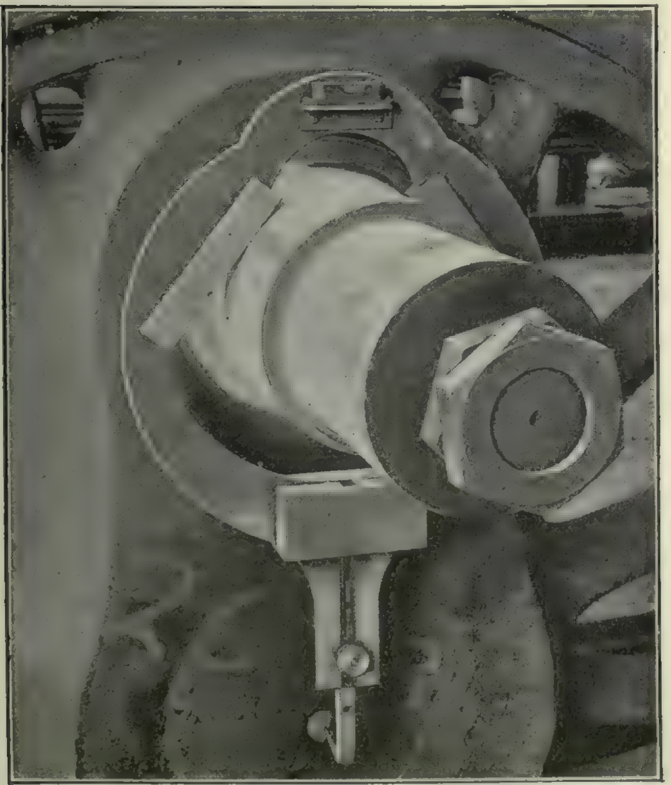


FIG. 12. FIXTURE FOR PLUMBING CRANKPINS

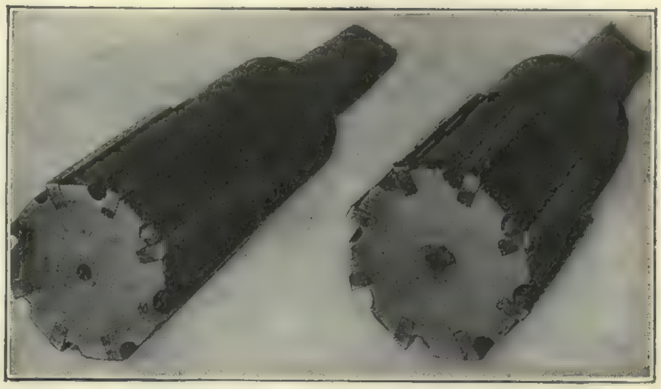


FIG. 10. ROSE BIT REAMERS WITH H. S. STEEL BLADES

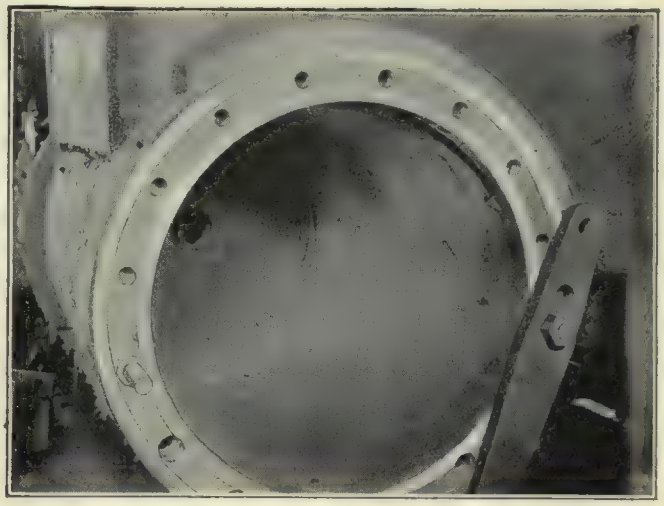


FIG. 13. CYLINDER REPAIRED BY OXYACETYLENE WELDING

FIXTURE FOR PLUMBING CRANKPINS

An interesting tool which is used in connection with eccentric keyway work in axles is shown in Fig. 12. This is a fixture for plumbing crankpins and is used for obtaining the positions of eccentric keyways before the driving wheels are placed under the engine.

The device can be used in connection with any size of driver and crankpin. It consists of a frame with an arm at the bottom into which is fitted a sliding pointer which may be adjusted along the center line according to the different distances from crankpin to wheel center. The frame carries two steel straight-edges or jaws which are accurately fixed at right angles to each other. On the center line bisecting the angle formed between the two steel straight-edges a small spirit level is attached.

In use, the driving wheel is rolled over until the crankpin is approximately in line vertically over the wheel center, then the plumbing device is applied as

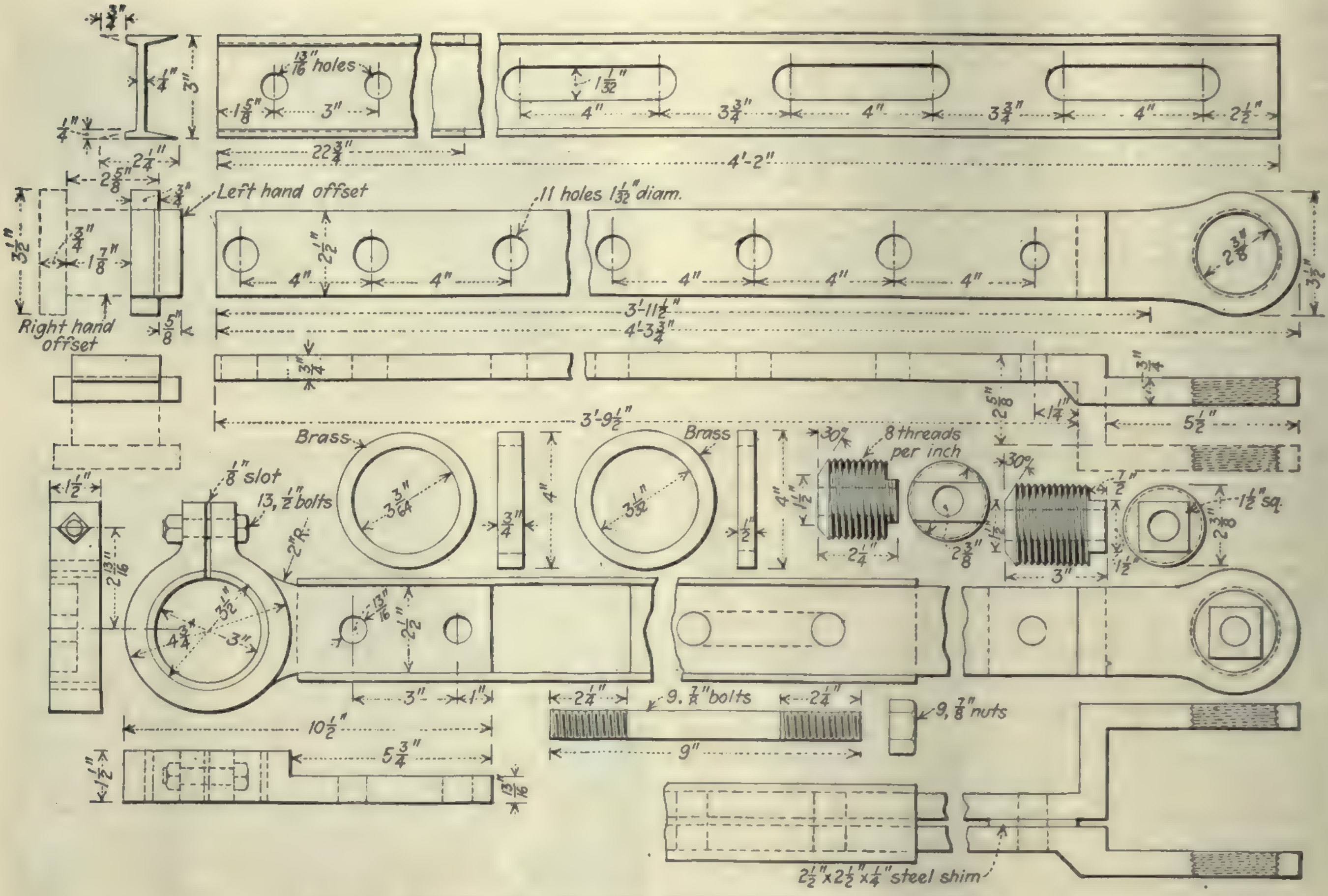


FIG. 11. FRAME FOR SETTING WALSCHAERT VALVE GEAR

shown. The lower pointer in the groove in the arm is slid endwise until it enters the center punch in the wheel center and is then clamped by the small knurled screw. The wheels are then rolled slightly either way until the bulb in the spirit level shows that the pin is plumb over the wheel center. Then a center device and level are applied at the inside on the axle and with the addition of a templet for giving allowance for advance, etc., the keyways are quickly and accurately laid off for cutting for the eccentrics.

COMPOSITION OF BEARING METALS AND SOLDERS—LOCAL USE—S. P. CO.—PACIFIC SYSTEM

Item	Use	Component Metals	Desired Composition, per Cent	Shop Limits in Composition, per Cent
			Hard Babbitt	
1	Crossheads and eccentric straps	Lead	62.4	60.0 to 64.0
		Tin	21.4	20.0 to 22.0
		Antimony	15.6	13.0 to 17.0
		Copper	0.6	0.5 to 1.0
			Lining Metal	
3	All locomotive work, other than Item 1, including driver, engine truck, and trailer bearings. Packing rings for saturated steam. Relining all car and tender bearings	Lead	85.0	83.0 to 87.0
		Antimony	10.0	8.0 to 12.0
		Tin	5.0	4.0 to 6.0
4	Metallic packing rings for superheated steam	Lead	50.0	48.0 to 52.0
		Copper	50.0	48.0 to 52.0
			Armature Babbitt	
5	On steamers	Tin	85.58	84.0 to 86.0
		Antimony	8.64	8.0 to 10.0
		Copper	5.78	5.0 to 7.0
			Solder No. 1	
6	Locomotive, machine and tin shop work, etc	Lead	50.0	48.0 to 52.0
		Tin	50.0	48.0 to 52.0
			Solder No. 3	
7	Wiping joints and plumber's work	Lead	60.0	58.0 to 62.0
		Tin	40.0	38.0 to 42.0

The locomotive cylinder shown in Fig. 13 was broken at a point inside the flange, the casting being broken out for a width of several inches and the break extending between a third and a half way round the bore. The repair was successfully made by the oxyacetylene process and the cylinder rebored and returned to service with a net saving of at least $750 over the cost of a new cylinder.

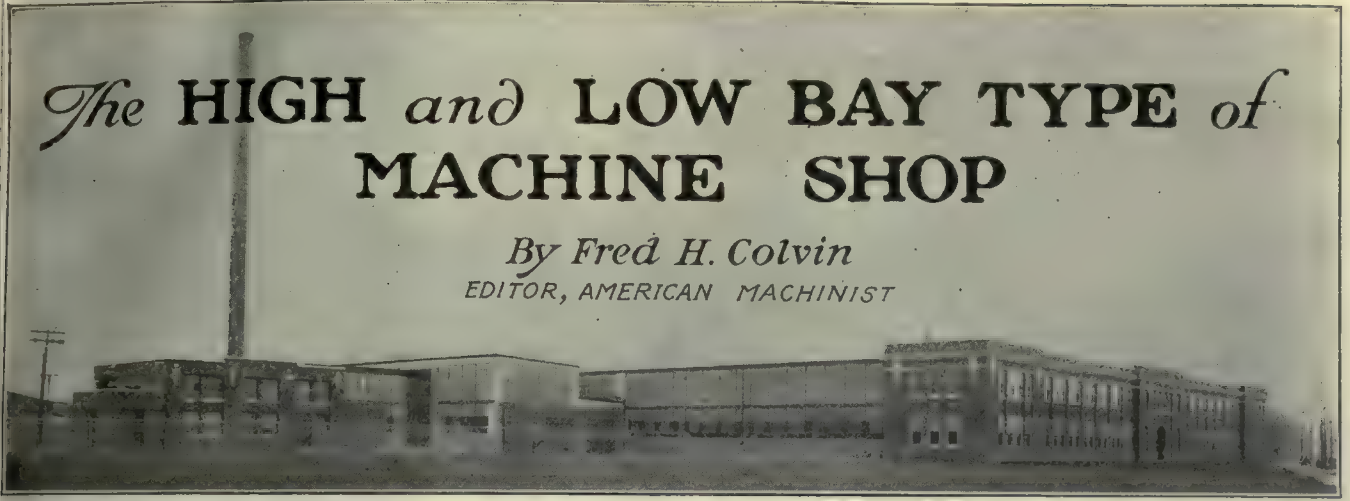
The bolt and strap used to pull the flange up into position and hold it during the welding are shown at the front of the photograph. It is customary in such work to use bolts or rods and clamps wherever required to restore the work to its original place, and if it is to be preheated, as is generally the case, a brick furnace is built up around the job and the heat kept up until several hours after the completion of the welding, to prevent cracking in the weld.

The table gives the formulas used by the Southern Pacific Co. for bearing metal compositions for crossheads, eccentric straps, bearings, packing rings and so on.

The tools and methods illustrated in this article are all from the Sacramento shops of the company.

The HIGH *and* LOW BAY TYPE *of* MACHINE SHOP

By Fred H. Colvin
EDITOR, AMERICAN MACHINIST



Wide, High Bays, with Low Bays Between, Give Light from Both Sides—Standard Columns and Shapes Make Rearrangement Easy at Any Time—Excellent Artificial Lighting

BY F. H. COLVIN
Editor, *American Machinist*

THE building of a shop is perhaps the most important step in any manufacturing business. On its location and arrangement depend many factors affecting the cost of production. And once built it becomes an investment which can seldom be shifted without considerable financial loss. For these reasons it is of the utmost importance to consider carefully the location with regard to receiving and shipping material, the accessibility to a desirable supply of labor and the probable growth of the community.

Next comes the type of building to be erected, and here, of course, the decision must depend largely on both the location of the ground and the nature of the product. The details will, however, be modified by the grade of the property, the proximity and location of connecting railroad spurs and the ideas of the owner or engineer. For the architect, in the old sense, has no place in modern shop building, unless to make it a bit more ornamental than has been done in the past. But he should not be allowed to interfere with the engineering details or to restrict window lighting because of some fancied architectural effect in the style of a bygone period. The storage warehouse effect can be avoided without sacrificing light and other desirable features.

Perhaps the most important decision is whether to use a single-story or a multi-story building. This decision is affected at times by the location of the land, both as to its restricted area and its price. Both types have their advocates and the kind of machines built make less difference as to choice than might be supposed. For we find heavy machinery built in multi-story shops as well as in shops with a single floor, and modern construction of either steel or concrete makes possible the use of heavy machinery above the ground floor.

Taking the single-story shop first, we shall show several types. These will be different and yet all have points to be considered. The first is that of the Foote-Burt Co., of Cleveland, Ohio.

In deciding on the type of construction for the new shop building, the Foote-Burt Co. was influenced by the experience of the president, George E. Randles, in connection with his activities in the building of motor-vehicle shops for the Army during the war. The shop portion of the building consists of six bays, three

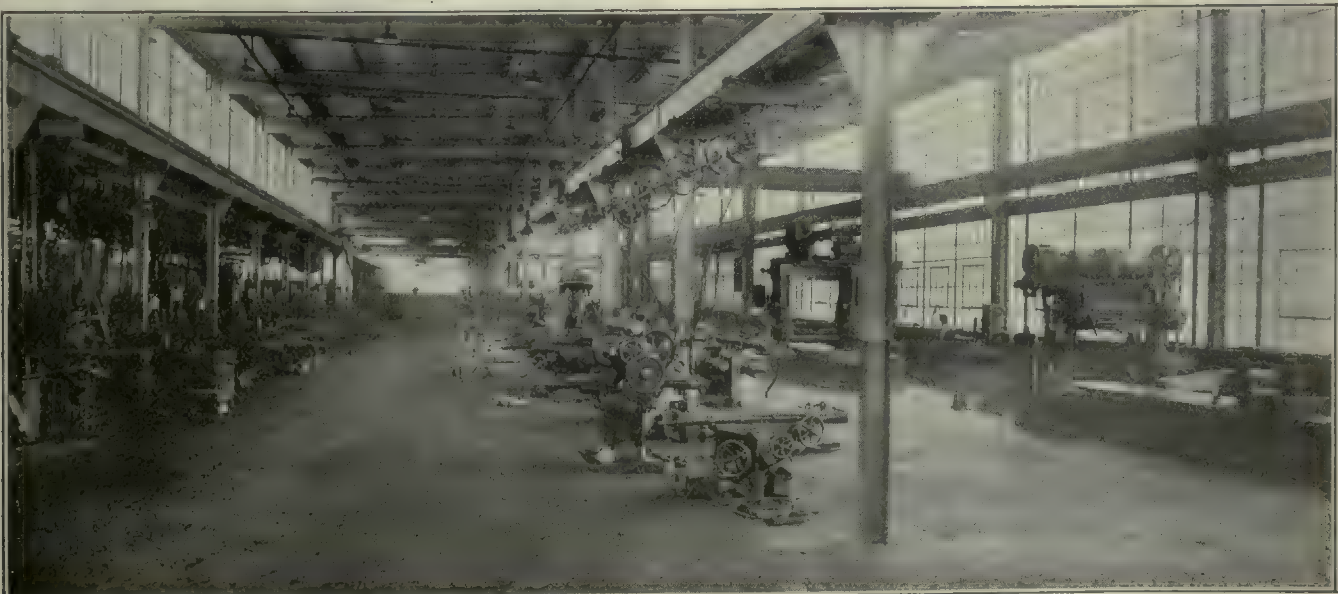


FIG. 1. ONE OF THE HIGH BAYS

high bays 58 ft. wide and three narrow bays 20 ft. wide, alternating so as to give the effect of huge monitors, the lighting being secured by windows where the high bays rise above the low-bay roofs. The appearance of this construction in the high bays, and the excellent lighting secured, can be seen in Fig. 1. As the high bays are 26 ft. in height and the low bays 16 ft., this gives large window area distributed the whole length of the shop. Details of this construction can be seen in Fig. 2.

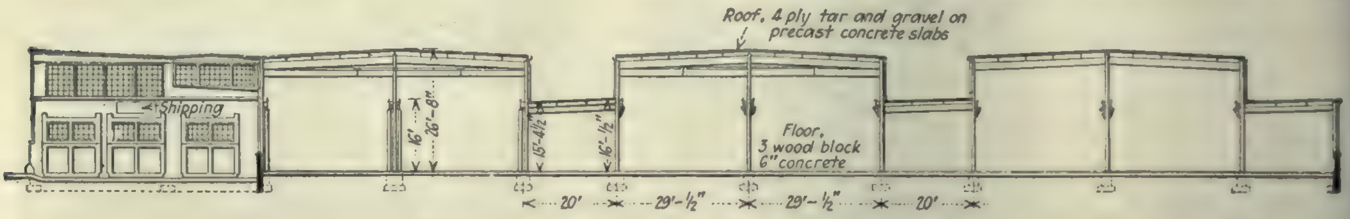

Roof, 4 ply tar and gravel on precast concrete slabs
Shipping
16'
26'-8"
15'-4½
16'-½"
Floor, 3 wood block 6" concrete
20'
29'-½"
29'-½"
20'

FIG. 2. A CROSS-SECTION OF THE BUILDING

The high bays may be called double, as they have a supporting column in the center, but in both the high and low bays, care has been taken to utilize standard steel so that the building is in reality made up from standard material, with regular lengths, all special design and construction being carefully avoided. The shipping department is shown at the left of Fig. 2, being at the extreme end of this bay, as will be seen later in the plan view of the shop.

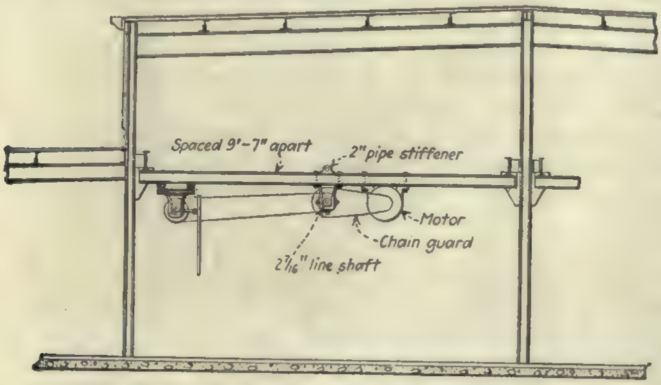


FIG. 3. DETAILS OF A HIGH BAY

Fig. 1, which is a section of the planer department, shows very clearly the type of column used, the way in which the crane runways are supported, as well as the simple standardized construction used for supporting countershafts under the crane runways. This also shows the roof construction, the arrangement of electric lights and sprinkler heads, as well as the distribution of some of the heavier machinery.

As can be seen in Fig. 2, the roof of the wide bay pitches slightly in both directions from the center, while the low bay has a pitch of 8 in. in 20 ft., bringing the drainage down through suitable piping beside the building columns. The height of the craneway is 16 ft. from the floor, which is of 3-in. wood blocks laid on a 6-in. base of concrete. The roof consists of precast concrete slabs laid on the longitudinal beams, the outside being covered with a four-ply tar and gravel roof coating.

Wherever it has been found desirable to place machine departments in the high bays, both line and countershaft supports have been provided by channels fastened under the crane runways, as in Fig. 3. These channels are 10 in., two placed back to back and 1½ in. apart to allow holding bolts to be easily dropped between them if necessary. These double beams are spaced 9 ft. 7 in. apart, this being the distance between hangers. Countershafts are supported at either end of these beams in a suitable position over the machine to be driven. The countershaft supports are 6-in. channels, back to back, with 1-in. separation.

THE LINE-SHAFT DRIVE

Each line shaft is driven by a suitable motor, also mounted on the large channels and driving the shafting by means of a silent chain which is inclosed in an oil-tight case. The line shafting is 2$\frac{7}{16}$ in. in diameter and driven at 200 r.p.m. for cone-pulley driven machines and 350 r.p.m. where single-pulley drives are in use. Various sizes of motors are used, these ranging in five sizes, 10, 15, 20, 25 and 30 horsepower.

Further details concerning the shafting supports are shown in Fig. 4, which shows the line shaft supported at the center of each side of the high bays, the way in which the countershaft supports are hung, and the pipe bracing *A* which runs parallel to the shafting along the upper side of the long beam. This acts as a stiffener.

All the countershaft supports are standardized and is an easy matter to re-arrange machinery in any department or to materially alter the layout of the different departments should future development of the business make it seem advantageous to do so. Fig. 4 also shows one of the inclosed motor drives at *B* the motor itself being at *C*, almost hidden behind the

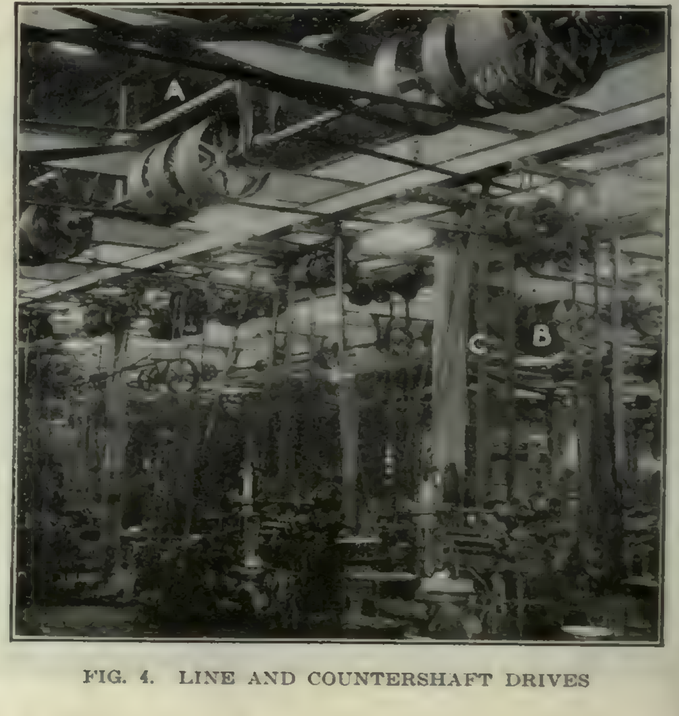


FIG. 4. LINE AND COUNTERSHAFT DRIVES

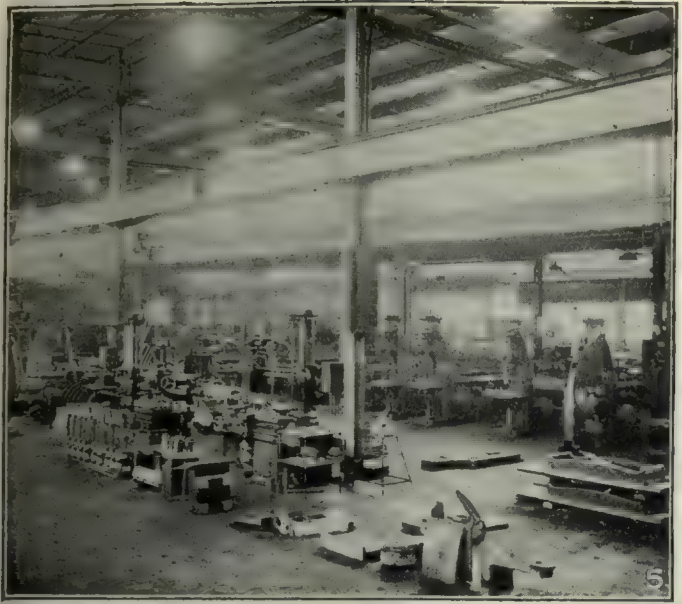


FIG. 5. HOW THE SHOP LIGHTS UP AT NIGHT.

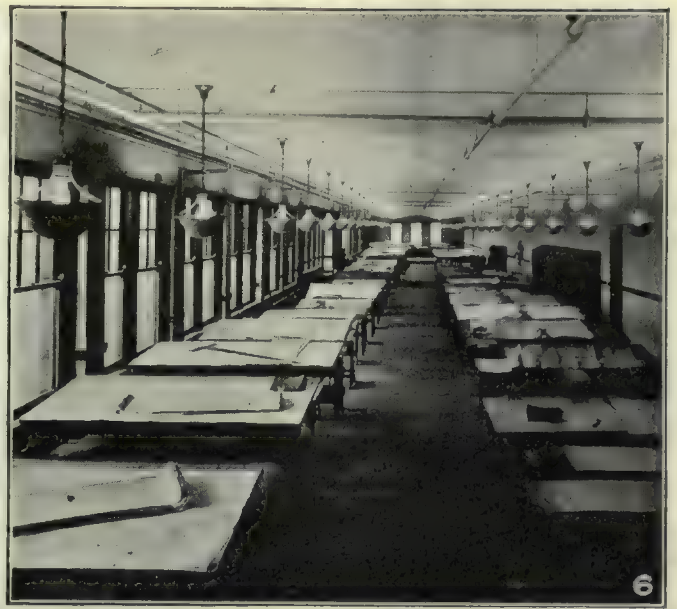


FIG. 6. THE DRAFTING ROOM

supporting column. The view shows a portion of the gear-cutting department and gives a good idea of the way in which both the natural and artificial lighting is accomplished.

This standardization has been carried out throughout the shop, every column being alike and every column punched for crane girders whether they are in position or not. The same size channels and the same length girders equally spaced make a very flexible design and one which should be carefully considered.

THE ARTIFICIAL LIGHTING

The artificial lighting of the plant has also had careful study. Mazda lamps of 300-watt capacity in standard RLM reflectors are used in all manufacturing space. This figures out to 1.3 watts per square foot of floor space with an intensity of 8½ foot-candles. The shop lights are 21 ft. 6 in. from the floor in the high bay and 12 ft. 6 in. in the low bay and are so distributed as to equalize the distribution of light to the bays. Fig. 5 was taken at night, entirely by artificial lighting.

The lighting of the drawing room is by the indirect method as can be seen in Fig. 6. Here the lamps are of such size as to give 2.7 watts per square foot, more light being necessary in the indirect system. The lighting in both Figs. 5 and 6 is, however, remarkably clear from shadows, which is highly desirable in both drafting room and shop. It should be noted in this connection that the drafting room is over 230 ft. long and accommodates 100 men.

Two washrooms are provided, these being located in one of the low bays and occupying, with the toilets above, the entire height of the bay. Fig. 7 shows the neat arrangement of these washrooms, with their cement flooring and white enameled sinks and racks.

The sinks are supported on pedestals instead of spreading legs, which are always in the way, and it will also be noted that all the water pipings above the sinks are neatly inclosed by an enameled channel which completely hides the pipes and presents an appearance which is not only neat but is easily kept clean. A drinking fountain is also provided here as well as at other points.

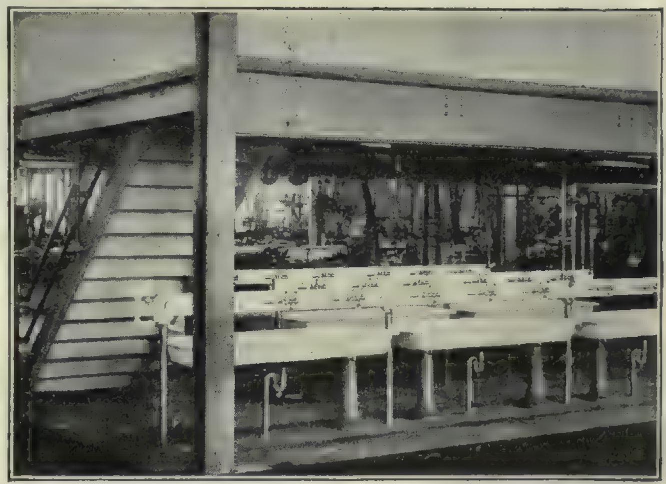


FIG. 7. ONE OF THE WASHROOMS

A second article will deal with the layout of the shop and methods of handling material from department to department.

Caring for Tools at Puget Sound Navy Yard

A Well Equipped Central Tool-Grinding Room—Novel System of Sliding Racks for Storing Milling Cutters—Cleansing and Lubricating Pneumatic Tools

SPECIAL CORRESPONDENCE

WITH the great diversity of work to be done in a Navy Yard handling all classes of vessels, as well as other work, it is necessary to have a large variety of both special and regular tools of various kinds. These tools, however, lose much of their value unless they are properly cared for and are so stored as to be easily found when wanted. The methods employed at the Puget Sound Navy Yard are to be commended, as tools are not only well cared for but they are easily accessible whenever they are needed.

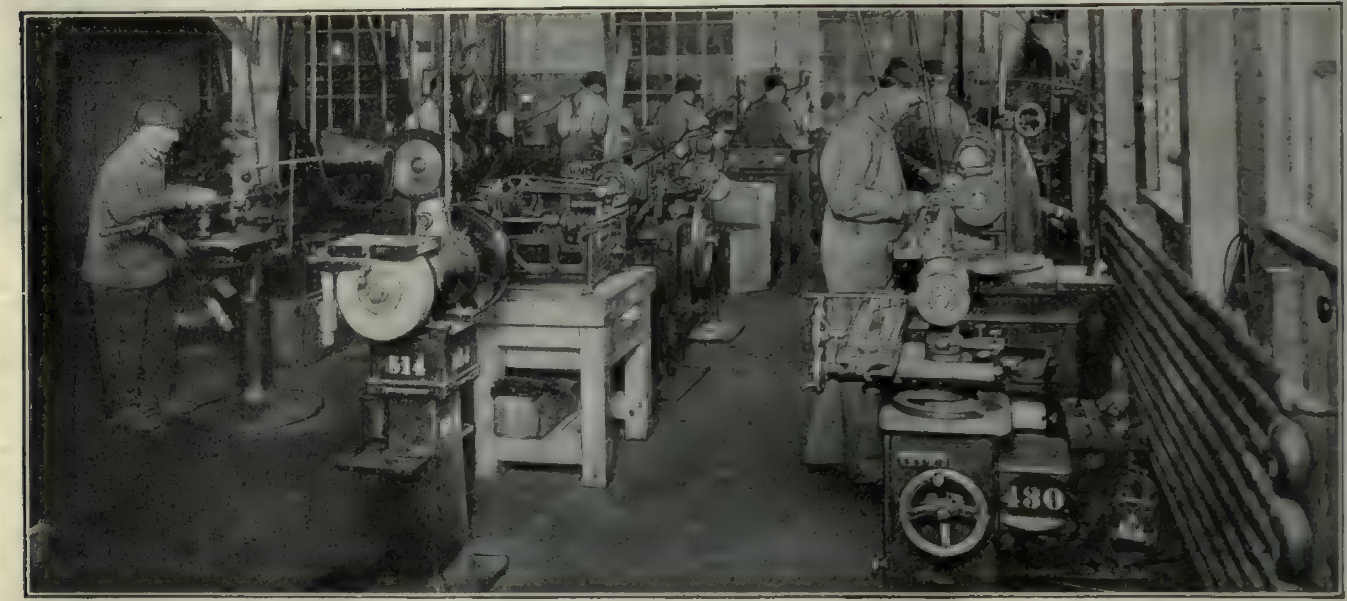


FIG. 1. THE CENTRAL TOOL-GRINDING ROOM

There is provided a central tool-grinding room for cutters, reamers and all tools of that type. A corner of this room is shown in Fig. 1. As can be seen, it is well equipped with machinery for this kind of work, including the grinding machine for sharpening cutting-off saws, which can be seen in the center of the illustration.

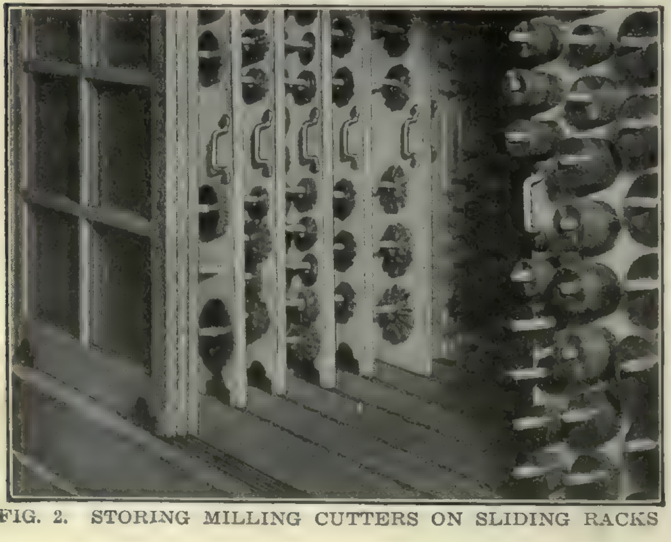


FIG. 2. STORING MILLING CUTTERS ON SLIDING RACKS

The cabinet shown in Fig. 2 illustrates one method of storing cutters. It consists of a number of sliding racks, properly indexed and protected by glass doors to keep out the dirt and dust. Being mounted on good rollers the racks are easily moved and the plan makes possible the storage of a large number of cutters in a small space.

Another type of storage rack is shown in Fig. 3, being for collets, centers and small jigs and fixtures. The latter are for the most part kept in the boxes shown in the bins below the numbered trays, each box serving to keep a jig and all its attachments together, so that the whole thing can be issued at once.

Tools, such as drills, reamers and counterbores, are kept in the racks shown in Fig. 4. There is nothing unusual about these racks but they are conveniently arranged and the tools can be easily found. The rack at *A* enables cutter arbors and similar tools to be kept where they are convenient. This view also shows some of the hollow gages for pipe threads at *B*. This room is known as the tool-issuing room.

Bolts, clamps, blocks and angle plates are stored as shown in Fig. 5. This view shows a considerable variety of shop furniture for various machines, including V-blocks, angular work tables as at *A*, and adjustable angle plates at *B*. There are collars of various sizes at *C;* clamping jaws for planer and similar work at *D;* lathe dogs at *E;* turn-buckles for various purposes at *F*, and both eye- and hook-bolts at *G*. These appliances are kept in a convenient quarter and can be easily issued on demand.

Caring for Pneumatic Tools

In too many places pneumatic tools are sadly neglected. They are not only abused by the users, but little or no care is taken of them in the toolroom and as a result they are short-lived and fail to give the satisfaction they should during their existence. One instance is told by a builder of pneumatic tools who endeavored to lighten his product by using an aluminum casting for the main frame. No difficulty was experienced until in one case, he found the thin aluminum shell worn through from dragging instead of carrying the tool over steamship decks with their rivets and projection.

In the Puget Sound Navy Yard, however, pneumatic tools are very carefully cared for, the oil service station shown in Fig. 6, being provided especially for this purpose. All pneumatic tools, whether chipping hammers or rotary motors, for drilling or other work, are kept in better shape with thorough inspection and oiling.

Suitable oil tanks, in combination with benches, are provided at *A*. Here the tools can be soaked in kerosene or any cleansing compound which may be preferred and, after being thoroughly cleaned, they can go into the next tank which contains lubricating oil. Here they are thorougly soaked so that all parts will be perfectly lubricated. Air-hose connections are provided so that the tools can be operated after coming out of the oil bath, the funnel *B* being provided to catch the surplus oil. Bearings which require grease are filled from the grease press *C*.

Adjoining the washing and oiling room are the racks for the pneumatic tools, as shown in Fig. 7. These racks are substantially built, thoroughly braced by the tie rods shown, and have simple but substantial hooks for supporting the various tools. The hooks consist of what may be called headless bolts or studs, threaded on one end and bent to the shape shown. They are supported in the flanges of the angle-iron uprights by a nut on each side of the plate. This makes a very substantial form of rack on which the tools are easily accessible and which supports them where they are out of the way until wanted as may be readily seen on examination of the illustration.

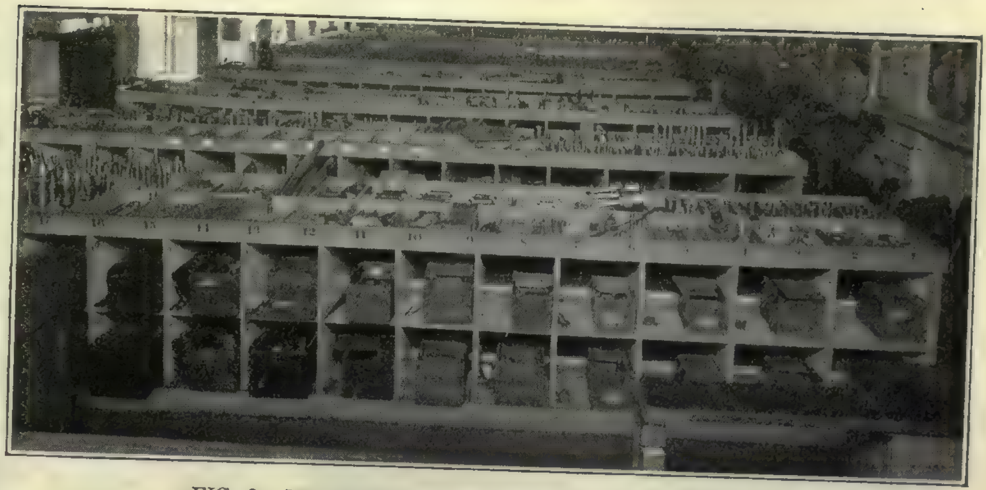


FIG. 3. WHERE JIGS AND FIXTURES ARE STORED

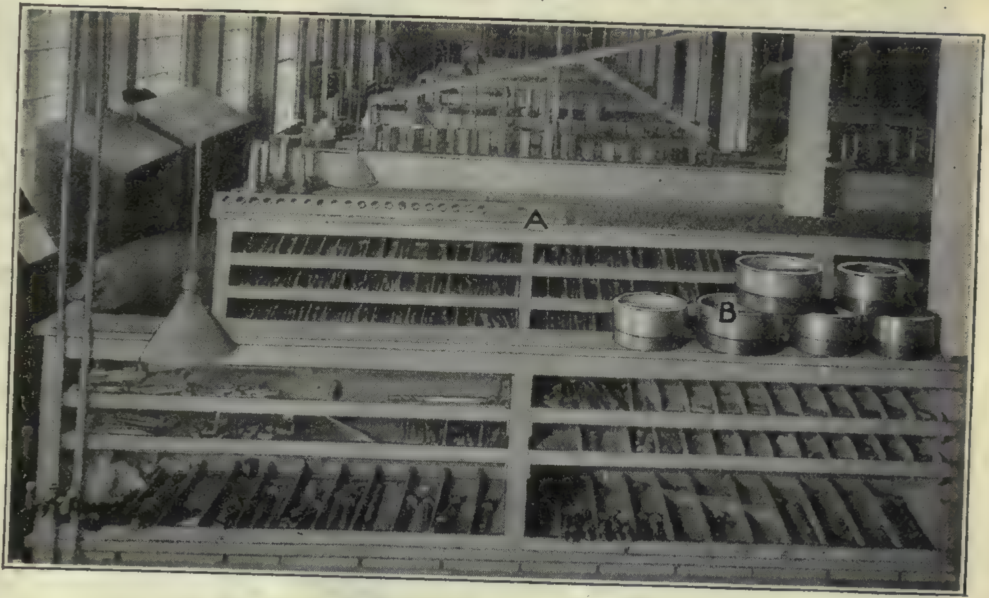


FIG. 4. A SECTION OF THE TOOL-ISSUING ROOM

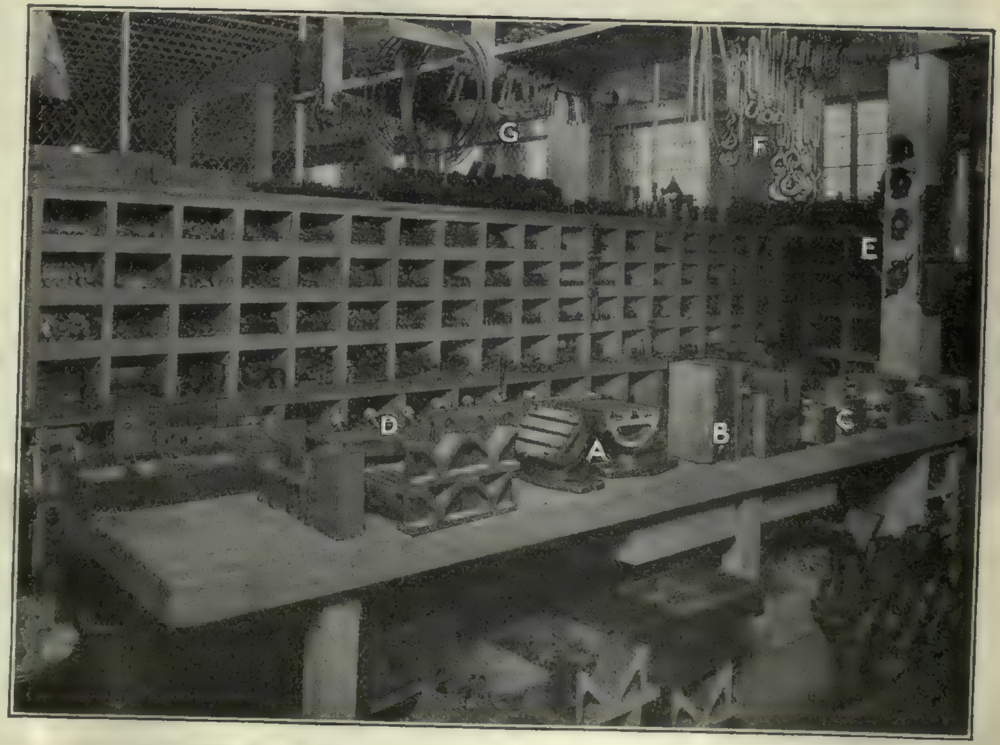


FIG. 5. BOLT, CLAMP AND ANGLE BLOCK STORAGE

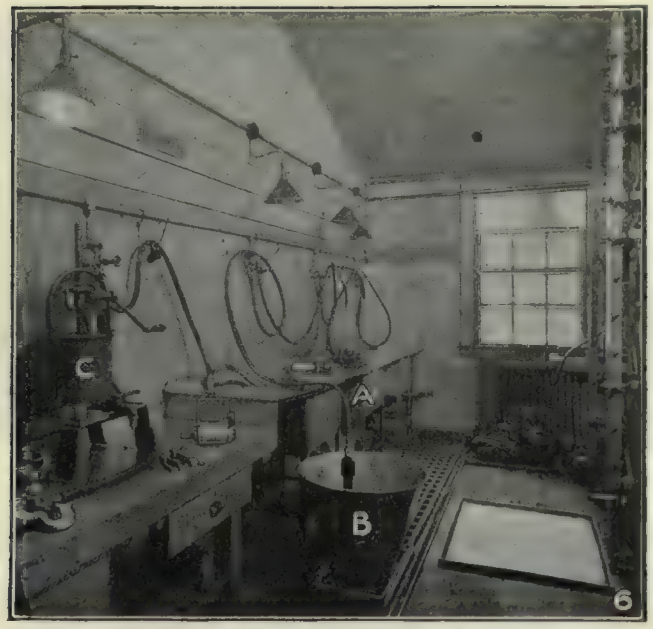


FIG. 6. PNEUMATIC TOOL SERVICE STATION

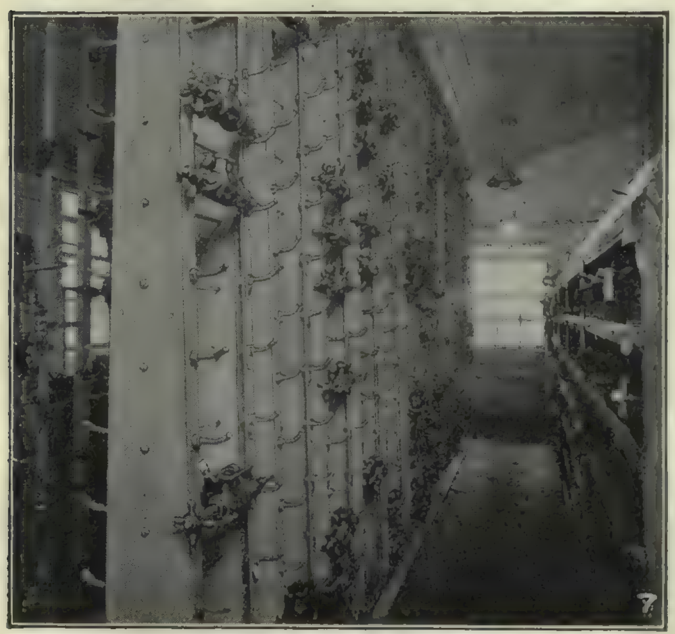


FIG. 7. RACKS FOR PNEUMATIC TOOL STORAGE

By the use of such methods of cleaning and storing pneumatic tools the danger of out of order tools being issued for use is obviated or at least lessened.

Service Given to Purchasers

By John Mark May

Manufacturers of machinery seem to be more inclined as time goes on to follow their product to the setting-up and using stage, that they may be sure that it is started under the most favorable conditions. They feel that a first impression of a new machine, if unfavorable, even though later developments may indicate that a reversal of the first decision is due, has injured the reputation of the machine to a certain extent, and that the impression is slow to wear off. Whereas, if the machine starts off right and makes a favorable first impression, much will be overlooked because of the fact that it did do satisfactory work at the start, and because later developments are more likely to have been due to the manner of operating the machine rather than to the machine proper.

There are some manufacturers, mostly of small machines, who notify their purchasers that the machine has been tested and adjusted before leaving the factory and request them not to make any adjustments or changes; but, if the machine is not satisfactory in every respect, to either notify them at once or return it to the factory for examination and replacement.

Some other manufacturers feel justified in furnishing a very thorough set of instructions gotten up in attractive and durable form. The book which the Jones & Lamson Co. furnishes with its flat turret lathe is a notable example, as it not only gives all instructions that are likely to be needed, but also gives the operator an insight on principles, economics, and ethics, as well.

S. O. Livingston's article on page 237, Vol. 54, of the *American Machinist*, entitled "The Cost of Unnecessary Service," reminds me of a typical case which came under my observation.

A certain machine was purchased and set up according to the instructions which came with it. It started off fairly well; but very soon began to fall short of what was expected of it and grew gradually worse until, when about two weeks had elapsed, it had gotten to a point where it was delivering only about 75 per cent of its capacity. The machine, when running satisfactorily seemed to be superior to another type of machine which it had replaced; and the purchaser, very anxious to know at once if it could be depended upon, at this time wrote the manufacturer to send a representative at once.

Practical and Efficient Diplomacy

The manufacturer wrote immediately in effect that, there being no representative free to send, either from the home office or on the road within a reasonable distance from the purchaser's plant, he was writing them fully about certain adjustments that were sometimes needed under similar working conditions, citing other adjustments that should be made under certain unusual conditions. He asked that he be informed a little more fully as to the details of the troubles encountered, stating further that if, after the suggested adjustments had been made, their troubles were not entirely overcome, he would be very glad to send a representative to go into the matter more thoroughly and do whatever was required to give them the service, even to replacing the machine if found necessary. The adjustments were made as outlined, and the machine afterward made a satisfactory performance.

It seems to the writer that this case was handled in a diplomatic, practical, economical and satisfactory manner, as it answered every requirement of the case involved and developed a well-satisfied customer.

The purchasers of machinery should understand that every dollar of extra expense that they put upon the manufacturer, they, the purchasers, must eventually pay, perhaps indirectly. It may extend over a considerable period of time, but nevertheless they must eventually settle the bill. With such an understanding in the minds of purchasers, unnecessary expenses along these lines should be materially reduced, to the mutual benefit of both parties—not only reducing unnecessary expense, but worry as well.

Manufacturing with Special Machines vs. Standard Equipment

II. The Forgings and Some of the Tools Used in Machining Them—Details of Boring and Milling Cutters—Difficulties Encountered and Overcome

BY COLONEL G. F. JENKS* AND M. H. CHRISTOPHERSON†

THE sleigh forgings shown in Figs. 2 and 3 were made by the Carnegie Steel Co., at the Munhall, Pa., works. Chemical and physical tests on the forgings were made at the same plant.

From April 24, 1918, to Jan. 8, 1919, the following forgings were received: 149 forgings of chrome-nickel steel, of which 120 were formed as per sketch *A* and twenty-nine were formed as per sketch *B;* 237 forgings of carbon steel, of which 135 were formed as per sketch *A* and 102 were formed as per sketch *B*.

The Carnegie Steel Co., rough planed: Forty-four sleigh forgings, fifteen of chrome-nickel steel, twenty-nine of carbon steel; two chrome-nickel steel sleighs developed forging defects in various stages of machining; three chrome-nickel steel sleighs developed forging defects in the hydrostatic test after being fully machined; six carbon steel sleighs developed forging defects in various stages of machining; one carbon steel sleigh developed forging defects in the hydrostatic test after being fully machined.

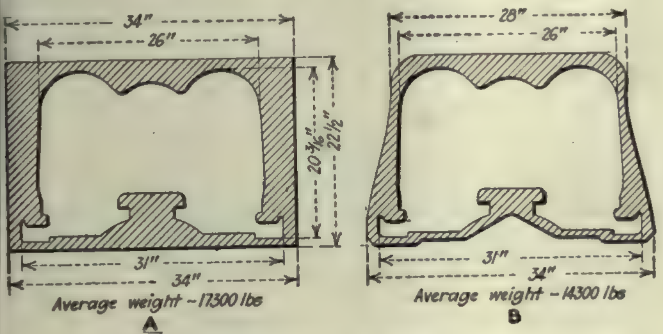


FIG. 2. DIMENSIONS OF SLEIGH FORGINGS

OPERATION 1

Face milling both sides of sleigh forging preparatory for finish milling edges in Operation 3, and for finish planing both sides to angle preparatory for Operation 16 is shown in Fig. 4.

In Operation 1 it was necessary to reduce both sides, full width of the sleigh from the rough to within ¼ in. of finished size, removing from forging A about 3,575 lb. The great amount of metal to be removed was due to difficulty and delay in preparing the forming dies from which the forgings B were finally made. Setting and removing sleigh, time 1 hour. On sleigh A (alloy steel) machining time, 7 hr. 40 min.; table feed, 15 in. per hour = 0.0625 in. each revolution of spindle; peripheral speed of 29-in. diameter cutters, 30 ft. per minute. No record of time for this operation at the arsenal.

Experience proved that B sleighs of carbon steel could be machined at the rate of 22½ in. per hour, making machining time 5 hours. Very few B sleighs were machined, so the feed was continued at 15 in. per hour.

When machining alloy forgings, it was necessary, on an average, to replace four cutters in each head after machining each sleigh. The tools were ground in the toolcrib on a Gisholt tool grinder. Various kinds of tool steels were used as it was customary to regrind broken planer tools for this work.

A heavy flow of cutting compound was maintained on the cutters through ¾-in. pipe at 80 lb. pressure.

Four Otis type-4 machines were supplied but only two were put into operation owing to signing of the armistice.

In machining forgings A the machine removed from 500 to 600 lb. of metal hourly. The machine with its worm gear and internal gear drive, having a combined reduction ratio of 200 to 1, required only 35 hp. when removing 600 lb of metal per hour from alloy forgings.

Fig. 5 shows the cutter heads with arrangement and shape of cutting tools. The cutter set-up is well adapted for rough machining heavy forgings where much tonnage of excess metal is to be removed. The machine with its cutter heads is really a constant feed rotary planer with a number of planer tools set in series of four, the forward cutters are set to suit the irregularity of the rough forging and each succeeding cutter in the series is set so it will remove its share of the required depth of cut, the fourth cutter being set to the full depth of cut.

OPERATION 2

Planing top of sleigh from the rough to within ⅛ in. of final size preparatory for finish milling in Operation 3, is shown in Fig. 6. Two remodeled planers, with tool clappers operated by air cylinders to prevent tools dragging on return stroke, were used and two sleighs were set tandem in rugged holding fixtures. A Cincinnati standard 42 in. x 10 ft. planer was used a portion of the time on the work. Setting and removing time average on each sleigh, 40 minutes. Machining time average on each sleigh, 4 hours. No record of time for this operation at the arsenal.

For carbon forgings the planer cutting speed was 38½ ft. per minute though it was necessary to reduce this to 26 ft. per minute when machining alloy forgings.

Red cut and Clarite high-speed steels 1¼ in. square were used on this work with a liberal supply of cutting compound. It was originally planned to finish plane the top and edges of the sleigh and some were machined in that way. Additional output required more capacity, and from experience in other milling operations it was decided to finish mill as shown in Operation 3. This method gave very satisfactory results both in time saving and accuracy.

OPERATION 3

Finish milling the top and edges of the sleigh is shown in Fig. 7. These surfaces were used to set the sleigh in the fixtures on various succeeding operations,

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*Chief of Artillery Division, Ordnance Bureau, U. S. A.

†General Works Manager, Otis Elevator Co.

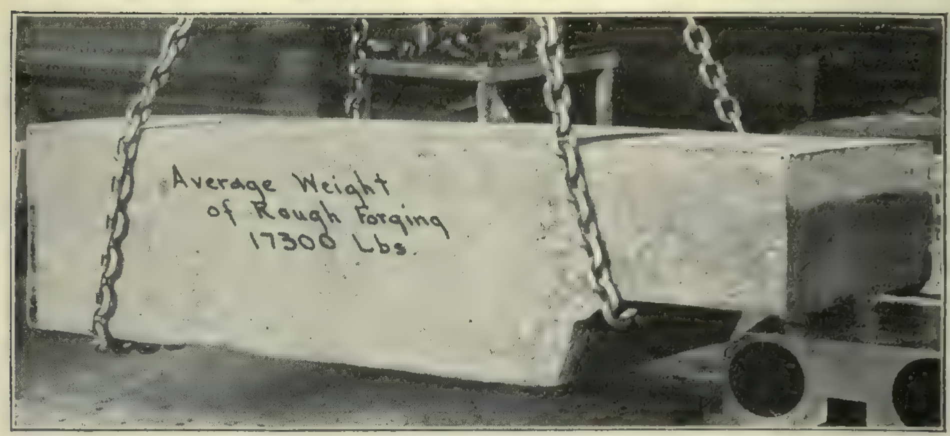
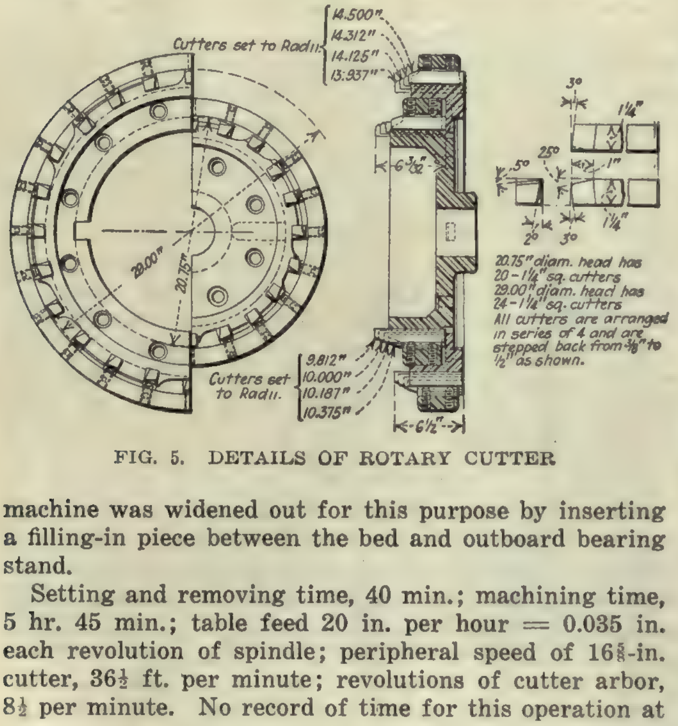


FIG. 3. ONE OF THE ROUGH FORGINGS. FIG. 4. A LARGE ROTARY PLANER

consequently it was important that they be finished smooth, parallel and uniform in width. The less frequent setting of cutting tools in the milling heads insured more reliable workmanship and also resulted in saving of several hours on each sleigh. One Otis type-6 machine was widened out for this purpose by inserting a filling-in piece between the bed and outboard bearing stand.



20.75" diam. head has 20 - 1¼" sq. cutters
29.00" diam. head has 24 - 1¼" sq. cutters
All cutters are arranged in series of 4 and are stepped back from 3/16" to ½" as shown.

FIG. 5. DETAILS OF ROTARY CUTTER

Setting and removing time, 40 min.; machining time, 5 hr. 45 min.; table feed 20 in. per hour = 0.035 in. each revolution of spindle; peripheral speed of 16⅝-in. cutter, 36½ ft. per minute; revolutions of cutter arbor, 8½ per minute. No record of time for this operation at the arsenal. The cutter heads were of forged steel with inserted high-speed steel cutters. Chip breaking grooves were ground on the cutting surfaces of each cutter to prevent chatter. The grooves were staggered so that the cutters left perfectly smooth surfaces. The cutters did continuous work 20 hr. daily for three weeks without regrinding; in the interval between grinding a large oil stone was satisfactorily used for stoning the cutters while in place.

OPERATION 4

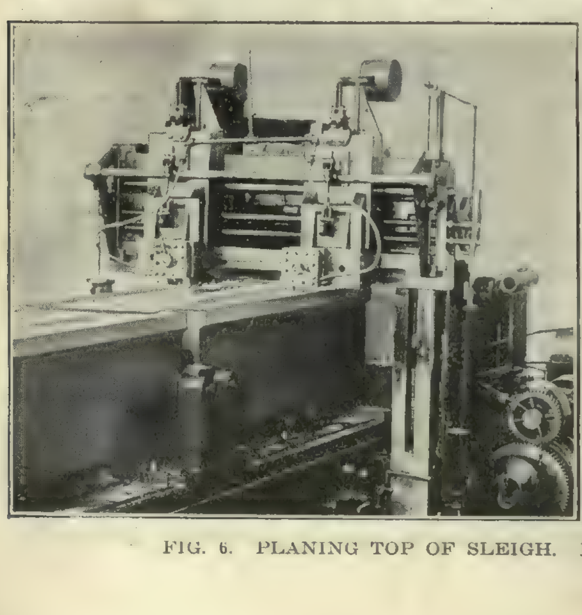
Face milling both ends of sleigh to finished length. One Otis type-3 machine was used for this purpose.

Setting and removing time, 20 min.; machining time, 1 hr. 30 min.; table feed, 30 in. per hour = 0.083 in. each revolution of spindle; peripheral speed of 24 in. cutter, 35 ft. per minute; revolutions of cutter spindle, 6 per minute. The cuts varied in depth from ¾ in. to 1⅜ in. on each end.

The cutter heads had twenty-four 1¼ in. square high-speed-steel cutters which were set in multiples of four as in Operation 1. A liberal supply of cutting compund was used.

Operations 4 and 11 were combined as a single operation at the arsenal and the time given as 8.86 hr.

In the early time studies of the recuperator it was feared that troubles might be encountered in rough boring a straight and regular hole from the solid, and in designing the type-5 boring mills, Fig. 8, these points were kept in view. This resulted in making the machines and boring bars very strong and rigid and



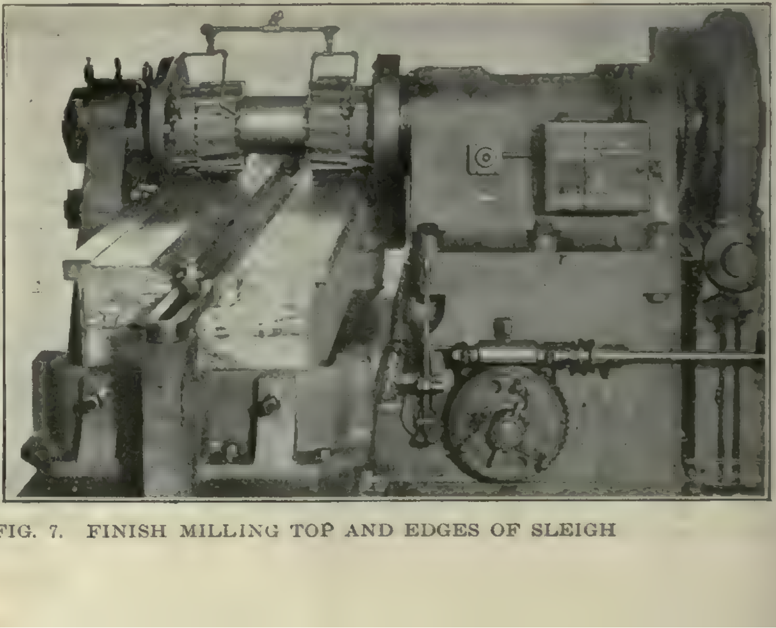


FIG. 6. PLANING TOP OF SLEIGH. FIG. 7. FINISH MILLING TOP AND EDGES OF SLEIGH

in installing a steadyrest on the machine bed into which was placed a hardened and ground bushing which fitted very closely the wearing strips of the drill head. This bushing formed the jig for starting the drill into the work and guided the drill head until the bore was sufficiently deep for the drill head to be guided by the bore.

The drill and boring heads with their cutters, as shown in Fig. 9, were found most practical after a number of tests. All heads were fitted with semi-steel wearing strips shimmed out and turned to size as often as necessary. In drilling the alloy steel forgings it was customary to refit the shims after each hole had been completed; in the carbon steel forgings usually two holes were drilled without refitting the strips.

Boring head No. 24, Fig. 9, was made in sizes 6½ in. for the recuperator cylinder and 7⅜ in. for the recoil cylinder holes. Before finish boring and reaming on type-9 triple bar machines, shown later, the 7⅜-in. drill was used for drilling the 50-in. deep holes for both reservoirs preparatory for the second cut where boring head No. 22 was used. The reservoirs were finish bored with boring head No. 25.

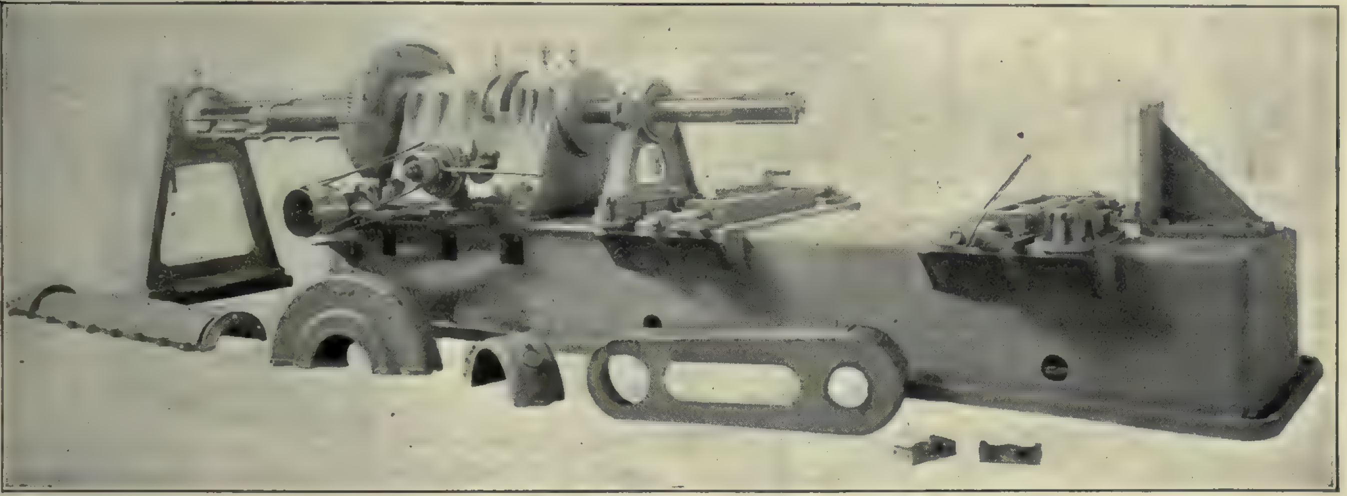


FIG. 8. A SPECIAL BORING MILL

The 7⅜-in. drills were also used in Operations 8 and 26. The cutters were made interchangeable for their respective heads and were ground to a template. The cutting edges had several notches ground on each side of the center staggered so as to cut the chips into short rings that were forced to curl into a small diameter by the short radius lip ground in the face of the cutter. The chips were readily forced out of the bore by the strong flow of cutting compound.

OPERATIONS 5 AND 6

Rough boring from the solid, two 7⅜-in. diameter recoil cylinder holes through the sleigh. Length of bore 62 in. Fourteen Otis type-5 machines were used for this purpose. Operation 6 rough boring from solid one 6½-in. diameter recuperator cylinder hole through the sleigh; Length of bore 62 in. Seven Otis type-5 machines were used for that purpose. Drilling the three holes is preparatory to finish boring and reaming in tripple bar boring mills.

Operations 5 an 6 were originally combined in one operation. The recoil holes were bored first with the sleigh set on the machine fixtures, and as the design required that the recuperator bore should be 9/16 in. below the recoil cylinder centers, it was planned to insert 9/16-in. hardened plates between the fixtures and the sleigh to establish the proper center for the recuperator bore. The tendency was for the men to forget to insert the plates and in one case the three holes were actually bored on the same horizontal center line. As that sleigh was spoiled it was decided to arrange some of the mills for boring only the two recoil cylinder holes. The sleigh was then moved to another machine where the holding fixtures were 9/16 in. higher for boring the recuperator hole.

Considerable trouble was experienced in rough boring many of the alloy steel forgings due to hard spots in the material, evidently segregation of alloys. A cutter peripheral speed of 38 ft. per minute, boring 6 in. in depth an hour, was established as about all that could be accomplished in the alloy forgings without considerable breakage of drill bits. In some instances the 3-in. steel boring-head nipple would also break when the drill entered a hard spot.

Results in boring the carbon steel forgings were much more satisfactory and the drill bits frequently bored two full depth holes without regrinding. Tests in drilling the carbon forgings were not completed at the signing of the armistice when the boring was discontinued. In a number of instances boring was done at a rate of 11 in. an hour and from the results accomplished it is believed that 12 in. depth an hour, with 40 ft. peripheral drill speed could have been maintained.

The total time on drilling the 6½-in. and 7⅜-in. holes in 334 forgings was 15,195 hr., including the time of setting the work and the time lost due to irregularity of metal and other causes. Average time on boring three holes through alloy and carbon steel in all the sleigh forgings was 45 hr. Setting time, 40 min. each sleigh. Average time on boring one hole through ten alloy steel sleighs that were most troublesome was 19 hr. each hole. Average time on boring one hole through ten carbon steel sleighs, where the feed was 11 in. per hour, was 7 hr. The arsenal time for boring the three holes in these two operations was 21.04 hr.

A constant stream of cutting compound, at 80-lb. pressure, was maintained at the point of the drill to keep it cool and to compel the chips to flow back through the bore.

Idle time of the machines due to trouble in rough boring alloy forgings and the probability of breaking parts of the machine itself made the single bar boring mill most satisfactory for the purpose, but it is believed that the multiple bar machines are better suited for rough boring carbon steel sleighs as they did the work equally as well as a single bar machine and, fewer machines being required, less floor space is used and some settings of the work avoided.

While boring a recuperator cylinder in one of the sleighs, the cutter evidently ran into a segregation of alloys which deflected the drill from its true path and this error was not noticed until several later operations had been completed. The sleigh was rejected. One brake cylinder was also rough bored eccentric to such an extent that it would not finish to size, consequently it was rejected.

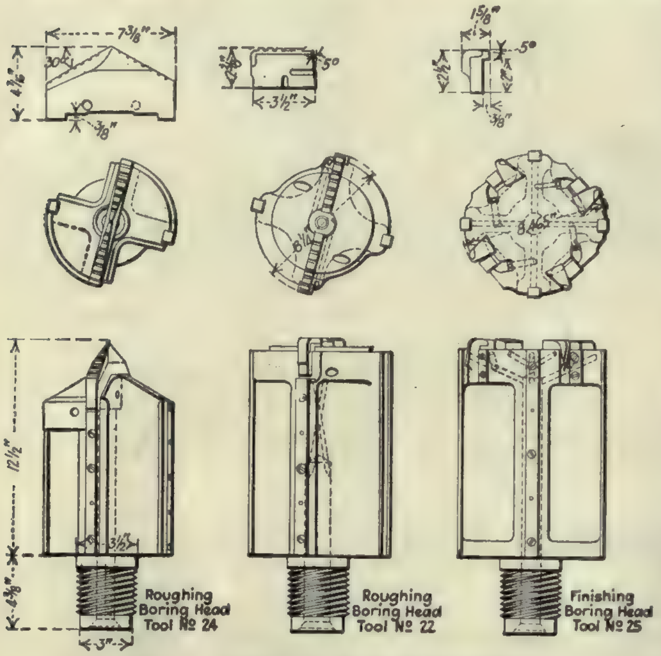

7⅜"
30°
4⅛"
⅜"
5°
3½"
1⅝"
5°
2½"
⅜"
8¼"
8.465"
12½"
3½"
4⅞"
3"
Roughing Boring Head Tool № 24
Roughing Boring Head Tool № 22
Finishing Boring Head Tool № 25

FIG. 9. DETAILS OF BORING HEAD

OPERATION 7

Drilling two 7⅜-in. holes 50 in. deep from the solid for reservoirs and increasing the diameter to 8¼ in. by rough boring in a second cut is shown in Fig. 10. Fourteen Otis type-5 boring mills were used in this operation with 900 r.p.m. motors. Boring bar revolutions 17 per minute; peripheral speed of 7⅜-in. drill, 33 ft. per minute. Arsenal time on this operation, 18.91 hr.

Operation 13, also shown in Fig. 10, consists of finish boring the two reservoirs to 8.465 in. diameter. For this operation the sleighs were moved to another type-5 boring mill, as changing the work from one fixture to another was more expedient than to change the boring heads; particularly so as the machines were operated by one-speed alternating-current motors direct connected and the best results were accomplished in finishing with motor speed at 600 r.p.m. Seven Otis type-5 boring mills were used on this operation; boring bar revolutions, 12 per minute; peripheral cutter speed, 23 ft. per minute.

A liberal supply of cutting compound, at 80-lb. pressure, was maintained during these operations. Reservoirs in 326 sleighs has been completed when work was discontinued. Average time on drilling one 7⅜-in. reservoir hole 50 in. deep in ten alloy steel sleighs that were most troublesome was twenty-three hours. Average best time on drilling one reservoir hole 50 in. deep in ten sleighs was 9 hr. Average time on combined Operations 7 and 13, including setting the sleighs, drilling and rough- and finish-boring two reservoir holes in 326 sleighs was 71 hours.

Operations 13 and 14 were combined as a single operation at the arsenal and the time given as 4.75 hr.

The same difficulties were encountered as in rough boring cylinders in Operations 5 and 6 with additional loss of time on account of need for boring the reservoirs to an exact depth. Drilling and rough-boring was at the rate of 6 in. depth per hour on all the reservoir holes, although when work was discontinued the machine feeds were being changed for carbon forgings to 11 in. an hour. If work had continued, the carbon steel sleighs, combined Operations 7 and 13 would doubtless have averaged less than 47 hours.

OPERATION 8

Drilling two 7⅜-in. holes in breech end of sleigh to enable milling cutters to be readily started to their full depth in Operation 29. The holes were drilled 10 in. deep from top of sleigh and spaced 14½ in. between centers and 10 3/16 in. from end of sleigh to centers.

Two Otis type-5 boring mills with shortened beds and fitted with setting fixtures for holding the sleigh on end, were used in this operation: Boring bar revolutions, 17 per minute; peripheral speed of 7⅜-in. drill, 33 ft. per minute; boring bar feed, 6 in. per hour; average time on boring two holes in 280 sleighs including setting time, 3½ hr. No record of arsenal time on this operation.

OPERATION 9

Fig. 11 shows sawing several transverse cuts (usually four) across the back of the reservoirs, preparatory for Operation 10 where the saw, by making four longitudinal cuts removed the surplus material due to irregularity in forging.

One Otis type-3-A machine with holding fixture was used on this operation.

Worm and gear reduction 100 to 1. To secure the slow spindle speed necesary for this operation the motor was belted to the worm shaft, reducing the speed one half: Spindle revolutions, 3 per minute; peripheral speed

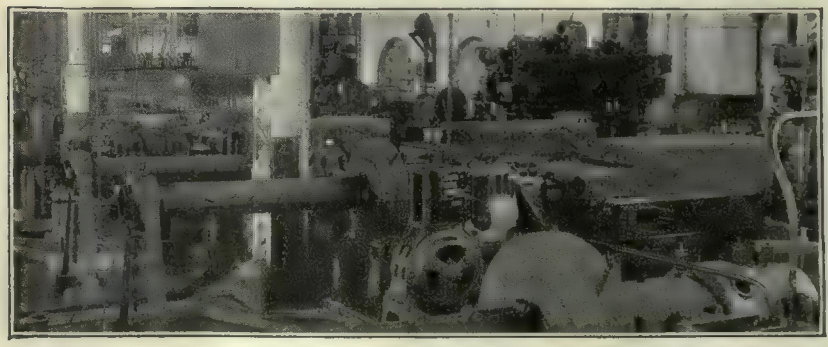
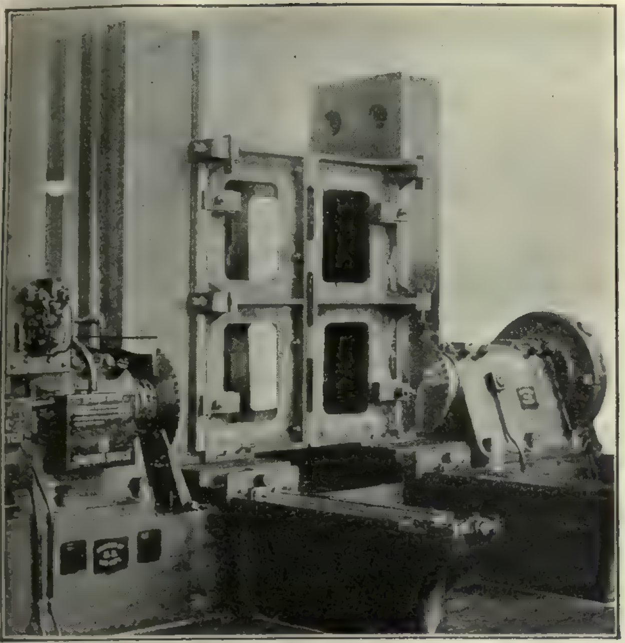


FIG. 10. BORING HOLES 50 IN. DEEP.

FIG. 11. SAWING TRANSVERSE SLOTS



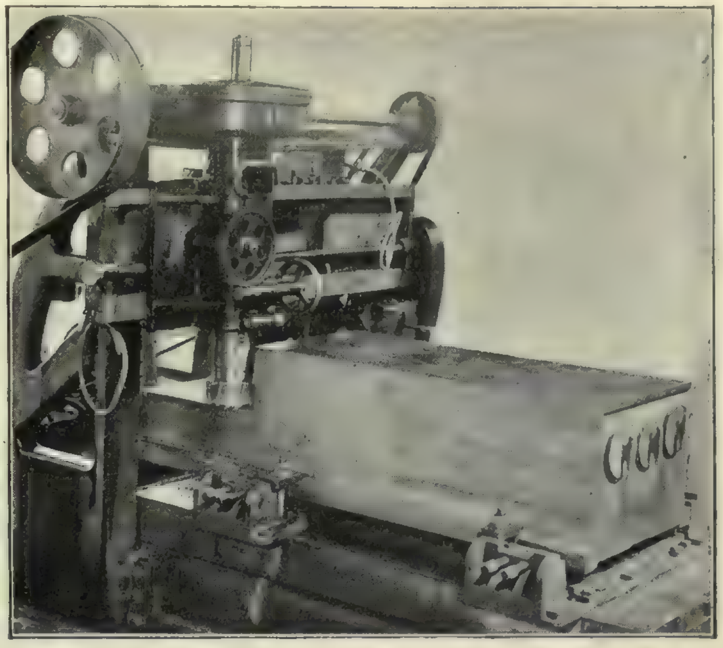


FIG. 12. ANOTHER SAWING OPERATION. FIG. 13. A SPECIAL PLANER-TYPE MILLING MACHINE

of 40 in. diameter saw, 32 ft. per minute; table feed, 27 in. per hour; average time on setting sleigh and making four saw cuts, 5 hr. No record of arsenal time on this.

Simonds saws with 66 inserted high-speed steel teeth, set alternately one round nose and one flat nose, were used on this machine. A constant flow of cutting compound was maintained.

OPERATION 10

Two sleighs set vertically in a duplex holding fixture sufficiently high so the end of the forging will pass over the saw arbor are shown in Fig. 12. After completing each cut across, the sleighs are lowered and the surplus material in the recesses under the reservoir is removed in slabs.

One Otis type-3 machine was used for this operation with motors direct connected to each worm shaft. Worm and gear reduction, 100 to 1; spindle revolutions, 6 per minute; peripheral speed of 26-in. diameter saws, 40 ft. per minute; table feed, 30 in. per hour; average time in setting each sleigh and making four saw cuts, 5½ hr. No record of arsenal time on this operation.

Simonds saws with fifty inserted high-speed steel teeth, set alternately one round nose and one flat nose, were used on this machine. The type-3 machine used for this purpose was originally intended for Operation 4. The efficiency of the machine on that operation, however, was much better than anticipated and with slight changes the milling machine proved to be quite a satisfactory cold saw.

The saw arbor on this machine held a number of cutting tools and it was intended to feed the 26-in. saw into the work and make a saw cut 24 in. long, the tools in the arbor in the meantime cutting a slot for arbor clearance. Tests of this method were not carried to a final conclusion due to difficulty in removing the chips. Experiments indicate, however, that the method can be satisfactorily used and all the metal removed in one cut. A constant flow of cutting compound was maintained.

OPERATION 11

Finish milling the stuffing box end of the three cylinders after surplus material has been removed by the saws in Operation 9 and 10, is shown in Fig. 13. Two Otis type-10 vertical-spindle milling machines were used. Worm and gear ratio, 31 to 1. Spindle revolutions, 19¾ per minute; peripheral speed of 8½-in. cutter, 43½ ft. per minute; average time setting and removing sleigh and milling one cut across face, 6 hours.

Type-10 milling machines are of the same general design as type-11 machines except for the omission of power table feed on the type-10 machines. It was the original intention to remove all the surplus material in the recess by milling and many sleighs were machined in that way before the saws used in Operations 9 and 10 were installed.

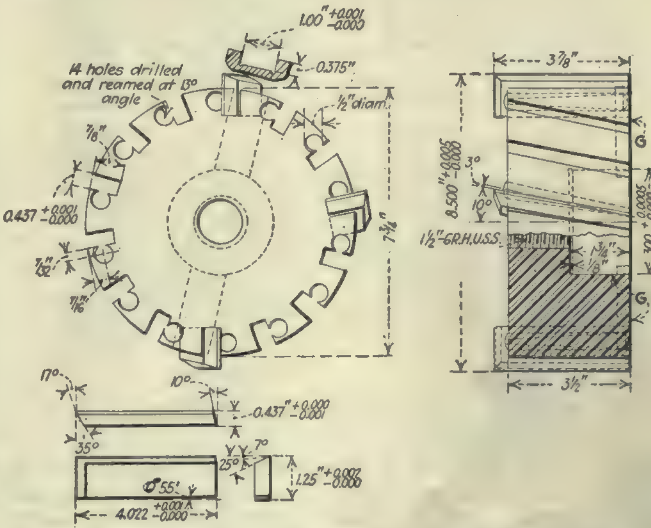
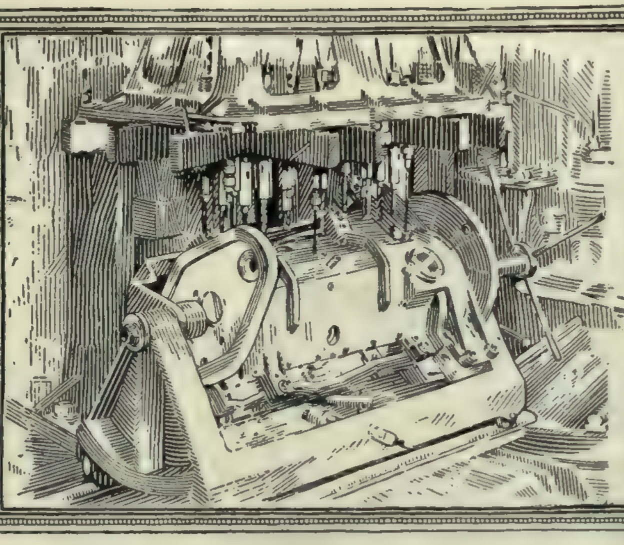


FIG. 14. DETAILS OF LARGE MILLING CUTTER

The combined average time in removing the surplus material with saws and finish milling the cylinder faces was 16½ hr. while the average time in removing the surplus material and finishing the cylinder faces by milling alone was 44½ hr. Cutter No. 30, shown in Fig. 14, was used in this operation.

Operations 4 and 11 were combined as a single operation at the arsenal and the time given as 8.86 hours.



Tool Engineering

By
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Design of Milling Fixtures—Types of Milling Machines — Important Details in Fixture Construction—Elimination of Lost Time—Elements Necessary in Efficient Tool Designing

AS A FACTOR in high production of interchangeable parts, the milling machine is of the greatest importance. With the exception of the turret lathe and screw machine there is no other machine tool which approaches it in importance to manufacturing. On account of its value as a producer, the fixtures used in connection with it should be of the most up-to-date character and should be so designed as to obtain the greatest efficiency from the machines to which they are applied.

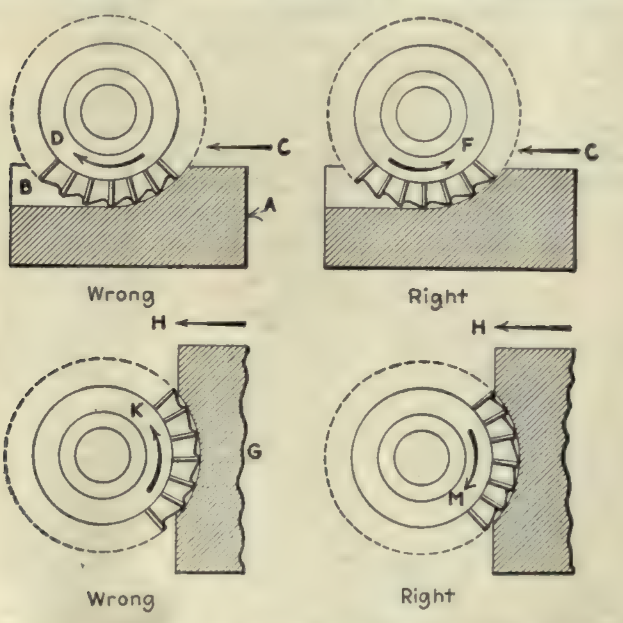

FIG. 112. DIAGRAMS ILLUSTRATING CUTTER ACTION

Types of Milling Machines

In order to understand thoroughly the requirements of milling fixtures, it is necessary first to know the various types of milling machines in order that their adaptability for different classes of work may be fully appreciated. There are a number of forms of machines, among which are hand-milling machines, Lincoln type, plain and universal, duplex, multiple spindle, vertical, continuous and some other varieties more or less specialized either in general mode of operation or in their application to particular kinds of work. Among the latter class are spline milling, profiling, cam cutting, automatic form-milling, rack cutting, gear cutting and hobbing machines. There is also the thread milling machine for milling screw threads and worms. In fact, the process of milling is adapted to so many kinds of work that new machines, which employ milling as a means for removing stock, are continually being developed to assist in the solution of production problems.

Considered as a machine type, there are more varieties of milling machines on the market than any other machine tool in use today. The engine lathe is frequently used in small shops as a milling machine and many horizontal boring mills are arranged so that they can be used for milling as well as for boring. In reality, any machine having a spindle to which a milling cutter can be applied has possibilities in the line of milling, and can be adapted to this kind of work by the use of a sliding fixture arranged to operate at right angles to the spindle.

However, we shall take up the application of milling fixtures to only those types of milling machines that are commonly used for production.

Important Points in Design of Milling Fixtures

In the design and construction of milling fixtures, the following points should be carefully considered:

1. Production required. This is an important factor as the number of pieces to be machined should influence the design of the fixture to a great extent. Simple fixtures should be made for work which is machined only in small quantities, while for high production work the best type of fixture should be designed.

2. Dead time on the machine. In analysing a production problem in which the milling machine is to be used, the dead time on the milling machine should be reduced to a minimum in order to obtain the maximum efficiency of the machine. The milling fixtures should be so designed that there is as little time lost as possible during the loading and unloading of the fixture. In very high production work it is frequently desirable to make up fixtures that permit one piece of work to be

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inserted and clamped while the other is being machined.

3. Accuracy required. When work is to be milled within a tolerance of 0.001 in., it is frequently necessary to make provision for both roughing and finishing cuts. As a rule two fixtures should be made for work of this kind, each one being provided with suitable set blocks for setting the cutters to the required sizes.

4. Rigidity of fixtures. There is no operation in manufacturing in which *rigidity* is as important as in milling. Weakness tends to develop "chatter," which is injurious both to the cutters and to the machine. Care must be taken in the design of milling fixtures to make sure that there are no weak points and that all portions are well ribbed to withstand cutting strains.

5. Safety of the operator. The importance of designing milling fixtures so that the operator will not be endangered during the process of loading and unloading the work cannot be over emphasized. The operator's hands should not approach the cutters closely. The position which the operator is required to take when using the fixture must be studied so that there is no chance for injury due to lack of attention.

6. Chips. As the milling machine is a great producer of chips, attention should be paid to the cleaning of the fixture, and clamps, locating surfaces, and other important parts should be so designed that chips will not interfere with their proper functioning.

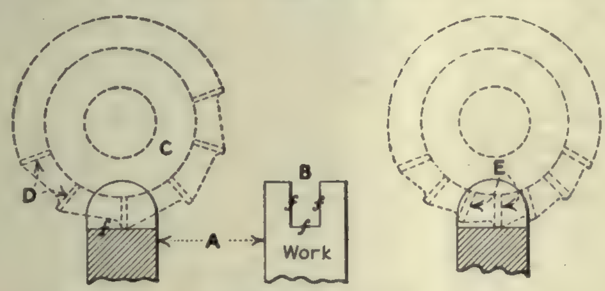


FIG. 113. ACTION OF CUTTER TEETH

7. Set blocks. All milling fixtures should be provided with set blocks so arranged that the cutters can be set in correct relation to the work. A size block or "feeler" can be interposed between the cutter and the set block when making adjustments. If all fixtures for milling are provided with set blocks the accuracy of the work is assurred, and resetting after grinding the cutters is very easily done.

8. Selection of machines. The selection of the machine best suited to work requires judgment, knowledge of conditions, and a list of machines which may be used, as well as an understanding of the best type of machine for the work in the event that new tools are to be purchased. Although the choice of machines may be limited, the selection should always be made with a view to economy in production.

9. Upkeep of fixtures. Fixtures for high production work should be so designed that replacement of locating parts, studs, clamps and other parts can be readily made. It is very necessary to provide a suitable method of fastening the various units to the fixture in order to facilitate their removal and replacement when worn.

10. Material to be cut. The kind of material to be machined affects the design of the fixture to some extent, due to the fact that cast-iron or other cast work such as aluminum and brass can usually be cut faster than such material as alloy steel. Therefore, the kind of material and the speed and feed at which the job will run have to be considered in planning milling fixtures.

A piece of work being milled is subject to two forces, viz., the feed and the cutting action. The combined result of these two forces tends to move the work out of its position, hence it must be resisted by the fixture and the clamps which hold the work. Due consideration must therefore be given to the manner in which the work is held in relation to the feed and also to the cutter.

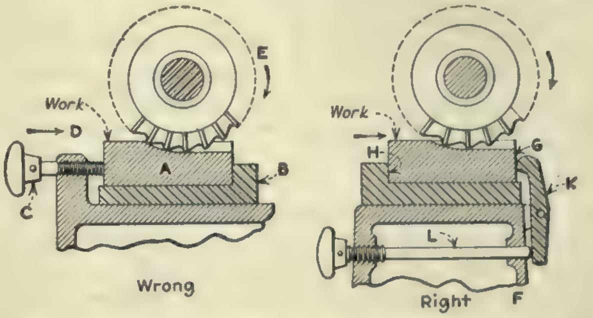


FIG. 114. CUTTER ACTION IN RELATION TO CLAMPS

Fig. 112 shows a piece of work at *A* in which a slot *B* is being machined. The feed of the table is in the direction of the arrow *C*, while the cutter revolves as shown by the arrow *D*. The action of the cutter tends to pull the work toward it, which is very bad practice for the reason that any lost motion in the feed screw of the table will cause "chatter" in the work; also the work tends to "crowd" into the cutter teeth so that the cutting action is not good. When the work is fed in the same direction *C* with the cutter revolving in the direction *F*, there is no "chatter" and the teeth of the cutter attack the work in the proper manner.

The work *G* is being fed in the direction of the arrow *H*, while the cutter is revolving as at *K*. This is incorrect because the cutter action tends to lift the work

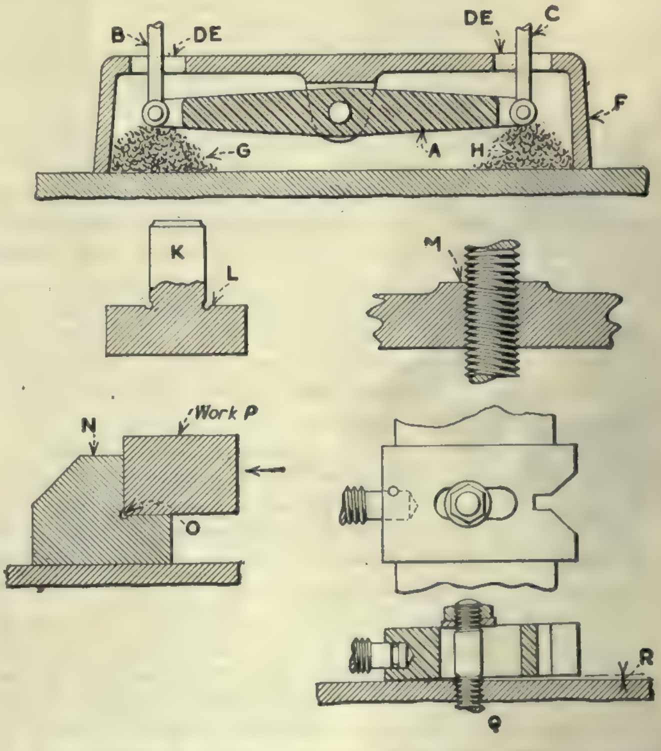


FIG. 115. TROUBLE CAUSED BY CHIPS

and may therefore be acting against the clamps which hold it down on the fixture. It may even lift the table itself unless the gibs are adjusted tightly.

When the cutter is revolving in the direction *M*, the pressure of the cut is resisted by the stability of both the fixture and the table.

Fig. 113 shows a lug *A* which is to be slotted as indicated at *B*. Unless care is used in the selection of the cutter, a condition like that shown in the cutter *C* may be found. This cutter has teeth *D* spaced so far apart that not more than one tooth is in action on the work at the same time. If the feed is coarse, considerable "chatter" and poor work may result.

It is much better to select a cutter having teeth spaced closer together as indicated at *E*, so that there will be several teeth in action on the work at the same time.

In designing milling fixtures it is not generally considered good practice to clamp the work in such a way that the cutting action is against the clamp. Fig. 114 shows the work *A* held in a fixture *B*, by means of a clamp screw *C*. The direction of the feed *D* and the rotation of the cutter *E* both force the work against the clamp screw. This is very bad indeed and should be avoided.

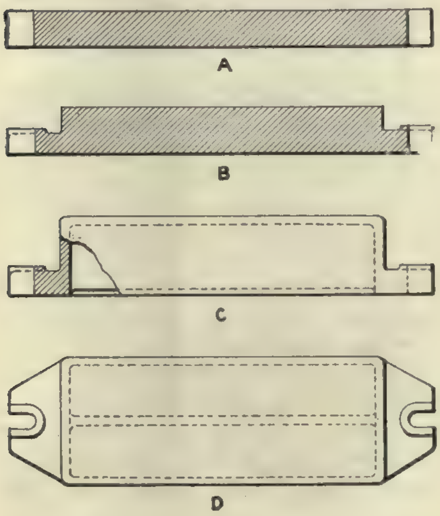


Fig. 116

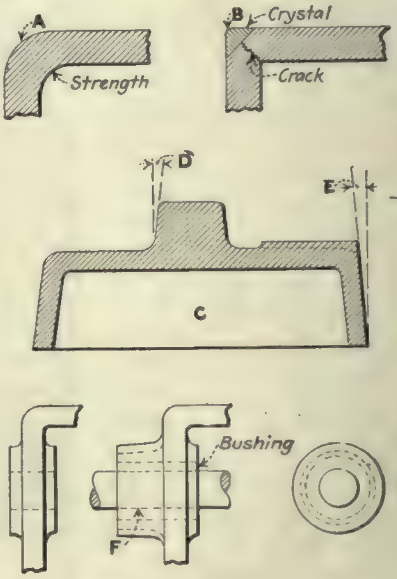


Fig. 117

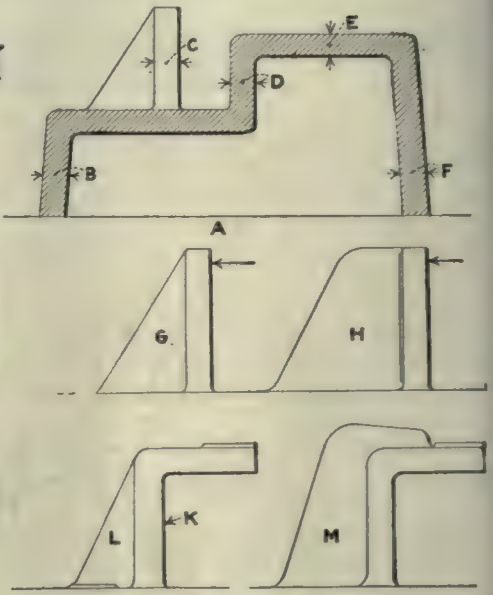


Fig. 118

FIG. 116. DESIGN OF FIXTURE BASES FIG. 117. DETAILS OF CONSTRUCTION
FIG. 118. UNIFORMITY OF RIBS AND WALLS

At *F* the work *G* is firmly clamped against a solid shoulder of the fixture *H* by means of a rocking clamp *K* operated through the threaded rod *L*. The thrust of the cut is then taken by a solid wall of metal and there is no possibility of "chatter."

Milling cutters produce chips very rapidly and in large quantities. Therefore milling fixtures should be designed so that locating surfaces, clamps, screws and other devices will not become clogged with chips so as to interfere with their proper working. Fig. 115 shows an equalizing lever *A*, connected to two rods *B* and *C* which pass through the holes *D* and *E* in the body of the milling fixture *F*. The openings around the rods permit chips to fall through and accumulate at *G* and *H*, resulting eventually in interference with the action of the levers. The holes should be covered in order to prevent this accumulation or else the fixture should be arranged so that it can be readily cleaned. As a milling fixture is always bolted down to the table in a fixed position, provision for cleaning should not necessitate its removal from the table. Openings in the side of the fixture can be made but it is better to prevent the chips from entering and thus do away with the necessity for cleaning.

At *K* is shown a locating stud with a groove at *I* into which chips or dirt may drop so that work located on the plug will seat itself properly. This is very bad indeed as after a time the groove fills up with chips and dirt which have to be cleaned out frequently to allow the work to locate properly. *M* is an adjustable, threaded member in a fixture base. This also should be avoided as far as possible because chips will eventually work into the thread and make it difficult to operate.

The locating block *N* is relieved at *O* in order to ensure correct location of the work *P*. This design is open to the same objections as the example *K*.

The type of adjustable V-block shown at *Q* is most annoying to an operator, as the chips get in to the elongated slot and also under the block causing it to rise as shown at *R*.

There is some difference of opinion as to whether a well-ribbed milling fixture will give as satisfactory results as one which is made of very heavy section cast iron without ribbing. Those advocating heavy sections without ribbing claim that the solidity of the metal in a heavy milling fixture tends to lessen vibration and thus give better results than a ribbed milling fixture. The writers believe that a well-ribbed milling fixture of substantial section will answer the purpose in nearly all cases although for extremely heavy cuts a good body of metal is desirable.

Fig. 116 shows at *A* a solid base plate of cast-iron on which a built up fixture can be placed. The illustration *B* shows a similar, though heavier plate. The latter would be better designed as shown at *C*, with the mass of metal reduced and the sections strengthened by the use of ribbing. The view at *D* indicates the position of the various ribs. The ribs of a fixture of this type should be so proportioned that there wil be no tendency to "buckle" and thus cause vibration while a cut is in progress.

Fig. 117 shows a corner wall *A* which has been made to a large radius in order to give maximum strength.

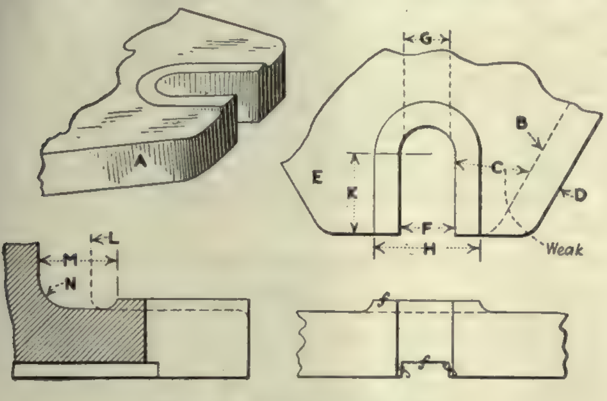


FIG. 119. U-LUG DESIGN

Square corners on castings and sections of unequal thickness should be avoided. *B* shows a square corner which is likely to crack at the points shown, due to strains set up by unequal cooling in the foundry.

The diagram at *C* is given in order to emphasize the fact that all castings should be so designed as to allow for "draft." Draft is not necessary to the casting, but the pattern has to be tapered so that after the mold is made, the pattern can be removed from the sand without injuring the mold. And as the pattern is a duplicate of the casting, the necessary draft is included in the design of the casting. The amount of draft necessary varies from ⅛ in. to ¼ in. per foot. It is advisable to show the draft on deep castings as indicated at *D* and *E*.

Where bosses are provided on castings it is well to make them larger in diameter than appears necessary, in order that the location of holes in the bosses may not be seriously affected by variations in the casting. Also when bosses are used as bearings, it is advisable to make them large enough so that they may be bushed for wear as indicated at *F*. There is nothing much more annoying to a toolmaker than to find insufficient allowance for stock on a boss, so that the hole is not central with the boss, allowing a shouldered stud to lap over the edge.

In order that the castings used for fixture work may be substantial and not subject to cracks due to unequal cooling, uniformity in the sections should be preserved as far as possible. Fig. 118 shows a section *A* in which the walls *B*, *C*, *D*, *E* and *F* are all of uniform thickness. A fixture designed in this manner will be free from defects or cracks in the metal which are often caused by unequal cooling.

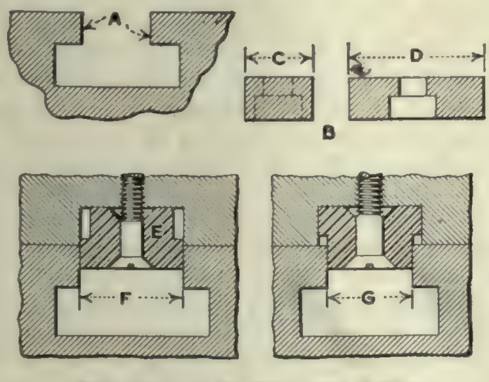


FIG. 120. T-SLOTS AND KEYS

The correct design of ribs is an item which should be given the most careful attention. It is not uncommon to see an angular rib like that shown at *G* when there is no good reason for making it so light. A rib like that shown at *H* will withstand pressure very much better than the other one.

In the case shown at *K*, the rib *L* has very little value; yet if it were to be made as at *M* it would give stability to the construction and add to the general rigidity of the fixture.

A milling fixture must be bolted to the table on which it is used, therefore a means of fastening must be provided so that it can be quickly adjusted when removing or replacing it. In Fig. 119, *A* shows a good construction for U-lugs. Lugs made to the outline shown by the dotted line at *B* develop a very weak section at *C*. By designing the lugs as indicated by the full lines at *D* and *E*, greater strength is obtained and there is less likelihood of breakage. U-lugs are usually cored at *F* and the cored dimensions should be not less than 1/16 larger than the T-bolt used to hold the fixture down. A key slot *G* is provided for locating the fixture on the table.

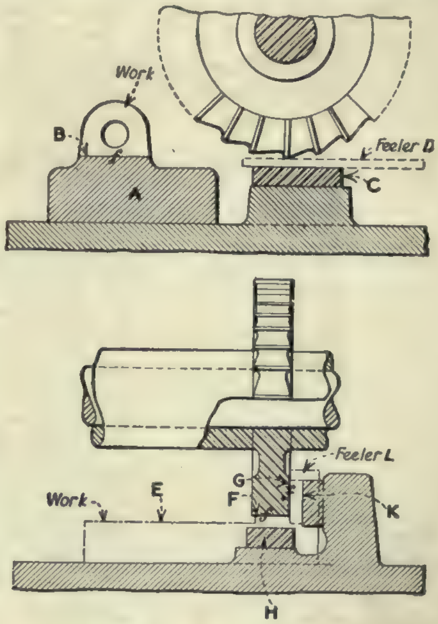


FIG. 121. SET BLOCKS

In proportioning the outlines of the boss *H*, it is well to make each side of the finished portion at least one-half the distance *F* and even more than this is not objectionable. The depth *K* should always be from one and one-half to two times the dimension *F*.

U-lugs should not be set in too close to the body of the fixture as indicated by the dotted lines at *L*. It is much better construction to make the distance *M* at least as much as the dimension *F*. When this is done a large fillet can be used at *N* thus giving additional strength to the fixture.

Milling fixtures are located on the tables of milling machines by means of rectangular keys which fit the T-slot *A* in Fig. 120. A common form of key is shown at *B*. The dimension *C* is made to the size of the slot in the milling machine table. The length of the key *D* is generally from 2 to 3 times its width.

As milling machine table slots vary from ½ in. to ¾ in.

with intermediate sizes, it is often desirable to make fixtures transferable from one machine to another. To provide for such a condition, the keys can be made as shown in the illustration at *E*. This type of key is so proportioned that it can be used to fit a slot having a width as shown at *F* and it can also be reversed and used to fit another slot like that indicated at *G*. An arrangement of this kind is of great advantage where a number of milling machines having different size slots are to be used in production.

In order to make sure that cutters are set in the correct relation to the work on a milling fixture, it is essential that each fixture be provided with suitable set blocks.

Assuming that the work *A* shown in Fig. 121 is to be machined at *B*, a hardened set block *C* should be provided. In setting the cutter to the correct depth a "feeler" *D* is interposed between the cutter and the set block *C*. The thickness of "feeler" can be standardized and suitable allowance made between the top of the set block *C* and the depth of the cut desired.

In the example *E* the work is to be finished on the surfaces *F* and *G* and it is, therefore, necessary to provide set blocks at *H* and *K* so that the feeler *L* can be interposed as indicated in order that the cutter may be accurately set, both vertically and horizontally.

Foreman or Teacher—Which?

By William A. Ayars

For some sixteen years it was my enjoyable and congenial duty to earn my living as a technical teacher. But I did not, like the majority of such teachers, go directly from graduation in mechanical engineering to teaching. Nor, after starting to teach, did I desert all other branches of engineering to stick closely to the educational side. Most colleges grant from three to four months of summer vacation, and no live man wants to waste that much time, intellectually, physically or financially. I found it highly profitable on all these grounds to get a job of some sort during these vacations, and whenever such jobs were available I took one. They kept me from going stale, they provided me with abundant material to use in my next year's teaching, and they more than paid expenses. But I think the most valuable thing I got out of those summer jobs was the associations I had, not alone with skilled workers, but with executives, minor and major. As more or less of a "free lance," I was given far more of a look behind the scenes in many cases than I should have had as a permanent employee, and frequently had an opportunity to discuss the same problems with men in vastly different departments.

One interesting case came up in a locomotive works. At lunch one day the general foreman told me he was much upset by an order from the general manager that he reduce his force by a certain number, and that with the order had come a list of the men's names who were to be laid off; and that they were the best men he had. The same evening I sat on the porch with the general manager, and he told me the same story, saying that he knew Jim was rather upset; and then explained why he had issued the order. Future contracts were not very plentiful, and it was necessary to cut down. In anticipation of some such contingency he had some time before had the employment department give him a pretty complete history of each man in the shops, including their ages, whether married or single, and how many dependents or children each had. When the time came to cut down the force, he had himself selected all the younger and stronger men, and those without dependents; his reason being that these men could get new jobs much easier than the older ones, and would suffer less if they were out of work for a short while. This manager was an exceptionally good one, and he was also a man with a very kindly disposition and a big heart. I have had plenty of experience with the other sort as well.

Bossing, or Teaching?

One of the new "slogans" we hear much about is frequently printed on a heavy card and prominently displayed in executive offices. It is "TEACH, DON'T BOSS!" Probably some of the men who display it really mean it, but I know many who don't. A very successful works manager once told me that he owed a debt he never could repay to the shop where he had served his time. This was a small country shop, and the foreman was also owner, superintendent and manager. Every boy in the shop was a personal responsibility to him, and he saw that they learned all he could teach them, even when that teaching meant delay or loss on some of the jobs. I said to him, "Bill, if that old owner-foreman came to you today and wanted a job as a foreman, would you give him one?" "Not as a foreman," said he, "but if I were running a trade school, or had a regular department for training apprentices, I'd hire him on the spot!" This seems to show that teaching and foremanship do not always harmonize.

The Training Department

Again, during the late war, I was employed for some time in the education and training division of the Emergency Fleet Corporation. The work of this division was to supervise and assist in the intensive training of the unskilled men employed by the shipyards. There was always trouble with some of the yards in trying to make the management see that the green men taken on in the training department were first to be taught, and that during their training period it was rarely advisable to try to make them productive. In other words, the training department was not to be gaged by the amount of productive labor done by the learners, but by the number and the skill of the men turned over to the shops and ways. Where this principle was cordially accepted by the management, the results were excellent; where it was either openly or secretly opposed, the results were poor. I remember almost the same problem coming up repeatedly in technical education, with regard to school shops.

University Products

Successful practical men, who nevertheless knew nothing about educational work, were and are continually asking the colleges why they do not make their shops turn out something of commercial value—some tangible product that can be sold at a profit. Now the usual college that has well equipped shops feels that it *does* turn out a valuable product, but the product thought of is not a machine or a piece of furniture. It is a boy who has learned something valuable to him and to his future employer. I am referring, of course, to shops foming part of the mechanical equipment of a college or a university, not of a trade school. In a trade school it is quite feasible to secure a fair profit by manufacturing some article or articles that are salable. Or if this be not expedient, work can be secured that at least cuts down on the running cost of the school. One such instance occurred in the re-education shops run by the Department of Soldiers' Civil Re-habilitation in Canada. One of the courses taught was machine tool operation, and as the school had no foundry, the cost of small rough castings to be machined was a considerable item. A further disadvantage, as all who have taught manual work well know, lay in the fact that small rough castings which, when machined, have no further use or value, have very little interest to the embyro craftsman. So an arrangement was made with a large manufacturer of pumps to send to the school unfinished parts of small duplex pumps, and these were machined by the students under close supervision by the instructors (all of whom were highly skilled mechanics) and then shipped back to the factory. Thus the school saved a great deal of needless expense and the manufacturer got a certain amount of labor at no greater cost than the freight on the castings between the factory and the school. As these two establishments were a great many miles apart, the manufacturer did not get off so cheaply as might be imagined, but it was a very satisfactory arrangement just the same.

Producing in the School Shop

There are school and college shops today where a commercial product is made and sold, but I have been told by those who know, that it required practically a double organization to keep them running: a number of paid skilled workmen with a foreman to attend to the purely factory side of the shops, and the instructors to look after the teaching side. From an instructional point of view, any one who has had experience knows that a spoiled piece of work frequently teaches the man who did it more than if he had done it correctly. But if that piece happened to be one of a lot needed to complete an order, and the whole order is thereby held up until a new one can be made, the man who is responsible for the commercial output of the shop is by no means pleased, no matter how much the bungler may have learned by the mishap.

Difference in Methods of Teaching

Some "practical" man may ask why there should be any difference between the methods of teaching a student in an engineering school or university, and in a trade school. This is still debatable, I admit, but I think most men who speak with authority in matters of technical and engineering education are fairly well agreed. To me the difference appears very simple: the object of the trade or industrial school is to teach a trade; and of the college or university, a profession. It is highly desirable that a mechanical engineer should have had a good shop training, not so much to make him a skilled mechanic, but to give him a thorough knowledge of shop processes and of planning his work so that it can be done with a minimum of cost of both labor and material. The trade school, on the other hand, aims to train its students so that they may be accurate, rapid and efficient workers at their chosen trades.

A shop foreman should have teaching ability as well as executive, but he cannot afford to devote much time to teaching anything but the "high spots" during his working day. If a new machine comes into the shop, he should himself learn that machine thoroughly and when he assigns a man to that machine, he should be able to instruct him, not in the essentials of the trade, but in the operation of that machine. It is quite probable that in a short time the man operating the machine will know far more about it than the foreman or even the designer. I have had the chief engineer of a great machine-tool factory tell me that many customers know far more about the machines than the builders themselves and that frequently when buyers write in to the factory for information as to how the machine is to be used or adjusted, they answer by referring the questioner to another customer who is using the machine on a similar process, and who can give the help asked for better than the builder. Designing and building ability is quite different from operating ability. It is only necessary to watch a competent typist at work to prove this, or to note the annoyed helplessness of the professional organist when something happens to his intricate instrument.

Responsibility for Training

It seems that the old apprenticeship system has gone, never to return. Still, industry must carry on, and it must train its thousands of recruits every year. How will they get the training? When times are good and shops are busy, there is lively competition for good men, but the novice has a hard row to hoe. As soon as he confesses to his lack of training he is told he is not wanted. Every employer is willing to pass the buck and "let George do it," and some are none too scrupulous in taking George's men away from him just about the time they are getting useful. What is the remedy? It seems to me that there are two ways of solving this problem. One is by means of trade schools which should be liberally helped and supported by all factories in the vicinity which expect to draw on them for future employees, and the other is by means of well-equipped apprentice-training departments in large organizations. And in the latter case, let those in charge be duly and even forcibly impressed with the fact that they are supposed to turn out skilled men and not commercial products. It will usually be found that a great deal of commercial product can be turned out of an apprentice-training department, but if so, let this product be accounted "velvet," and the department judged and weighed solely by the number and quality of its graduates. This is of course nothing novel; many such training departments are in successful operation today and a few of the smaller plants still have regular apprenticeships, where the boy who starts in has no obstacles thrown in his way, even if he does not get a great deal of real assistance. Let the foremen in productive work teach, if necessary, the *how* of doing the various jobs and the *why* of certain things that may appear inexplicable to intelligent and reasoning men. But he should neither be allowed nor encouraged to teach the *trade;* that should be taken care of in either of the two methods indicated above. And in choosing men to teach the trades, see to it that they are born teachers, and do not compel them to make too much of a financial sacrifice in order that they may do the work they love to do, and can do far better than one who does it for a living only.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Emergency Repair on a Crusher Shaft

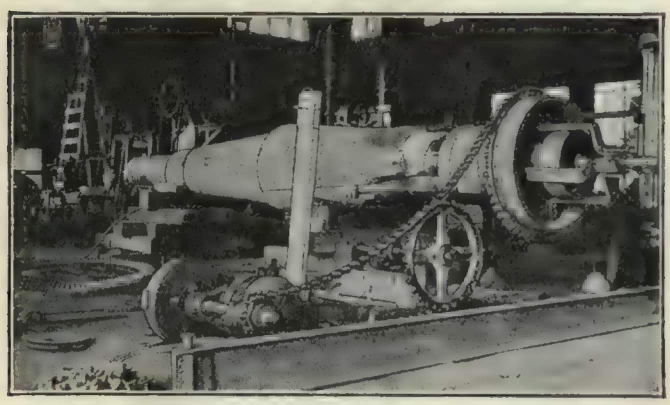
By H. Beard

The part shown in the accompanying illustration is the vertical spindle of a No. 24 Gates crusher. It weighs 37 tons and is about 25 ft. long.

The nut that holds the core on worked off, and the thread on the spindle was so badly damaged as to make rethreading necessary. There was no lathe within 500 miles large enough to handle such a job and it was therefore up to us to devise a means of cutting a new 14-pitch thread, 24 in. in diameter with the means at hand.

The spindle was blocked up and the top bearing babbitted and bored to fit the shaft. The rim of an old sprocket was fitted to the flange of the bearing and a 5 x 5-in. billet of steel bolted to it in such a way as to extend parallel to the axis of the spindle. The lead screw of an old lathe was fitted in the eyebolt hole and a nut on this screw connected by forged straps to the bearing to feed the latter along.

The cross-slide of the lathe was bolted to the billet to manipulate the tool and power for driving the device was furnished by a reversing motor, driving through chains and countershaft.



EMERGENCY REPAIR ON A CRUSHER SHAFT

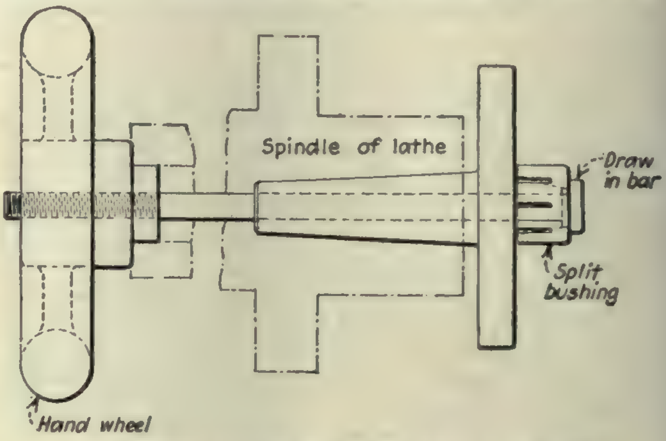
It took a machinist and helper about eight hours to turn off the old thread and cut a new one. The operation was very smooth and without chatter. The setting up naturally required more time, but the freight on the piece to the nearest lathe would have been more than our entire cost.

Expanding Arbor to Hold Small Gear Blanks for Facing

By Lester Ferenci

On page 693, Vol. 54, of *American Machinist* Milton Wright suggests a method of chucking gear blanks for the finish facing operation on an expansion stud arbor. An idea that I have found better suited for this kind of work is shown in the accompanying illustration. I believe there is a decided advantage in this construction.

In this class of work the important factor is to make the two faces of the work parallel with each other. Using the construction shown herewith, as the split bushing is drawn in over the taper of the body it grips the bore of the blank and at the same time forces the face of the work, by its own movement, against the face of the arbor; thereby squaring it up. If the face of the arbor runs true, the faces of the work will be parallel.



EXPANDING ARBOR TO HOLD SMALL BLANKS FOR FACING

Another advantage is that by using a split bushing the bore will be gripped on its entire length, even in the case of a large bore, where as by Mr. Wright's construction the arbor will grip only on the outer end when the bore is oversize.

Converting a Planer from Screw to Worm Drive

By R. T. Wilson

In our machine shop we had a large English screw planer which it was found necessary to convert to a worm drive. This work required the boring of a 3¼-in. hole at an angle of 12 deg. 30 min., the angle of the worm and rack, for a distance of 24 in. through the solid bedplate casting and a number of heavy ribs. We had no boring mill in the shop, and to do the work we set up an old engine lathe bed on the floor at the right height for the bore and at the required angle, with the planer ways. Parallel to the lathe bed we fixed up a jackshaft with two pulleys driven from a 3-hp. motor.

Our first operation was to drill a 1¼-in. hole the full length of the cut to be made. This we did by setting an electric drill with a twist drill having a shank three feet long in the tailstock center with the shank guided through the lathe steadyrest. The tailstock spindle advanced the drilling machine until the first cut was finished.

We replaced the drilling arrangement with a 4-ft. boring bar $2\frac{7}{16}$ in. in diameter, turned on the cutting end to $1\frac{1}{4}$ in. diameter for a length of 2 in. to form a pilot. A hole $\frac{1}{2}$ in. square was made in the boring bar, close to the shoulder of the pilot, to take the toolbit.

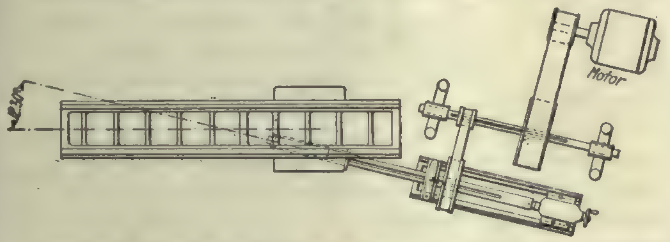
The first bit used was ground with two cutting edges, one a little ahead of the other and set for a $4\frac{1}{4}$ in. diameter cut. With this bit held in place by a setscrew the hole was spot-faced. We then exchanged the toolbit for a similar one $3\frac{1}{4}$ in. wide, the final diameter required for the hole.

After the first 14 in. of the cut was made a guide bushing, flanged at one end to fit into the $4\frac{1}{4}$-in. spotfacing at the beginning of the cut, was placed in the cut. This guide bushing together with the steadyrest furnished a means of holding the boring bar in an absolutely true position.

As the boring bar advanced in the cut, the spline in the bar and in the jackshaft permitted the necessary adjustment of the pulleys.

The entire cut of 24 in. was made without removing the planer from its position on the floor. Only such material as we had available in the shop was used to do the work. With only one mechanic we finished the job in two working days. The illustration shows the manner of the set up.

The boring was the most difficult part of the job, as we had to improvise the rig for doing it. As there was nothing unusual in making either the rack or the worm no further description is necessary.



BORING LARGE HOLE IN PLANER BED AT AN ANGLE

Division of Prime Numbers

By A. E. Twigg

I should like to make formal acknowledgment for the many useful kinks, learned from the *American Machinist*, that I have profited by during the last twenty years. I am sending a description of a method for originating an index plate to be used in cutting gears. I saw this method worked by an old friend and foreman instructor some years ago, and he told me that he learned it from his grandfather, an old working machinst. That was in the days when dividing heads "were not."

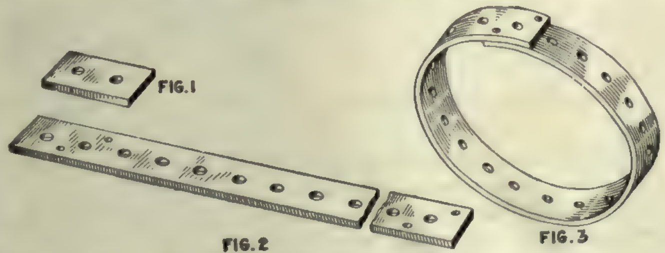


FIG. 1. THE JIG. FIG. 2. BAND IRON DRILLED WITH JIG SHOWN IN FIG. 1. FIG. 3. BAND IRON BENT IN A CIRCLE

Take a piece of hoop iron sufficiently long, also a short piece of sheet iron or steel of any suitable gage and length for use as a jig. In the latter drill two holes about $\frac{1}{8}$ or $\frac{3}{16}$ in. in diameter any distance between centers as in Fig. 1. Fix a short piece of drill rod in one of the holes and use it as a step jig to drill aforesaid strip of hoop iron, drilling the number of holes required for the index plus one or two extra for overlap, as in Fig. 2. Bend the hoop iron into a circle bringing the overlapped holes fair and fasten the ends with rivets, as in Fig. 3. Turn a disk of cast iron or hard wood to fit inside the diameter of the hoop and force the hoop on it. The disk is driven on the dividing spindle and the arrangement is complete.

Volume Removed from a Sphere by Boring

By Francis M. Weston, Jr.

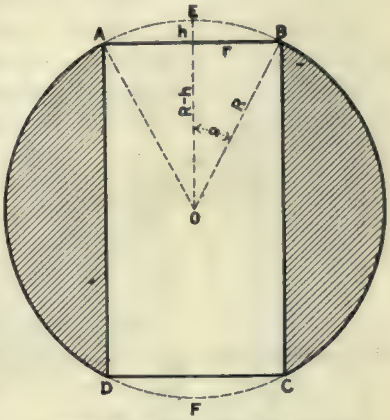


DIAGRAM FOR DETERMINING VOLUME REMOVED FROM A SPHERE BY BORING

A machinist once asked me how large a hole should be bored through a 4-in. cast-iron ball to remove one quarter of its weight? After working out the proper diameter of hole for the particular case in question it seemed that a general formula covering all possible cases might prove useful. From the accompanying diagram it will be seen that a hole bored through a sphere removes material as follows: (A cylindrical central portion, *ABCD;* and two equal spherical segments *AEB* and *CFD.*)

Let $D = 2R =$ diameter of sphere.

$d = 2r =$ diameter of hole $= AB$.

$h =$ height of sperical segments AEB and CFD.

$D—2h = 2(R—h) =$ length of cylindrical part of hole.

$a =$ half of central angle subtended by chord $AB = EOB$.

$m =$ percentage of volume of sphere to be removed.

Then: Volume of sphere $= \frac{4}{3}\pi R^3$.

Volume of cylinder $= \pi r^2 \text{x}\, 2(R—h) = 2\pi r^2 (R—h)$.

$$\text{Volume of spherical segment} = \pi h^2 \left(R \frac{h}{3}\right).$$

From the diagram it will be seen that

$$r = R \sin \text{a} \qquad (1)$$

$$h = R(1 - \cos \text{a}) \qquad (2)$$

The volume of material to be removed by boring is expressed by the equation

$$2\pi h^2 \left(R - \frac{h}{3}\right) + 2\pi r^2 (R - h) = \frac{4}{3}\pi R^3 m \qquad (3)$$

Substituting in equation (3) the values of r and h as given in (1) and (2),

$$2\pi R^2 (1 - \cos \text{a})^2 \cdot \left[R - \frac{R(1 - \cos \text{a})}{3}\right] + 2\pi R^2 \sin^2 \text{a} \, [R - R(1 - \cos \text{a})] = \frac{4}{3}\pi R^3 m.$$

Dividing both members of this equation by $2\pi R^3$ and clearing of fractions, we have

$$(1 - \cos a)^2 (2 + \cos a) + 3 \sin^2 a \cos a = 2m$$

Performing the indicated multiplication and collecting terms (remembering that $1 - \sin^2 a = \cos^2 a$), we obtain

$$\cos^3 a = 1 - m$$

$$\cos a = \sqrt[3]{1 - m}$$

$$a = \cos^{-1} \sqrt[3]{1 - m} \qquad (4)$$

Substituting this value for a in equation (1),

$$r = R \sin (\cos^{-1} \sqrt[3]{1 - m})$$

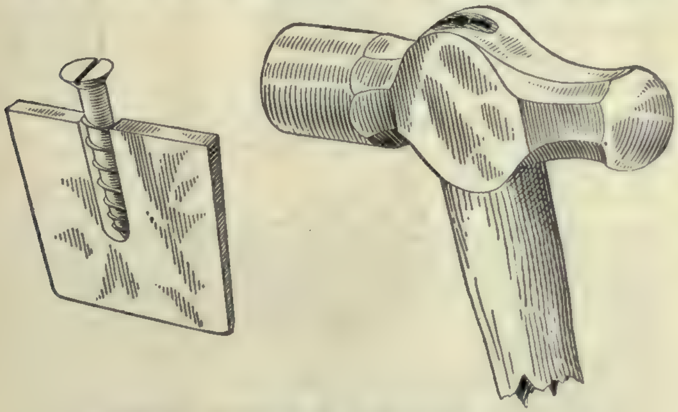
$$\text{or } d = D \sin (\cos^{-1} \sqrt[3]{1 - m}).$$

An Efficient Wedge for a Hammer Handle

By R. McHenry

At last I have hit upon a simple form of wedge for a machinist's hammer that seems to hold. The continued jar and the slight shrinkage of the wood soon causes the usual type of wedge to work out and the head to loosen.

The wedge shown in the sketch is of steel and extends nearly across the eye lengthwise. I first drilled a hole through the center of the wedge slightly larger in diameter than the thickness of the wedge at the top. Two parallel saw cuts down to the outside edges of this hole were then made, forming a deep slot with rounded bottom.



HOLDING A WEDGE IN A HAMMER HANDLE

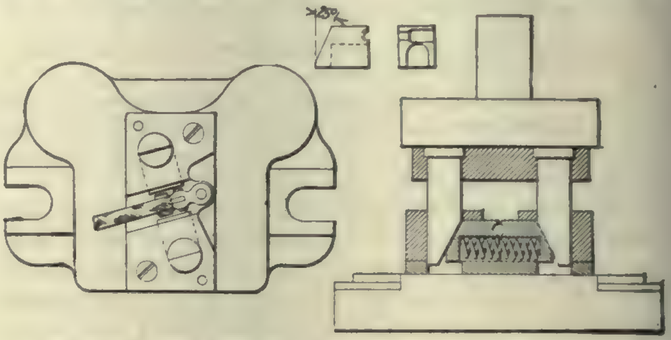
The wedge was then driven into the hammer and a short wood screw of suitable diameter started in the rectangular opening left in the center. The screw, which cut firmly into the wood on each side, I turned in beyond its threaded portion and until the point struck hard on the bottom of the wedge slot; after which the projecting portion was sawed off and smoothed over with a file, making a neat and permanent job.

A Unique Closing Die

By E. H. Tingley

The closing die shown in the accompanying sketch is used by the Delco-Light Company, Dayton, Ohio, for closing in the sheet copper or sheet brass clips around the ends of the electric wire leads of the switchboard, field coils or collector brushes. The clips are blanked, pierced and formed, and the electric wire is stripped of the insulation for about ½ in. from each end.

A supply of completed clips and of the stripped wire is supplied the girl operator of a No. 81 Consolidated press, in which the closing die is mounted, and she places a clip over a pin in the die. She next lays in the end of the electric wire in the clip at the proper place (see sketch) and trips the press. The die blocks move inward and roll down the tips of the clips.



CLOSING DIE FOR ELECTRIC WIRE CONNECTORS

It will be noticed that the clip has two sets of tips, one which clamps around the bare wire, and the other to hold the cut end of the insulation, thereby preventing it from unraveling. The wire with clip attached is removed and solder applied to make a tight connection.

The design of the die is unique as it uses the principle of the wedge. The plunger rods are made of drill rod beveled to 25 deg., and the same angle is placed on the ends of the die blocks. A spring keeps the dies apart when the plunger rods are up out of the die.

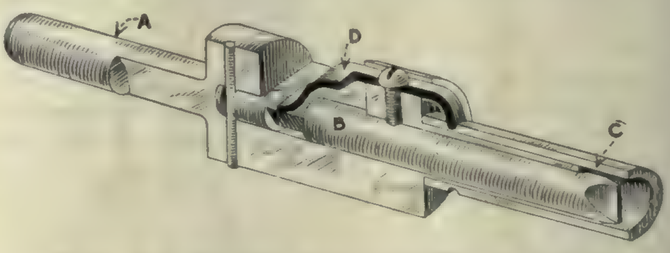
This type of die has been designed and built for several sizes of clip and wire. Fromerly a pair of pliers were used to close in the clips, but the dies give a far neater and better result.

Setting Screws by Power in Assembly

By H. S. Beeston

Notts, England

The setting of screws and nuts, as referred to by Amos Ferber on page 739, Vol. 52, of the *American Machinist*, forms a great part in the assembly of electrical instruments. Many and varied are the methods used to boost the assembly, to keep abreast of the demand. The writer desires to show a simple, efficient tool used for this purpose.



TOOL FOR SETTING SMALL SCREWS BY POWER

The tool may be used in a lathe or other horizontal spindle, but is much more efficient when used in a vertical position with suitable receptacles to hold the work and permit easy handling. As many as 7,000 No. 8-32 A. S. M. E. connection head screws have been assembled in terminal plates, springs and the like in an 8-hour day, the work being done by a boy.

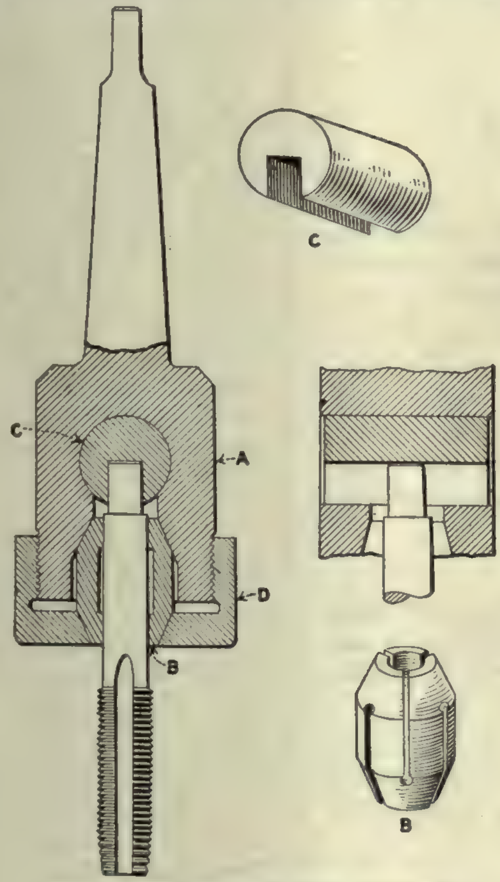
Referring to the sketch, *A* is the toolholder, made of machine steel casehardened; *B* is the driver, made of tool steel and hardened. A three-sided section is filed on it near one end, as shown; the sleeve *C* is made of machine steel and casehardened, fitting over the toolholder to locate the screw over the driver *B*. *D* is a tempered, flat steel spring, bearing at one end on the three flats on *B* and at the other in the groove in the sleeve *C*.

The action of the tool needs very little description. The operation of assembling screws is as follows: The screw is put into the sleeve *C* and the work placed over the screw. A downward push and the screw is home, the spring *D* riding over the flats of the driver *B*, which then remains stationary so as not to strip the threads or damage the finish on the screw heads. The tool may be run 2,000 or more revolutions per minute.

Tap Holder and Driver

By Frank W. Curtis

Many tap holders are so made, that the tap is only gripped on the shank and not driven by the square section intended for driving purposes. The tap holder illustrated not only holds the tap by the shank but also drives by the square end. This holder can be used in connection with a friction tapping attachment and will avoid marring the shank.



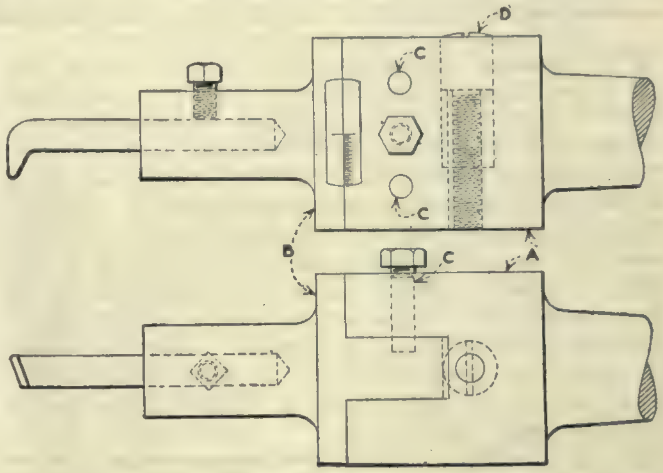
POSITIVE DRIVING TAP HOLDER

The body or main section of the holder *A* can be standardized to hold various sizes of taps. The collet *B* and the driver *C* are respectively made to fit the shank and square end of the tap to be used. By screwing the cap *D* on the body of the holder, the collet grips the tap at two points. The driver *C* is pressed in the body and if it is to be removed for the substitution of other sizes, a taper pin can be used for holding it in position. This holder will give good service and can be made at small cost.

An Adjustable Boring Toolholder

By Harry Moore

A handy boring toolholder for use on the milling machine is shown herewith. It is made in two parts, *A* being turned to fit the spindle of machine and slotted across the face to take *B*. This piece is in turn slotted or grooved for the pins *CC*. Part *A* is drilled and tapped for adjusting screw *D*, the head of which bears on the cut away portion of *B*, as shown. A flat milled across the top of both parts when together is afterwards graduated, this little addition making adjustment finer and easier. One screw only is needed for tightening purposes, the hardened pins holding the two parts in line.



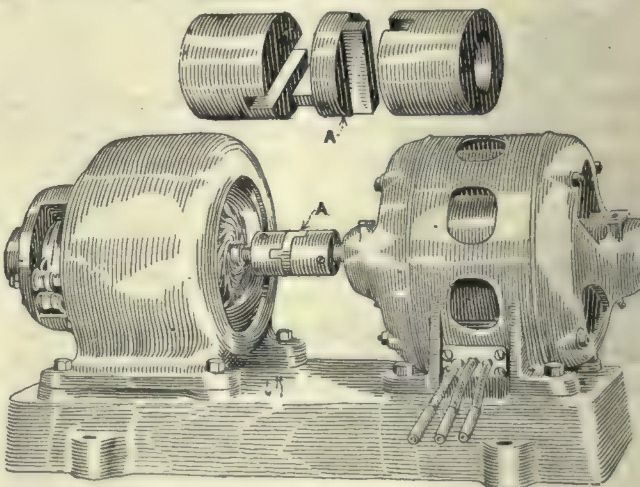
AN ADJUSTABLE BORING TOOLHOLDER

A Simple Compensating Coupling

By Charles H. Willey

We had a motor generator charging set mounted on a cast-iron base, which gave constant trouble by reason of the bearings running hot, due to misalignment of the shaft.

The shop foremen made a quick repair by removing the solid coupling between the two units and cutting it in half, machining in each part a slot and making a dutchman, as shown in the sketch at A, the lugs of the dutchman being a loose fit in the slots.



A SIMPLE COMPENSATING COUPLING

IN THIS ISSUE

THE leading article this week is the first of the series "Organization and Management of the Small Shop" by Elmer W. Leach, which we mentioned several months ago and have since referred to frequently. This article indicates that there is a whole lot more to the small shop than would ordinarily be thought. The author shows that we cannot get away from hard work any more than we could in the large shop and while it may appear to be a trite statement, it is nevertheless true that, as a rule, hard work and plenty of it is back of anything that is really successful. The point is emphasized that no matter how small a shop may be it must have an organization and a management just the same as must any large organization. The current article is, of course, to a large extent introductory. Future articles will take up methods and system. The author states that he plans to present a reasonable mixture of theory and practice, and that everything that will be offered is the fruit of actual personal experience and is not guess-work.

Another of the Rolls-Royce articles appears on page 85. Colvin has given it the title "Some Unusual Features of the Rolls-Royce Car" and has selected for description some of the details of design which are rather unusual in automobile practice, involving different construction and requiring special machining methods. He takes up the construction of the rear end of the chassis, machining operations on the control sphere, boring a torque tube; and boring and turning the rear axle tube.

We continue the dissemination of information for railroad shops with the article "Miscellaneous Railroad Shop Tools and Methods" by Frank A. Stanley, page 87. We have been running what may seem to some of our readers an abundance of railroad articles. Just because they are railroad articles is no reason why other than railroad men should not read them. They are representative of certain classes of work that are found in many shops. This particular one of Stanley's articles shows, among other things, a method for guiding taps and reamers, the design of an inexpensive high-speed steel reamer and the design of certain fixtures, all of them applicable to many kinds of jobs.

There have appeared in the past, two articles on the monitor and multi-storied types of shop which were two of the announced series on designs of buildings. The third of this group is the article beginning on page 91, on the high- and low-bay type of machine shop. Features of its design are the wide, high bays with low bays between, giving light from both sides, the use of standard columns and shapes, and the facilities offered for artificial lighting.

The third of the articles on the Puget Sound Navy Yard begins on page 94. It tells of a central tool grinding room, a system of sliding racks for storing milling cutters, and the handling of pneumatic tools. The short series "Manufacturing with Special Machines vs. Standard Equipment" which was introduced two weeks ago is continued this week beginning on page 97. This installment describes the first eleven operations performed on the sleigh forgings. Details of some of the tools are given and some of the special machines are illustrated.

With the subject of drill jig design concluded last week, the authors of "Tool Engineering" now take up the subject of milling fixtures. Throughout the group devoted to milling, the authors follow the method—so well established in the preceding articles—of furnishing many specific examples as well as giving general treatment. They do not fail to point out conclusions that have been drawn or can be used as a basis for establishing rules. At the same time, the articles contain the proper amount of theory, a feature that will appeal to the thinking reader. This week's installment begins on page 102.

No one should fail to carefully read the News Section this week. On page 120 is the "Business Barometer," a new feature that appeared for the first time last week. The object of this barometer is the same as that of any other, namely to indicate what is coming. There are also reports on business conditions in Germany, Russia and France and there is, in full, the address delivered by Herbert Hoover before the National Shoe and Leather Exposition and Style Show.

Coming Features

The next issue will be largely devoted to complete articles, among them, "Balancing High Speed Rotors," by A. Schein; "Transfer Dies for a Shallow Cup," by Frank A. Stanley; "Machining Transmission Cases," by Fred H. Colvin; and "Trade Associations and the Law," by Frank K. Nebeker.

The fourteenth of the Dowd and Curtis "Tool Engineering" series will continue with the subject of milling fixtures.

The fourteenth of the Morris apprenticeship articles will detail the various apprentice and training courses of the Winchester Repeating Arms Co.

The thirteenth of A. L. DeLeeuw's "Metal Cutting Tools," devoted to boring tools, will be a part of the issue.

EDITORIALS

Coal—Is This the Time to Buy?

THE mercury in the thermometer seems to have made up its mind to settle down to an average of 90 in the shade for some weeks to come. Consequently it is time for the forehanded manager to consider the condition of his coal pile and to plan for the cold weather that will be here six months hence.

In any year the problem of how much coal to lay in and when to buy is not easy of solution, but this year with almost everything doing precisely what it shouldn't it is worse than ever. We hesitate to give advice in such a case but we feel that it is distinctly within our province to present the facts as they are.

At the present time prices are down, 'way down. Taking the index figure established by the Government Fuel Administration on the basis of cost of production at 100, the present index is 89. As a result not a great deal of coal is being mined for the simple reason that most of the mines, where the cost of getting out the coal is relatively high, have been forced to close down. Just as soon as there is an increase in demand the amount now being mined will be insufficient, it will be necessary to call upon the high cost mines to produce it, and prices will stiffen. The old law of supply and demand will operate as usual.

One reason for the present low prices is the fact that certain non-union mines, which ordinarily do not produce coal for sale to the public but only for the industries which own them, are now mining coal for sale while the industries are closed down. They seem able to undersell the union-operated mines by about a dollar. The amount of coal they can produce is not large and will be withdrawn from the market just as soon as there is any sign of improvement in the industries which these mines normally serve and immediate stiffening of prices will follow.

There has been some hope that the union mine workers would listen to reason and agree to a voluntary reduction in wages but it seems likely that they will insist upon the fulfillment of the national agreement which runs until next spring, and remain idle rather than work for less money. As the f.o.b. cost of steam coal is approximately 70 per cent labor the chance of any appreciable reduction in price is slim.

On the average about half of the cost of coal to the consumer is transportation charges. There is no doubt that freight rates are high and that certain adjustments should be made. As a matter of fact, however, the great majority of adjustments that have been made in coal rates have been up and not down. There is much talk of reducing freight rates but with the railroads in their present financial condition there is little chance of relief from this direction.

The man who has laid in his winter reserve of coal can devote his energies to solving others of the many problems that beset him, but the man who is sure to need coal before the first of July next will do well to face the facts squarely and make his decision accordingly.

Organization and Management of the Small Shop

THE series of articles "Organization and Management of the Small Shop" of which the first installment appears in this issue, will answer a question which has been asked, either verbally or mentally, thousands of times—"Can I compete with established businesses?" The origin of every great business was an idea, and practically every one of our greatest industries started with decidedly meager equipment and facilities.

The author lays stress on the necessity of organization in the small shop and discusses manufacturing and marketing problems, citing his own experience as an example. Many a potential industry has been lost to the world because of lack of faith and confidence, and many are the ventures that have failed because of lack of competent counsel.

Mr. Leach takes up each phase of development in detail, covering the subjects of equipment, organization, market analysis, selling the product, and sales policy, in a manner which will undoubtedly be valuable to the man who has created, mentally at least, something that will fill a definite want.

Special Equipment vs. Standard Machine Tools

ALTHOUGH the series of articles which began in the issue of July 7 deals with the making of the recuperator for the 240 mm. gun, this is not the object of their publication. The real object is to give a direct comparison between the use of special equipment in one shop, with the use of standard machine tools in another shop, on identically the same work.

This is clearly brought out in the introduction by Col. G. F. Jenks, Chief of Artillery Division of the Ordnance Bureau. He points out the differences between the two systems, the machines employed and the results obtained. It should also be noted that in both cases the men selected for the work were among the best obtainable, so that the comparison is evidently as fair as could be made. As is to be expected, the advantages of either method apparently depend upon the quantity to be built.

The first portion of these articles will show the special machines designed and built for this work and the way in which the work was handled. The data given are particularly valuable from the fact that they point out just the kind of things which the practical shop man wants to know. The second portion will show the use of standard machine tools, supplemented, of course, by special tools and fixtures as would be the case in any well-managed shop.

These articles cannot fail to prove of great value to all who are interested in the modern use of machine tools, and who realize that success comes to those who can adapt the ideas of others to their own needs, rather than by waiting for something which can be copied without charge.

Shop Equipment News

Poliakoff Milling Machine Dynamometer

In order to determine the pressure exerted by a milling cutter at work, the Poliakoff dynamometer, shown in Fig. 1, has been devised. The device has just been placed on the market by the Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio. The dynamometer is intended for mounting on the machine table, to hold the piece being cut. The pressure of the cutter on the work is shown by means of dials, one of which gives the vertical and the other the longitudinal thrust.

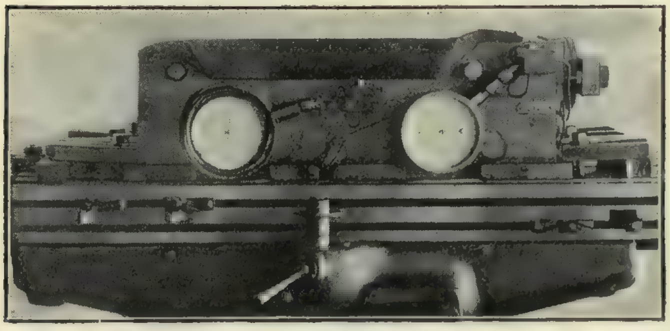


FIG. 1. POLIAKOFF MILLING MACHINE DYNAMOMETER

The device should be of particular use in comparing the pressures exerted by different types of cutters, as well as in determining the stresses set up in the milling machine itself, so as to aid in properly designing its parts. It gives much more definite data regarding the conditions at the cutter than can be obtained by measuring the input to a motor direct-connected to the machine being tested. The reason is that the thrusts in each direction can be accurately determined by means of the dynamometer, and because the efficiency of the driving train in the milling machine, which, of course, varies for different speeds and feeds, does not enter into the test as it does when measuring the power input only.

The work-holding platen of the dynamometer is supported at each end by a wide "Emery" plate fulcrum, the lower end of which rests on two levers, which carry a definite portion of the vertical load on the platen to an hydraulic chamber placed centrally under the work table. This chamber is connected with the left-hand gage, which is graduated by trial in terms of the vertical load in pounds.

The horizontal load is transmitted through bars which are flexible vertically, to the crosshead seen at the right in Fig. 2, which illustration shows the device set transversely on the table, so as to measure the thrust of the helical cutter parallel to the arbor. The crosshead transmits the load to the hydraulic chamber between the crosshead and the end of the main frame of the dynamometer. This chamber is connected to the right-hand gage by the pipe. Heavy springs are used to put initial loads on each chamber, so that they will show loads in either direction.

The Emery plate fulcrums carrying the loads to the levers are so constructed as to be rigid against vertical and cross loads but flexible to longitudinal loads, and the bars to the crossheads are flexible to vertical loads, so that neither system interferes with the action of the other. Guards are provided, so that any desired lubrication or flooding of the cutter may be used.

The dynamometer has the capacity to withstand longitudinal loads of 25,000 lb. in one direction and 4,000 lb. in the opposite direction, vertical downward pressures of 10,000 lb. and upward pressures of 7,000 pounds.

The working surface of the table is 16 in. long by 10 in. wide, and is provided with three T-slots. The height of the working table above the bottom of the base is 8 in. The total size of the base of the dynamometer is 35 x 14 inches.

The dynamometer will be found particularly valuable to manufacturers using extensive milling machine equipment, as an aid to the study of milling operations and the action of milling cutters, thus enabling them to definitely determine the exact requirements of milling jigs and fixtures, a knowledge of which is so essential for their correct design. It will also be found valuable for shops where milling operations are studied, as in experimental shops, laboratories, and shops of technical schools and colleges. Problems attending standardization of machines and cutters can be more readily solved with its aid.

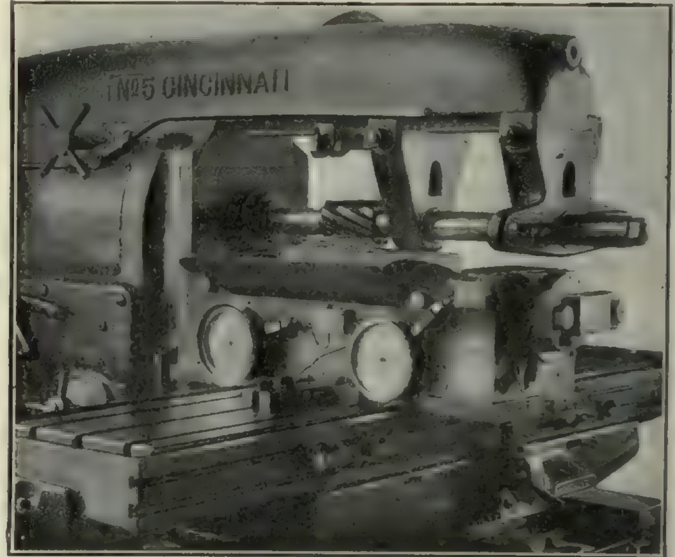


FIG. 2. DYNAMOMETER PLACED TRANSVERSELY ON MACHINE TABLE

The instrument is said to have proved extremely satisfactory and to be very sensitive under tests. Quite obviously, its use is not confined to milling machines, but it is equally adaptable for making tests on planers, shapers and, with slight variations, on drilling machines.

General Electric Arc-Welding Generator Sets

The General Electric Co., Schenectady, N. Y., has recently placed on the market two types of gas-engine driven arc-welding generator sets, one for medium, or intermittent duty, and the other for heavy duty. Both outfits are well adapted to industrial plants where the work to be done is located in odd places, and is not sufficient to warrant the installation of permanent equipment. Their particular field, however, is in places where electric power is either unavailable, or inconvenient or costly to bring to it, such as in marine work, or for welding experts who travel about in localities where there is no electric power.

The medium-duty equipment, shown in Fig. 1, was designed particularly for intermittent work. The generating unit consists of a type WD-10 generator, directly connected by a flexible coupling to a Matthews, Model F, 4-cylinder, 4-cycle, 20-hp. gasoline engine. The engine, radiator, generator and welding panel are assembled on a rigid cast-iron base, which, in turn, is mounted on wooden skids. The set is 86 in. long, 28 in. wide, and has a net weight of about 2,000 lb., making a light and compact affair to move about. The gas engine used with the outfit is said to be especially adapted to the requirements of intermittent welding service. It is of the overhead-valve type, the cylinders being cast in one block with the upper half of the crankcase. The lubrication is a combination of splash and forced feed, and the cooling thermo-siphon, except where special conditions require the addition of a pump driven by the accessory shaft.

The generator is self-exciting and regulating, giving practically constant energy throughout the working range. It gives a no-load, or striking voltage of 60, which automatically decreases to the proper welding voltage, usually 18 to 20 volts, when the arc is struck. It is driven at a speed of 1,200 r.p.m., has a normal output of 4 kw. and delivers a maximum working current of 200 amp. The panel carries the generator field rheostat and series field dial switch, by which the current can be adjusted from 200 to 75 amp. in 25-amp. steps. A reactor choke coil mounted on the set and connected in the welding circuit protects the generator from current surges.

The heavy-duty equipment, shown in Fig. 2, can be arranged to supply either one or two welding circuits. It consists ordinarily of a 20-hp., 2-cylinder, opposed Reliable Heer, Model 00 gas engine, a type WD-9 generator and welding panel, the whole mounted on a welded structural steel base. The net weight is 2,400 lb. for the single-operator equipment, and 3,200 lb. for the double-operator equipment.

The gas engine is designed for continuous operation at the rated output. Careful balancing is said to practically eliminate vibration, and the horizontal cylinder and relatively small flywheel make possible a compact assembly with the rest of the outfit. It will run on kerosene, distillate, gasoline, or natural or artificial gas, with a fuel consumption per brake-horsepower not exceeding 1 pint of kerosene, distillate or gasoline, 10 to 12 cans of natural gas, or 17 to 22 ft. of average illuminating coal gas.

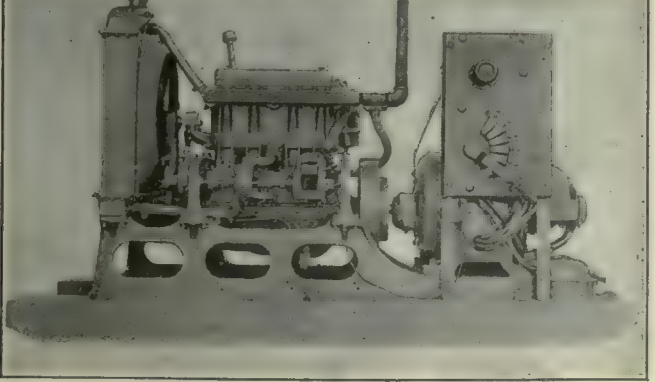


FIG. 1. G. E. MEDIUM-DUTY WD-10 ARC WELDING GENERATOR SET

The generator is driven by a silent chain running in oil, and, except for the speed, its characteristics are similar to the WD-10 generator used in the medium-duty outfit. It runs at 1,750, instead of 1,200 r.p.m., and differs somewhat in the windings because of the difference in speed and service requirements. An ammeter is mounted on the panel of the heavy-duty machine, but in other respects the electrical equipment is identical with that of the medium-duty set. A mere change of location constitutes the only difference between the reactors of the two sets.

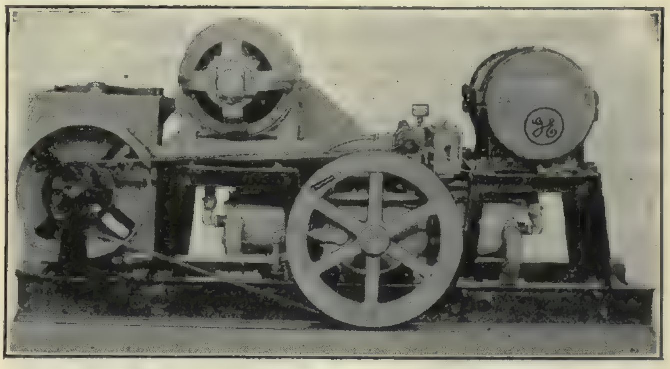


FIG. 2. G. E. HEAVY-DUTY WD-9 SET

Pearson-Scott Mechanical Control for Hand Screw Machines

The Pearson-Scott Co., 1523 East Washington St., Indianapolis, Ind., has recently developed a machine for attachment to a hand screw machine, so as to make the operation automatic. Since the machine does mechanically the work ordinarily performed manually by the operator, it is known as the "Iron Man." It is designed so that it is suitable for placing either at the turret end of the screw machine or at the head end, the latter arrangement being shown in Fig. 1. The machine has means at both ends for the connection of the working arms and reach rods to the control handles on the screw machine, so that it is not necessary to turn it around to connect it. Also, the "Iron Man" can be set between two screw machines working on the same part, so as to control both of them at the same time.

The appearance of the interior of the mechanism after the removal of the oil guards on the front side of the machine is shown in Fig. 2. The essential element of the machine is the large worm-driven disk, upon the sides of which cams can be mounted, their positions being indicated by the light-colored spots. The disk is drilled and tapped with a number of holes for the attaching of the cams. This saves the time of the operator in fitting up the machine, as he usually finds sufficient holes already drilled and tapped for the needs of the job.

The cams run in an oil trough in the base of the machine. They operate to press against hard steel rollers carried on the horizontal crosshead, causing this crosshead to slide back and forth on the finished guide at the center of the machine as the disk revolves. The motion is conveyed to the screw machine controls through a combination of levers. There are six of these levers, located on both the front and rear sides of the disk, and the cams are set on both sides, one set operating the turret slide and the other the collant and return mechanisms. These different cam motions either start, reverse, or stop the machine and throw the back gear in or out, as required by the operation on the work being handled. The turret is indexed, and cutting-off and forming tools operated as desired.

A special feature of the machine is the stock-feed unit, which can be adapted to any screw machine. It affords a continuous speed and can give a 12-in. stroke, if necessary, instead of the 3- or 4-in. stroke that is ordinarily provided on a hand screw machine. This unit is separate and distinct from the "Iron Man" attachment, as is also the turret lock and die-setting unit, which automatically locks and unlocks the indexing turret and sets the die for chasing threads. Either of these units can be attached to any make of screw machine. The stockfeed unit makes it unnecessary for the operator to leave his position in front of the screw machine and go to the stock end to change the stock.

A particular feature of the device is the arrangement for changing the speed of the drive from the countershaft to the device, in order that the worm may be speeded up during the idle periods of the screw-machine turret. Thus, high speed may be used when moving the turret tools to the work and withdrawing them, but a slow speed should be used while cutting.

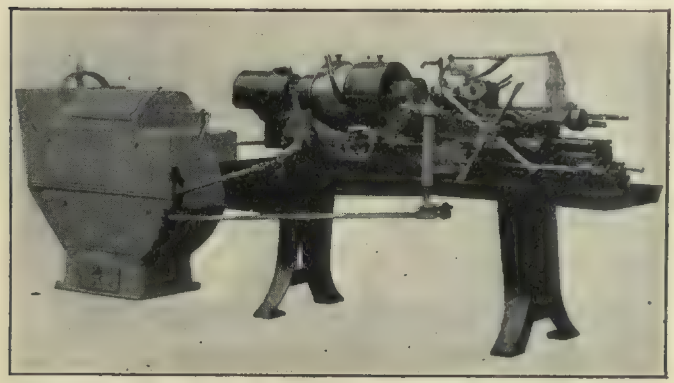


FIG. 1. PEARSON-SCOTT "IRON MAN" CONTROLLING HAND SCREW MACHINE

The speed of the attachment is always under control from high to low by means of buttons placed on the ring gear. The design of the countershaft allows for speed variation to suit the material being cut. In case of clogging of the parts, or shaving or slipping of the belts of the machine or any other such emergencies, a safety pin shears to prevent damage to the machine. Practically all the cams used for the majority of operations are furnished, and special cams can be very cheaply made.

As many as four complete cycles can be set up on the camplate at one time, when operating on pieces that require only one or two cuts from the turret tools. In case a turret must carry working tools on all sides, the camplate will be practically filled with cams, each one engaged in controlling some one of the various operations. When the camplate is not filled, it will run at high speed through that portion of the cycle where it is not carrying operating cams. When setting up the machine, the operator can slowly turn it over by means of the hand crank.

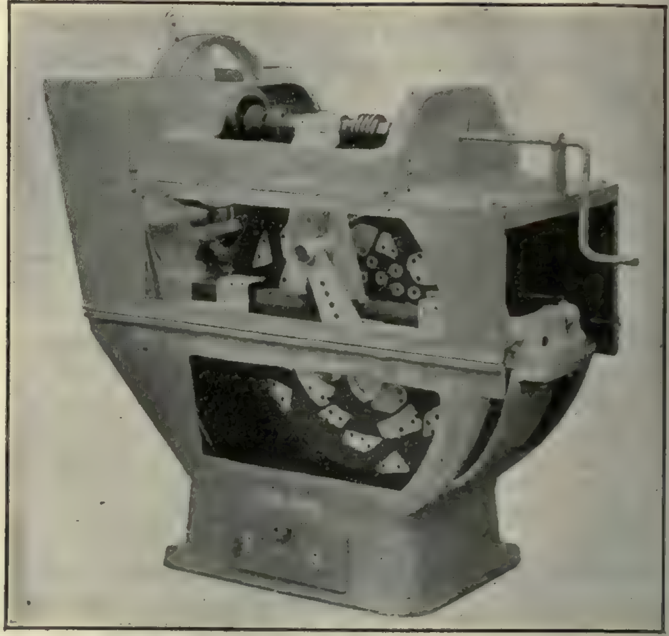


FIG. 2. MECHANISM OF THE "IRON MAN"

The reach-rods can be disconnected in a very few minutes and the screw machine can then be operated by hand in the same manner that it was previous to setting up the attachment. The throw levers are provided with a number of holes extending throughout their length, to permit adjusting the reach-rods for different lengths of throw. Each reach-rod is also provided with a joint, that permits accurate adjustment of the depth of cut.

"Supreme" Universal Drilling, Boring and Milling Attachment

A fixture for attachment to a milling machine and for use in drilling, reaming, boring and milling has recently been placed on the market by the Supreme Machine and Tool Co., 1738 St. Clair Ave., Cleveland, Ohio. The device is intended especially for jig boring; and it is said to eliminate the necessity of figuring and checking the angles on the work in the toolroom, of buttoning the jig, and of moving the work.

The attachment is arranged to fasten on the column

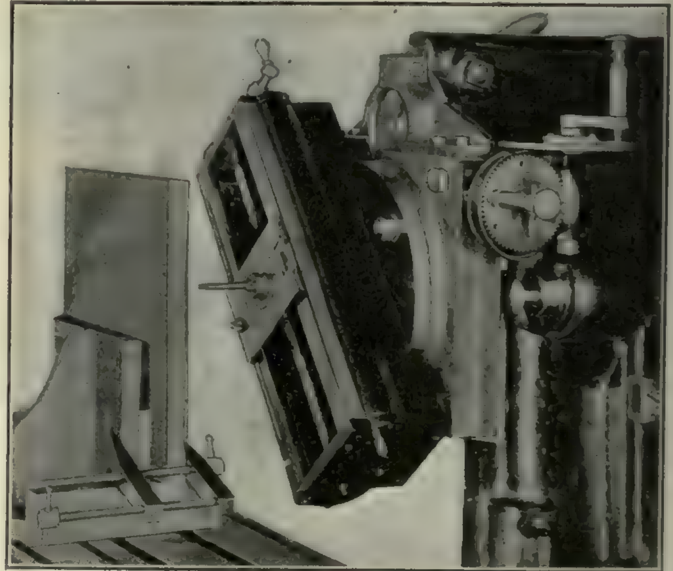


FIG. 1. "SUPREME" UNIVERSAL BORING AND MILLING ATTACHMENT

and overarm of a milling machine, as shown in Fig. 1, the base, of course, being adapted to the particular size of the milling machine to be used. The boring spindle is driven from a main gear which is adapted to the spindle of the milling machine, and it drives the spindle of the attachment through bevel and spiral gears. The movements of the traveling spindle are two, radially in a slide which, in turn, has a circular movement imparted by a series of worms and gears, so that any angle can be obtained. The attachment is self contained and easily attached, and when in place it forms an integral part of the machine. It does not extend beyond the spindle of the milling machine any more than the ordinary drill chuck or boring toolholder.

The work is clamped on the milling machine table, the starting hole located, and the knee and table are then clamped, all further movements being made by the attachment itself. In Fig. 2 is shown a job done on the machine. It is a jig plate, the maximum allowable error being 0.002 in. It is said that the time taken to make the plate was reduced 85 per cent by using the attachment. Graduating to a fine degree and the machining of old cams and shapes are stated to be easily performed by the device. A feature of the tool is a chart which, when set at any desired angle, reads on the opposite side the exact movements of the driving gears necessary to set the boring head at the required angle. No other figures are visible and there is, therefore, no chance for the operator to misread the directions. The chart eliminates all necessity for calculation of the angles and distances.

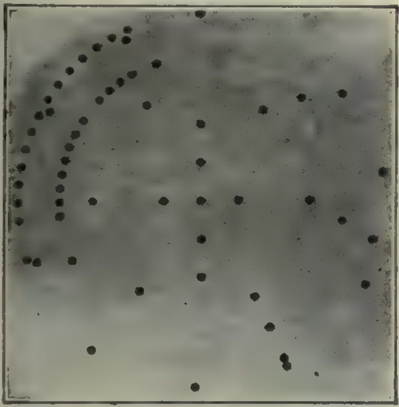


FIG. 2. JIG PLATE DRILLED BY MEANS OF THE ATTACHMENT

Any angle to the second may be obtained by the dividing apparatus. The radial adjustment is made by means of a venier scale; and the angular adjustment is made by means of the chart especially designed for the machine. The spindle is provided with taper front bearings adjustable for wear, and provision is made to keep back-lash out of the dividing worms. It is claimed that great accuracy is obtainable, due to the tool moving around the stationary work.

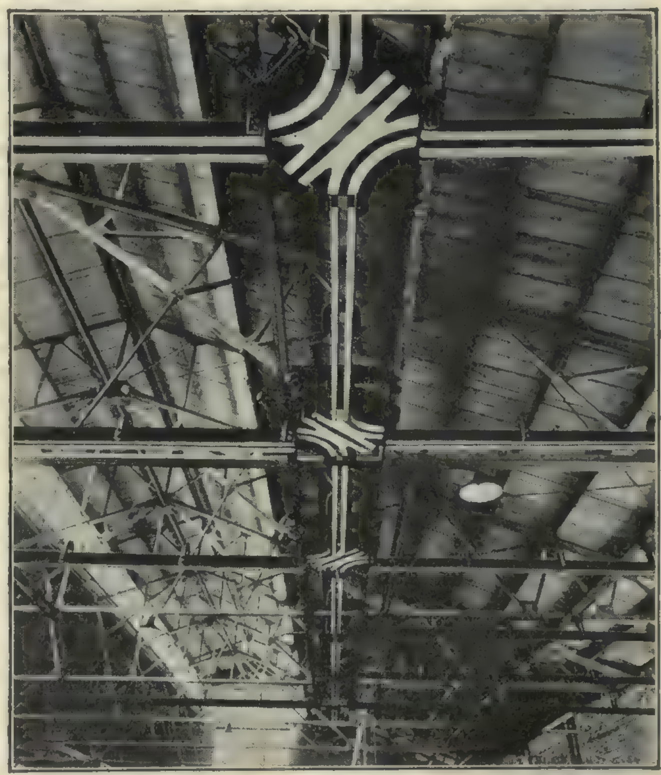
The attachment will do any work of circular form, and a great many operations requiring irregular shapes and locations; and fine or accurate movements are more readily obtainable than on either a vertical or a horizontal milling machine where the work and the weight of the knee and table must be moved. On account of the lightness of the moving spindle, it is not liable to settle, as does the spindle of a large machine, and the work can be checked from the preceding operation

Whiting Short-Turn Overhead Trolley System

The Whiting Corporation, Harvey, Ill., has recently placed on the market an overhead trolley system for the carrying of chain blocks or hoists. The track itself consists of two parallel, standard, rolled channels, spaced 2⅛ in. between the flanges and held in place by clamps. The track is designed to carry loads with no intermediate supports, except at the splices, corners and switch points. In making a long span, as over a driveway or from one building to another, a heavier section of channel can be used.

The apparatus is known as the "Short-Turn" trolley system and consists of the standard channels, turns, 90-deg. right or left switches, 45-deg. right or left switches, and the universal switches. The illustration shows a view looking up at the track equipped with a series of universal switches. Each corner and switch connection is interchangeable, so that at any time a corner or turn can be removed and a double switch or universal switch be bolted in the same place.

All of the corners and switches have a track curvature of 18 in. This is especially adaptable to foundries, as when serving a row of brass furnaces or machines close to the wall, without losing space by long curves. It is also particularly adaptable to use in freight and terminal houses. The track is built, shipped, and can be erected in units.


WHITING SHORT-TURN OVERHEAD TROLLEY SYSTEM

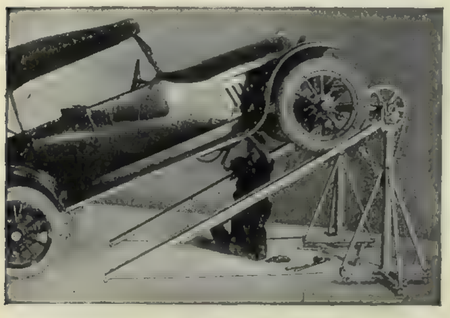
The hoist is carried on either 2-, 4-, or 8-wheel trolleys. The trolleys have ball-bearing wheels and guide rollers, which latter run between the toes of the channels, preventing the wheels from binding against the track when rounding the curves. The wheels of the trolley run on the level tops of the channels, and its design permits it to swing in the 18-in. radius curves. The system can also be readily wired, should it be desired to use an electric hoist in place of a chain block.

The fact that the track is built from standard channels, or can be built from I-beam sections where long spans and greater strength is required, makes it easy to obtain from local stocks and easier to erect. The whole system is said to be so designed that it is impossible for the trolleys to run off the track or go in a direction not pre-determined.

Manley Floor-Level Under-Worker

The illustration shows in use a device recently placed on the market by the Manley Manufacturing Co., York, Pa., for use in automobile repair plants. It is intended for elevating either the back or the front end of an automobile, so as to give access to the under parts of the chassis. Its use eliminates the necessity for a pit in the floor for the doing of work on the under side of a machine. The mechanic using the under-worker is on the floor level of the shop, so that the work of getting in and out of a pit to obtain tools or parts is obviated.

The mechanic can work in a sitting position and with the job in front of him, varying the height of the machine to suit his convenience. The position permits light to reach the parts. Because of the ease with which the automobile can be raised, it is said that the use of a creeper to enable the mechanic to get under a car in a prone position is desirable for only very minor adjustments. The device is fitted also for use on the washing stand, to enable the proper cleaning of the under side of the car. The under-worker is made entirely of metal, and is said to have a large factor of safety. The two tracks on which the wheels of the automobile rest are 6-in. channels stiffened at the middle. The two uprights are of 2½-in. steel pipe resting on angle-steel bases, each braced in three directions and mounted on three ball-bearing casters. Tie rods fasten the lower ends of the channels to the bases, to prevent the channels from slipping. The distance between the tracks can be varied, so as to permit of use for wide-tread cars.



MANLEY UNDER-WORKER FOR AUTOMOBILES

A double crank on one of the uprights is used to rotate the top horizontal member of the frame, through a chain and sprocket. This action winds around the member a heavy chain attached to the axle of the automobile and pulls the machine up the incline. The car is prevented from running back by means of a ratchet and pawl.

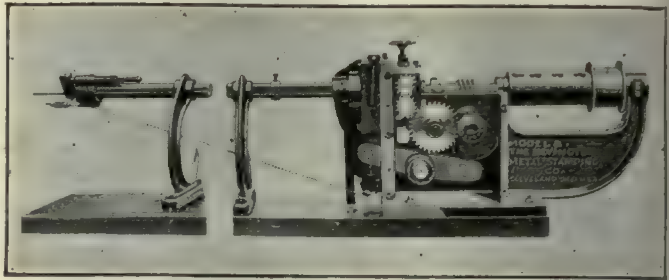
The tracks can easily be removed from the under-worker so that the device can be put out of the way, requiring but little space. The under-worker can quickly be moved wherever desired, so as to work on a car in any part of the shop, only one man being required to handle it.

Specifications: Length of channels, 9 ft. Height of chain drum, 4 ft. 10 in. Length of operating handles, 22 in. Length of base angles, 30 in. Overall width; for 56-in. tread, 88 in.; for 62-in. tread, 94 in. Net weight, 450 lb.

Bevico Automatic Wire Straightening and Cutting Machine

The accompanying illustration shows a phantom view of the "Bevico" Model "B" automatic wire-straightening and cutting machine recently placed on the market by the Bevington Metal Stamping Co., 1545 E. 18th St., Cleveland, Ohio. The machine handles round wire directly from the coil. It is driven by a single belt. Norma ball bearings are used for the arbor, and interchangeable bronze bearings for the other parts, so that the machine runs easily.

An operator can attend to several machines at once.



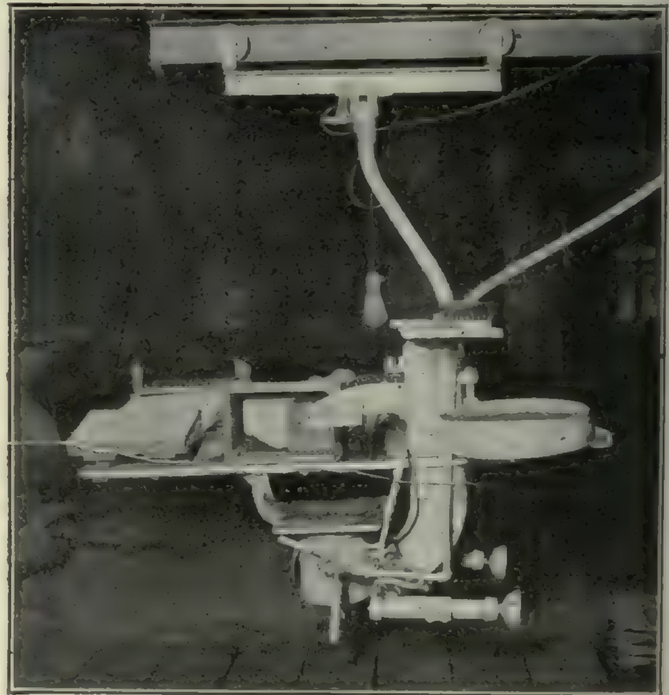
BEVICO MODEL "B" AUTOMATIC WIRE STRAIGHTENING AND CUTTING MACHINE

The machine is said to be compact, simple, durable and fool-proof, to be noiseless in operation, and free from vibration. The feed rolls and cutting dies are made of heat-treated tool steel. The straightening dies are either gray iron, wood, babbitt or brass, depending upon the kind of wire to be handled.

The Model "B" machine handles wire from No. 20 W & M gage to 5/32 in. in diameter, cutting it automatically into lengths from 6 in. to 4 ft. The machine can be furnished to cut any length of wire, however, and machines of the same design are built to handle wire from No. 30 W & M gage to ¾ in. in diameter. The width of the machine is 12 in., and the length 24 in. plus the length of the wire to be cut. It requires ¾ hp. to operate it, and it weighs 250 lb.

Howe-Teetor No. 9 Molding Machine

The R. J. Teetor Co., Muskegon, Mich., has recently made some changes in the design of its No. 9 molding machine. The illustration shows the machine suspended, the trolley wheels running on roller bearings, so that the machine can be moved along as the row of molds is made. The device can be swung about a vertical axis.



HOWE-TEETOR MOLDING MACHINE NO. 9

The machine can be supported from the floor by means of two legs operated by compressed air. In operation, the air is admitted into the legs, thus creating an upward pressure of approximately 500 lb. to stabilize the machine and hold it rigid. When it is desired to move the machine, the air is released and the feet are drawn up by means of springs contained within the air cylinders in the legs, thus allowing the machine a clearance of from 4 to 5 in. above the floor. If it is desired to move the machine over molds, the legs may be turned into a horizontal position, as shown, giving a clearance of 19 in.

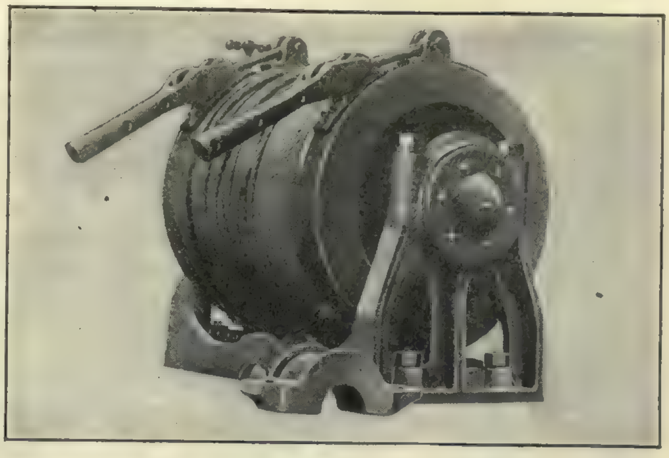
The squeezer platen is a malleable-iron casting mounted on a 2-in. shaft pivoted between point centers in the main casting of the machine. It has a vertical adjustment of 6 in., to provide for different heights of flasks. The cylinder and column are cast in one piece. The side bench at the left of the machine is rigidly attached to the main casting and provides room for the molder's cores, patterns, flasks, match, parting sand and tools. At the right of the machine is a swinging riddle shelf, pivoted vertically, so that it may be swung over the mold in position for riddling sand onto the pattern. The plain squeezer may be adapted to stationary work. It is mounted by means of two vertical steel angles, bolted to the column and set in concrete. The construction of the stationary unit is such that, should it become desirable at any time to mount it for portable use, it can be done with merely the addition of the necessary equipment and with no changes in the squeezer itself.

Sullivan "Turbinair" Hoist

The accompanying illustration shows the air-operated hoisting engine recently placed on the market by the Sullivan Machinery Co., 122 South Michigan Ave., Chicago, Ill. The device, known as the "Turbinair" hoist, is intended for general hoisting or hauling work, being so compact that it may be mounted in a very small space. It is stated to be very powerful, considering its size, having a capacity of 1,500 lb. dead load lifted at 100 ft. per minute, using an air pressure of 80 lb. per square inch. It is stated that the hoist can be very easily controlled.

The hoist is simple in construction, although of unusual design. It consists primarily of a cylindrical drum, mounted on a steel frame and completely enclosing the operating mechanism. This mechanism, consisting of a motor and reduction gearing, drives the drum shell. The motor is said to be the same in miniature as that used on the Ironclad coal cutter made by the same concern. There are two cylindrical rotors, each provided with right- and left-hand helical flutes converging to a spur tooth in the center. The rotors mesh together, and are caused to revolve by the pressure of the incoming air, which is admitted at the axis of the drum through a hollow shaft. The motor is said to have a high starting torque, to be economical in the use of air, since it is used expansively, and to show a long life and sustained efficiency.

The hoist is provided with a friction clutch and brake. When both are released, the rope may be pulled freely from the drum. The friction clutch may be locked in position and the load raised or lowered, being controlled entirely by the throttle valve. The brake is of the band type and is of sufficient strength to hold any load within the capacity of the hoist. Ball bearings are employed, and all mechanism is totally enclosed. An automatic oiling device is provided to lubricate the rotors. The hoist is said to be very quiet in its operation.

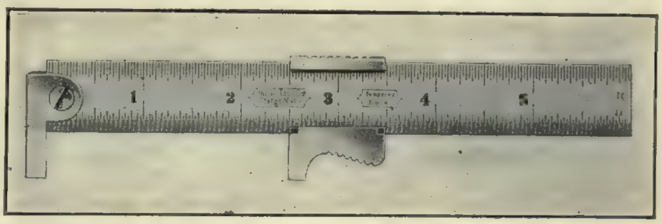


SULLIVAN "TURBINAIR" HOIST

Specifications: Capacity at an air pressure of 80 lb. per square inch, 1,500 lb. vertical lift. Speed at maximum load, 100 ft. per minute. Capacity of drum, 500 ft. of 5/16-in. wire rope. Hose or pipe connection, ¾-in. Horsepower, 4½. Drum: diameter 9½ in.; length 9½ in. Height, 15¾ in. Floor space, 22 x 13½ in. Net weight without rope, 285 lb.

"Union" Machinists' Caliper Rule

The Union Tool Co., Orange, Mass., has added to its line the caliper rule shown in the accompanying illustration. The slide is held to position on the rule by the tension of an elliptic spring and may easily be moved in either direction by the pressure of the thumb. The slide is ground to exactly 1 in. in length, and beveled edges are provided at each end to facilitate reading the scale. When reading from the outer end, allowance is made in the number of full inches for the length of the slide the fraction indicated being the same at each end.

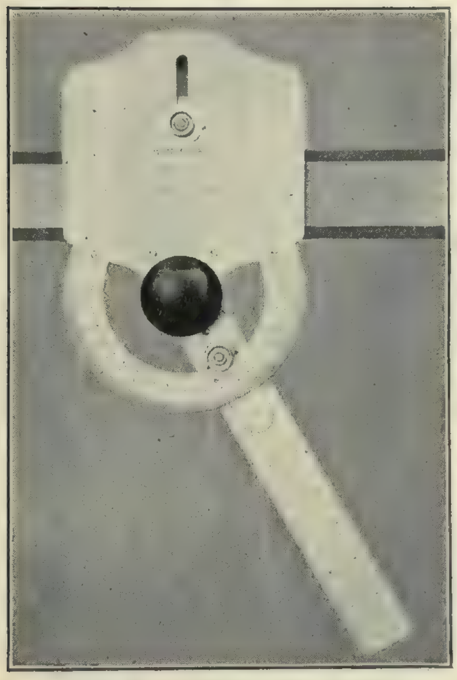


"UNION" MACHINISTS' CALIPER RULE

Turner "Protractagraph"

The drafting instrument shown in the accompanying illustration has recently been placed on the market by Turner Devices, Inc., 5 South Newstead Ave., St. Louis, Mo. The instrument is intended to take the place of the usual drafting tools, such as triangles, scales and protractors; and it is said to be a combination of all of these tools, so that the draftsman has but one instrument to handle when making a drawing.

The device is intended for use with any parallel-ruler attachment on a drawing board, being shown in the illustration clamped to the straightedge. It consists primarily of a plate formed at its lower end into a semicircular protractor graduated to ½ deg., the working arc being 180 deg. Various scales and a transparent amber inking blade, all of which are easily detachable and when in use are held in position on a plate pivoted at the center of the protractor arc, are furnished with the machine. A knob on the axis of the device is used to



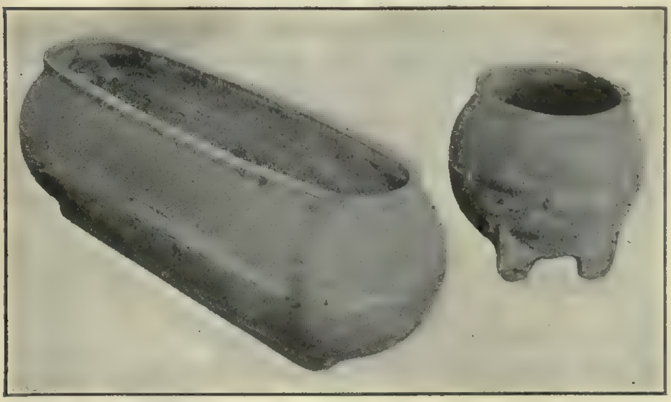
TURNER "PROTRACTAGRAPH"

revolve the scale, and a screw is provided for locking it in position. The instrument is formed on its under side into a channel section, the width of which can be adjusted to fit any width of straightedge, so that the instrument can slide along the blade without lost motion. The combination of the longitudinal movement of the machine on the straightedge and the lateral movement of the latter, enables the instrument to be manipulated to any part of the drafting surface. When working near the top of the drawing board, the machine can be reversed so that the scale and the protractor are above the straightedge.

The parts of the instrument are made of nickel-plated metal, or of white celluloid, the knobs being of hardwood. Scales having any number of standard divisions can be furnished. It is claimed for the instrument that its use makes drafting work more easy, more accurate, and more speedy, because of the fact that it is not necessary to change from one instrument to another while performing the work.

Pioneer Carbonizing and Case-Hardening Boxes

The Pioneer Alloy Products Co., Cleveland, Ohio, has recently placed on the market a line of carbonizing and case-hardening boxes made of a patented heat-resisting alloy steel. The boxes are cast in any size or shape desired. However, square and rectangular boxes are not used, because of the fact that they are more apt to crack. The small round box shown on the right of the illustration is 13¾ in. inside diameter, 20 in. overall in height, has a 10-in. opening at the top, and weighs with the cover 108 lb. The long box of cylindrical shape, shown on the left, is intended for the heat-treating of camshafts. It is 34½ in. long and 12½ in. wide on the inside, the height overall being 12¾ in., and the inside radius 5¾ in. The weight with the cover is 280 lb.



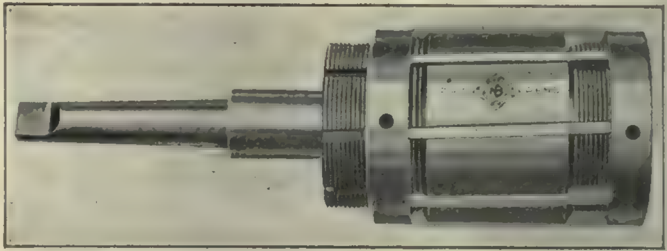
PIONEER CASE-HARDENING BOXES

The material from which the boxes are made is an alloy steel containing sufficient chromium to make it practically non-oxidizing. The merits of the box and its long life are said to be due not only to the alloy used but to the shape employed. The cylindrical or circular form allows the box to expand and distort, due to temperature changes, without the liability of producing cracks. In boxes made with flat sides there are planes of weakness caused by the crystals of the metal forming at right-angles to each other at the corners. Cracking is, then, a result of this inherent weakness, when stresses and warping result from temperature changes.

New Britain Pilot-Blade Expansion Cylinder Reamer

The New Britain Tool and Manufacturing Co., New Britain, Conn., has added to its line a set of expansion reamers for reaming the cylinders of gas engines, particularly automobile engines, and will carry in stock sizes suitable for the more popular makes of cars.

The reamers are designed to be used in pairs, a roughing and a finishing reamer for each oversize.



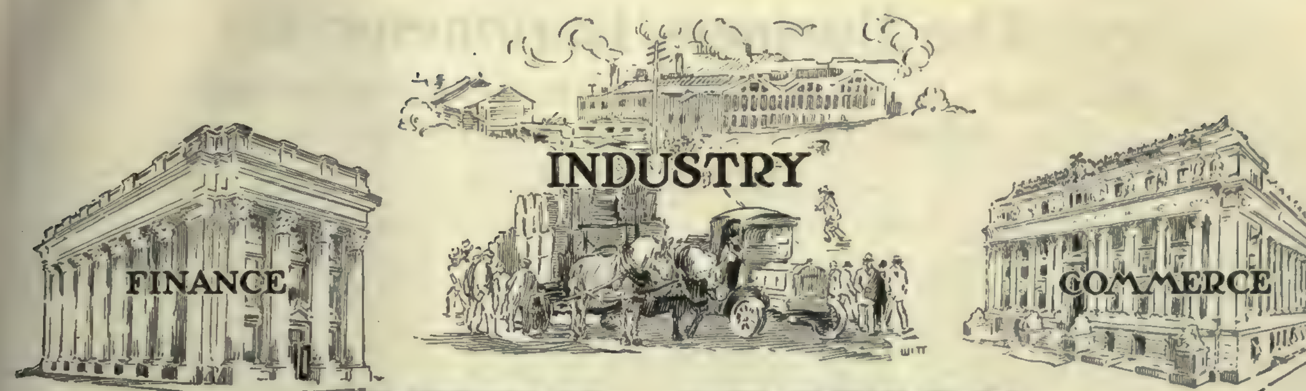
NEW BRITAIN PILOT-BLADE REAMER FOR GAS-ENGINE CYLINDERS

The pilot portion of the roughing reamer, shown in the illustration, is ground to fit the normal bore of the cylinder with which it is to be used, while the cutting portion of the blades is so made as to remove about 0.030 in. of stock. Similarly the pilot of the finishing reamer follows the bore left by the roughing reamer and the blades remove about 0.005 in. of metal, leaving a true and nicely finished surface. The device is said to provide a very simple means of reboring worn or scored gas engine cylinders.

The tools are made in the form of shell reamers, and shanks can be furnished with either Nos. 3 or 4 Morse tapers.

Erratum

In the description of changes in Brown & Sharpe small tools in our issue of June 23 the following typographical error appeared in connection with vernier calipers Nos. 570 and 571: "The readings are direct, that is, there are *two* deductions to be made for thickness of the jaws as formerly." This sentence should have read: The readings are direct, that is, there are *no* deductions to be made for thickness of the jaws as formerly.



NEWS SECTION

Combination of Hill Interests at Cincinnati

The John Hill Foundry and Supply Co. and the Hill & Griffith Co. of Cincinnati, will consolidate this month under the name of Hill & Griffith Co. John Hill, one of the founders of the old Hill & Griffith Co., will be president and general manager, and William Oberhelman will be vice-president and general manager of the southern district with headquarters at Birmingham, Ala. John Hill is one of the pioneer manufacturers of foundry supplies and has had wide experience among foundrymen of the United States and Canada. Oberhelman has been connected with the Hill & Griffith Co. for twenty-one years. Bruce Hill, who will be sales manager, has represented the company in a sales capacity in several states. The other officers include L. J. Pfeiffer, treasurer, and D. N. Hill, secretary. Elmer R. Ritter, president and works manager, and Percy L. Ritter, general manager of the old Hill & Griffith Co. have disposed of their interests and have retired from the business. By the consolidation of these two companies many economies will be effected and the trade will be served to better advantage, officials claim. A complete line of foundry facings, partings, core compounds of iron, steel and brass foundries will be continued to be manufactured as well as supplies and equipment for the general use in casting plants.

◆

New Machinery Combination Working Overtime

The recent combination of the interests of the Mayhew Steel Products Inc., of New York, and the Ready-Tool Co., of Bridgeport, Conn., are reported working not only full time on the day-shift, but to have added a night force in the factory at Shelburne Falls, Mass.

The expansion reamers which have been manufactured by the Mayhew Company as its main product, are also being made at the Ready-Tool plant.

No change in the executive personnel was made by the merger of the two companies. Officers of the combination are: President, J. W. Thurber; vice-president, J. B. Parsons; treasurer, H. W. Hatch, and secretary, L. S. Brown The only addition to the staff is H. C. Cady, who was recently appointed sales manager.

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A. S. M. E. Delegates to Engineering Council

The American Society of Mechanical Engineers has nominated nine representatives to serve on the Executive Board of the American Engineering Council. The nominees, who will be formally elected by mail ballot, are: Francis Blossom, of the firm of Sanderson & Porter, New York; Charles A. Booth of Buffalo; Gano Dunn, president of the J. G. White Co., New York; H. H. Esselstyn of Detroit; W. S. Lee, Charlotte, N. C.; Irving E. Moultrop of Boston; John A. Stevens, Lowell, Mass.; A. E. Walden, Baltimore, and Perley F. Walker of Lawrence, Kansas.

The American Society of Mechanical Engineers is the first organization to submit the choice of its Federated American Engineering Societies' delegates to a vote of its member society.

American Engineers Get British Honors

With the presentation of the John Fritz Medal to Eugene Schneider, head of the famous Creusot Works, in Paris on July 8, by a mission of American engineers, came cable advices from London to the national headquarters of the American Society of Mechanical Engineers in New York announcing that more foreign honors had been conferred upon Americans distinguished in the engineering profession.

The cable message, addressed to Secretary Calvin W. Rice, stated that Ambrose Swasey of Cleveland, sponser of the Engineering Foundation and past president of the American Society of Mechanical Engineers, had been elected to honorary membership in the British Institution of Mechanical Engineers, in the British Institution of Mining and Metallurgy and in the British Institution of Mining Engineers.

Charles F. Rand, of New York, it was stated, had been elected an honorary member of the Institution of Mining and Metallurgy, and of the Institution of Mining Engineers. Mr. Rand, who is chairman of the executive board of the Engineering Foundation, has just been made an honorary member of the British Iron and Steel Institute.

Other elections announced by cable were those of Col. Arthur S. Dwight, of New York, and William Kelly, of Vulcan, Mich., to honorary membership in the Institution of Mining Engineers. This group of honors is believed to be without precedent in engineering and was described by Mr. Rice, who has been active in promoting closer relations between American and British engineers, as an important step in bringing about world solidarity in the engineering profession. A movement, it was said, has been started in the direction of federating the engineering societies of the British Empire according to the general plan adopted by Herbert Hoover and his associates in organizing the Federated American Engineering Societies, in which are gradually coalescing the national and local engineering organizations of the United States.

The ceremonies in Paris, participated in by a special deputation of thirteen American engineers under the general chairmanship of Mr. Swasey, followed similar ceremonies in London on June 29, when the John Fritz Medal for distinction in applied science was presented to Sir Herbert Hadfield, known for his work in the development of manganese steel. The Hadfield award was for 1921 and the Schneider award for 1922. M. Schneider received the gold medal in person for his achievements during the war "in the industrial and scientific defense of civilization."

Mr. Rand, it was said, becomes one of five honorary members of the Iron and Steel Institute, the others being the Prince of Wales, King Albert of Belgium, and Dr. Richard Akerman and Baron Gustaf Tamm, of Stockholm.

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Germany Returning Polish Machinery

According to Kurjer Warszawski, Germany is gradually returning to Poland the property taken by the German armies of occupation. During the first half of March, 1921, there was transported, of this property, the first carload of transmission belting and the first carload of machinery destined for Lodz. The second carload of machinery and the Poznanski turbo-generator formerly in Lodz will be returned later.

New Superintendent of Babcock & Wilcox Co.

Isaac Harter has been appoined general superintendent of the Babcock & Wilcox Co., of New York, succeeding the late James P. Sneddon.

Mr. Harter was born in Mansfield, Ohio, in 1880 and was educated at the University of Pennsylvania. Immediately upon graduation he entered the employ of The Aultman & Taylor Machinery Co.. He began at the bottom in the boiler department as a gang boss on inventories, and was transferred later to the cost department, where he became familiar with the details of each branch of the business. He was elected a director of the company while in this department, and a little later was appointed acting superintendent of the boiler department. In September, 1905, the company sold its boiler business to the Stirling Co., and Mr. Harter joined the staff of E. R. Stettinius, the business head of the latter company, which was absorbed by the Babcock & Wilcox Co. in 1907. When L. I. Summers resigned the position of superintendent of the Stirling works at Barberton, Mr. Harter succeeded him, and in 1911 became superintendent of the Bayonne works. He served in this capacity until about a year ago, when he became assistant to the president, at New York, where his office will remain as general superintendent.

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Tower to Aid Hoover in Dept. of Commerce

W. S. Tower, former director of the division of planning and statistics of the Shipping Board, has been appointed by Secreetary Hoover as chief of the iron and steel industrial division of the Department of Commerce. The appointment was made under the export industries appropriation of $250,000, available by act of Congress July 1.

Preliminary to assuming his job as chief of the division, Mr. Tower will make a study of the American shipping problems in conjunction with the Shipping Board. He will go into the question of establishment of trade routes, allocation of ships, and assignment of tonnage. He is recognized as an authority on shipping questions. He comes to the Department of Commerce from the Consolidated Steel Corporation of New York.

The reorganization and development of trade generally will be given consideration by Mr. Tower, who is particularly qualified for this work by reason of his long and intimate association with this industry and his knowledge of the commercial possibilities of our steel business.

◆

War Department to Encourage Military Patents

Announcement is made that it is the policy of the War Department to encourage the development of military inventions by officers, enlisted men and civilian employees. In consideration of assistance to be given by the department in the issue of patents, it will require of inventors no more than a license to manufacture and use their inventions for governmental purposes, thereby reserving to the patentee complete freedom and ownership of the patent in its commercial application. In special cases of inventions of great military importance, however, provision is made for exclusive Goverment ownership and the utmost secrecy.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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A. G. Gardiner, a leading English Liberal. has just published a book called "The Anglo-American Future" that has attracted no little attention in America. It contains two chapters that are especially germane to the week's developments. In one the author pleads for a settlement of the Anglo-Irish question in the interest of Anglo-American harmony upon the ground that the Irish question is an American question because "the Irish are in the United States as a result of an English policy that depopulated Ireland in the last century and sent a nation with bitterness in its heart across the seas."

The other, in which an Anglo-American agreement that will limit naval construction is urged, concludes with this passage: "The announcement that the Anglo-American peoples had taken a step which would make naval war henceforth impossible would strike a death-blow to competitive armaments generally, stabilize the world on a peace basis, and turn its face confidently to the light. There will be no menace to any people, but the assurance to all that in the peace of the English-speaking nations is the enduring guarantee of the peace of the world."

I quote these two passages because it is doubtful whether the business men on either side the Atlantic have as yet commenced to sense the importance of the conference between Lloyd George and Valera now being held in London or the disarmament conference called for next autumn by President Harding. The details of both these history making meetings are fully described in the newspapers. They need not be repeated here.

If. as every one must hope, the results shall be permanent tranquility in Ireland and a compact between England and America that will insure the world against war, the debts with which society is now burdened can soon be repaid and the return of prosperity will be greatly hastened.

Even the dull markets of mid-summer seem to show a subconscious appreciation of the reconstructive statesmanship that is now in the ascendant. The fear that a bonus bill might make a new bond issue necessary has been temporarily allayed by the President's outspoken opposition to the measure and business is becoming almost normal as the crops approach maturity.

There are, however, two industries that are exceptions to this statement. In both the hope of lower prices restrains present buying. One is the steel industry. The other is coal. In so far as steel is concerned procrastination is unlikely to do much harm. The manufacturers are used to extremes of activity and dullness and can adjust their affairs accordingly.

But the winter shortage of coal that is to be expected unless consumers soon commence buying is not to be so complacently contemplated. Last autumn when the country was almost panicky in its fear of a winter coal famine and people were being stampeded into paying outrageous prices, I repeatedly pointed out in these letters that there would be enough coal to go round. But this year the position is different. We entered the spring with comparatively light stocks, the production of bituminous and anthracite since January 1 is 62 million tons behind last year and if the winter should be severe and industrial activity revive as is likely there may be a fuel shortage that will cause great distress and loss. Making due allowance for high freights and labor soft coal is now relatively low and those who would be wise in time will in my judgment do well to hive a substantial portion of their requirements at once.

As to a revival of business it may be said that it has already commenced in the textile markets. In six out of seven large cotton commission concerns visited this week I was told that the demand for immediate delivery was in excess of the supply and that there was a very noticeable increase in buying for export to East India and China. This, as was pointed out last week, is in part due to the Government Report on the cotton acreage which indicates that the South has at last learned to co-operate in controlling the size of the crop but it also reflects the world wide shortage of cotton goods that has resulted from under production in Europe during the war and since.

Cables from Liverpool and Manchester are almost unanimous in predicting sustained activity in the Lancashire cotton trade now that the coal strike is ended and the operatives have accepted a reduction in wages.

But the textile trade is not the only one from which quickened activity is reported. The shoe industry is picking up, and the Endicott Johnson Co. is operating at full capacity to fill orders that are said to be 25 to 50 per cent above those of the corresponding period last year. Briefly, there is a steady though "hand to mouth" demand for all essentials that are cheap except coal, but there is no anticipatory buying as yet and stocks must be low everywhere.

Reports to the Credit Clearing House indicate a reduction of only 4½ per cent in the money value of the merchandise sold during the week ending July 15, and bank clearings for the same week as compiled by Bradstreet are but 26 4 per cent under last year. These figures, as I have so often pointed out, mean that more goods are changing hands and while the profits made are not as large as in the extravagant days of the war it is plain that there is no lack of business. A corporate report that is interestingly corroborative of this view is that of the American Telephone and Telegraph Co. in which it is announced that 285,000 new telephones were installed during the last six months and that the telephone traffic of the system for that period was larger than in 1920 despite the slowing up in general business. On the other hand it is to be noted that the buyers' strike still continues where prices have not been reduced and that it is now extending itself even to such indispensables as ice cream soda, as witness the self denial of the children and mothers in the Bronx and Brooklyn in refusing any longer to pay more than five or ten cents a glass for what has become almost a staple form of food and drink in this country. As I am informed that the expenditure at the soda fountains in the United States last year was $500.000.000, which is about the present value of the growing cotton crop, it is plain that a 50 per cent cut in the cost of sodas and sundaes has greater economic importance than might generally be supposed.

The railroads are doing better. Car loadings for the week ended July 2 were 774,808. This, while not as large as last year when business felt the stimulus of the spring boom, is in excess of the more normal traffic of 1919, and earnings, both gross and net, are now larger than in either year. It is not, however, to be expected that the roads will admit prosperity until they get all that they can from the Government and there seems to be every reason to expect that they will obtain at least $500,000,000 in new cash shortly. Meantime railway stocks are steady and bonds are gradually working higher as a result of the growing ease of money as well as of the improved condition of the transportation industry.

Except for the gyrations of Mexican petroleum and a fairly steady demand for the "rails" the stock market has been in the doldrums. The bears have ceased to attack it but the hot weather has checked the development of any speculative enthusiasm.

The weekly statement of the Federal Reserve Banks shows an increase of 1.6 per cent in the reserve ratio, which now stands at 61.6 per cent and a further gain of $15,000,000 in the gold on hand. It is said that some of the gold recently arriving in New York has been put "out of sight" lest its continued accumulation in the Federal Reserve Banks might have an "inflationary effect."

Merchandise exports and imports for June compare as follows with the previous month and last year:

	June, 1921	May, 1921	June, 1920
Exports.....	$340,000,000	$330,000,000	$631,082,648
Imports.....	198,000,000	208 000,000	552,875,088
Excess exports...	$142 000 000	$122,000 000	$78,207,560

The excess of imports for the fiscal year ending June 30 is $2,852,596,000 as compared with $2,872,418,000 in 1920 and $4,136,562,000 in 1919, which was a record. For the seven years ending June 30, 1921 value of our merchandise exports exceeded that of imports by a total of $19,693,000,000, or an average of $2,817,000,000 annually as compared with a pre-war average of about $500,000,000.

We must be prepared for a return to the pre-war average if the Fordney Tariff Bill passes, for we cannot expect to sell if we refuse to buy. Meantime, and pending the passage of the bill, importers will naturally try to bring in all they can in an effort to escape the higher duties imposed. The decline in foreign exchange registered during the week will also operate as a stimulant to imports.

The cause of this decline is a mystery. The speculation in foreign exchange is enormous. 50,000,000 marks were bought and sold in New York in one day last week and the trade at London, Paris, Berlin and Frankfort is probably quite as large. It is preeminently the gamble of the war and the influences that affect values are complex beyond the grasp of even the best informed. Whether and why sterling and the various continental currencies should go up or down in the future no one can pretend to know and the safest course is to avoid the risk of a problem so inscrutable.

The tariff debate is fully reported in the daily press. The President's opposition to the duty on petroleum has been disclosed and the Mexican oil companies are thereby somewhat reassured. Opposition to the valuation clause of the Fordney Bill seems to be increasing. Money is in good supply in New York but 6 per cent for the best commercial paper remains the minimum here and higher rates prevail in the West and South.

The Cuban crisis is still unrelieved though there is much talk of a large American loan to carry over the surplus supply of sugar.

From Mexico there is no authoritative news. The best opinion is that Obregon is so fully employed in putting his own back yard in order that he cannot pay much attention to externals.

Our trade with Latin America is, however, so small in comparison with our domestic commerce and finance that it takes a subordinate place in the public mind which is gradually becoming more cheerful and would be almost optimistic were it not for the unconscionable delay of Congress in dealing with the oppressive taxation that makes capital inert and timid.

Cincinnati to Produce Gas Conserver

Cincinnati has gained a new industry in the formation of the V. & P. Vacuum Co., which has been organized to manufacture and distribute a purely mechanical attachment—known as the V. & P. Vacuum system—for the motors of automobiles. This device is said to be a gas conserver, to reduce the gasoline consumption by the motor and increasing the mileage obtainable on a gallon of gasoline. And is also said to prolong the life of the lubricating oil as much as fourfold.

The company, which is chartered under Ohio laws, is capitalized at $25,000 at the start. Its principal offices will be in Cincinnati. The company organized by electing Frank J. Zumstein, president; A. C. Van Kirk, vice-president, and William Pope Anderson, secretary and treasurer.

These officials, with George A. Sawyer, H. M. Potter, and Attorney Joseph Sagmeister, all of Cincinnati form the directorate.

Free Rent!

Antrim Iron Co., Mancelona, Mich., which closed down for the summer, has given free rental of its houses to employees while the plant remains idle. the only condition being that the men agree to return to their jobs when the company resumes operations.

Business Conditions in Germany

BY OUR BERLIN CORRESPONDENT

The various schemes hatched in the government for enabling it to pay the 50,000,000,000 marks, which is the annual reparations for several years to come, are now gradually becoming visible in their outlines, much to the alarm of the industry. A number of radical measures are contemplated, which must inevitably lead to a further increase of the cost of living. Such measures are the mortgaging of all real estate in cities and in the country for raising a large capital. Neither agriculture and in a far lesser degree the owner of city real estate, could pay the interest on such mortgages under the present rate of revenue. The whole conglomerate of measures for artificially keeping down rent and the price of certain foodstuffs must necessarily collapse. Rents would go up to a multiple of the present standard, and the price of foodstuffs must clearly follow suit, ultimately arriving at the world market level. This trend of affairs, which at first was only surmised with keen apprehension, is now frankly confirmed by the highest authority, the German Minister of Economy, who clearly expressed himself that the government's policy of keeping the cost of living in Germany below the world market level would have to cease. The consequence would, of course, be the immediate increase of wages and salaries in leaps and bounds up to the foreign standard. The chief advantage which the German industry enjoyed over foreign rivals would thus disappear completely. It is even probable that the upward movement would surpass the boundaries represented by the cost of living in the surrounding countries, and that Germany, from being one of the cheapest countries of Europe, with the lowest wages viewed from the basis of gold currency, would become one of the most expensive. Apart from that, another incisive measure projected by the government is threatening the industry. Similarly to obtaining a share in the real estate of the country, the government is endeavoring to get a share in all industrial property. If these measures are finally adopted, they would put the industry in a position the consequences of which cannot yet be foreseen by anyone. It would probably mean the end of all business which solely existed on the strength of cheap labor, and would practically amount to a fresh start from the bottom rung under entirely new and unlooked-for conditions. The industry would not even retain the advantage of cheaper raw material, as the prices of the latter would in conjunction with the universal upward movement of prices naturally get flush with those in other countries of Europe. It has already been announced by the government that the coal tax would be raised to such an extent that the difference in price between German and foreign coal would disappear. Moreover the state is contemplating a number of monopolies on the distribution of raw materials, which, handled with fiscal considerations foremost, would surely not reduce their price.

Needless to say, the government, when trying to introduce such schemes, would find a strong opposition against them. Whether it will succeed in carrying them out in their entirety will be seen in the near future. It is probable that it will have to pour some water into them, and serve them in doses, but it seems inevitable that the country will have to traverse a steep up-hill road. The most critical times of the German industry are apparently not past, but still ahead.

Conventions Well Attended

The present season is the time for annual conventions, which are usually held in May and June. At no previous time, however, have they been chasing each other in such bewildering numbers as now, and are attended by audiences as numerous as at the present time. The conventions are significant for the willing spirit and intended desire for co-operation, which has developed so far that it has become a serious danger to individualism. While the repertory of such conventions is chiefly filled with paper dealing with engineering progress, private discussions are monopolized by the present business and the outlook. The annual convention of the German machine building industry, which has just taken place, has not even made a pretense of treating technical subjects, but has solely devoted itself to economical matters. During the war, and in the after-war years, this society has from a rather insignificant organization grown to an institution which now represents almost the whole machine building industry and allied branches. In 1914 it had 250 individual members employing only 180,000 men, which number since then has increased to nearly 1,000 members, employing 550,000 workers. Besides it includes more than 100 other societies of various branches of the machine building industry, representing roughly 2,500 factories.

The official proceedings of the convention were chiefly devoted to the inner organization of the society. Of interest is the resolution passed to continue the control of export prices, for the significant reason that its removal would inevitably lead to price cutting. The effects of the sanctions, especially the customs barrier in the Rhineland, were extensively dwelt upon, and the opinion was voiced that the continuation of the sanctions would result in paralyzing business between the Rhineland and the interior of Germany.

The German Association of Machine Tool Builders has now issued its report on the year 1920 in advance of the annual meeting, which will be shortly forthcoming. This report is clad in the form of a communication to the members, and considerably falls short of the reports issued in previous years, in length as well as in substance. It is, however, full of complaints on the business situation in general, and reflects rather gloomy views. According to the report, the situation of the industry has in 1920 hardly improved. The after effects, so the report says, of the enormous increase of production required by the war were felt more and more.

Machinery from numerous shut-down works, or such sifted out by the readjustment to peace work, has been pressing heavily on the market. The increase of stock in most machine-tool building factories, it is said, justifies the opinion that the industry has got into a state of overproduction. After dealing with the general business depression, which the report attributes to the increase of prices, and the decrease of purchasing power, it is declared that the industry has reached a very critical stage. If hopes were entertained that the experienced owners and managers of the machine tool factories would be able to find a way out of the present crisis, it can now be said that not all have succeeded. This is the expression the report finds for the fact that in the course of time a number of machine-tool factories have got more or less into distress, of which manifest signs have become noticeable of late. The Association of German Machine Tool Builders has again expanded as regards number of members as well as to organization. In the former respect it can be said, however, that it has reached its culmination. There are numerous manufacturers who have deliberately stayed away from the association in pre-war times, and who have only joined during the war because the association has, owing to public functions which it has been given during the war, assumed an authority which no manufacturer could easily afford to ignore. The return to normal conditions has deprived the association of these functions, and it seems that the spirit of independence amongst the members is again rising, although no actual exodus of members has taken place as yet. A number of members are, however, contemplating to leave the association at the first appropriate opportunity.

The hotbed of dissent is evidently to be found in the committees which have been formed with a view to close co-operation and a uniform price policy between manufacturers of kindred types of machinery. These committees, which at first were hailed as a great achievement, are showing signs of decay. As long as business was brisk, and co-operation seemed instrumental to obtaining the best possible prices, the committees were considered excellent institutions, but in the present time of depression they have lost favor. The main task of the committees is to prevent price cutting by stipulating standard prices. This is very well for the factories enjoying high reputation, but it is turning business away from the others, who are unable to balance lesser reputation by more attractive prices. The number of truants from the rigid rules the committees have established is therefore growing, and co-operation in the committees has considerably relaxed.

Another reason for the tendency to disperse in the association is its enormously enlarged organization, involving it in heavy expenditure. The association now occupies extensive premises, and has nearly a hundred employees. The maintenance of such an organization is no small item for the 392 members, although a number of other organizations—like the society of makers of wood-working machinery, of grinding material, small tools and twist drills—take part in the expenditure. The share falling to the single manufacturer is, however, large enough not to be borne without remonstrance, unless for good reasons. Apart from that, an organization of such size can be trusted to perform a large volume of clerical work, which among manufacturers is felt more and more in the nature of a bother. Moreover, the chief enterprise of the association, which also is a very expensive one, the exhibition of machine tools at the Leipzig Fair, is now more and more recognized as a failure. The report of the association tries to disarm criticism by throwing the blame on the particular mischance by which this exhibition has up to now been prosecuted. It also gives to understand that no actual sales can be expected from such exhibitions, but that they must be regarded as an advertising scheme. The report is, however, compelled to admit that the association has become rather doubtful whether to make the Leipzig Fair a permanent institution, or to abandon it.

Lack of Co-operation

There can be no doubt that the increased importance the association assumed during the war and in the turbulent years immediately following is now decidedly on the wane. The work of the association is too onesided, too much centered on the price policy. Other most urgent requirements have been neglected or overlooked. Most factories have during the last five or six years extended their manufacturing programme, as it is called in Germany, meaning the number of lines carried, thus increasing competition. In spite of the common cry for specialization, the industry has turned away from it rather than made progress towards it. A retrograde movement seems imperative. The association has done nothing to exercise an influence in this respect. In most essential details, co-operation, even advice, as to over- or underproduced lines, of which the association from its high point of observation which it has attained would be quite capable, has been lacking altogether. Otherwise it would not have been possible that in numerous instances the same type of machinery has been adopted simultaneously by several manufacturers, an instance of which is the Gridley automatic, now manufactured by no less than seven German firms. It is therefore no surprise that manufacturers are looking for other and more effective means of co-operation and cutting down of competition through agreements or business combines between themselves.

Several Mergers

The movement towards combines and merging, which has seized so many branches of the German industry, has up to now been peculiarly absent in the machine-tool industry. It is true that a number of firms have been welded together, but this was done by purchase from outside, like in the case of the works acquired by the large concern of iron dealers, Otto Wolff in Cologne, which first bought the Defries works in Düsseldorf, and amalgamated the latter with the Klingelhöffer works, to which have thereafter been added a number of smaller firms. Another group of this kind has been formed by a firm of second-hand machine tool-dealers, which in the obscurity in which it existed before and during the war has amassed a large fortune, and has now bought up a number of machine-tool factories. Combines of machine-tool manufacturers among themselves have so far been rather scarce, but a few instances of the last months show a growing tendency in this direction. One of these instances is the combine between two large Chemnitz machine tool-works, the Union and Sondermann & Stier. These two firms have up to now been keen competitors in almost all lines. By an agreement which will probably lead to amalgamation they have divided ther manufacturing lines between themselves, in conjunction with the factory of Carl Wetzel in Gera. Sondermann & Stier is giving up the construction of horizontal boring and turning mills in favor of the Gera firm, which is specializing in such machinery, and by the way is making a very good copy of the Lucas machine. A similar agreement has previously been arrived at between this firm and the Union Company.

Other cases of a similar kind are expected to follow. The tendency in all such cases is to eliminate or cut down side lines with a view of getting some recompensation for the business abandoned, in preference to giving them up entirely.

Business "Picking Up"

During the last weeks a marked improvement of business has taken place, not only in inquiries coming forth again in fair numbers from domestic sources and from abroad, but an increasing amount of orders has actually been placed. A more hopeful outlook prevails with regard to export business. Many negotiations for machinery which were started several months ago, and were dropped at the time of the London conference, have been taken up again, and new inquiries have come in. The Scandinavian countries, mainly Sweden, which had almost withdrawn from the market, are again showing increasing interest in German machinery. A slight revival has also taken place in the business with Belgium, France and England. In the latter country German machine tools are still barred, but it is an open secret that they are sold under foreign flag, at least in small quantities. Rumors have spread of large sales of German machine tools made in the United States, but although it is true that some sales have been effected of types which already had a market there in pre-war times, like Reineker's backing-off lathes, Henry Pels' punches and presses, and Pfauter gear-hobbing machines, the volume of business actually transacted is negligible. Such rumors have evidently been caused by numerous inquiries from American dealers for German machinery, promising large orders. Manufacturers are skeptical, believing that such inquiries are prompted more by curiosity than by serious business intentions. It can not at present be seen whether the revival of business is any more than a backflow after the standstill of the last two months, or whether it signifies a turning of the tide. The coming months will no doubt clear up this point, which is awaited everywhere with keen anxiety.

Comment on the Machine-Tool Business in France

By Birger Erichson

Since the war started we have had a succession of "crises" of various kinds ranging all the way from a spaghetti "crise" to a copper coin "crise." Today, however, they all seem to have joined hands to form one grand "super crise," which has taken into its stranglehold all branches of industry and business to an extent where nobody buys anything.

And the machine tool business has followed in the track of its fellow businesses, and gone and left its many followers with plenty of spare time on their hands, and even the "second hand" business, for a long time the only prosperous branch of the machinery trade, has dwindled to proportions where its many enthusiastic friends become faithless to the cause and go hunt for other things to sell.

Due to the fact that the French government is accused of killing the goose with the golden eggs in fixing price of gasoline at $2.50 a liter or somewhere around 80 cents a gallon, nobody but the "nouveau riche" can ride in autos any more. A serious "crise" in the automobile field has been the consequence. Everybody knows what a fine lot of machine tools the automobile factories bought during the war, in fact they have been accused together with most of the other industries the world over, of putting their profits into "bricks and machinery" instead of into the cash box of the country. Now a considerable quantity of these tools are for sale and there is hardly a shop in the country that is not willing to part with some of its equipment for cold cash, even if this consists of dirty paper money with not much backbone to speak of.

Exactly how much equipment there is available is practically impossible for anybody to say, but that there is enough to last for the next few years, even if a general pickup of business takes place this fall, is clear to anybody who is going around today to the shops in this country.

Surely the North of France when the time comes that we have reached the bottom of the curve and start climbing skywards, and when some of the German indemnity billions have found their way across the border, will want quite a quantity of machine tools, but they will in all probability almost entirely be found right here in this country or bought from neighboring countries with favorable exchange rates. There are rumors about at present that the French government will take one billion francs worth of machinery and tools as part payment of the indemnities due from Germany to be distributed among the devastated factories in the North. These rumors are not yet officially confirmed but it is very probable that the same system will be used for machinery as for the housing question, where actually 25,000 wooden houses are to be delivered. Naturally this whole billion will not be in machine tools only, but in all kinds of equipment such as compressors, pumps, etc. If, however, only one-half or 500,000,000 francs, should be in machine tools this would mean no import of American machines to supply the devasated regions.

German Competition

Quite a quantity of German tools were bought by shops in the North last winter and spring. Naturally at present German competition does not make itself felt at all simply because a difference in price, however big, will not induce a customer to pass an order. When business comes back to life however, the German competition will again be strongly felt, as no Frenchman, however patriotic and "boche" hating, will pay twice the price to avoid buying stuff made in Germany, barring political complications or that the dollar exchange should suddenly decide to take steps toward helping the lame and wounded French franc back on the road to prosperity.

To give the readers some idea of the prices that American machine tools can be bought at today in France I shall cite a few examples: A Gisholt tool grinder overhauled and to all practical purposes as good as new can be had for the equivalent of less than $200 delivered to the customers works. I doubt that our friends in Madison even with their truly highly efficient organization can deliver their machines in France at that price. Or a Warner & Swasey fully-tooled, brand new 3-A hollow hexagon turret lathe for the equivalent of less than $2,600. And there are hundreds, if not thousands, of similar cases.

And if the exchange should go down and the American manufacturers be able to reduce their prices still more, the prices hat the possessors demand here will follow down. For mind you that the selling prices today are based on the present value of the dollar, whereas the machines offered were mostly bought at a rate of six or seven francs to the dollar. Consequently the machines can in case of necessity be sold at about one-half to two-thirds of the present price without causing a loss to the owners.

And on top of all this France is turning out a respectable lot of first rate machine tools. They are somewhat behind in the more difficult types of machines such as grinders, boring bills and milling machines, but lathes, planers, drills, radials, etc., are fully up to the better class. A Swiss firm is putting on the market a milling machine of a new design, that will surely prove a success.

American Salesmanship

The American machine tools have before and during the war gained a market in Europe, and the problem today is not to work in on a new market but to keep an old market under extremely adverse circumstances.

With all due respect to American business men and methods, the successful salesman in America is not always a success in Europe, more so as the young American sent over by his firm in the States mostly considers his stay in Europe as some kind of a vacation and with the idea of remaining only a short time before his return to America. Ways and means of business are widely different here and it takes a man with thorough knowledge of the field to make a success. Especially is a thorough knowledge of the language necessary for the men trying to maintain the old reputation of the American machine tools and their manufacturers on this side.

As far as the financial part is concerned, the sooner the American manufacturer forgets the eternal "cash against inland bill of lading" the better for his export business. Let us hope that the movement now under way in the United Staes for furthering and financing foreign trade will soon bear fruit.

And the packing!. Much ink has been flowing in this battle, but the importance of proper boxing has seemingly not yet reached all concerned. The writer received a few weeks ago some American machines packed in cases, that anybody might indeed be proud to own in his home as bookcases, or that might make a beautiful home for some poor devil. Unfortunately the packer had not thought of fixing the machines properly inside his beautiful boxes, and as the cases were incidentally about 4 times bigger than the machines, these had been rolling around inside, rocked by the Atlantic swell and knocked about by the gentle longshoremen and railroad employees. When after several days' work we managed to pry the boxes open we found inside the remainder of what had once been perfectly nice milling machines. And no insurance company will listen to a claim for damages under these circumstances.

Peculiar Needs

The needs for certain types of machines are different in the various countries. For instance here in France nine out of ten customers when they want a lathe ask for a gap lathe. This is due to the fact that with a few exceptions the industries are not producing "in serie" as in America where machines are bought for and employed on the same job continuously. Here a lathe has to be prepared to take on any kind of a job at short notice, consequently a gap bed is the thing in demand. This question of supplying what the customer wants and not what you think he ought to want has been the proverbial success of the Germans, and considerable of a stumbling stone for the American manufacturers and American salesmen in France.

Automobile and Tractor Market in Algeria

An interesting report on economic conditions, with special reference to the automobile industry, by Consul Edward A. Dow, Algiers, contains the following information:

Algeria has excellent vehicle roads and more than 10,000 automobiles, the larger part of which are French cars, owing to preference for the products of the mother country, absence of customs duties, and nearness to the French market.

A few American cars have been sold with the advantage of low price, and but for the unfavorable rate of exchange would find a good market. An American truck of about 7 tons should under normal conditions find a good sale in Algeria. Since the war most transactions are on a cash basis. Nearly all the gasoline is imported from the United States. Motor vehicles are in common use between coast cities and also between mountain and desert settlements, competing favorably with train service both as to time and cost.

For the five years ended September, 1920, Algeria imported 525 tractors, of which 450 were American. Recent crop failure has prevented this rate being kept up, but a good crop is expected this year; and should there be an improvement in the exchange rate, a good opportunity would be found again for American tractors.

Western Editor of "American Machinist" Takes Up New Work

J. V. Hunter, Western editor of the *American Machinist* for the past several years, recently resigned to become editor of *Motor Service* a new magazine being launched in Chicago with headquarters in Machinery Hall.

English Machinery Combination in Argentina

Several British machinery manufacturers have recently combined in opening a general sales office in Buenos Aires. Unity and concentration are the key words of the combine. The "Review" of the River Plate in commenting on the opening of the office states that "its inauguration here proves that the British manufacturers intend to make a big bid for Latin-American trade in these lines which have been largely in the hands of German and American competitors."

A number of prominent manufacturers' representatives and American business men in Argentina have suggested the idea to American manufacturers not only for machinery but for hardware, textiles, and other items. Such a combination could be promoted in a manufacturing association, offices of this type could be opened in various foreign centers, especially those where competition is strongest and the advantage obtaining from concentration, closer application, centralization, and well directed advertising and propaganda would doubly repay for the initial trouble and expense.

Hoover Decries Pessimism

Secretary of Commerce Says We Must Help Raise Standard of Living in Europe—So Doing Will Help Our Own Recovery from the Effects of the War

We print herewith in full the address of Herbert Hoover before the National Shoe and Leather Exposition and Style Show (Inc.), at Boston, Mass., on Tuesday, July 12.

"There is a feeling of some uneasiness and even of pessimism regarding the future of our foreign trade, in which I do not participate.

"Our exports and imports during the last few months have dropped nearly 50 per cent in value from the high-water mark of a year ago. Some of this decrease is due to the fall in prices relatively more than volume; some of it to the temporary world depression, and some of it lies deeper.

"In these times of troubled minds we find much conflict of opinion as to the situation and its remedies. Some extreme groups insist that inasmuch as our exports comprise but 10 per cent of our total production, therefore our foreign trade bears only this ratio to our economic life, and that consequently our true course is to forget it and to devote ourselves to healing our internal economic wounds. Other extreme groups consider that for our internal situation the only remedy is restoration of our export trade and they would undertake desperate measures to accomplish it. In either case we must not allow the present extreme industrial depression to obscure our view. We have passed through several depressions since the Civil War and we have already turned the corner of this one.

"The importance of our foreign trade requires but little defense. I may say in passing that our whole standard of living greatly depends upon our imports and that our exports are the great balance wheel for our production. Exports are vital to the stabilization of our industries, of price levels, of wages, and of employment. While our exports do cover but a small per cent of our total production, on the other hand they do comprise a large percentage of the production of certain industries. For instance, we generally export 20 per cent of our wheat, 60 per cent of our cotton, 75 per cent of our copper, not to mention others. Unless we find a market for the surplus production of our great industries, we shall continue to keep some 25 millions of our people in reduced buying power. We might even drive them into poverty—during the many years that would be required to shift the whole basis of our internal production. Nor does a nation become rich by its exports alone—but by its trade.

"While many of the causes of the present depression lie within our own borders, yet there may be no recovery from these hard times for many years to come, if we neglect our economic relations abroad. Even if we lower our vision of civilization in this crisis solely to our own selfish economic interest, we are yet mightily concerned in the recuperation of the entire world. The hard times that knock at every cottage door today came from Europe. No tariffs, no embargoes, no navies, no armies can ever defend us from these invasions. Our sole defense is the prosperity of our neighbors and our own commercial skill. The recovery of our foreign trade can march only in company with the welfare and prosperity of our customers.

"When we analyze the present foreign trade situation, we find tremendous shifts in economic currents since 1914. Indeed, we find great changes still in progress. If we would guide our policies of production and trade aright, we must keep these great changes constantly in mind. These profound alterations naturally fall into two divisions: The shift in the world's production and markets and the shift in the world's financial relations. They bear upon each other, and they affect our three primary groups of food, raw material, and manufactured goods differently.

World Changes in Production and Markets

"There have been great changes in our own economic situation. We have not alone shifted from a debtor to a creditor nation. Our capacity for surplus production in food and manufactures has grown enormously during the war until we have taken front rank of the world in foreign trade.

"The direction of our trade has shifted greatly. During the last year about one-half of our whole foreign trade was with Europe, but of our exports to them 80 per cent were foodstuffs and raw material; of our exports to states outside of Europe about 75 per cent were manufactured goods. Europe in turn is our serious competitor in marketing of our manufactured goods to the rest of the world. We have enormously increased our imports of tropical and other commodities that we do not produce.

"Since the World War began, the world outside the fighting states of Europe has gained mightily in wealth, in standards of living, and in consuming power. Even omitting the United States, it has gained something like *forty* millions in population. The countries not directly affected by the war are indeed suffering from the general depression, but this depression with them is only the aftermath of the malevolent forces born of the past war booms. They have none of the deep economic wounds of the fighting states, and they will be quick to recover. During the war the productive capacity of these states, except possibly Japan, had no unusual increase because of their isolation through shortage of shipping.

"One of the economic shifts that affects the whole world profoundly is from Russia. Russia bore much the same relation to western Europe before the war that the Mississippi Valley bears to our Northeastern states. Russia was one of the great food bases of the manufacturing countries of western Europe, exchanging food for their fabricated products. These manufactured goods in turn were to some degree produced from our raw materials. Even at best it will be many years before Russia will have recovered. We are today the only great source of enlarged food production. Europe must and will draw from us a great proportion of food supplies that she formerly drew from Russia. I see no basic reason why we should not continue to export approximately the same large volume of foodstuffs that we have shipped abroad during the past twelve months. This item alone at even present prices would be triple our pre-war food exports, and would represent the equal of more than 60 per cent of our whole pre-war export trade.

"Another great but uncertain shift in world forces will arise out of Germany. The reparation payments must have a profound effect upon the whole economy of the world. Germany is to pay outside her borders to the Allies $500,000,000, plus 26 per cent export duty, or, say, a minimum of about $750,000,000 per annum. Germany is left without much gold foreign property, or foreign business earnings of consequence; therefore, these payments must be made mostly by the sale of manufactured goods outside her borders. But beyond the reparation payments, she must also sell goods abroad in the amounts necessary to buy her imports of food and raw materials. Any calculation based on the pre-war trade of Germany implies an enormous increase—perhaps more than doubling—of her pre-war exports. In view of the export duty and other payments, she must produce these goods for about one-half our production cost in order to take our markets. Such an increase in exports must be manufactured goods, and until the world consumption grows, these must be marketed in displacement of the goods of other industrial nations. We shall certainly feel the effects of this flow of goods that must be produced if she is to make reparation payments. On the other hand, Germany must take more raw materials from us for this purpose. In any event, the crowding in the market of German exports will affect her immediate neighbors more than ourselves, for 80 per cent of her market, pre-war as well as in the future, must lie in Europe itself.

Other Changes Among Combatant States of Europe

"The economic changes in the other combatant states in Europe obviously affects us also. The economic wounds given to them all by the war will be a long time in healing. The sacrifice of skilled labor, of brains, and of property will require a generation to cure. The hates of many newly liberated states must cool slowly, and their many new borders check the free flow of commerce. Many of these states possess masses of people who have suffered from exploitation and tyranny for generations. Their extreme reactions of Bolshevism and socialism and nationalization are slowly dying out. Many governments have been unable to raise sufficient taxes to meet expenditures, and the ceaseless printing of currency carries destructive inflation. All of them except the enemy states bear the burden of greater military establishments than even before the war. All this must accumulate to decrease their productive power and to lower their standards of living.

"In balance against this loss of productive power, their people over great sections are now coming to a full realization that they must work harder than ever before and that they must export commodities for all that is in them, in order that they may make exchanges for the bare margin of life. They will some of them receive payments from Germany in relief of their tax burdens. They are mobilizing the skill and the intelligence of their people to their economic salvation with the same diligence that they were mobilized in war. The great manufacturing states are straining every device of science and thought to the improvement of their industrial processes, to the simplification of products, to the elimination of waste—that they shall make every reduction in production costs. In reinforcement of their marketing machinery, many of the governments are stimulating the consolidation of banks and of manufacturing concerns. Governmental and government encouraged combinations are being created to control exports and imports to exploit foreign markets. They are seeking special concessions for development and trade throughout the world. Altogether these policies comprise a militancy in commercial expansion that compared with Elizabethan England.

The Effect Upon Us

"Any improvement in European production of manufactured goods will favorably affect our market for those raw materials such as cotton and copper, where we possess the final supplies. In considering the demands for such raw materials, we must remember that the manufacturing countries of western Europe have lost for a long time to come any great markets in Russia and Turkey; the population of Europe as a whole has not the consuming capacity for manufactured goods that it had before the war and, therefore, we must expect a less than pre-war consumption in the confines of Europe for their remanufacture of our raw materials. But on the other hand, they will find after this depression is passed that the markets of the rest of the world are larger than before the war. I am confident they will gradually return to prewar demand for our cotton, copper, etc. Fortunately, our producers have realized this temporary situation and have vigorously reduced their production so that they should eventually realize better prices than at present.

"It seems to me that it was inevitable that the balance of the forces at work in Europe would improve their ability in competitive manufactured goods. Their production costs were bound to be low, both by better organized industry and by lowered standards of living. Some of them are today through government subsidies, artificially low and will undoubtedly increase. If we analyze the effect of these forces on the market for our manufactured goods, either in Europe or in our much larger market outside of Europe, we quickly find two directions in which we occupy a position of some security. The first is in those exports of lower production costs which are the result of great repetitive production, which has its firm root in our enormous consumption. The second is in that large number of special manufactures in which the inventive genius and skill of our people have been developed beyond any country in the world. Your own industry of shoes and shoe findings is typical of these two characteristics. I believe we will recover and can hold our share of the market for these products after the present world depression.

"As to our manufactures containing a large element of labor cost, in which we do not enjoy special advantages, we must look out and take measures of our own. We can no doubt devise tariff measures that will protect our domestic market. But if we are to hold to our foreign markets in this vast group of our manufactures, and thus to keep our people employed, we have several things to attend to. Fundamentally, we must get our production costs down.

That lies only along the road of increased efficiency in our whole industrial machine. It means a willingness of our working people to put forth every effort that is in them consistent with health, proper family life, and good citizenship. The surest road to a continued high wage, and the surest safeguard against unemployment is to remove every restriction on effort. This must extend from our mines to the railways, to the factories, to the wharf, and to the ship. It means smaller margins of profit. It means that ultimately we must have much lower transportation rates. It means we must have better organized marketing machinery abroad under Americans themselves. It means the establishment of adequate short time credit machinery and much more care in foreign credit risks than our merchants have shown in the last 12 months. It means elimination of the great wastes in industry. For instance, in the Atlantic seaboard area alone, by the development of these great water powers and through economies by electrification generally, we could profitably save 30,000,000 tons of coal per annum if we had the courage to go at it. It means the Government must remove as quickly as possible those unnecessary domestic burdens upon commerce to which the Government is a party, by the reorganization of our tax system, the settlement of the tariff question, the reduction in Government expenditure through the reorganization of the Federal Government, through reduction of armament and through reduction of Shipping Board losses and by the settlement by the Government of the outstanding claims of our railways. It means we must cease trying to drive American ship owners off the sea with tax-paid shipping losses. We must carefully determine what particular trade routes we will maintain in development of our commerce over a period of years, and let our merchants know them. It means the Govermnet must provide such information to commerce and industry, from both at home and abroad, as will enlarge its judgment. It means we must extend scientific research into the problems of waste, the perfection of processes, the simplification of methods that are beyond the ability of one manufacturer acting alone, and we must co-operate with industry to perfect these things. I am confident we can hold our markets, our higher standards of living and of wage if we will all put our backs into it.

The Shift in Credits

"Overriding all these questions of production and markets is one of credits. Our whole financial relation to the rest of the world has greatly shifted. From a nation owing some five billions of dollars to the rest of the world for moneys borrowed, the war has reversed our position so that the world, principally Europe, owes us today from thirteen to fifteen billions of dollars, of which about ten billions is due our Government. Before the war we had to export a surplus over our imports, and beyond this had to contribute through remittances of immigrants, tourists, shipping, etc., great sums to pay interest upon our debts.

"The reason for the piling up of this vast debt is, of course, that we have not only loaned money to the Allies but have also since the war vastly increased the surplus of our exports, and the movement still continued to accumulate in our favor. Unless we would cease a large part of our war increased productivity with all the resulting unemployment and losses of such a cessation, we must continue for some time to export in excess of our imports. Eventually the increase in our imports of tropical supplies, minerals and commodities that we do not ourselves produce, together with the spending of tourists and the investment of surplus capital abroad, etc., should overtake our export balance and establish a proper equilibrium. In the meantime, if we would maintain our economic position, we must continue to give credits to buyers of our goods and if we should demand interest or principal on our established loans we would nullify any benefits of such credits. I may repeat that if today we stop giving more credits and demand payment of interest on debts due our Government, our exports will further decline, and the decline will find its interpretation in more unemployment among our own people and more displacement of our industries.

"The natural effect of our surplus of exports (although we have as yet made no demand for payment of interest on the Government debt), is that our dollar is at a premium over even the most stable currencies in the world. Thus the cost of producing our commodities is higher than in any other country. This does not so materially affect the export of those commodities of which we hold a final supply, such as the food supplies and our raw materials, or those articles in the manufacture of which we have unique ability. It does, however, partly biockade our exports of manufactured goods in which we directly compete with Europe. Exchange itself is not the cause but the effect. It bears the same relation to trade that the barometer does to the weather. It is but an indication of the movement of commodities and credit. Our high barometer means we need more credits outward or alternative we must send less goods out or take more goods in.

"I may say in passing that I am confident that our debtors can eventually carry the debt due to us with ease, provided they have the time necessary for the healing of their economic wounds, that they succeed in the reorganization of their fiscal policies so as to balance their government expenditure, and above all, that they secure disarmament and continued peace. Before the war the world carried a debt to a single European nation of twice the size of our foreign claims without knowing it, and with the renewed growth of the world's commerce and wealth our debt will be no burden. Our problem is the difficulties of our debtors during the few years until these blessings are attained.

"All of my rightful and optimistic view that we will maintain the flow of our goods is based upon the assumption that we can wisely manage these credit problems. There is a general agreement that we must extend credit if we would market our surplus and upbuild our customers during these next few years of readjustment, but as to the methods there are many minds; there are those who would directly try to stabilize exchange back to parity; those who would create securities jointly guaranteed by the principal nations, either through international banks of issue, bonds or currency; those who would extend credits directly or indirectly from the United States Treasury to buyers of goods, in order to stimulate exports; and also those who have confidence that the processes of business will find their own way out.

"Attempts to bring exchange to parity or to create international securities of any kind are open to the objection that they involve an element of inflation and that they practically open the gates of credit from the United States without regard to risk, how its purpose affects us or whether it really benefits the borrower. Loans from our Government direct to foreign governments or foreign merchants have a hundred objections and disagreeable entanglements which we learned well enough during the war. In all this maze of difficulty and the unsettlement over credits and debts, I would sum up that wisdom consists in knowing what to do next rather than debates upon perfection.

"As necessary as the continued establishment of foreign credits are, if we are to maintain our large volume of export trade, we should not overestimate the amount needed for legitimate trade for refinance and for reconstruction purposes. The amount is not so great as popularly supposed and will annually decline. I believe all trading states of consequence in the world can even now finance their imports of food supplies. The stronger of them can finance their imports of raw materials. We are, indeed, importing very much larger quantities of tropical produce than before the war and our own consumption of these commodities will continue to grow. The margin of credits needed beyond our imports in order to keep commerce alive for the present are, first, comparatively short term amounts to cover part of our exports of raw materials and the distribution period of our manufactured goods and, second, constant refinance of debts or interest already owed to us.

"In summary, on the production and marketing side of our commerce, we can say that our food exports should remain on a greatly enlarged scale; that the demand for our raw materials should slowly increase toward pre-war amounts; that in respect to our manufactures we should be able to hold special fields of repetitive production and ingenuity; that we will need to make a fight to hold the markets for manufactured goods where we come more directly into competition with the European manufacturer but that we can do it if we will work and apply our brains to it. On the financial side of our situation, I do not believe our world credit situation is at all so unsurmountable or that it requires extraordinary solutions.

"I may repeat that we need to realize above all things, that even if we lower our vision of civilization in this crisis solely to that of our own selfish economic interest, we are mightily concerned in the recuperation of the entire world. There is an economic interdependence in the world that recognizes no national boundaries. The greatest jeopardy to the standard of living of our people is the lowered standards of Europe. Now that we have become a great debtor nation, we must learn that this great debt must be wisely directed so that we do not stifle both our own growth and the growth of others.

"There are, indeed, many complexities arising out of our great expansion on productive power and our suddenly born creditor position. I do no need to say that we are confronted with a hundred difficulties, that we must be alert to steer our commercial policies against the winds of the world in an economic storm. We are suffering greatly in this immediate world-wide industrial depression. This depression is partly due to the war; it is partly due to our post-war boom, with its speculation, its extravagance, and its slackening of efficiency. The Government can help recovery by removing the obstructions to commerce and industry. But when all is done, the real cure for all depressions is courage and applied intelligence and the return to primary virtues of hard, conscientious toil and economy in living. On every side there is evidence that the vast majority of our whole nation is making again an effort in those directions equalled only by that of 1918, and the day some months ago when we entered this effort we fundamentally turned the corner of this depression. While our recovery may be slower than some may expect, nothing can prevent the prosperity of a country where the people have enlightenment, wish to work, wish to produce, and wish to do right by their neighbors.

"We are not a nation of machines and houses, factories, and railways. We are a nation of men, women, and children. Our industrial system and our commerce are simply implements for their comfort and happiness. When we deal with those great problems of business and economics we must be inspired by the knowledge that we are increasing and defending the standards of living of all our people. Upon this soil grow those moral and intellectual forces that make our nation great."

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Ford Plant Breaks More Records for Production

A new high record for production in one month was reached at the Ford Motor plant at Detroit, Mich., in June, the total cars and trucks being 108,962, a statement by the company says.

During April, May, and June the production of Ford cars and trucks was 301,796, an increase of more than 80,000 over a year ago.

The July schedule calls for an output of 109,000 cars and trucks. A car or truck will leave the assembly line every 6½ seconds, if this schedule is maintained—a production of 4,360 cars a day.

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Steel Prices and Wages Still Going Down

The United States Steel Corporation has announced another reduction in steel prices and also a cut in wages. With the new price schedule in effect, the whole steel industry of this country will again be practically on a uniform base. The last time that the industry was uniformly quoting the same schedule was April 15 last, since when there has been more or less cutting by various independents on all products and by the leading interest on several products. The Bethlehem Steel Corporation has published a new schedule of prices, or rather made official the prices current in the market, which is exactly similar to the recently one put out by the Steel Corporation. The Republic Iron and Steel Co., the Lackawanna Steel Co. and most of the independents that were not already quoting the new base or lower, followed suit. The new prices are not down to pre-war levels as yet as shown below. The new prices as compared with those recently current and some of those quoted in January, 1913 follow:

Finished steel products.	New price.	Old price.	Jan. '13 price.
Bars	$1.90	$2.10	$1.20
Structural shapes	2.00	2.20	1.75
Plates	2.00	2.20	1.75
Blue annealed sheets	2.65	2.85	....
Black sheets	3.50	3.75	2.31
Galvanized sheets	4.50	4.75	3.46
Tin plate	5.75	6.25	3.60
Semi-finished—			
Sheet bars	35.00	39.00	30.00
Billets, 4 x 4	33.00	37.00	28.30
Slabs	34.00	38.00	.....
Skelp	2.00	2.20	.....

Russia's Orders for Railroad Supplies

BY V. LEITIS
Riga, Latvia

(Formerly representative in the U. S. of the United Credit Union of Siberia.)

Soviet-Russia has ordered 1,000 locomotives in Germany and 700 in Sweden. All railroad orders are centralized in the hands of a special Russian railroad mission with headquarters at Stockholm and agencies in Berlin and London. The locomotives ordered are all of the old Russian type and are for freight only.

The Bolsheviki report that they will not order any passenger locomotives in the near future. The reason for this is that at present the condition of tracks and cars do not allow traveling at high speed. The average mileage for trains in Soviet-Russia is 230 miles in 24 hours. Trains are short and locomotives must be changed every 40 or 50 miles. The Russian climate has much to do with the condition of the track. Crossties are of pine, not treated with a preservative. From a total of 87,000,000 crossties 13,500,000 should be changed in 1921, but only about 5,500,000 will be changed. Compared with American standards the entire 87,000,000 should be changed.

From a total of 455,132 cars 95,000, according to the Bolshevist reports, are in bad order. The truth is that not less than 50 per cent are in bad condition. Soviet-Russia is sending to Latvian harbors so called newly repaired cars to receive goods for interior Russia, but many of these cars must be uncoupled after they have traveled some 50 miles with load. Passenger cars are in even worse condition.

The railroad control system is out of order. At the beginning of 1921, 32,000 from a total of 38,000 railroad telephones required repairing and 8,590 from a total of 10,250 telegraph instruments were in the same condition.

It seems that the Bolsheviki wish to replace only those locomotives which are over 45 years old. There were in Russia in 1914, 147 locomotives over 50 years, 1,537 from 40 to 50 years, 2,083 from 30 to 40 years, 1,247 from 20 to 30 years, 7,937 from 10 to 20 years and 7,108 under 10 years. Of course, the war with its heavy work and the attending improper repairing caused the majority of the locomotives to get in very poor condition. The Bolsheviki are endeavoring to make repairs and they boast that they now have in operation 19,157 locomotives against 9,400 in 1920. These figures are hard to believe as parts of the damaged locomotives are sent to Latvia and parts to Esthonia.

Soviet-Russia has ordered in Germany and in Sweden reserve parts and repairs for locomotives, cars and tracks valued at about 56,000,000 Swedish krones. Included among these parts are some 500,000 boiler flues at 200 gold roubles per ton; 124,000 poods of tin at 1,950 gold roubles per pood; 880,000 poods of lead at 183 gold roubles per pood; and rails at 91 gold roubles per ton. Some of these parts have been shipped across Latvia and Esthonia and the remainder of them will reach Russia by or during August. According to the Bolsheviki these supplies are estimated to cover their requirements for one year.

The locomotives that have been ordered will cost on an average of 130,000 gold roubles each. According to the reports of the railroad mission the German prices are 30 to 50 per cent lower than the Swedish and English prices because of cheaper German labor. The mission intends to order more parts in Germany and send them to Sweden to reduce the cost of production of locomotives ordered there.

The orders in Germany are distributed among nineteen factories and the total order of 1,000 locomotives is expected to be completed by March 1922. The 700 locomotives ordered in Sweden are to be built by the Nidkost & Holm Works as follows: 50 in 1921; 150 in 1922 and 250 each year in 1923 and 1924.

The 17,000 locomotives are not a large quantity for Russia but she has neither gold nor valuables to pay for more. The total cost of the present order will be about 250,000,000 gold roubles. In January 1921 Soviet-Russia had only about 350,000,000 roubles in gold. In addition to the necessity for repairs she has other needs and other expenses. Export business is slight and will remain that way so long as the Bolshevist-Communist regime remains in Russia. Recently there was some declaration that Russia will cease to pay for purchases with gold and will pay instead with goods. This is not because they have become thrifty but rather because they have no more gold.

Will Soviet-Russia order locomotives in the United States? This is a question hard to answer. The Bolsheviki are claiming that there were ordered in America, and paid for by Kerensky, 265 locomotives which were not delivered to Russia but were taken on lease by the Government of the United States and that at present the government refuses to deliver these locomotives to Soviet-Russia. It is said that at least sixty speculators offered them to the Bolsheviki officials at reasonable prices. The Bolsheviki believe that these locomotives were paid for by Russia, belong to Russia and should be delivered to her without additional payment. It seems pretty clear that the Bolsheviki receive better treatment in Germany, England and Sweden than in the United States and that their orders are influenced accordingly.

Washington Notes

BY PAUL WOOTON
Washington Correspondent

One of the important considerations of present day military development, in the opinion of Brigadier General William S. Peirce, Assistant Chief of the Ordnance Department of the Army, is to avoid the assumption that the next war will be fought along the lines of the last struggle. Were the next war to come even ten years hence, it would be fought along lines vastly different from those followed during the struggle with Germany. He points to potent possibilities in mechanical devices. Officers of the Army and Navy recently have seen a battleship without a soul on board started, stopped, steered and intricately maneuvered by radio from a distant point. This, General Peirce says, in discussing the matter with the Washington correspondent of *American Machinist*, suggests that whole fleets of ships could be sent into combat without endangering the lives of their manipulators. That airplanes and even tanks can be adapted to similar control seems to be well within the range of possibility. While General Peirce cautioned against any jumping to conclusions before theories or experiments are fully developed, he cited this example of what may be developed in the next few years. Predictions can not be made as to just what the changes will be, but nevertheless it is entirely certain that the procedure in the next war will be as different from the practice during the last war as was the Civil War from the World War. The principal change, General Peirce forsees will be because of mechanical developments. The Ordnance Department, he says, is trying to keep its eyes open to the possibilities of developments of all kinds and while there is a tendency on the part of long established institutions, like the Army and the Navy, to be too conservative, every effort is being made to avoid any Bourbon-like policy.

Particular attention is being given to the developments in aviation. It is admitted that the increasing effectiveness of the airplane carries with it the possibility that all artillery may be immobilized. The point almost has been reached at which it is highly advisable to make important artillery movements in the darkness of the night.

Up-To-Date Equipment

General Peirce cautions against placing too much reliance on our accumulations of munitions. When the time comes to use much of this material it will be found to have become obsolete. In addition to munitions, there is also the matter of gages, dies, fixtures, tools and special purpose machines. These are valuable only, General Peirce declared, for the reproduction of the same kind of articles. It is the desire of the Ordnance Department to conduct its affairs in the same way an enterprising manufacturer would conduct his establishment. Development in the automobile industry, for instance, is such as to necessitate continual changes in equipment. There is a tendency on the part of the public to think that ordnance manufacture can stand still during the interims between wars. In the effort to be best prepared for any emergency, the Ordnance Department is co-operating very closely with private manufacturers. Every new design is submitted to these manufacturers. Careful consideration is given to any objection which the manufacturer may point out in the study of the design, from the standpoint of quantity production. In that way designs are in readiness at all times in case the country should be called upon to begin the production of the most improved war material.

The New Tariff on Metals and Machinery

In explaining the tariff schedule covering metals and manufactures thereof, Representative Tilson of Connecticut, chairman of the sub-committee which drafted the schedule, pointed out that the articles contained in that schedule had been divided into three classes.

The first class includes articles produced in large part by machinery where the element of labor is relatively small as compared with the quantity and value of the product. An example of articles falling in this class is iron and steel in the earlier stages of manufacture. Mr. Tilson pointed out further that formerly many articles of a higher state of manufacture fell within this class because labor saving machines and appliances were used to a degree unknown in any other country. "With proper machinery," said the Connecticut representative, "and an adequate equipment of tools, jigs, dies, gages and fixtures, one American workman could turn out several times the output of his brother workman abroad." Under present conditions, Mr. Tilson said, much of this advantage has ceased to exist and in many of the older industries has ceased entirely to exist.

In the second class the Tilson sub-committee placed articles produced by industries which have been long established and thoroughly developed. In those industries advantages of labor saving devices have ceased to exist. The element of labor is relatively most important and the difference in labor cost is the controlling factor in competition. As typical of that class he cites clocks and cutlery.

The third class consists of those articles the production of which was begun or developed during the war period and which have not yet reached the point where they can compete with the older industries in foreign countries. As examples of articles falling in that class he cites surgical and scientific instruments.

Discussing clock manufacture, Mr. Tilson pointed out that so-called watches of the Waterbury and Ingersoll types are not watches at all, but clocks. They are made without jewels and built in the same way as are the cheaper clocks. "When it became possible for a comparatively few workmen," said Mr. Tilson, "with a number of power machines properly equipped to stamp out parts of these clocks by the cartload, then the making of the clock became a simple problem of assembling. The same work was done in foreign countries largely by hand. Hence however low the wage there, the cost was considerable. Now foreign manufacturers not only have as good machines but in many cases the very kind of machine made in this country."

In addition to machine tools and parts of machine tools, which call for a rate of 35 per cent ad valorem, the Fordney bill contains many other items of interest to the machinery industry. Steam engines and steam locomotives take a proposed rate of 15 per cent ad valorem. Automobiles and parts of automobiles, not including tires, carry a proposed rate of 25 per cent ad valorem. This item carries the proviso that if there be imported into the United States similar articles manufactured in or exported from any country which imposes a duty greater than 25 per cent ad valorem, "there shall be levied, paid and collected upon such articles a duty equal to the duty imposed by such country upon such articles imported from the United States, but not to exceed in any case 50 per cent ad valorem." The duty proposed for airplanes, hydroplanes, motor boats and their parts is 30 per cent ad valorem. Bicycles and motorcycles take the same rate.

Agricultural implements are on the free list. In this category is included machinery for use in the manufacture of sugar. Other items on the free list are cash registers, linotype and all typesetting machines, sewing machines, typewriters, shoe machinery, sand-blast machines, sludge machines and tar and oil spreading machines.

New Iron and Steel Works in South Africa

The Newcastle Iron and Steel Works in South Africa is expected to commence production about the middle of this year. It will be equipped with 4 Cowper stoves, 50 coke ovens, 5 boilers to be fired with pulverized fuel, and a blast furnace 70 ft. high and of 3,000 tons per month capacity. To begin with the furnace will be hand charged, but it has been erected with a view to mechanical charging at a later date. A site for another furnace of similar design has been selected, and it is proposed to proceed with its erection in the near future.

Business Items

The clubrooms and library of the Swedish Engineers' Society of Chicago have been removed from the City Hall Building to the new clubhouse at 503 Wrightwood Ave., Chicago, Ill.

The Raymond Rims and Wheel Co. Toledo, Ohio, has been incorporated with $50,000 capital stock, by A. A. Meggett, Benjamin T. Batsch, E. M. Sieloff, E. H. Young and Forrest Jeffries.

The B. M. Jones & Co., Inc., Cleveland branch, 115 St. Clair Ave., N. W., is now being managed by the Connelly & Kendal Co., which has moved into the above adaddress.

The King Tool Co., Asbury Park, N. J., has been incorporated with $100,000 capital by A. C. Klopper, Joseph Pilling and Joseph C. Tynan, to manufacture tools and mechanical products.

The Johnstown Steel Car & Supply Co., Johnstown, Pa., has been incorporated with $600,000 capital stock, by H. H. Thompson, I. Schermin and H. Earl Sorber, to manufacture mine car wheels, etc.

The Hawkins Traction Flange Co., Pittsburgh, Pa., is being organized by Albert C. and Anthony J. Pauley and M. J. Koch, to manufacture flanges for traction wheels.

The Pitt Railways Equipments, Ltd., Montreal, Canada, has been incorporated with $1,000,000 capital to manufacture electrical railway equipment, machinery, tools, appliances, etc., by George L. Alexander, William A. Pitt, both of Montreal; John W. McLeod, New Glasgow, N. S., and others.

The Wonder Recharger Co. of Canada, Ltd., Montreal, has been incorporated with $150,000 capital stock to manufacture electrical machinery and equipment, by John W. P. Ritchie, Leslie G. Bell and others of Montreal.

The British Empire Steel Products Co., Ltd., Montreal, Canada, has been incorporated with $100,000 capital to manufacture iron, steel, metals, castings, forgings, machinery, tools, implements, etc., by Frederick H. Markey, Waldo W. Skinner, George G. Hyde and others, all of Montreal.

The Combined Grate and Radiator Heating Co., Knoxville, Tenn., has been incorporated with $30,000 capital stock, and will operate a plant at Fountain City, Tenn. Organizers of the company are H. E. Kelly, W. E. De Armond and others.

The Richard Punch and Die Corporation, Detroit, has been incorporated with $200,000 capital stock, by Otis K. Richard, Clement C. Richard and Clarence A. Richard.

George F. Snyder, Inc., Alpine, Mich., has been incorporated with $50,000 capital by George F. Snyder and Samuel Taig, to manufacture aluminum, brass, bronze and other metal castings.

The Detroit Alloy Steel Co., Detroit, has been incorporated with $50,000 capital by Frank L. Griffin, Robert H. Hall and John Grant, to manufacture alloy steel products.

The Associated Machinery Corporation, New York, recently was incorporated with $50,000 capital stock, by H. Harnischfeter, A. G. Hendricks, J. F. Dempsey and F. J. Knorr of Albany, N. Y.

The South Jersey Iron Foundry, Inc., Pleasantville, N. J., has been organized to make iron and steel castings, by W. C. Arnold, Commonwealth Building, Philadelphia, and others.

The Newark Die Co., Newark, N. J., has been incorporated with $50,000 capital stock, by L. G. Aierstok, John Hohl and H. H. Kunzelman, to manufacture dies, etc.

The Behrens Crane Co. Merchantville, N. J., has been incorporated with $125,000 capital stock, by Albert Burling, J. N. Wilkins and others, to build cranes, etc.

The Canuck Tool Mfg. Co., Ltd., Toronto, Ont., has been incorporated with $40,000 capital to manufacture tools, etc., by Arnold K. Graham, Percy I. Innes and Frederick E. Claxton.

The Continental Electric Co., Ltd., Toronto, Ont., has been incorporated with $40,000 capital to manufacture and deal in electrical appliances, etc., by M. L. Gordon, Bert H. L. Symmes and Craig A. C. McKay, all of this city.

The New England Smelting Works, Inc., Springfield, Mass., has been organized with $25,000 capital by A. J. Saffer, Morris Levin and P. M. Saffer.

The Stay New Filter Corp., Rochester, N. Y., has been incorporated with $100,000 capital by W. F. and L. L. Dellinger and J. J. McInerney, Insurance Building, to manufacture air filters for automobile service.

The Master Piston Ring Corporation, New York, has been incorporated with $50,000 capital stock, by B. Bursch, J. I. Polstein and S. S. Budlong, to manufacture piston rings, etc. The company is represented by Sanders, Zelenko and Polstein, 217 Broadway.

Coates Steamers Inc., Terre Haute, Ind., has been incorporated with $5,000,000 capital stock, by Earl R. Cox, W. S. McCloud, Terre Haute, and Louis Clements, Danville, Ill., to manufacture steam-driven automobiles.

The Victor Piston Ring Co., Baltimore, Md., has been incorporated with $500,000 capital by George D. F. Robinson, F. Pyrce and E. A. Leiby, to manufacture piston rings, automobile accessories, etc.

The Buffalo Shock Absorber Corporation, Buffalo, has been incorporated with $50,000 capital stock, by A. J. Argue, F. A. and J. P. Abbott.

Samuel E. Bernstein, Inc., New York, has been incorporated with $300,000 capital by P. J. M. and Samuel E. Bernstein, to manufacture cutlery, etc.

Warren Bros., East London, Ont., are making arrangements to erect a machine shop here at a cost of $25,000, and will shortly be in the market for machinery and general equipment.

The Bridesburg Foundry and Engineering Co., Philadelphia, has been incorporated with $125,000 capital to manufacture foundry and machine shop products, by Wary C. Arnold, Harold C. Lansinger and Frank A. Cabeen Jr.

The Hineline Engineering Co., Providence, R. I., has been incorporated with $300,000 to build machinery and make tools, by Theodore Beauregard, Leon S. Courcy and John B. Pinault.

The Barde Industrial Co., Seattle, has purchased a tract on which it plans a steel storage warehouse and machinery depot at an estimated cost of $250,000.

Personals

H. P. Simpkinson, has been transferred from the home office of the C. & G. Cooper Co., Mt. Vernon, Ohio, builders of engines and generators, to Dallas, Texas, where he has taken charge of the company's office.

Stanley Mazurek, Jr., of the sales force of the Federal Machine and Welding Co., Warren, Ohio, has been appointed manager of the Chicago office of that company. A. E. Hackett succeeds Arthur E. Meyer, who resigned as manager of the Detroit office.

J. E. Thorp, Jr., who has been superintendent of the blast furnace at the Columbus, O., plant of the American Rolling Mill Co., Middletown, O., has resigned.

William N. West, formerly superintendent of mills and roll shop of the Elyria Iron and Steel Co., Elyria, Ohio, has been appointed general superintendent to succeed Walter Ferrier, resigned.

Charles H. Collins, president of the Village of Colonie, and who for the past eight years has been associated with Stephen Sanford & Sons, Inc., Amsterdam, N. Y., as inventor and mechanical expert, has severed his connection with that firm and hereafter will devote his entire time to the manufacture and sale of carpet, silk and knitting machinery. The Perkins Machine and Foundry Company, Inc., of which he is the president and majority stockholder, is being reorganized and will be known in the future as the Collins Loom Works, Inc.

R. C. White, manager for the B. M. Jones & Co., Inc., Cleveland branch, has been appointed special western representative, of that company and will be located in Chicago. His headquarters will be with the western sales agents, Crerar Adams & Co., of 259 E. Erie St.

K. A. Juthe, for eighteen years with Wheelock, Lovejoy & Co., of New York, has joined the forces of the American Industrial Furnace Corporation and the American Metallurgical Corporation as chief engineer and treasurer.

H. M. Thomas of Oakland, Cal., has been appointed district representative on the Western coast for the Batterman-Truitt Co., of Chicago, Ill.

Harry F. Quinn, vice-president of the Fairbanks Company and manager of the New Orleans branch, has submitted his resignation, the same to take effect immediately upon the appointment of a successor.

I. D. Bielostozky has arrived in this country from Russia as representative of Morris & Bramer, of Petrograd. He is desirous of getting in touch with manufacturers of high-class machine tools with a view of securing their representation at Vladivostok. Mr. Bielostozky can be reached at 44 Whitehall St., New York, care of the W. P. Neth Co.

Col. C. L. H. Ruggles, who organized the technical division of the Ordnance Department and who has been in active charge of it since its foundation, January 1, 1919, has been instructed to take the next course at the Army War College. He will be succeeded as chief of the technical division by Col. John W. Joyes, who has been in charge of the Artillery Division of Ordnance. Col. Samuel Hof will succeed as head of the Artillery Division.

Nicholas A. Buotich has sold his interests in the business and equipment of the American Foundry at San Diego, Cal., to his partner, Bartholomew Skarpa, and the latter will continue the business, still using the name of American Foundry.

W. L. Conrad, who for many years was manager of the office of the late H. L. Gantt, assisting in the introduction of modern methods of management in industrial plants throughout this country, has opened an office in New York for consulting practice in management. He will follow along the lines advocated by Mr. Gantt and the work contemplated will include the introduction of modern methods of management, production and costs.

A. M. Morrell, formerly purchasing agent for Nordyke & Marmon Co. of Indianapolis, Ind., is now sales engineer of the Edward R. Ladew Co., Inc., and is located in San Francisco, Cal.

George Greenlee, formerly general superintendent and mechanical engineer for the National Wire Wheel Works, Geneva, N. Y., has become connected in the same capacity with the Morrison Machine Products, Inc., Rochester, N. Y., maker of collets for lathes and screw machines.

J. M. Meany is now president of the Ball Engineering Co., Portland, Ore. He was formerly western manager for the Clyde Iron Works, of Duluth, Minn.

Edgar MacNaughton has been made professor of mechanical engineering at Tufts College, Mass.

Philip W. Swain is now associate editor of *Power*. He was previously with the Franklin Manufacturing Co., Franklin, Pa.

L. W. Helmreich, formerly with the Arkansas Corporation Commission, Little Rock, Ark., is now chief mechanical and electrical engineer for the Missouri Public Service Commission, Jefferson City, Mo.

I. N. Zavarine, until recently metallographist for the Winchester Repeating Arms Co., New Haven, Conn., has been appointed assistant in mechanical engineering department of the Massachusetts Institute of Technology, Cambridge, Mass.

Paulsen Spence is no longer connected with Crane Company but has accepted the position of sales engineer for A. W. Cash Co., valve specialists of Decatur, Ill. His headquarters are in Detroit, Mich.

Forthcoming Meetings

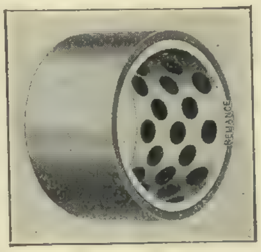
The third annual convention and exhibition of the American Society for Steel Treating will be held in the Manufacturers Building, State Fair Grounds, Indianapolis, Ind., during the week of September 19 to 24 inclusive.

A joint meeting of the American Society of Mechanical Engineers, the Society of Automotive Engineers and the Army Ordnance Association will be held at Aberdeen, Md., Friday, October 7.

Condensed-Clipping Index of Equipment

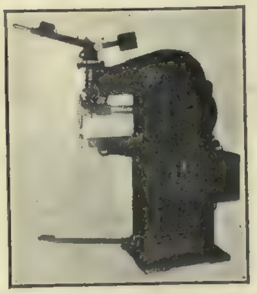
Patented Aug. 20, 1918

Bearing, Self-Lubricating
Reliance Machine and Specialty Co., 101 Green St., Jamaica Plain, Boston, Mass.
"American Machinist, April 14, 1921



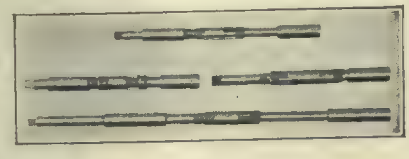
The bearing is made both in a wide range of sizes, and in many different types, both radial and thrust. The illustration shows one of the standard types of radial bearing or bushing. The bearing consists of two parts, the outside bushing usually being made of steel tubing. The inner bushing is made of bronze, and is drilled with a number of ¼-in. holes, the holes being slightly larger on the outside than on the inside of the bushing, so that the lubricating mixture with which the holes are filled will be retained in them. In assembling the bearing, the outer casing is expanded by heating and then shrunk on the inner casing, after which the two are pinned together. Neither of the bushings is split.

Welding Machine, Spot, Series-4.
Taylor Welding Co., Warren, Ohio.
"American Machinist," April 21, 1921



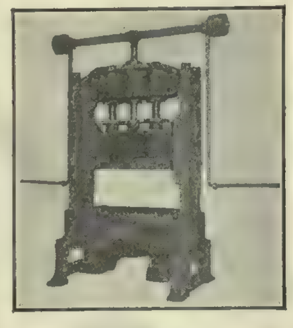
The machine is intended for welding together pieces of sheet steel from 1/64 to ¼ in. thick. The operation is by hand lever and treadle, used either together or independently of each other. When using the automatic switch the elecrodes are brought in contact with the work under spring pressure, further movement of the hand lever or treadle turns on the current, the work heats immediately to a welding temperature, and continued movement of the lever or treadle turns off the current and applies pressure to the molten metal to complete the weld. The machine can be adapted to 220 or 440-volt, 25 to 60-cycle single phase alternating current. A 10-step self-contained regulator is provided for adjusting the current. One set of 1¼-in. water cooled electrodes, 2 straight, 2 offset and 1 flat, are standard equipment.

Reamer, Line, Expansion
New Britain Tool and Manufacturing Co., New Britain, Conn.
"American Machinist," April 21, 1921



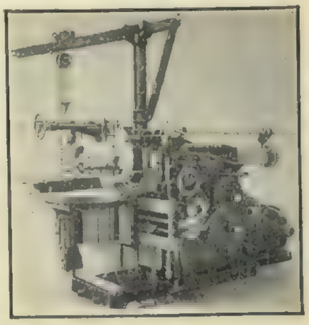
The reamer is intended primarily for use in the garage and automobile repair shop, for the purpose of reaming to a standard oversize the worn holes in pistons and connecting parts of automobile engines. All parts are of tool steel, hardened and ground to size. The cutting part of the tool is not different from the regular expansion reamer made by the same concern, except that it is placed in the middle of a long shank to which adustable bushings are added, so as to guide the cutting portion when reaming holes that are worn out of size or shape.

Press, Screw, Double
Toledo Machine and Tool Co., Toledo, O.
"American Machinist," April 28, 1921



The press is made with sufficient capacity and area of bed to try out dies such as used for blanking, forming, drawing and stamping sheet metal and which are too large for the ordinary single-screw press. The frame is of the four-piece, tie-rod construction. It is fitted with two screws 4 in. in diameter. The bed is arranged with a powerful spring-pressure drawing attachment, which can be used when trying out combination and deep-forming dies. Weight, about 14,000 lb. Area of bed, 30 x 54 in. Area of slide, 24 x 49 in. Height of slide above bed: slide down, 14⅜ in.; slide up, 32½ in.

Shaper, Railroad, Draw-Cut, Heavy-Duty
Morton Manufacturing Co., Muskegon Heights, Mich.
"American Machinist," April 21, 1921

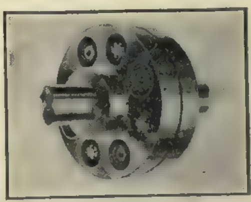


The machine is intended for rapid production work in railroad shops on driving boxes, crown brasses, shoes and wedges, and connecting-rod brasses. On work within the range of the tool, it is said to remove metal as fast and as accurately as a planer, although it consumes one-third less power than a planer and takes half as much floor space. The taking of the cut on the back stroke increases the capacity of the machine. The column is of heavy box section and provided with square rail bearings. The ram is made of steel, is square in section and cast hollow. The length of stroke is adjusted by tappets on a circular disk, and can be changed while the machine is in operation. Either belt or motor drive and all necessary fixtures can be furnished.

Tractor, Twin Steering Wheel
Mercury Manufacturing Co., 4118 S. Halsted St., Chicago, Ill.
"American Machinist," April 21, 1921

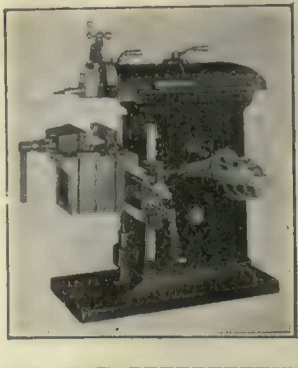
The steering arrangement now put on the company's line of industrial tractors is designated as the "Twin-Three" and is shown applied to a type "L" tractor. It consists of two wheels mounted on a very short axle, which is attached to a bracket by a semi-elliptic spring. The bracket supports the front of the chassis and its trunnion is directly attached to the steering lever. The steering is accomplished in the same manner as though there were a single wheel carried in a fork.

Coupling, Shaft, Flexible
Ajax Flexible Coupling Co., Westfield, N. Y.
"American Machinist," April 21, 1921



The coupling is simple in construction, being made of two flanges into which are fitted hardened steel bolts projecting from one flange to the other and entering oilless bronze bearings, the heads of the bolts being on alternate sides. The bolts pass through flexible members, each consisting of a brass sleeve into which is compressed Para rubber surrounding the bronze bearing. The bolts have free endwise movement through the bearings. The coupling can be put on the shaft either assembled or disassembled. There are no projections from the body of the coupling. The coupling permits the connected shafts to float freely in their own bearings, compensating for both endwise movement and angularity between the shafts.

Shaper, Crank, 12-in.
Whipp Machine Tool Co., Sidney, O.
"American Machinist," April 28, 1921



This 12-in., single-geared, crank shaper has a maximum stroke of 14 in. It is belt-driven and the cone-pulley is provided with three bronze bearings, one being located on each side of the bull-gear pinion to prevent the pinion from springing away from the bull-gear during a heavy cut. The third bearing is placed to insure the shaft alignment under a heavy belt pull and to avoid the necessity of an out-board support. The ram is of box-type construction and is fitted in square ways. It is driven by a long rocker arm. The swivel-head is graduated and is held in place by an eccentric lock. The vise has a graduated base, is fitted with tool-steel jaws and its screw acts tension. Shipping weight: domestic, 1,350 lb.; boxed 1,450 lb.

Clip, paste on 3 x 5-in. cards and file as desired

THE WEEKLY PRICE GUIDE

This Week's Market

The recent steel decreases are being reflected in the warehouse prices. Steel sheets are down 25c. per 100 lb. in Cleveland, making No. 28 black $4.25. Spring steel, both weights, down 1½c. per lb. in Cleveland. We show the new Pittsburgh basing card for steel pipe; discounts increased 2 per cent.

The metal market remains dull, with zinc a trifle stronger than last week. Metal products are sold at last week's prices, except brass sheets in Cleveland, which are down 2c.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.80
Northern Basic	25.50
Southern Ohio No. 2	25.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	32.26
BIRMINGHAM	
No. 2 Foundry	22 00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75	27.26
Virginia No. 2	*27.00
Basic	†25.00
Grey Forge	24 40
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern, sil 2.25@2.75	28.67
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	24.96
Basic	23 46
Bessemer	24.96

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$3.03	$2.89	$3.23
Soft steel bars	2.93	2.79	3.13
Soft steel bar shapes	2.93	3.48	3.13
Soft steel bands	3.63	6.25	
Tank plates	3.03	2.89	3.23

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.20
Warehouse, New York, delivered	2.93
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	3.68	3.40	4.13
No. 12	3.15	3.73	3.45	4.18
No. 14	3.20	3.78	3.50	4.23
No. 16	3.30	3.88	3.60	4.33
Black				
Nos. 17 and 21	3.75	4.30	4.05	5.20
Nos. 22 and 24	3.85	4.35	4.10	5.25
No. 25 and 26	3.90	4.40	4.15	5.30
No. 28	4.00	4.50	4.25	5.40
Galvanized				
No. 10 and 11	4.00	4.50	4.25	5.70
No. 12 to 14	4.10	4.60	4.35	5.80
Nos. 17 and 21	4.40	4.90	4.65	6.10
Nos. 22 and 24	4.55	5.05	4.80	6.25
No. 26	4.70	5.26	4.95	6.30
No. 28	5.00	5.50	5.25	6.40

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb.	$4.43	$4.63	$4.00
Flats, squares and hexagons, per 100 lb.	4.93	4.63	4.50

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	55%
Cleveland	55%
Chicago	50%

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 3/32, 8½c. per lb.; 1/8, 7.15; 5/32 to 1/4, 6.75. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	5.00	6.50	8.25
Spring steel (light)	8.00	6.50	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.20
Hoop steel	4.03	3.49	3.[illegible]
Cold rolled strip steel	7.50	8.25	7.90
Floor plates	5.00	3.09	5.78
Special best cast steel	....	15.00	....

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of July 7, 1921:

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
BUTT WELD					
1 to 3	64½	52	¾	33½	18½
			1 to 1½	35½	20½
LAP WELD					
2	56½	44	2	30½	16½
2½ to 6	60½	48	2½ to 4	34½	22½
7 to 12	57½	44	4½ to 6	33½	21½
13 and 14	45	37	7 to 8	24½	12½
15	42½	32	9 to 12	19½	7½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	62½	51	1 to 1½	35½	21½
2 to 3	63½	52			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	54	43	2	31½	18½
2½ to 4	58½	47	2½ to 4	34½	22½
4½ to 6	57½	46	4½ to 6	33½	21½
7 to 8	53½	40	7 to 8	24½	12½
9 to 12	48½	35	9 to 12	19½	7½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	13¼@13½
Tin in 5-ton lots	28.50
Lead	4.75
Zinc	6.00
ST. LOUIS	
Lead	4.35
Zinc	5.60

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	20.75	22 00	23 50
Copper wire (carload lots)	15.50	16.50	19.50
Brass sheets	15.75	18 00	10.75
Brass pipe	18.50	22.00	23.50
Solder (half and half) (case lots)	20.00	23.50	16.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.: polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	14.25
Cleveland	16.00
Chicago	18.00

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel

Ingots and shot	41
Electrolytic	44

Monel Metal

Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese-nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots........ 10.00

	Warehouse In Casks	Warehouse Broken Lots
New York	11.50	12.00
Cleveland	11.15	11.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	6.00
Chicago	6.00
Cleveland	6.75

OLD METALS—The following are the dealers' purchasing prices in cents per pound

	New York	Cleveland	Chicago
Copper, heavy, and crucible	9.50	9.50	$10.00
Copper, heavy, and wire	9.00	9.00	9.00
Copper, light, and bottoms	7.50	7.00	8.00
Lead, heavy	3.25	3.50	3.75
Lead, tea	2.00	2.50	2.75
Brass, heavy	5.00	5.00	9.00
Brass, light	4.50	4.00	5.00
No. 1 yellow brass turnings	5.00	4.00	5.00
Zinc	3.00	2.50	3.50

ALUMINUM—The following prices f. o. b. shipping point in cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	25.00	25.00@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	19.50
Chicago	23.00
Cleveland	22.00

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	41.00	35.00
Commercial	30.00	14.75	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

This market is very soft, and our quotations for the present are useful only as a guide.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	2.00	$2.25	1.60
Hot pressed hexagon	2.00	2.25	1.60
Cold punched hexagon	1.50	2.25	1.60
Cold punched square	1.50	2.25	1.60

Semi-finished nuts, $\frac{9}{16}$ and smaller, sell at the following discounts from list price:

	Current
New York	75%
Chicago	50%
Cleveland	80%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in.	50%	60–10%	50%
1¼ and 1½ in. by 3 in. up to 12 in.	40%	50–5%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York...... $3.00 Cleveland...... $4.50 Chicago....... $4.00

For cast-iron washers, ¾ and larger, the base price per 100 lb. is as follows:

New York...... $4.25 Cleveland...... $3.75 Chicago....... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	50%	60%	40%
Larger and longer up to 1 in. by 30 in.	45%	50–10%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40%	10%
Chicago	net	net
New York	40%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel $\frac{7}{16}$ and smaller	50–10%	60–10%	45%
Tinned	50–10%	60–10%	30%

Structural, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:

New York...$4.40 Cleveland...$4.25 Chicago....$4.88 Pittsburgh..$2.90

Boiler, same sizes:

New York...$4.50 Cleveland...$4.35 Chicago....$4.98 Pittsburgh..$3.00

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	18.00	24.00	25.50
Brass	16.00	22.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ½-2 in., inclusive in rounds, and ½-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$6.85 per 100 lb.; New York prices is $7.50.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	7.50@10.00	12.00	14.25
Colored mixed	5.50@ 9.00	9.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.00
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$2.75@$3.00
Prompt foundry	4.00@ 4.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current New York	Current Cleveland	Current Chicago
Raw in barrels (5 bbl. lots)	$0.76	$0.83	$0.84
5-gal. cans	.83*	.98	1.09

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current Red Dry	Current Red In Oil	Current White Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.25
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount. Business is good in white lead.

NEW *and* ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Md., Baltimore—D. C. Elphinstone, 408 Continental Bldg., manufacturer of machinery—one late model Byers auto crane, caterpillar tread. Six jackhammer drills. One 10 ton, 3 wheel, double cylinder steam roller.

N. Y., Buffalo — The Artistic Leather Shop, 139 Sycamore St., G. Eberl, Prop.—one 40 in. bookbinder shear.

N. Y., Buffalo—Automatic Transportation Co., 2933 Main St., E. D. Miller, Purch. Agt.—woodworking machinery including sanders, shapers and mortisers, motor or belt driven.

N. Y., New York—V. Bach, 204 East 85th St.—one "Seneca Falls" lathe.

N. Y., New York—Kotz & Ogust, 26 West 47th St.—one power hammer.

N. Y., New York—The Noble Mchy. Co., 130 Bleecker St.—lathe, 48 in. swing, 8 or 10 ft. centers, must be double spindle, second hand.

N. Y., New York — Tiphany Phonetic Corp., 50 East 42nd St., manufacturer of talking dolls—

One No. 1 universal Ohio milling machine, complete. Two 14 in. high speed sensitive drill presses. One 20 in. back geared drill press. One No. 2 grinder complete with steel guards, etc. One No. 2 Reid surface grinder. One magnetic chuck. **Two 9 in.** x 4 ft. bench lathes. One No. 3 26 in. Brown & Sharpe automatic cutting machine. One No. 2 7 in. Rhodes horizontal crank shaper, complete. One 9 in. x 4 ft. screw cutting engine lathe. One No. 2 universal cutter and tool grinder. One No. 1 universal grinder.

N. Y., North Tonawanda—T. K. Banks, 60 Chipman Pl.—one 12 in. engine lathe, small drilling machine and small emery wheel.

N. Y., Rochester—Michel Machine Co., 71 North Water St., T. Michel, Purch. Agt.—all kinds of woodworking machinery.

N. Y., Rochester—Poze & Natapon, 17 South Water St. (general contractors)—medium size 2 spindle shaper.

N. Y., Silver Springs—Lucus Tuttle Mfg. Co.—automatic woodworking lathe.

Pa., Harmony—The Robinson Ventilating Co.—two electric cranes for machine shop.

Pa., Newport — Susquehanna River & Western R.R. Co.—

One No. 14 Berlin 4 side planer to work 20 in. wide x 14 in. thick with countershaft attached.

One 42 in. car wheel boring mill.

One center drawn axel lathe for turning axels.

One power driven hydraulic car wheel press, 250 ton capacity.

Pa., Philadelphia — A. Box & Co., Inc., 813 North Front St., G. A. Mitchell, Sales Mgr.—one Amer. four foot radial drill, motor driven by 220 volts, direct current (used).

Ala., Mobile—Reliance Equipment Co., 7 North Water St., manufacturer of paints, oils, wire rope, etc.—rubbing bed with disc, about 8 ft. diameter, under geared preferred.

La. New Orleans—The W. L. Baker Machine Wks., 819 Burgundy St., W. L. Baker, Prop.—36 in. radial drill, 12 in. dividing indexing center and 3 Universal jawed chucks.

La., New Orleans — The International Auto Repair and Serv. Co., 1133-34 North Rampart St., R. M. Lerch, business mgr.—medium sized lathe and equipment for automobile repair and machine shop.

La., New Orleans — Loubat & Cabirac, 1308 North Rampart St., J. Loubat, Prop.—one medium sized jack, reamers, die nuts, etc., for garage.

Ill., Chicago — The Acme Stamping & Machine Co., 637 Marshfield St.—4½ to 5 ton, 7 in. stroke, combination drawing press, die space of 12 to 15 in.

Ill., Chicago—The Birthman Electric Co., 640 West Lake St.—20 to 30 ton toggle press.

Mich., Detroit—W. J. Baird Mchy. Co., Jefferson and Bush Sts.—one 6 x 30 in. lathe.

Mich., Detroit—Dept. of Purchases & Supplies, Marquette Bldg., G. J. Finn, Comr.—one 6 ton electric traveling crane with 2 yd. clamshell bucket, for asphalt plant.

Mich., Detroit—Hinkley Motor Corp., 3420 West Fort St.—traveling crane and equipment for assembling plant at Ecorse.

Mich., Ironwood — Universal Auto Co.—repair shop machinery for garage.

O., Cincinnati—Randle Mchy. Co., Cincinnati, Hamilton & Dayton R.R. and Powers St.—one 48 x 48 x 12 planer, 14 or 16 ft. table, single head on cross rail.

O., Cleveland—The Bd. Educ., Rockwell Ave. and East 6th St.—portable grinder for use on blackboards.

O., Conneaut—W. E. Lewis—28, 30 or 32 in. lever or power paper cutter, also punching machine.

Wis., Hartford — O., Wollner & Co.—cheese making machinery, power driven.

Wis., Madison—The 3-F Laundry Co., 731 East Dayton St.—laundry machinery.

Wis., Milwaukee—Badger Concrete Mixer Co., 221 Grand Ave., E. McVicker, Mgr.—lathes, drill presses and other machine shop equipment; also sheet metal working machinery for factory at Winthrop Harbor, Ill.

Wis., Milwaukee—G. Getzlaf, 1016 19th St.—tool maker, slip roll forming machine.

Wis., Milwaukee—Mid Western Soap Co., 330 Caswell Blk.—special soap making and filling machinery.

Wis., Milwaukee—The Rogers Corp., c/o C. J. Hendricks, 487 Belleview Pl.—machinery and equipment to manufacture carburetors.

Wis., Milwaukee — Supreme Candy Co., 1222 8th Ave.—candy making machinery, including caramel cutters, sizers, rollers, beaters, etc.

Wis., Milwaukee — Thesco Mfg. Co., 425 East Water St., manufacturer of wooden novelties, H. E. Cogesall, Purch. Agt.—planers and rip saws.

Wis., Waukesha — Held & Kendall, 312 Harrison St.—repair machinery for garage, including lathe and drill press.

Mo., St. Louis—J. Greenspons Sons Iron & Steel Co., 3130 Hull St.—one pipe cutting and threading machine of lathe type to handle pipe from 6 in. to 12 in.

Neb., Omaha — Bd. Educ., c/o W. E. Burke, secy., City Hall Bldg. — manual training equipment for proposed high school on Burt, Cummings, 30th and 33rd Sts.

Ont., Belmont — J. Dawes — auto repair shop equipment.

Ont., Guelph—The Stewart Lumber Co., Wyndham St. — lumber and planing mill machinery and equipment.

Que., Montreal — Parissienne Shoe Co., 614 Lasalle Ave., I. Leclerc, Purch. Agt.—complete shoe making equipment.

Que., Montreal—Farand & Dalorme Co. Ltd., 228 Richmond St., I. Delorme, Purch. Agt.—equipment to fabricate acetylene gas.

Metal Working Shops

NEW ENGLAND STATES

Conn., Bridgeport—The Amer. Tube and Stamping Co., 471 Hancock Ave., plans to build a large 1 story plant on Wordin Ave. for the manufacture of hot and cold rolled steel. Private plans.

Mass., Brookline—Gorfinkle & Barkin have awarded the contract for the construction of a 1 story, 150 x 175 ft. garage on Harvard St. Estimated cost, $100,000. Noted July 7.

Mass., Pittsfield—The Berkshire Auto Co., South St., is building a 1 story, 60 x 232 ft. and 20 x 40 ft. garage. Estimated cost, $60,000.

Mass., Springfield—O. P. Thompson, et. al., 145 State St., are having plans prepared for the construction of an 8 story, 100 x 190 ft. garage and repair shop on Dwight St. Estimated cost, $700,000. H. B. Warner, 168 Bridge St., Archt.

R. I., Woonsocket—Lockwood, Greene & Co., Archts. and Engrs., 60 Federal St., Boston, Mass., receiving bids for the construction of a 3 story, 85 x 160 ft. plant on North Main St., here, for Shambow Shuttle Co., 583 Main St. Estimated cost, $125,000.

MIDDLE ATLANTIC STATES

N. Y., Jamaica—The Multiple Storage Battery Co., Van Wyck Ave., has awarded the contract for the construction of a 1 story, 60 x 125 ft. factory. Estimated cost, $60,000.

Pa., Harmony—The Robinson Ventilating Co. has awarded the contract for the construction of a 1 story, 60 x 120 ft. machine shop. Estimated cost, $25,000.

Pa., Pittsburgh—W. W. Martin Co., 5847 Center Ave., has awarded the contract for the construction of a 3 story, 100 x 140 ft. auto sales and service station on Ravenna St. and North Highland Ave. Estimated cost, $150,000. Noted June 23.

MIDDLE WEST STATES

Ill, Herrin—The Illinois Central R.R., c/o C. H. Markham, Pres., 135 East 11th St., Chicago, plans to build a 1 story repair shop, here. Estimated cost, $60,000. D. T. McLaughlin, 109 12th St., Chicago, Archt.

American Machinist

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Volume 55 NEW YORK, JULY 28, 1921 Number 4

Balancing High-Speed Rotors

Factors Entering Into Condition of Unbalance—Determining Critical Speed—Method of Balancing a High-Speed Rotor—Centrifugal Force of Unbalanced Rotating Bodies

BY A. SCHEIN

THE balancing of high-speed rotating masses has become a subject of considerable study and development for inventors and engineers in recent years. As a result there are now on the market several balancing machines of exceptional merit. With a knowledge, however, of the fundamental principles of unbalanced bodies, it is possible to obtain very good results by a simple method much used when the number of elements to be balanced is small. The present article therefore will not attempt to do more than set forth clearly these fundamental principles, especially as they are applied to the particular case of the balancing of gyroscope rotors for ship stabilizers and compasses. These rotors vary in size from 58,000 down to 9 lb. but the same method of procedure can be followed for almost any rotating element with accurate results.

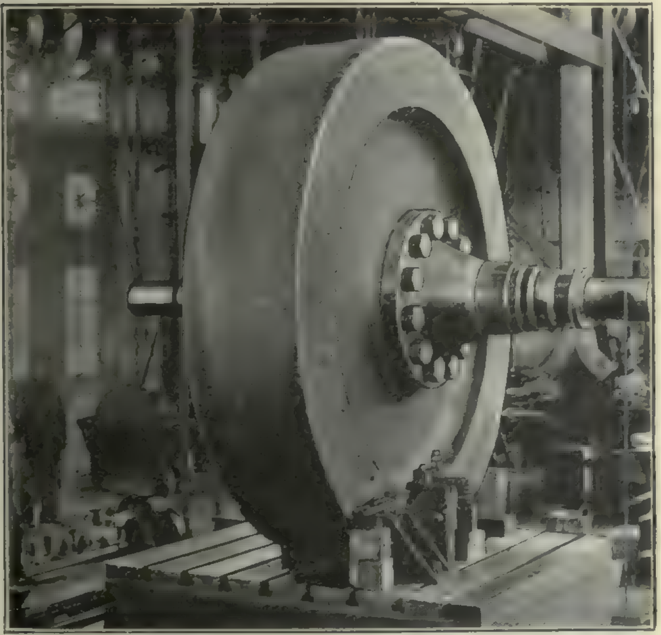


FIG. 1. GYROSCOPE ROTOR FOR SHIP STABILIZER. WEIGHT, 58,000 POUNDS

It is not intended to go into the theory of an unbalanced body. This has been treated exhaustively in several periodicals. Only the practical application and a method now in successful use will be described, followed by a short discussion on the degree of accuracy to be obtained by this method.

The large rotors in question are those used in the Sperry Gyroscopic Ship Stabilizers. They are made in one piece of forged or cast steel, finished all over, and have nickel-steel shaft stubs bolted to the rotor faces. Some of these are shown in Figs. 1 and 5, which are photographs of wheels now in use. Fig. 5 clearly shows the rotor of the three-phase induction motor used to drive the wheel. The stator of the motor is mounted on the gyro casing which incloses the wheel and an external view of which is shown in Fig. 8. The rotor shown in Fig. 1 is the largest yet balanced by this method and is 9 ft. in diameter, weighing 58,000 lb. and running at a normal speed of 1,150 r.p.m. Two such rotors were balanced in their casings mounted in the manner shown in Fig. 8. The details of construction and the special requirements for balancing this way will be treated more fully in later paragraphs.

FUNDAMENTAL PRINCIPLES OF UNBALANCE

There may be three conditions of unbalance in a rotating body; static, dynamic, and a combination of static and dynamic. A static unbalance is evident when the rotating element is rolled on knife edges, in which case the heavy side will always seek the lowest point. A static condition is present whether rotating or not. A dynamic condition becomes evident only when rotating. Either a dynamic unbalance or a combined static and dynamic unbalance may occur either above or below the so-called "critical speed." It is most advisable to balance above the "critical speed" as the unbalanced condition is much more pronounced and more easily located. A method of determining whether the rotor is above or below the critical speed will be described later.

In any unbalanced condition of a rotor such as is shown in the photographs, the axis of spin does not coincide with the geometric axis. It may parallel it, as in the case of a static unbalance, or it may intersect it as in the case of dynamic unbalance, or it may do neither, as in the case of a combined static and dynamic unbalance. In any case the centers of the journals tend to move in minute circles about the true axis of spin, so that if a soft pencil or crayon is held against the journal while running it will be found on stopping the rotation that one side of the journal has been marked by the crayon, locating what is commonly known as a "high spot." These markings may lead or

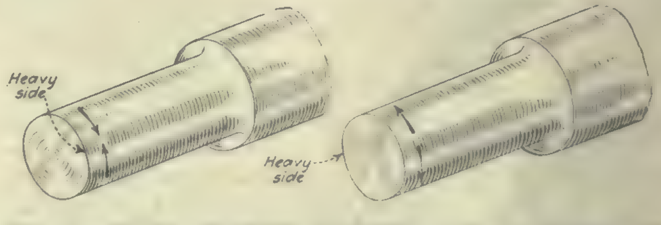
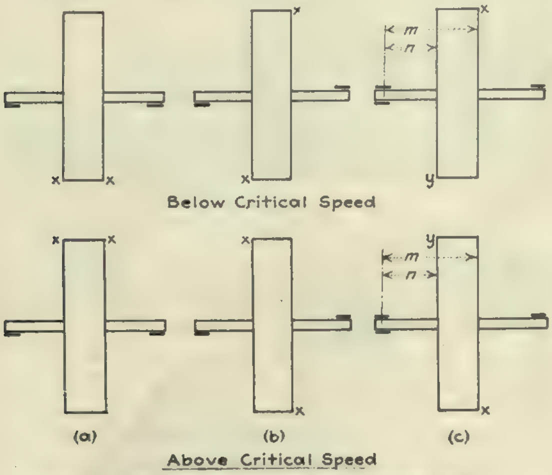


FIG. 2. SHAFT SHOWING MARKING AND LOCATION OF HEAVY SIDE WHEN ROTATING BELOW CRITICAL SPEED. FIG. 3. SHAFT SHOWING MARKING AND LOCATION OF HEAVY SIDE WHEN ROTATING ABOVE CRITICAL SPEED

lag the true high spot by varying amounts. Their location depends upon the speed of the rotor, elasticity of the material, angular momentum, friction, etc., and the relation of these is usually not known. Nevertheless, if the rotor is run at the same speed, in opposite directions, and the high spot found for each direction of rotation, the true high spot will be displaced equal amounts from the marks so obtained, all other conditions being the same. We are thus able to locate quite accurately the plane of the true high spot which will be half-way between these two marks. To definitely locate the heavy side of the rotor it is necessary to know whether the speed of rotation is above or below the critical speed. If arrows are placed at the marks pointing in the direction of rotation, they will point together if the speed is below the critical, and will point apart if the speed is above the critical. See Figs. 2 and 3. The following rules may be stated: (1) Below the critical speed the markings will be on the heavy side of the rotor and the arrows will point toward each other; (2) above the critical speed the markings will be on the light side of the rotor and the arrows will point apart from each other. It will be noted that the arrows point toward the heavy side in either case.



The dash marks (—) on the shaft represent the mean high spot. Weight should be removed at "x" in the same radial plane as the high spot.
(a) Simple static unbalance
(b) Simple dynamic unbalance
(c) Special case, weight should be removed at "x" and "y" in the ratio m : n

FIG. 4. DIAGRAM SHOWING SHAFT-MARKINGS

As stated above, it is desirable to balance above the critical speed. This is not always possible, however, so that for convenience, the sketches in Fig. 4 are given to show the procedure for any speed of rotation. The first step in balancing is to determine at what speed the rotor is being run—that is, whether it is above or below the critical speed. Changes in weight are then made as in Fig. 4. It will be remembered that the rotor must be run in both directions to locate the true high spot after each change in weight. "High spot" here refers to the markings and not to the heavy side of the rotor which may be on the same or opposite side of the rotor depending on the speed.

BALANCING A 15,600-LB. ROTOR

In Fig. 5 is shown a 15,600-lb. rotor, 5 ft. 10½ in. in diameter which runs normally at 1,700 r.p.m. This rotor was successfully balanced by the method described with only nine changes. The balancer was not an experienced man in this work but his judgment in changing weights was guided by a chart on which were marked each change and the result. This chart is reproduced in Fig. 6. The numbers 1 to 18 on each face of the rotor are arbitrarily assigned to the balancing plugs. These are steeel plugs 1¾ in. in diameter and about ¾ in. deep, which are screwed into the rotor rim in the manner shown in Fig. 1.

The rotor was turned up to a speed of 1,000 r.p.m. and marks made on each shaft for each direction of rotation. Referring first to the back side of the rotor we notice that clockwise rotation showed a high spot at plug No. 17 and counter-clockwise rotation showed a high spot at plug No. 5. The mean, or true high spot is therefore plug No. 2. It will be further noticed that the arrows indicating direction of rotating for the marks at 17 and 5 point apart from each other. We see immediately by reference to rule (2) above that the speed of rotation is above the critical speed, and that the heavy side indicated by the marks is opposite the true high spot. This locates plug No. 11, from which the balancer made a trial removal of 3 oz. By a similar process plug No. 2 was located on the front side, and 3 oz. were removed from this plug also. Following down the first three changes we see that they were all made on practically the same plugs. But the fourth run indicated that too much weight had been removed from these points, as the high spots suddenly shifted to the opposite sides of the shaft. Weight was therefore added again and the high spots appeared at plug No. 3 on each face of the rotor in the fifth run. This will be easily recognized as a condition of static unbalance, since the heavy spot is at the same point on each face of the rotor. By a change of 5.5 oz. at plug No. 12 which is diametrically opposite on each side the rotor, the balancer was able to correct this static unbalance on the first trial. This is shown by the fact that the high spots now appeared at entirely new points on the shafts indicating a dynamic unbalance in a new plane. The heavy spot on the back side was now at plug No. 16 and on the front side was at plug No. 7. To correct for this, the balancer removed 3½ oz. from No. 16 on the back side and added 3½ oz. at No. 16 on the front side. It will be seen that this change will not cause a static unbalance but will tend to correct the dynamic unbalance. Run No. 7 showed that 3½ oz. was too much, so that weight was added again in the following three changes, resulting in a perfect balance on the tenth run. On the eighth and ninth runs the

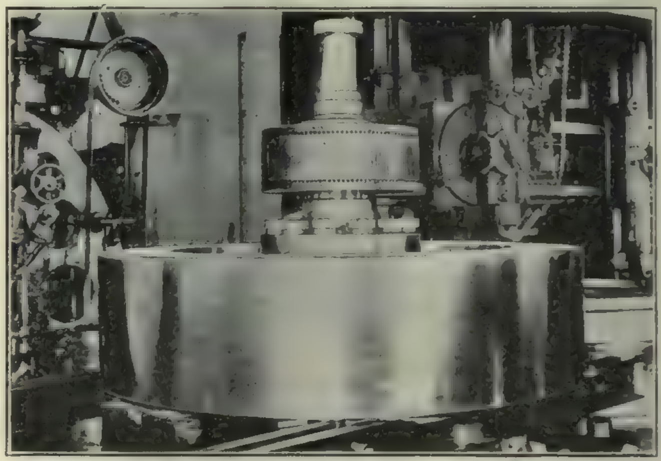
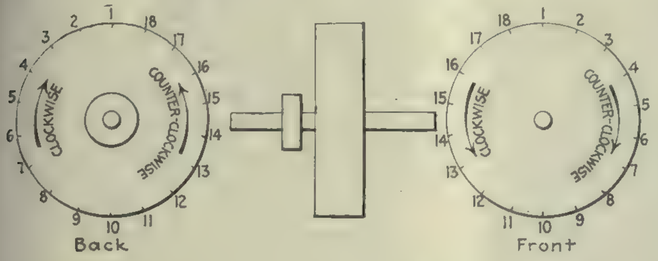


FIG. 5. 15,600-LB. ROTOR AFTER BALANCING

speed was increased to 1,300 r.p.m. because the unbalanced condition was becoming so small that the marking on the shaft was indistinct. The rotor was run at full speed of 1,700 r.p.m. on the tenth run without showing signs of unbalance. This was evidenced by the crayon markings extending all around the shaft.



	1	2	3	4	5	6	7	8	9	10
Back:										
High spot, clockwise rotation	17	17	17	8	18	4	12	13	17	....
High spot, counter, clockwise	5	5	5	14	6	10	8	1	15	....
Mean high spot	2	2	2	11	3	7	15	16	16	....
Front:										
High spot, clockwise rotation	14	14	14	5	6	2	7	4	8	....
High spot, counter-clockwise	8	8	8	17	18	13	7	10	7	....
Mean high spot	11	11	11	2	3	16	7	7	7	....
Rev. per min	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,300	1,300	1,700

CHANGES

1	Back: Off 3 oz. on No. 11	Front: Off 3 oz. on No. 2
2	Back: Off 1.5 oz. on No. 11	Front: Off 1.5 oz. on No. 2
3	Back: Off 7.5 oz. on No. 12	Front: Off 7.5 oz. on No. 3
4	Back: Add 6.0 oz. on No. 12	Front: Add 6.0 oz. on No. 3
5	Back: Off 5.5 oz. on No. 12	Front: Off 5.5 oz. on No. 12
6	Back: Off 3.5 oz. on No. 16	Front: Add 3.5 oz. on No. 16
7	Back: Add 1.5 oz. on No. 16	Front: Off 1.5 oz. on No. 16
8	Back: Add 0.5 oz. on No. 16	Front: Off 0.5 oz. on No. 16
9	Back: Add 0.5 oz. on No. 16	Front: Off 0.5 oz. on No. 16
10	No changes.	
11	....	
12	....	
13	....	
14	....	

FIG. 6. GUIDE-CHART FOR BALANCING ROTORS

A Summary of the Balance

A summary of the balance shows that the first four changes were made to correct for a dynamic unbalance in the plane *AB*, Fig. 7, amounting to a net total of 6 oz. on each face of the rotor. The fifth run was made to correct for a static unbalance in the same plane *AB* amounting to 11 oz. The last four changes were made to correct for a dynamic unbalance in the plane *CD* amounting to a net total of 1 oz. on each face of the rotor.

Criticism may be raised that the true plane of unbalance was not located accurately the first time. The first run apparently gave the unbalanced plane as passing through plugs 11 and 2, but the results show that it is in reality nearer to 12 and 3. Experience of the operator is the greatest factor in determining correctly the plane of unbalance. The proper interpretation of the markings comes only after practice and familiarity with the balancing of different types of rotors. The actual balancing did not require much time, this being consumed in the accelerating to speed and de-celerating. On small gyroscopic compass rotors the time is greatly reduced by bringing the rotors up to the balancing speed very quickly and de-celerating by mechanical braking, making it possible for an experienced man to average one rotor in four hours. The method of balancing is much the same except that there is no recorded data of each change. The time element is so short that the operator can easily remember from one change to the next, or he can become so experienced that he is guided only by the conditions as they arrive. On some small rotors the balancing plugs are omitted and weight changes are made by drilling small holes into the rotor faces. Recently a 10-ton stabilizer rotor was balanced by this method, but it is not recommended unless the operator is highly experienced.

Method of Supporting Rotor

In Fig. 9 is shown a cross-sectional drawing of one of the gyro units shown in Fig. 8. The rotor spins with its axis horizontal and is supported by two babbitted self-aligning bearings. The casing at one end of the shaft is closed by a cast steel cap and the other end is covered by a cap which incloses a thrust bearing to take care of end thrust under certain conditions of roll and pitch of the ship. During balancing, these two caps are replaced by special cap assemblies shown in Fig. 10. The purpose of the cap is to provide a small extension shaft called a "marking plug" which is bolted to the end of the journal and upon which the crayon marks are made during balancing, as shown in Fig. 8. It is important that the surfaces of these plugs be ground true with the rotor turning slowly, before any balance is attempted, as a slight eccentricity of one of these plugs would throw the markings off.

The babbitt bearings shown are 8½ in. in diameter by 12 in. long, giving a bearing pressure of nominally 300 lb. per square inch of projected area. The torque of the spinning motor is insufficient to overcome the starting torque on the babbitt after the rotor has been standing idle and the oil film squeezed out, so it is necessary to lift the rotor completely off the babbitt for starting purposes. This is accomplished by means of roller bearings supported in slings. The starting friction of the roller bearing is about one-sixtieth that of the plain bearing, so that the motor can easily turn the rotor and accelerate. After reaching a speed of 350 r.p.m. the rotor is lowered again on the babbitt and the speed of rotation is enough to maintain an oil film. Oil is supplied from an external source at a pressure of about 8 lb. per square inch.

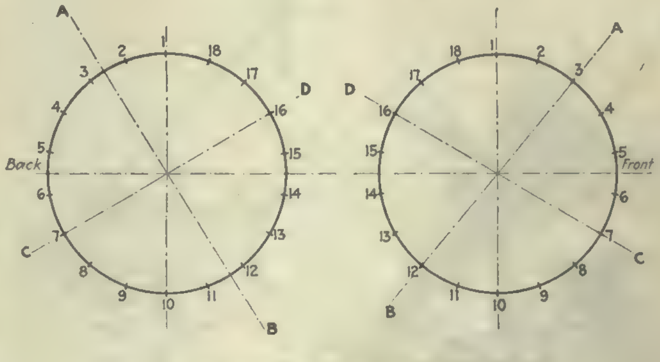


FIG. 7. DIAGRAM OF BALANCING TESTS

Balancing Small Compass Rotors

Some small compass rotors are balanced with the spinning axes vertical. They are suspended from one end of the shaft by a flexible steel cable driven by a vertical motor. No radial bearings are necessary but a loosely supported guide pivot may be used at the lower end of the shaft and during marking it is usually disengaged from the shaft. As it is impossible to spin the rotor in both directions because of the twist of the cable, an approximate method of locating the heavy spot is used. It will be found by trial that the heavy spot is usually leading the marks by a definite angle and once this angle is determined it is necessary to obtain one mark and advance a certain angle to find the heavy spot. Other small rotors are assembled with their ball bearings and balanced in their cases on horizontal axes, much the same as the stabilizer rotors.

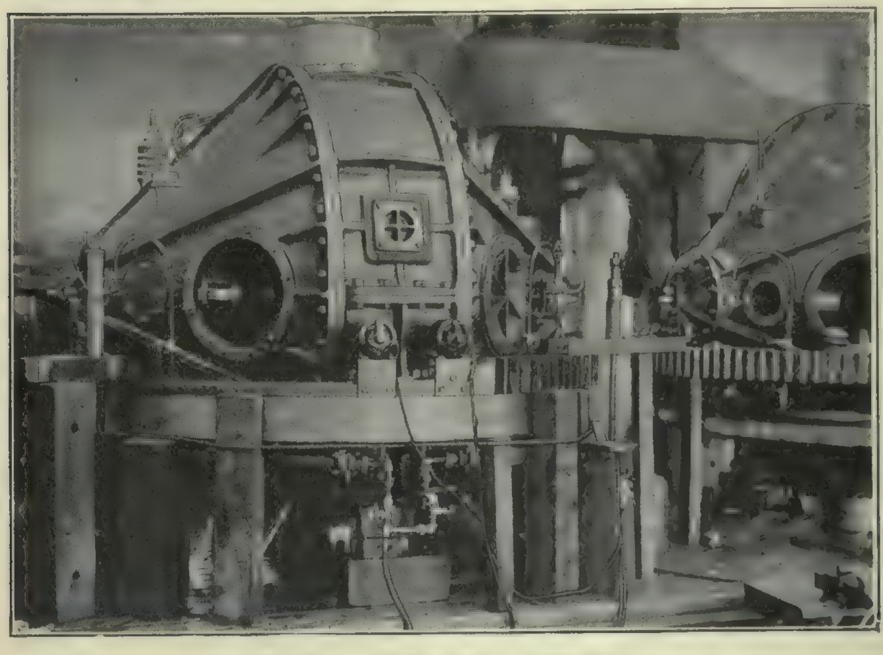


FIG. 8. A GYRO UNIT ASSEMBLY

The crayons used are soft black china marking pencils which are sharpened to a very fine razor edge. The marking plug or surface is cleaned with alcohol and may be wiped with nitrate acid to make the marks more discernible.

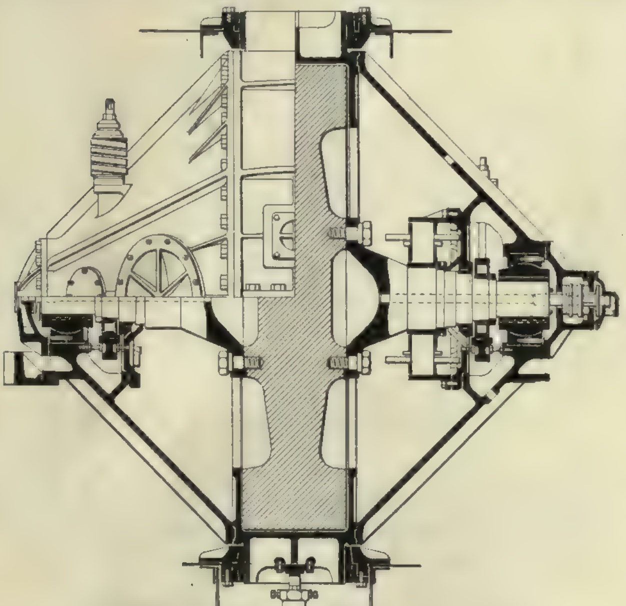


FIG. 9. CROSS-SECTION OF GYRO UNIT ASSEMBLY

It is an interesting fact that the large stabilizer rotors can be so accurately balanced that a new five-cent piece will stand on edge on any part of the casing when the rotor is spinning at full speed. The accuracy with which small rotors are balanced can be judged by the results of a test made by the author showing that the removal of 0.0085 gr. which is an amount equal to 0.003 oz. from one balancing plug was sufficient to throw the rotor out of balance. This particular rotor was 5¼ in. in diameter, weighing 9 lb. and the balancing plugs, which were ¼ in. in diameter were on a 2¼-in. radius. The out-of-balance condition was noticeable at 5,500 r.p.m., whereas the normal speed of the rotor was 12,500 r.p.m. The removal of 0.0085 gr. was accomplished by placing the plug in a suitable clamp and drawing a 6-in. file once across the end of the plug.

The 15,600-lb. rotor, Fig. 5, was thrown out of balance by removal of ¼ oz. which is an amount equal to 0.0156 lb. from a plug located on a 24-in. radius. This removal of ¼ oz. is equivalent to shifting the center of gravity an amount equal to

$$\frac{24 \times 0.0156}{15{,}600} = 0.000024 \text{ in.}$$

RESULT OF CHANGING BALL BEARINGS

This is a warning when using ball or roller bearings on the rotor. Assume the rotor has been accurately balanced in its ball bearings and some time later it becomes necessary to substitute a "spare" bearing. The chances are that the new bearing will throw the rotor out of balance, because the inner and outer race may not be exactly concentric, or an exact duplicate of the first one. The greatest eccentricity permitted on ball bearings for compasses is 0.0001 in. and on larger bearings it is much more. It is impossible to make ball bearings with greater accuracy except by very careful selection of the balls and races. If an eccentricity of 0.000024 in. will throw the rotor out of balance it is clear that in nine cases out of ten, substitution of a new bearing will do the same. For this reason the rotor should be given a check balance after the renewal of ball bearings. Difficulty may be experienced in balancing on ball bearings if the inner race of the bearing is not tight on the shaft. The tendency of the race would be to creep, and if there is any eccentricity it will be continually shifting to a new plane, disturbing the balance as it moves.

The 58,000-lb. rotors were balanced within ¾ oz. on a 4-ft. radius, which is equivalent to shifting the center of gravity not over 0.00004 in. The centrifugal force of this unbalanced weight at full speed of 1,150 r.p.m. is

$$0.00034 \times 56{,}000 \times \frac{0.00004}{12} \times 1{,}150^2 = 84 \text{ lb.}$$

VIBRATION OF SUPPORT IN PERIOD WITH ROTOR

This 84 lb. amounts merely to a disturbing force on the bearings, and is too small to be harmful, but if the elasticity and mass of the supporting members and foundation are such that they will start to vibrate in period with this 84-lb. force, it is evident that a finer balance must be obtained. On a stabilizer the casings and foundations are relatively heavy and they do not vibrate in unison with the 84-lb. force.

It is to be recalled again that the rapidity with which a rotor may be balanced and the accuracy obtained depend much upon the experience of the balancer. Machines have been designed to eliminate a great part of this human element factor, but it is for the aid of those who must balance occasionally without the help of such machines that the present article has been written. The method given is not new. It has been in use for a number of years for balancing compass and stabilizer rotors, and the time and cost considerations have not until recently brought up the possibility of machine balance. The reader who desires to apply this method to his own problems has the advantage of long and successful experience back of the method, and it is to be hoped that the few hints and examples given above will prove of value to him.

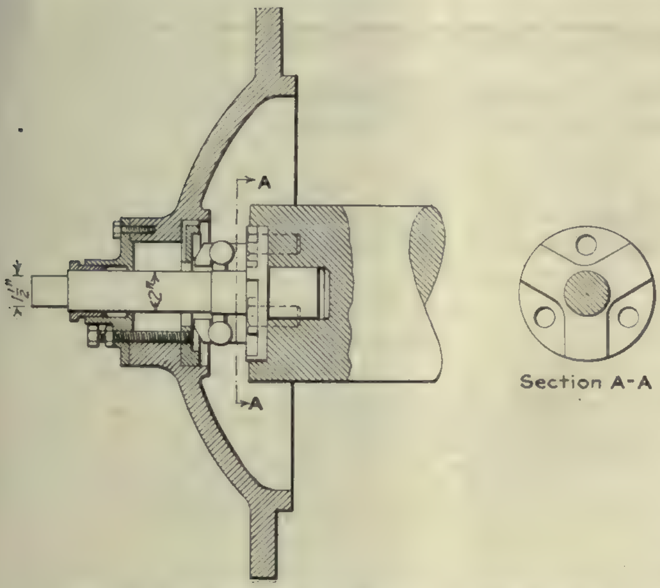


FIG. 10. SPECIAL BEARING-CAP ASSEMBLIES FOR BALANCING

How To Start the Business Engine

Business, like an automobile, has been running on high-gear for the past three years; and now, all of a sudden, the automobile has stopped for lack of gasoline. During the past few months, we have been cleaning out the tank and refilling it with gasoline. Now we are about ready to start up again. But when the car stopped we were in high-gear and we have not yet shifted. In starting the car again, is it advisable to attempt to start on high-gear, or is it better to put the car first into low-gear? Surely, the sensible way is to start low, move to second, and then into high. Attempting to start on high, will inevitably stall the engine.

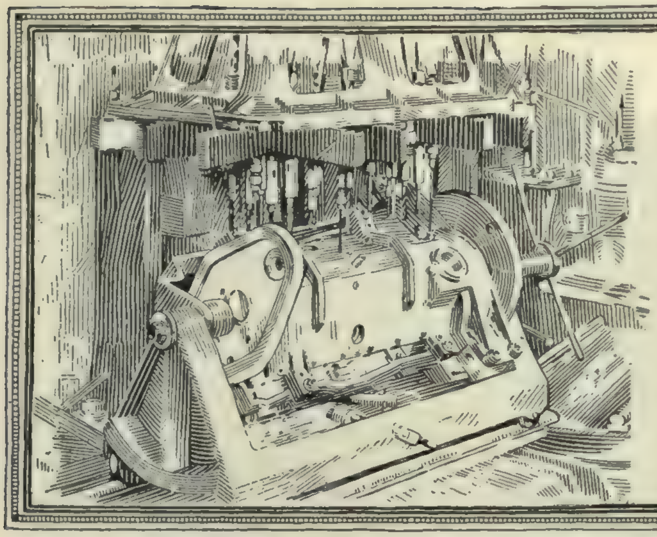
Yet we are trying to start business on "high," just where it stopped. The railroads want to get business back at the old high rates, or have no business at all; labor prefers to be idle for months rather than have wages cut; while retailers are holding up prices "until business revives." The result is that all business is at a standstill.—Roger W. Babson in *Forbes' Magazine* (N. Y.).

More About Tech Graduates in the Shop

By L. L. Thwing

In many ways it would be desirable if only those spoke who are reasonably familiar with their subject, but on the other hand we would never be able to stand the silence. With this excuse in mind I wish to say a little more on the subject of technical school and college graduates. Unfortunately, I have had very little direct experience as an employer of either class, but such as I have had has been quite satisfactory. In addition to this, however, I have worked with a former foreman of an erection department that took in quite a number of college and technical school men during the summer and after graduation. They came for the purpose of learning the construction of certain machines and were sent to the erection floor for that purpose. These machines were heavy and the work hard, but the foreman told me that his "students" did as much and as good work as could be expected of any green hand. It will be noted that these boys were set to work on the things that they wanted to learn, they were not put down in the snagging room and forgotten. They were in a place where it was evident to them they could best learn what they wanted to. This kept up their interest and gave their minds some exercise, as well as their muscles. These are all the facts that I can draw from my own experience. I would, however, like to protest against that hoary and moss covered tradition, sanctified by its continued use by those who take their opinions ready made, that technical graduates are "stuck up." There may be a few who are, but if there is one line of advice that is consistently handed out to graduates about this time of year, it is that they must learn to apply their theories before they will be of use to the world, and that they must begin humbly at the bottom and learn those things that the boy who did not go to college has been learning in those four years. On the screen and in fiction we have plenty of farmers with high-top boots, absent-minded professors, and sanctimonious clergymen, but no one takes these seriously. On the other hand we have fictional "tech men" who either fail miserably when confronted with practical problems, or who by a sudden stroke of inspiration solve engineering problems that practical men have been working on for years. The real technical graduate is neither of these extremes. He is a young man who has a mental leaning toward mechanical problems, and he has had the opportunity to study them.

It is not uncommon to expect too much of the recent graduate. Mechanical engineering is a science that is split up into numerous branches. Classroom work cannot be expected to cover all these details, and it does not. It is not fair therefore to expect him to design screw-machine tools, box jigs or any other machine or detail of machine, without the same drafting-room experience that the other junior draftsmen have had. The first question that was asked me when I started work in the shop, was whether or not whales had teeth. If I had not been able to answer this Edisonian query, I suppose there would have been an immediate drop in the supposed value of a technical education. What prompted my original article on this subject was the apparent fact that so few technical graduates seem to get anywhere in a machine shop. If they do not there is something wrong somewhere, and I do not believe it is all the graduate's fault either.



Tool Engineering

By
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Design of Milling Fixtures Continued—Locating Points — Methods of Clamping — Applications of the Lever — Multiple Clamps—Design and Use of the Hook-Bolt

In considering methods used in the location of work in milling fixtures, attention must be paid not only to the position of the locating surfaces, but also to their accessibility for the purpose of cleaning. In addition to these points the thrust of the cutters and their action on the work must also be given considerable attention so that proper provision will be made for resisting this action.

Fig. 122 shows a piece of work *A* which is being fed in the direction indicated by the arrow against the milling cutter *B* which is revolving as indicated. The work locates on a plate *C* and against a block *D* but it will be noted that the portion which is being cut lies in a plane considerably above the block *D* which takes the thrust. This is not good practice and much better results would be obtained by making the block as shown at *E*. Here the work is supported directly in line with the thrust of the cutter.

Locating and Supporting Work

It is often necessary to locate a piece of work from a finished surface such as that shown at *A* in Fig. 123, and also by means of a hole in the same plane but higher up as shown at *B*. When a condition like this is found it is essential to provide a "float" to one member or the other in order to take care of slight inaccuracies in machining. In the particular case shown the work locates on a central stud *C*, on the plate *A*, and by means of a plug *D* mounted in a vertical slide *E*.

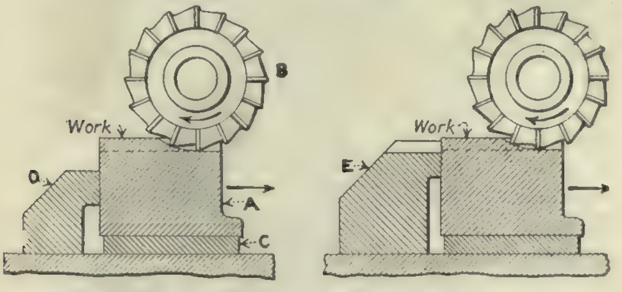

FIG. 122. METHODS OF BRACING WORK

If no provision were made for errors in machining it might easily be possible to set up the work and obtain a result similar to that shown at *F* in which the work locates on the plug but does not seat itself properly on the plate at *A*. As cases of this kind are frequent, provision should be made for variations either in the manner shown or by some other means equally good.

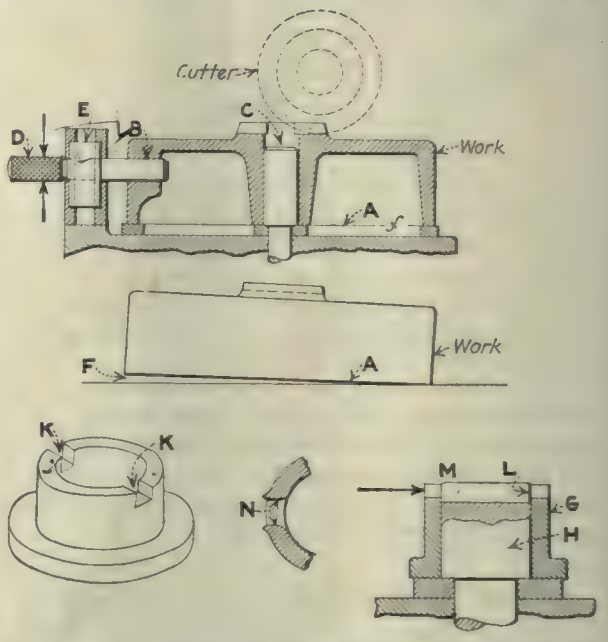

FIG. 123. LOCATING AND SUPPORTING WORK

The work *G* is a thin collar mounted on a locating stud *H* in order to mill the slot across the top as indicated at *K*. It is very easy to support the work while milling so that the slot on the side at *L* will be backed up well, but the opposite side *M* will have a tendency to open up when the cutter machines it, with a result like that shown at *N*. The designer should always bear this in mind when making a fixture for a similar piece of work and should provide support at the points where the cutter finishes its work.

In the article on the design of drill jigs various clamps are shown which are used to some extent in all kinds of fixtures. Exceptional cases may require slightly different methods of clamping due to the requirements of the work. The method of holding a piece of work for a

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milling operation is one of the most important things in connection with the design of the fixture, and as a consequence the clamps should be very substantial and should be applied at the proper points in order to obtain the best results.

Several varieties of clamps are shown in Fig. 124. The work *A* is located on a hardened plate *B* and is clamped down by means of the strap clamp shown at *C*. This clamp is slotted at *D* to permit its being withdrawn from the work by means of the pin *E* which acts as a handle. A slotted clamp of this sort is likely to become clogged with chips and, therefore, a suitable cover should be placed over the slot. A bushing *F* can be made so that it fills the hole *G* occupied by the spring *H* thus preventing the chips from accumulating around the spring and interfering with its action.

The clamp *K* is used for holding the work down when a clamp on the top of the work would interfere with a cutter used on the entire upper surface. This type of clamp thrusts against a solid shoulder *L* and the action of it in clamping tends to sink the point *M* into the edge of the work and at the same time hold it down. It is advisable to make the point *M* rather "stubby" so that it will not become dulled too easily. A clamp of this kind is useful when it is difficult to clamp the work in the ordinary way. It is possible to adapt it to a number of conditions to suit particular cases.

A swinging leaf clamp can be used to advantage in holding a piece of work such as that shown at *O*. The work locates on a hardened plate *P* and is clamped by means of the screw *Q* which is held in a swinging clamp R. A leaf-type of clamp is sometime found necessary in milling fixture design and the principle shown here can be applied if needed.

A rather peculiar type of clamp for work which cannot be clamped in the regular way, is shown at *S*. This clamp has a knife-edge at *T* which sinks into the work and at the same time clamps it down. The thumb-screw *U* has a wear plate under the point as shown at *V*. It is of the greatest importance in designing a clamp of this sort that the pivot *W* be located considerably lower than the point *T* so that the clamping action will be *down* in the direction indicated by the radial line *X*.

Special Forms of Clamps

Work of peculiar or irregular shape which has not been provided with clamping lugs often calls for the design of special clamps in order to hold it properly and without distortion or dislocation. Considerable ingenuity is sometimes required in order to devise a suitable method. A number of clamps designed to suit peculiar conditions of holding, are shown in Fig. 125. The casting *A* has an overhanging flange *C* which is to be machined as indicated by the *f* mark. The work rests on locating plugs, one of which is shown at *B*. The ordinary type of clamp would be difficult of access if used for a condition of this kind, therefore a device must be used which will give satisfactory results and which will be readily accessible. Several methods are shown which may be adapted to work of this kind.

The clamp *D* is slotted at *E* to allow it be moved back out of the way when placing the work in position or removing it. The clamping is accomplished by means of the cam *G* which is pivoted to the end of the clamp. The cam bears on the wear plate *F* and is operated by the thumb-screw *H*. This type of clamp is open to several objections, among which are the cost of manufacture and its limited range. If the castings should vary considerably in thickness at the clamping point the clamp might not hold the work at all as the adjustment is somewhat limited.

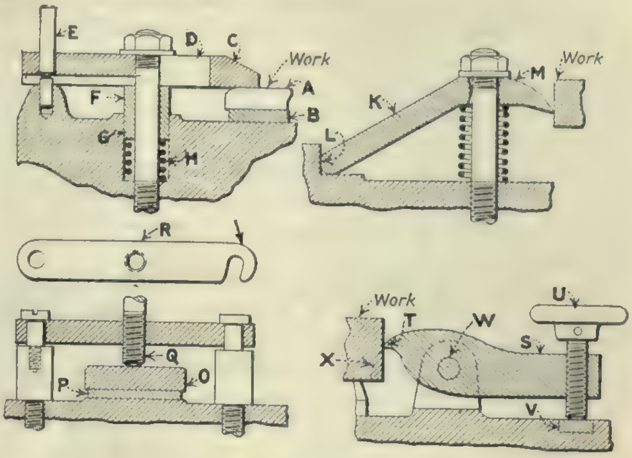


FIG. 124. VARIOUS TYPES OF MILLING-CLAMPS

Another type of clamp is shown at *K* for the same piece of work. In this case a projecting lug is provided on the fixture at *L* so that the thumb-screw *M* can be used to operate the clamp from beneath. This form can be frequently used on fixtures, providing the extra depth of fixture needed is not objectionable. Ample clearance for the operator's knuckles should be provided when designing this form of clamp.

Another form of sliding clamp is shown at *N*, for holding the same piece of work. This type is operated by means of the sliding wedge *O* which is forced under the end of the clamp by the action of the thumb screw *Q*. The wedge may be given a bearing on a hardened plate *P* if desired. Of the three clamps shown for this piece of work the one illustrated at *K* is the simplest and most practical.

An excellent method of clamping small work of certain kinds is shown at *R*. The work rests on a support *T* and is clamped against the knife-edge locater *S* by means of the sliding clamp *U*. It will be seen that the latter is set at a slight angle so that the pressure is partly downward. This form of clamp may be made up in units of several sizes and standardized. The block *W* carries the slide which is adjusted by the thumb-screw

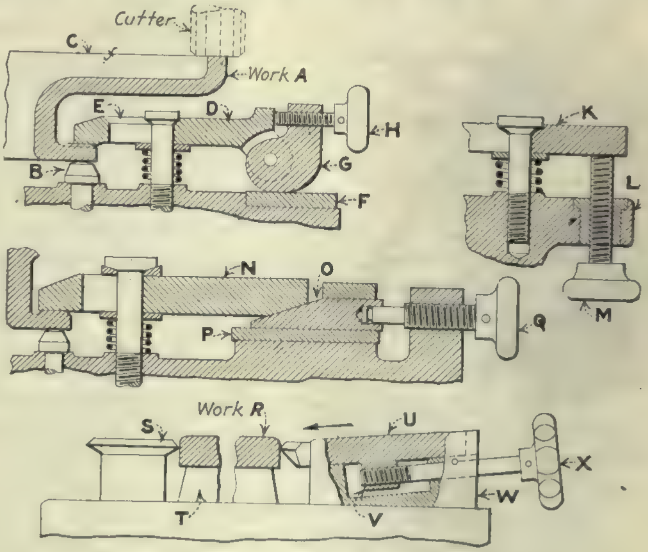


FIG. 125. SPECIAL FORMS OF MILLING-CLAMPS

X acting in the nut *V*. This clamp can be utilized for many varieties of small work when clamping space is restricted.

In order to make a clamp self-contained it is often desirable to operate it by means of a lever and thus avoid the use of a wrench. If there is plently of room on the fixture so that the handle can be revolved completely without interfering with the cutter or any part of the fixture, a lever can frequently be used to good advantage. Levers can be used on nearly all types of clamps which are operated by means of a nut, provided there is room enough so that they can be operated without interference.

Fig. 126 shows a piece of work *A* which is being milled by the cutter *B*. It is clamped in place by the slotted clamp *C* operated by lever *D*. It can be seen that if the thickness of the work should vary, the clamping lever might take the position indicated by the dotted lines at *E*, thus interfering with the cutter. If the work is finished on both locating and clamping surfaces, the variation would be very slight and the lever could be fitted so that it would not interfere with the cutter.

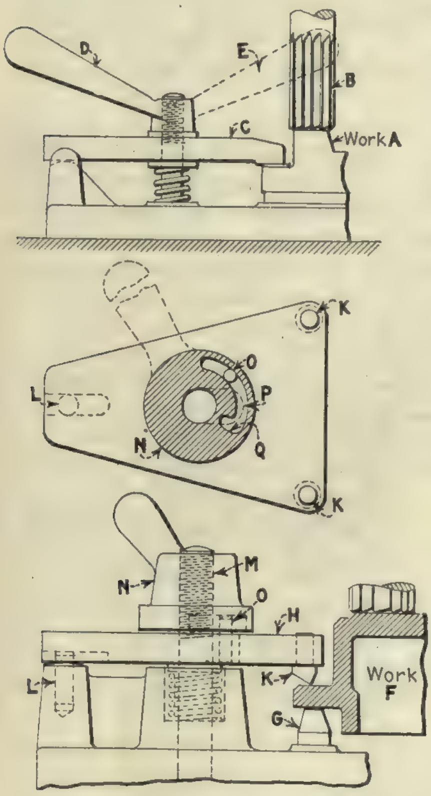


FIG. 126. CLAMPS OPERATED BY LEVERS

A special form of lever which pulls the clamp away from the work when it is loosened is shown at *N*. The work *F* locates on points *G* set in the fixture base. It is clamped down by the two points *K* in the equalizing clamp *H*, which is controlled by the lever. A cam path is cut on the lower side of the hub as indicated at *P*, the pin *O* in the clamp being controlled by the cam in such a way that when the lever is operated in loosening the clamp, a continuation of the movement causes the pin *O* to strike the end of the cam path at *Q* thus pulling the clamp back from the work. The pin *L* acts as a guide for the clamp.

In using this form, suitable allowances must be made for variations in the work in order that the clamp may work properly under all conditions. It is well to make the thread *M* of coarse pitch or even a multiple thread if the occasion warrant it. This type of clamp will be found more satisfactory on finished work where the variations are very small.

Work which is to be milled almost in line with a normal clamping surface is difficult to locate and clamp firmly, at the same time keeping the clamps below the end of the cutter so that there will be no interferences. A case in point is shown in Fig. 127, in which the work *A* is to be milled on the two bosses indicated. The surface *B* has been machined and is to be used for location. By setting it on this surface, on a hardened locating plate in the fixture *C*, it can be brought up against the knife-edge locater *D* by means of the swinging clamps on the opposite side at *F*.

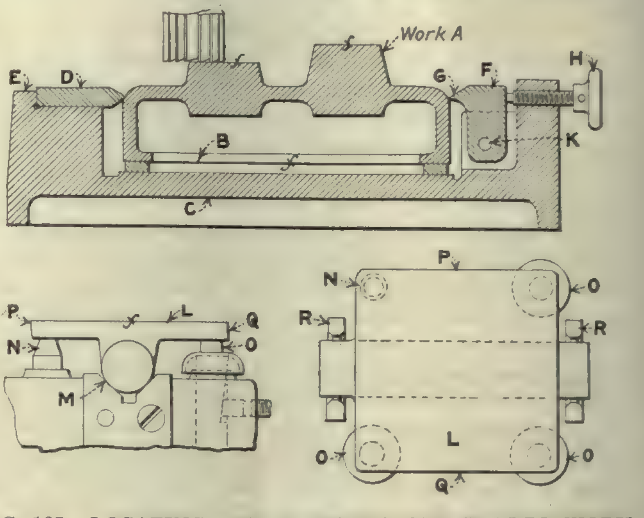


FIG. 127. LOCATING AND CLAMPING ODD-SHAPED WORK

The locater *D* is well backed-up by the lug on the casting at *E*. The operation of the swinging clamp *F* is controlled by the thumb-screw *H* so that the knife-edge point *G* forces the piece over against the locater *D* and at the same time holds it down on the locating plate *B*. The pivot *K* on which the swinging clamp moves should always be set well back of the knife-edge *G*, so that the action in clamping will be downward.

Another piece of work requiring a method somewhat out of the ordinary for locating and clamping, is shown at *Q*. Here the surface *L* is to be machined and the work must be located not only in relation to the underside of the surface mentioned but also in such a way that it will bear a certain relation to the hub *M*. The method used is to locate each end of the hub in a knife-edge V-block such as that shown at *R*. This gives a location on two of the three points necessary. It can then be tipped until it strikes the fixed locating point shown at *N*, after which the three spring-jacks indicated at *O*

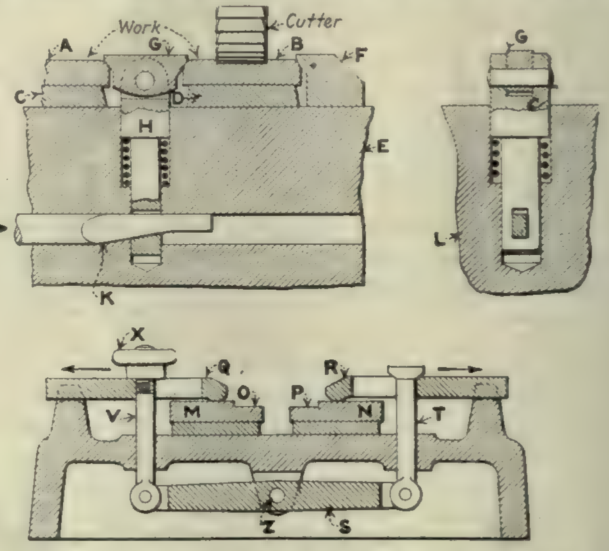


FIG. 128. APPLICATIONS OF MULTIPLE CLAMPS

can be released until they strike the underside of the flange, after which they should be locked. This work could be clamped with an arrangement similar to that previously described, using knife-edges at *P* and *Q*. Conditions similar to this are frequently found in general manufacturing and a careful analysis must always be made to make sure that the work does not locate on more than three fixed points.

It is often necesary to hold two or more parts at the same time. When this condition arises, the clamps should be made in such a way that they will exert a uniform pressure on the work. An equalizing type of clamp must therefore be used.

Fig. 128 shows two pieces of work at *A* and *B* which are to be machined on the upper surface. The work locates on the blocks *C* and *D* and there is a locater on each side as shown at *F*. The base of the fixture *E* contains a spring plunger *H*, on the upper end of which is mounted a rocker *G*, so formed that the angular surfaces will come in contact with the edges of the work. The lower part of the plunger is slotted to receive a wedge *K* which may be operated in any convenient manner. The action of the wedge draws the plunger down and the rocker *G* equalizes the clamping action so that it is distributed evenly on both parts *A* and *B*. The sectional view at *L* makes the construction easily understood. A clamp of this kind is useful when the work is of such a nature that it can be put into the fixture without difficulty, but if this cannot be done, this type should not be used because it requires too much movement of the plunger in order to remove and replace the work.

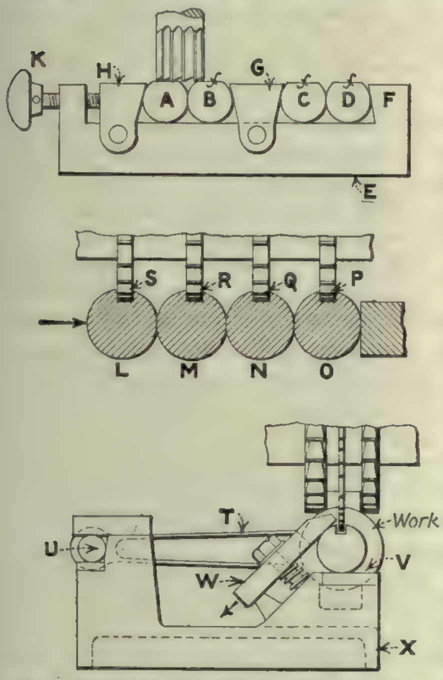


FIG. 129. CLAMPING WORK IN GROUPS

The two pieces of work shown at *M* and *N* are to be machined at the points *O* and *P*, therefore clamps should be provided which can be operated simultaneously, thus equalizing the pressure. The clamps *Q* and *R* are slotted so that they can be pulled back when removing and replacing the work. The clamps are operated by means of the eye-bolts *T* and *V* and their action is equalized by the lever *S*. When the thumb-knob *X* is screwed down, the same amount of pressure is applied on both clamps *Q* and *R* so that the pressure on the work *M* and *N* is the same.

This form of equalizer is very commonly used and can be applied to a variety of conditions. It is of course important that the pivot point *Z* be mid-way between the two operating eye-bolts *T* and *U* in order that the pressure may be uniform.

The greatest care must be used in clamping several pieces of work against each other so that slight errors in locating will not cause inaccuracies in the finished product. A case in point is shown in Fig. 129. The work consists of four bars *A*, *B*, *C* and *D* on which a small flat surface is to be milled as indicated. The bars are located in the fixture *E* so that the bar *D* is clamped against the under cut portion *F* on one side of the fixture. It will be seen that when the thumb-screw *K* is operated, the swinging clamp *H* strikes against the bar *A* throwing it over against *B* which in turn moves the angular rocking clamp *G* so that it forces the bar *C* against *D* thus holding the entire group of bars. .

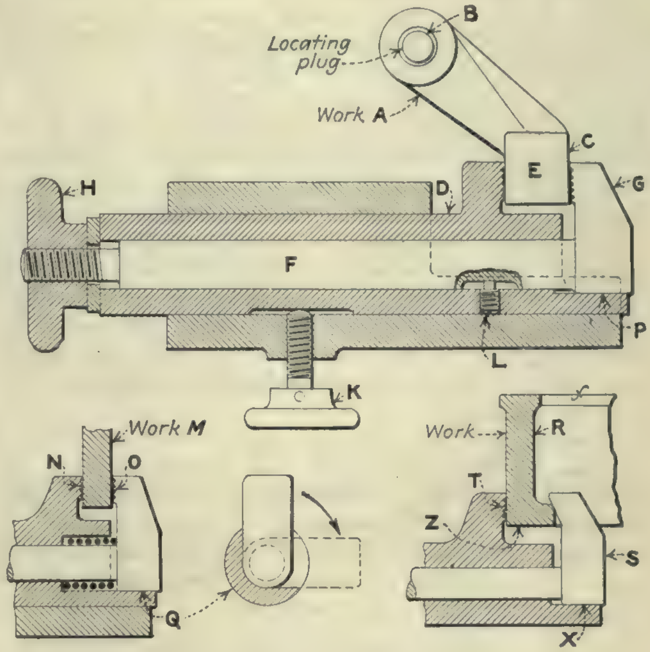


FIG. 130. DESIGNS OF HOOK-BOLT CLAMPS

For the condition shown this method of clamping is not objectionable, but assuming that the bars were to be located for a key-way as shown at *L*, *M*, *N* and *O*, it is evident that accumulated variations would be found in the positions of all of the slots with the expection of *P*. If the bars chanced to be a trifle large the slot *Q*

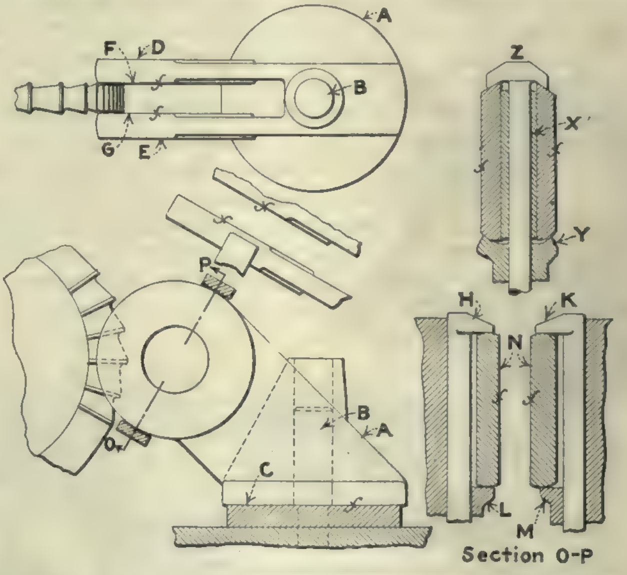


FIG. 131. SPECIAL APPLICATIONS OF HOOK-BOLT CLAMPS

would be slightly off center, *R* would be a little more so and *S* still more out of alignment.

This point must always be remembered in designing fixtures for holding a number of pieces, as a condition like that shown would be very serious, in that the errors in the key-ways would make it impossible to obtain a fit on the corresponding female member.

Another method useful in clamping work in groups, is shown at *T*. This is a connecting rod in which a pin has been inserted in the small end *U* so that it may be used to locate from during the progress of the work. The work is located at the large end by means of another pin which rests on the hardened block *V* where it is securely held by the sliding clamp *W*. The fixture *X* must be so arranged that the clamp *W* can be dropped down in the direction indicated by the arrow far enough so that the work can be easily removed. The machining on the rod consists of straddle milling the two sides of the bosses and saw cutting it at the same time as indicated.

It is common practice to set up work of this kind in groups, the number of pieces to be machined at the same time being governed by the capacity of the machine and the dimensions of the connecting rod. It is evident that when one side has been cut, the work can be removed and turned over in the same fixture so that the other side can be machined.

DESIGN OF HOOK-BOLT CLAMP

Some data have been given in one of the articles on drill jigs regarding the design of hook-bolt clamps in their application to drill jigs. Similar clamps may be used for milling fixtures, although they should be much heavier than those used for drilling. Fig. 130 shows a piece of work *A* located on the plug *B*, and which must also be held firmly on the rectangular end. A special form of combined hook-bolt and jaw is used in this case. The member *D* is a bushing having a jaw cut on it at *E* against which one side of the work locates. The rod *F* has a jaw *G* at one end and passes entirely through the bushing *D*, being operated by the thumb-knob at the other end *H*. This entire mechanism will "float," and when the thumb-knob is operated, the work is firmly gripped between the jaws *E* and *G* after which the thumb-screw *K* can be tightened, locking it positively. A teat screw *L* prevents the rod *F* from turning. Attention is called to the manner in which the jaw *G* is supported at *P*.

A somewhat similar device is shown holding the work *M*. This piece is also gripped between jaws at *N* and *O* and the hook-bolt is released by means of the spring indicated. In this particular case it is necessary to swing the hook-bolt out of position in order to remove the work, and the method used is clearly shown in the end view, the movement of the hook-bolt being indicated by the arrow and the dotted lines. The same careful provision has been made here for supporting the heel of the hook-bolt at *Q*.

An application of a similar principle is shown in the method of holding the work *R*. The jaw *T* grips the work on one side while the hook-bolt *S* draws it down and also clamps it. Suitable locating points must be provided on which the casting may be supported. This may be done at the point *Z* by the insertion of a stud or by some other convenient method. Attention is once more called to the support of the heel of the hook-bolt at *X*.

SPECIAL APPLICATION OF HOOK-BOLT CLAMPS

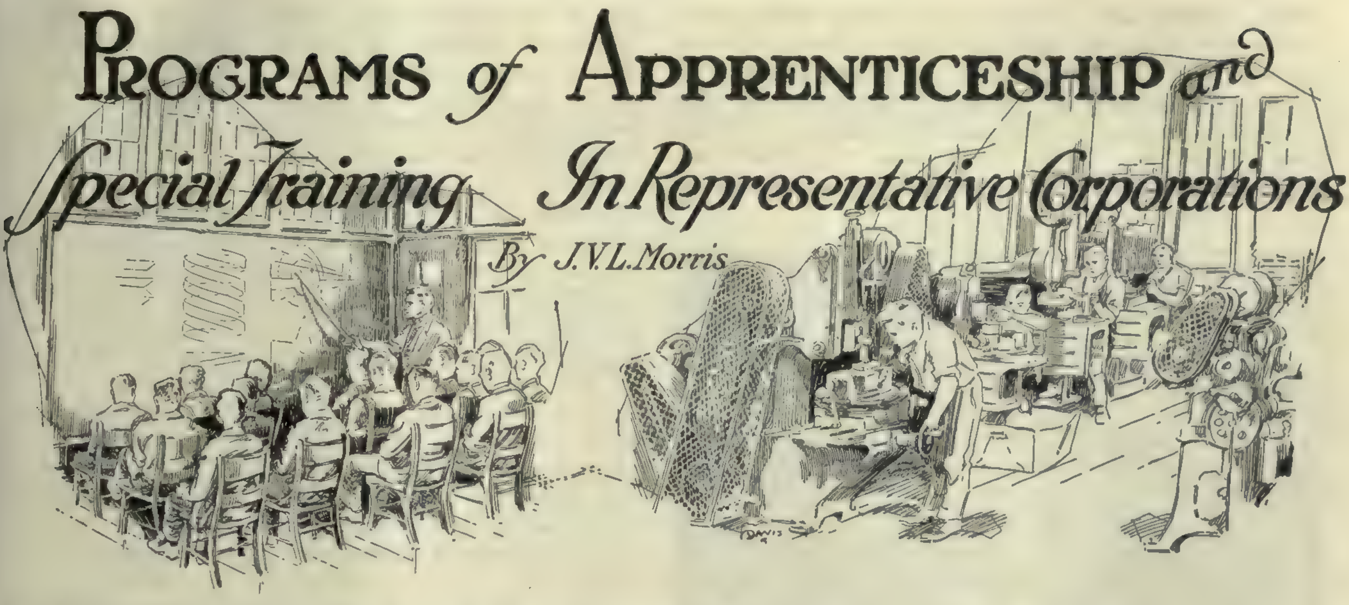
For thin work that is likely to be distorted either in the cutting or the holding, the hook-bolt may frequently be utilized to good advantage. An application of this kind to a very difficult piece of work is shown at *A* in Fig. 131. The work locates on a central stud *B* and on hardened ring at *C*. The arms of the bracket are straddle milled at *D* and *E* and are also finished at *F* and *G*. The material is manganese bronze and the two arms of the bracket *D* and *E* are very frail. Therefore, the method of holding during the process of machining must take into consideration the spring of the material and clamps of special form must be used. The work must be held close to the points where the cutting is to be applied and the clamping device must be of a "floating" nature in order that the location of the work on the stud *B* and the surface *C* may not be disturbed.

A pair of hook-bolts using a principle similar to that shown at *A* in Fig. 136 were used for the first operation while holding the work for the milling of the inside surfaces *F* and *G*. The section taken along the line *OP* shows the two sides of the work *N* gripped at the top by the hook-bolts *H* and *K* and at the bottom by the jaws *L* and *M*. The floating action of the hook-bolts allows the work to be securely gripped in such a way that the cutter can machine the piece without distortion.

For the second operation, which consisted of milling the outside surfaces *E* and *D*, a similar arrangement was used. The work locates on a central plug *X* through which the hook-bolt *Z* passes. The lower part of the work is held by a floating collar *Y*. Both the end of the hook-bolt and the collar are cut away on a slight angle so that the clamping action draws the work tightly against the central locating plug *X* and gives great rigidity during the straddle-milling operation. It may be well to state that both of these fixtures were made for work requiring great accuracy and that they were operated by girls.

PROGRAMS *of* APPRENTICESHIP *and* *Special Training In Representative Corporations*

By J.V.L. Morris



XIV—The Winchester Repeating Arms Co., New Haven, Conn.

Thorough Training Course for Apprentices—Special and Machine Training of Many Types—Course for Minor Executives—Instruction of Foremen by Lectures and Discussions

AT THE conclusion of the late war the Winchester Repeating Arms Co. found itself confronted with the alternative of either greatly retrenching its production or of branching out into new lines of manufacture. In order to utilize the greatly increased space, equipment and working force which had been required for war production, it chose the latter course. This action has meant the entrance into the manufacture of pocket knives, shears, and other forged and edged tools, skates, fishing tackle, batteries and flashlights, and still other products yet to be developed. To market these new products it was considered necessary to acquire a chain of district warehouses and of retail stores and agencies extending throughout the country.

To reorganize the personnel for the changed production, more minor executives, foremen, and office workers were essential, which argued for the installation of an educational division. Equally, the training of the workers in these new lines was believed to justify the development of a training department. It should be noted that in this corporation the two functions are considered distinct and co-ordinate. The educational work heads up to the personnel department, while training is subordinate to the manufacturing department. A third division of the field is found in apprentice training, which antedates the adjustment to war conditions and, of course, the other instructional features. Over this division, the educational director exercises only supervisory control.

Considering first the provision for apprentice training, only the machinists' and toolmakers' trade is at present offered. In this trade there is an enrollment at present of 116, for whom a three-year course is laid out. The usual provisions are found, such as limiting entrance to boys between the ages of sixteen and twenty, and requiring an apprentice agreement.

Apprentices are very carefully selected. In every case graduation from a grammar school is required, and to insure a satisfactory knowledge of arithmetic a rather difficult examination in that subject is imposed, which examination must be passed with a high standing. The applicants are given a physical examination with the requirements, in addition to good health and physique, of a minimum height of 5 ft. 3 in., a weight of 105 lb., good eyesight and hearing. Also, the character of the boy is investigated, to insure the best and most satisfactory material. If accepted, the boys are placed on probation for a two-month trial before the indenture for the three years is signed. They are then required to purchase their own individual measuring tools and a machinists' handbook.

To insure ample instruction at all the standard machine tools, a separate training department is provided under a highly skilled mechanic as supervisor, who takes a personal interest in the progress of each of the apprentices. He is assisted by carefully chosen machinist instructors. This feature of a separate training department with high-grade instruction, coupled with the high quality of tool work required in the production of fire arms, it is believed, provides an exceptionally favorable opportunity to learn the toolmaker's trade. An apprentice at work in the training department at a radial drilling machine is shown in Fig. 59, while Fig. 60 shows a class of apprentices receiving instruction in the making of jigs and fixtures.

Two hours per week of classroom instruction in mathematics and mechanics during working hours and an eight-week continuous period of intensive instruction in the drafting departments, provide the minimum requirements of supplementary instruction in drawing, mathematics, and science. This may, however, be supplemented by the more ambitious through evening instruction in English, mathematics, including trigonometry, and in drafting. These classes meet from October to July from 6:30 to 8 p.m. and are provided without cost to the student, though no additional compensation is given for taking them. A library of modern technical books and magazines is also at the disposal of those eager to learn.

Ordinary compensation at present starts at twelve dollars a week and is increased by two-cent-an-hour advances every six months until eighteen dollars a week is reached for the final term. A bonus of one hundred dollars is also paid if the apprentice completes the course and remains in the company's employ one year after graduation. This, in a sense, establishes the apprentice period at four years, which conforms to the practice in most plants. To stimulate and reward extraordinary effort and capacity, prizes are also given to those receiving the highest rating in their studies.

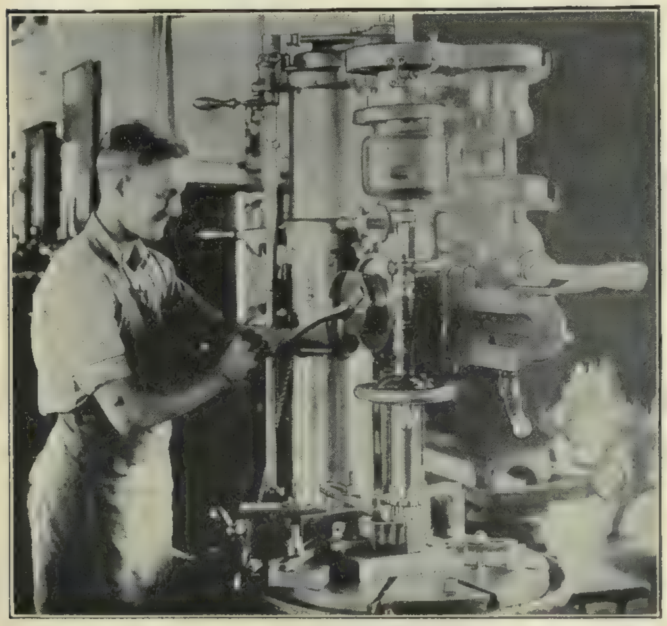


FIG. 59. APPRENTICE AT A RADIAL DRILLING MACHINE

Outside activities include athletics, with skilled coaches in all the major sports, dramatics, and music, all of which are provided in an effort to keep the work from becoming a dull grind for the lively young fellows.

Initial training has been organized throughout the plant under the director of training. Intensive instruction in trades, semi-trades, and operations is organized in forty separate sections. This includes definite instruction in such trades or specialties as that of sheet-metal workers, gun-mechanism adjusters, bamboo-rod winders, electrical wiremen, polishers, buffers, hafters, glazers, blade grinders, scissors and shear workers, fish reel assemblers, bench filers, milling machine, drill press, and profile machine operators, machine tool specialists, diemakers, die sinkers, drop forgers, and shop and office clerks.

The number undergoing training varies, of course, with the demands of the plant, depending upon departmental expansion and turnover. At present 175 are receiving instruction, for whom a corps of twenty-five instructors are required. During the process of training, experience has shown that about 15 per cent are eliminated as unsuited to the particular work, or else because they find it distasteful.

The director believes that much attention should be given to teaching the instructors efficient methods of instruction. For this reason he holds weekly conferences of his staff, when methods of teaching are discussed and solutions are suggested for problems arising in the work.

The length of training, of course, varies with the type of work concerned. Three days, for example, are considered sufficient in a punch press operation or in that of merely feeding a machine, while ten weeks are usually necessary for a machine tool specialty. In the latter case it may be of the nature of trade extension for a machinist inexperienced in the particular work required.

In general, it may be said that all work is of the nature of floor training on machines segregated from regular production but installed in the department where the employee in training will ultimately be utilized. As stated by the training director, the work of the department is to test, train, upgrade, and adjust all new or inefficient operators in the plant.

There are ordinarily about twenty young men in the plant receiving a varied experience to fit them for administrative positions. The major portion are college graduates, though on the average about one-fifth are promoted from the ranks in the plant.

A definite route through the plant has been arranged as follows:

Three months, in apprentice training department.

Nine months, various departments of the factory.

Three months, general administrative work.

Six months, specialization along the line they wish to follow.

This provides a total of 21 months of training.

The educational department requires that the men purchase and study the Alexander Hamilton Institute course, toward the cost of which the company pays one-half. Weekly conferences are held to discuss these lessons and during a similar period each week a talk is given by individuals from the executive staff of the plant.

One hundred and fifty foremen have been selected for a training course which has been organized and is being developed by the educational director. These men are grouped into six sections of twenty-five to thirty each. In the weekly meetings about fifteen minutes is taken up by a brief, pointed talk on the day's topic by the director. This is followed by an open discussion of the topic among the foremen in the group. Mimeographed outlines of the subject in hand are provided.

FIG. 60. INSTRUCTING APPRENTICES IN JIG AND FIXTURE WORK

The first subject, to which three to four months is being devoted, is that of management, on which the outlines of two conferences are here reproduced.

FOREMEN'S GROUP CONFERENCES — I
SUBJECT: AIMS OF MANAGEMENT

I. Interpretation of Management
A. Broad
1. Gathering data relating in general to
a. Conditions
b. Methods
c. Processes
d. Results
2. Applications
a. Interpretating data
b. Establishing of standards
c. Means of utilizing data and standards
d. Establishing means of further investigation
e. Securing maximum prosperity for employer, employee and consumer
B. Narrow
1. Collecting data relating to
a. A particular or specific activity
II. The three components, broadly speaking, in management
A. Organization
1. Division of work, to be done, into defined tasks
2. Assignment of these tasks to individuals
3. Deals with qualifications and characteristics of human beings
a. Engineers type (Edison, the Wrights, Bell)
b. Executive type (Schwab, Goethals, Pershing, Hoover)
c. Specialists
d. Functionalists
B. System
1. Method pursued by organization in carrying out tasks
C. Administration
1. Work of organization in operating the management mechanism or system

Questions for discussion:—
In what way does management help the foreman?
The effect of management on the initiative and inventive spirit of the employee.
The relation of system to organization and administration.
Types of men needed for planning and execution.

FOREMEN'S GROUP CONFERENCES—II.
SUBJECT: TYPES OF CONTROL

I. Line Control (Chart)
A. General manager, responsible to board of directors
1. Accounting (comptroller)
2. Producing (works manager)
a. Superintendent of foundry, forge shop, machine shop, etc.
a-1. Foremen
3. Selling (sales manager)
II. Line and stall control (chart)
A. General manager
1. Accounting (comptroller)
2. Producing (works manager)
a. Superintendents of foundry, forge shop, machine shop, etc.
a-1. Foremen
b. Chief engineer
c. Chief chemist
3. Selling (sales manager)
III. Winchester functional control (chart)
A. President or vice-president
1. Planning
a. Supt. sales production
b. Export head
c. Credit head
d. Sales engineer
e. Advertising engineer
f. Warehouse superintendent
2. Preparation
a. Manufacturing engineer
b. Product engineer
c. Industrial engineer
3. Scheduling and production
a. Manufacturing superintendent
b. Personnel superintendent
c. Purchasing agent
4. Inspection
a. Comptroller
a-1. Statistician
a-2. Accountant
a-3. Auditor
5. Office superintendent
IV. Committee control (chart)
A. Works manager
1. Committee
a. Manufacturing
b. Tool
c. Suggestion
d. Safety
e. Welfare
f. Educational
g. Etc.

Questions for discussion—
Of what use are organization charts?
Discuss the merits of the W. R. A. type of organization.

This instruction will be followed by a similar treatment of such comprehensive topics as economics, finance, personnel problems, accidents and safety work. The director has in mind the development of a course which will extend indefinitely, perhaps as long as five years.

It will be seen that this program has as its basis the assumption that the foreman will gradually acquire the fundamental philosophy and method of his administrative functions, in other words, that his efficiency is dependent upon a gradual growth in perspective and comprehension of his duties and opportunities. The brief intensive method of four or five months' instruction found in other plants is quite evidently of more limited scope, that of providing the initial attitude desired with a changing conception of the function of the foreman as that of the leader rather than the driver, or else to provide the technical knowledge of the product deemed essential for its efficient production. Of course, these newer conceptions are embraced in the program here provided, but the plan evidently does not stop there, as it proceeds with the idea of the continued development of these lieutenants upon whose efficiency so much depend for success in production.

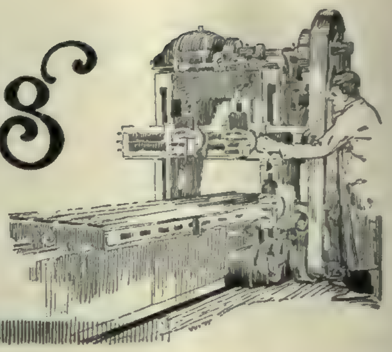
The company has a program of Americanization, chiefly of teaching English to its foreign laborers. For this, noon-hour classes are provided three days a week and a total of about two hundred alien workers are enrolled.

Classes in stenography and typewriting are provided, two hours a week in each, either during the noon hour or from seven to nine in the evening. In stenography fifty are enrolled, and in typewriting thirty. Of more interest from the standpoint of manufacture are classes in mechanical drawing arranged for four hours a week from 5:35 to 7:35 p.m.; arithmetic and shop mathematics two hours per week, 5:35 to 6:35 p.m.; the slide rule, two hours per week, 5:35 to 6:35 p.m.

As has been previously stated, training and education are considered two distinct functions for which in each case a director is provided. It is argued that training is properly a function of the manufacturing department, as only in that way can it be introduced without arousing the hostility of those responsible for production, who are the ones primarily interested in its provision.

Metal Cutting Tools.

By
A. L. DeLeeuw



XIII. Shear Tools—Where the Shear Tool Differs from Other Tools—Results Obtained from Shear Tools—Advantages and Disadvantages—Future Possibilities

IT IS not quite correct to speak of shear tools, for a shear tool is not essentially different from other tools except in the way in which it is used. To start again with the simplest example, that of a broad-nosed planer tool taking a cut over a piece which is narrower than the tool itself, we naturally expect the tool to be set in such a way that its lip is at right angles to the direction of the cut. Without having been told anything to the contrary we picture the tool as illustrated in Fig. 202, where the arrow shows the direction of movement of the tool. If we should set the tool as shown in Fig. 203, but without changing the direction of the cut, the tool would act as a shear tool.

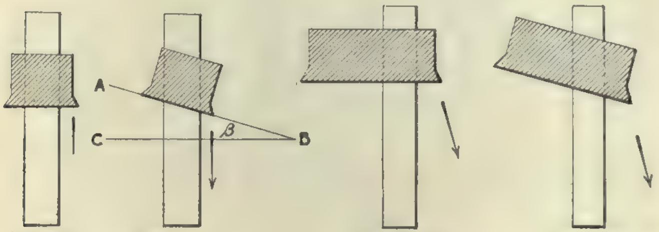


FIG. 202 FIG. 203 FIG. 204 FIG. 205

FIG. 202. ACTION OF PLANER TOOL. FIG. 203. SHEARING ACTION BY TWISTING TOOL. FIG. 204. SHEARING ACTION BY CHANGING DIRECTION OF FEED. FIG. 205. SETTING AND DIRECTION OF FEED BOTH CHANGED

Instead of changing the position of the tool we might have changed the direction of the cut, leaving the tool as shown in the position of Fig. 204. In that case it would have been necessary to make the tool much wider so as not to have the tool run off the work before the end of the stroke. Finally, we might have a condition as shown in Fig. 205 where both the position of the tool and the direction of cut are the same.

This trick of changing either the position of the tool or the direction of the cut or both is well known to us all. We use it in shaving, or in sharpening a pencil with a dull knife, and in many other cases. The question is, what is the difference between the action of a tool when used in the ordinary way or when used as a shear tool?

Fig. 206 shows a wedge which is supposed to be used as a tool or knife. When used in the ordinary way it would be moved in the direction of *BA*. When used as a shear tool it would either be moved in a different direction or else it would be set in such a way that the effect would be the same as if it were moved in a different direction—let us say in the direction *BD*. For the present we will neglect to consider the clearance of the tool, and we will assume that the plane *ABED* slides over the work so that the angle *CAE* is the contained angle as well as the active angle of the tool. We will assume that the tool has been turned through an angle β; that is, referring to Fig. 203, the angle *ABC* is β. We will further assume that the angle of the tool *CAB* equals α. It will readily be seen that it is not the angle α which is the active angle of the tool after it has been turned, but that we are concerned with the angle *CDB*. This angle we will call γ.

$$\frac{CB}{AB} = \tan \alpha$$

$$CB = AB \tan \alpha$$

$$AB = CB \cot \alpha$$

$$AC = CB \operatorname{cosec} \alpha$$

$$BD = AB \sec \beta = CB \cot \alpha \sec \beta$$

$$B\delta = AB \sec \beta = CB \cot \alpha \sec \beta$$

$$\tan \gamma = \frac{CB}{B\delta} = \frac{CB}{CB \cot \alpha \sec \beta} = \tan \alpha \cos \beta$$

The rake of the tool is the complement of angle *CDB*, so that the tangent of that rake is the contangent of angle *CDB*, or the inverse value of the tangent of $\gamma = \cot \alpha \times \sec \beta$.

Now the complement of α is the rake of the tool when it is not used as a shear tool; that is, if its direction of motion is at right angles to the line *AD*. We see, therefore, that by turning the tool through an angle β, we have multiplied the tangent of its rake angle by sec β. The secant of an angle is always more than 1. Thus, by turning the tool through an angle β, we have actually increased the tangent of the rake angle and therefore the rake angle itself. This is one of the two important things to remember about shear tools, namely, that the effect of a shear tool is the same as the effect of an ordinary tool with greater rake. It might be asked why the tool should not be made with that greater rake instead of making it with small rake and then setting it at an angle. The reason is this: That a large amount of rake means a weak tool, so that the shear tool makes it possible for us to use a strong tool and yet get the

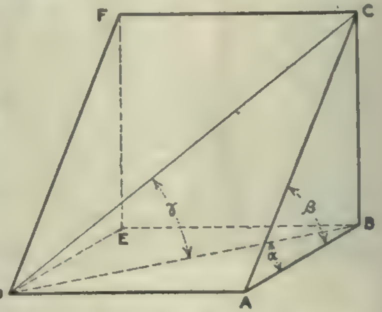


FIG. 206. DIAGRAM TO SHOW ANGLES OF TOOL

For the author's forthcoming book. All rights reserved.

same effect, as far as cutting is concerned, as though we were using a tool with a large rake angle.

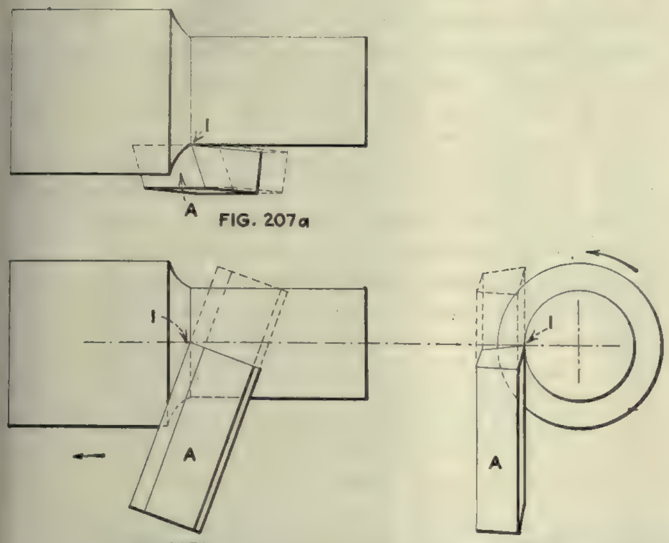


FIG. 207a

FIG. 207b

FIG. 207c

FIG. 207. SHEAR TOOL TURNING BAR OF STEEL

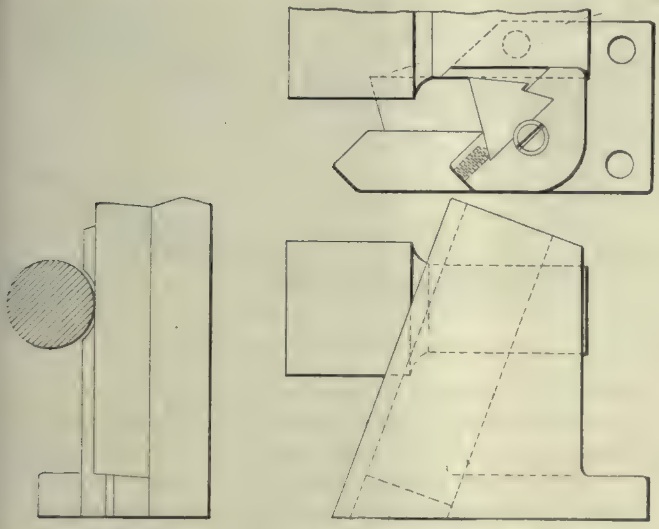


FIG. 208. SHEAR TOOL AS APPLIED TO A LATHE

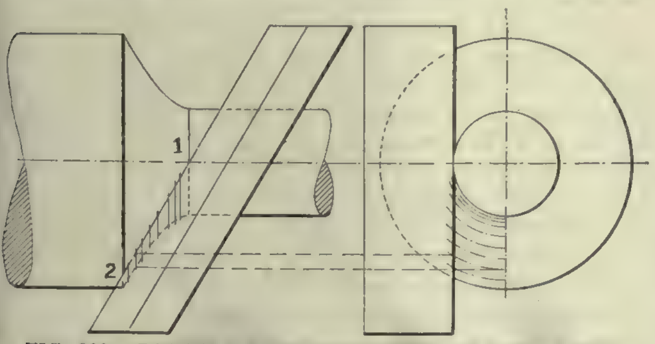


FIG. 209. POINTS OF INTERSECTION OF SHEAR TOOL WITH WORK

If, in Fig. 206, we should consider the angle *CAB* not as the rake angle but as the clearance angle of a tool, the angle *CDB* would be the clearance angle of the tool after it has been turned through an angle β. This angle *CDB* is always smaller than the angle *CAB*, so that the same trick which increases the effective rake angle of a tool decreases its effective clearance angle. To make this matter somewhat clearer, we will apply the above considerations to a few concrete examples:

We will assume that the rake angle of the tool is 15 deg. and the clearance angle 8 deg.; we will turn the tool through an angle $\beta = 10^\circ - 20^\circ - 30^\circ - 45^\circ - 60^\circ - 75^\circ$

1—If $\beta = 10^\circ$

Effective rake $= \delta_1$

$\tan \delta_1 = \tan 15^\circ \times \sec 10^\circ = 0.26795 \times 1.0154 = 0.27207$

Effective clearance $= \delta_2$

$\tan \delta_2 = \tan 8^\circ \times \cos 10^\circ = 0.14054 \times 0.98481 = 0.13840$

$\delta_1 = 15^\circ\ 13'$

$\delta_2 = 7^\circ\ 53'$

2—If $\beta = 20^\circ$

$\tan \delta_1 = \tan 15^\circ \times \sec 20^\circ = 0.26795 \times 1.0642 = 0.28515$

$\tan \delta_2 = \tan 8^\circ \times \cos 20^\circ = 0.14054 \times 0.93969 = 0.13206$

$\delta_1 = 15^\circ\ 55'$

$\delta_2 = 7^\circ\ 31'$

3—If $\beta = 30^\circ$

$\tan \delta_1 = \tan 15^\circ \times \sec 30^\circ = 0.26795 \times 1.1547 = 0.30940$

$\tan \delta_2 = \tan 8^\circ \times \cos 30^\circ = 0.14054 \times 0.86603 = 0.12171$

$\delta_1 = 17^\circ\ 11'$

$\delta_2 = 6^\circ\ 56'$

4—If $\beta = 45^\circ$

$\tan \delta_1 = \tan 15^\circ \times \sec 45^\circ = 0.26795 \times 1.4142 = 0.37893$

$\tan \delta_2 = \tan 8^\circ \times \cos 45^\circ = 0.14054 \times 0.70711 = 0.099377$

$\delta_1 = 20^\circ\ 46'$

$\delta_2 = 5^\circ\ 40'$

5—If $\beta = 60^\circ$

$\tan \delta_1 = \tan 15^\circ \times \sec 60^\circ = 0.26795 \times 2. = 0.53590$

$\tan \delta_2 = \tan 8^\circ \times \cos 60^\circ = 0.1405 \times 0.5 = 0.07027$

$\delta_1 = 28^\circ\ 11'$

$\delta_2 = 4^\circ\ 1'$

6—If $\beta = 75^\circ$

$\tan \delta_1 = \tan 15^\circ \times \sec 75^\circ = 0.26795 \times 3.8637 = 1.0353$

$\tan \delta_2 = \tan 8^\circ \times \cos 75^\circ = 0.14054 \times 0.25882 = 0.03637$

$\delta_1 = 47^\circ\ 0'$

$\delta_2 = 2^\circ\ 5'$

The foregoing calculations show that the tool must be turned through an angle of considerable size before its effect on the rake will be felt. As a matter of fact shear tools are turned through such a large angle. If there were no other effect except that on the rake angle shear tools would consume very much less power than the ordinary tools. However, there are other effects which more or less counteract this economy of power. In order to study this entire matter somewhat more closely we will consider the action of the simplest form of shear tools in the lathe.

There are shown in Fig. 208 three views in diagrammatic form of a shear tool turning up a bar of steel. *A* is the tool which is merely a bar of a section as shown in Fig. 207c, set in a vertical plane as indicated in Fig. 207b, but at an angle with the perpendicular as shown in Fig. 207a. The point *1* of the shear tool is on a level with the center of the lathe. As a result of the angle which the tool makes with the vertical line, all points of the cutting edge below this point *1* are to the left and all points above the point *1* are to the right. As the rotation and feed take place in the direction of the arrows it is clear that all points above point *1* are idle and that all points below point *1* are active up to that point where the cutting edge of the tool intersects the outside circumference of the work. Fig. 209 shows the points of intersection of the tool with the work, which shows that the axial section of the work between the point *1* and the last point of intersection is a curved line. In other words, if we should stop the lathe before the tool has completely passed over the bar we will get a fillet just as if the work had been done with a round-nosed tool. However, whereas all the active points of a round-nosed tool are located in a horizontal plane or practically so, the various points of the shear tool which produce the fillet are spread apart between the points *1* and *2;* so that there is a much longer line of contact between work and tool than would be had with a round-nosed tool.

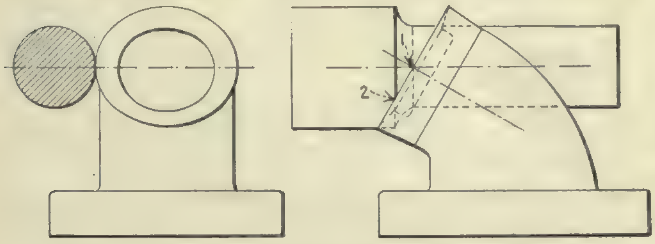


FIG. 210. ELEMENTARY CIRCULAR SHEAR TOOL

If the depth of the cut is ¼ in. and the feed per revolution is 1/16 in., the pressure required for the feed, using a round-nosed tool, is that pressure which will make ¼ in. of the edge of the tool penetrate into solid steel to a depth of 1/16 in., and the work done by the feed during one revolution can be expressed by these two items: Depth of cut and feed per revolution. With a shear tool the feed per revolution may be the same but the length of line of contact between tool and work is more than the depth, so that the amount of work required for the feed is more. If we should take a bar 3½ in. in diameter and to be reduced to 3 in., so that the depth of cut would be again ¼ in., the distance between points *1* and *2* would be a little over ⅞ in., so that the work done by the feed mechanism will be more than 3½ times the amount of work done for feeding with a round-nosed tool. Though the total amount of work for the removal of the same amount of metal may be less with a shear tool, the duty imposed in the feed mechanism is greater and the strains caused by the feed are different, so that a machine designed for the use of the ordinary lathe tools may not be entirely satisfactory when shear tools are used.

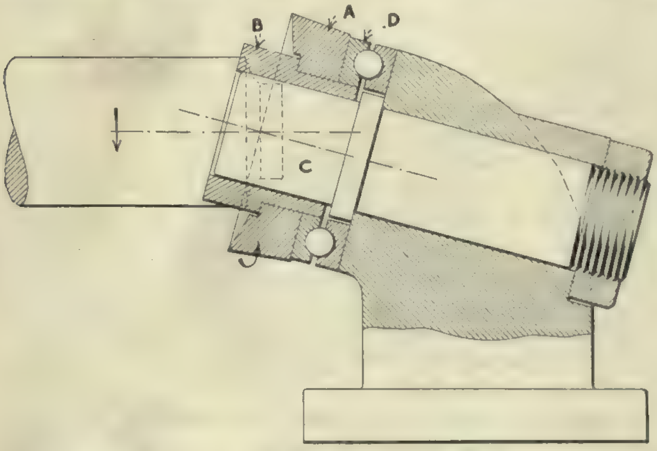


FIG. 211. CIRCULAR SHEAR TOOL

Fig. 208 illustrates the shear tool, diagrammatically shown in Fig. 207, as applied to a lathe. Such a tool would have great practical advantages besides the reduced power consumption and the better finish. It is possible to hold such a tool in a very rigid manner and with practically no overhang. When the active portion of the tool is worn out the entire tool bar can be shifted in the direction of its length to bring a new portion into play, so that long work could be turned up with a single tool. Still another advantage lies in the fact that such a tool can be ground on any surface grinding machine and can readily be polished if so desired. The entire bar does not need to be made of high-speed steel, but can be tipped over its entire length so that the tool cost can be kept low. If, on the other hand, the entire bar is made of high-speed steel and too much is finally ground off to permit its further use as a shear tool, there will be left a bar of sufficient length to make it available for other tools.

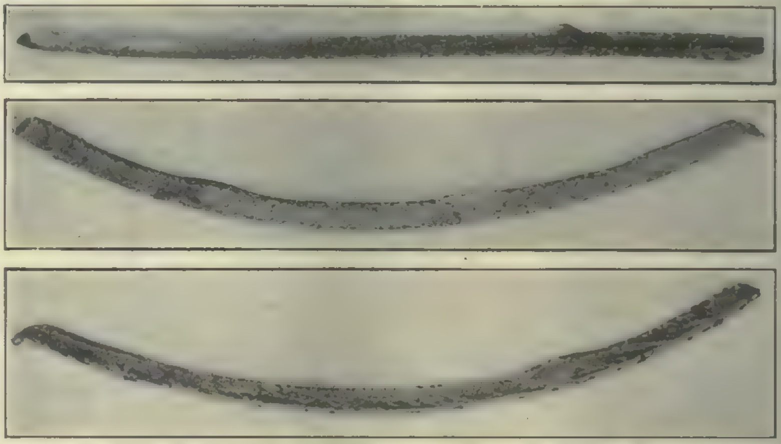


FIG. 212. ACTUAL CHIP FROM LATHE SHEAR TOOL

Before going further into the matter of the why and and wherefore of the reduction in power required for a cut, we will look into the other possible applications of the shear tool principle to the lathe. Fig. 210 shows two views of a circular shear tool. The principle of this tool is exactly the same as that shown in Fig. 208. Only its form is different. In order to bring a new piece of tool into play a clamping screw is loosened, the tool turned through a certain angle and the clamping screw tightened again. The grinding of the tool can readily be done on a cylindrical grinder.

The chips produced by the foregoing tools have a very different appearance from the ordinary chips and resemble more a solid steel wire or ribbon than the common form of chip. We will see presently why this should be so. However, the fact that such a ribbon is formed shows that there must be considerably less power required for producing this chip than the chip of ordinary form, because the sections of the chip are not entirely separated and are only slightly displaced in relation to one another.

The tool shown in Fig. 210 may be still further modified and so constructed as to revolve on a stud. If it were possible to have such a tool set in a vertical plane and this plane at right angles to the axis of the work, the friction between the work and the tool would revolve the tool just as if it were geared together with the work, and the speed of the cutting edge of the tool would be exactly the same as the speed of the finished part of the work. However, these conditions cannot be fulfilled. The tool must stand at an angle with the work so that the speed of the cutting edge will be equal to the speed of the work times the cosine of the angle between the cutting edge of the tool and a vertical plane. If the angle at which we set the tool were 15 deg. and the cutting speed should be 100 ft., the speed of the cutting edge of the tool would be 100 times the cosine of 15 which is 0.96592 or 96.592; so that the difference in speed between work and tool would be slightly less than 4½ ft. per minute. Of course the difference between speeds of work and tool is greater at the outside diameter of the rough work because the diameter of the work is more and the diameter of the tool is less. However, this greater difference of speeds does not have much effect on the tool because the conditions are much more favorable for radiating or conducting the heat generated.

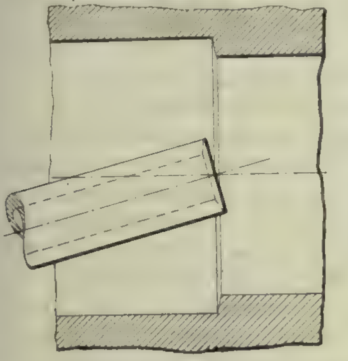


FIG. 213

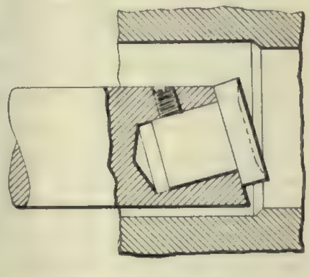
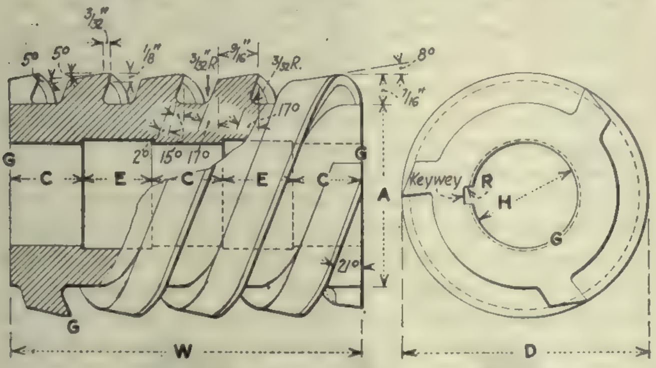


FIG. 214

FIG. 213. A SIMPLE BORING SHEAR TOOL. FIG. 214. A BORING CIRCULAR SHEAR TOOL

If we should, for a moment, imagine that the speed of the work and the tool were nearly the same, we would have the following set of conditions:



D	W	H	A	C	E	Keyway	R	Lead	Gears for Milling Gash
3½	3	1½	2⅝	1	1	¼ X ⅛	3/64	4.2000	72/48 X 28/100
3½	4	1½	2⅝	1¼	1½	¼ X ⅛	3/64	4.2000	72/48 X 28/100
3½	5	1½	2⅝	1	1	¼ X ⅛	3/64	4.2000	72/48 X 28/100
4½	6	2	3⅝	1	1½	5/16 X 5/32	1/16	5.4260	40/24 X 28/86
4½	8	2	3⅝	1¼	2⅛	5/16 X 5/32	1/16	5.4260	40/24 X 28/86
4½	10	2	3⅝	1½	2¾	5/16 X 5/32	1/16	5.4260	40/24 X 28/86

FIG. 216. DETAILS OF HELICAL CUTTER

As the difference in speed between work and tool is very small, very little heat will be developed by the rubbing of the tool against the work.

For the same reason very little heat will be developed by the rubbing of the chip over the tool. It is true that the difference in speed between chip and tool becomes greater when the chip comes nearer to the center of the tool, but on account of the curving of the tool there will be no contact between tool and chip except near the edge of the tool.

As the tool is a shear tool and consequently acts as a very sharp tool would act, the chip is not broken up; the sections of the chip do not slide over each other, so that no work, or rather very little work, is expended in the deformation or breaking-up of the chip.

The total work done in removing a chip from a piece of metal consists of the following items:

Work done to separate the chip from the metal.

Work done in breaking up and deforming the chip.

Work done to overcome the friction between tool and metal.

Work done to overcome friction between tool and chip.

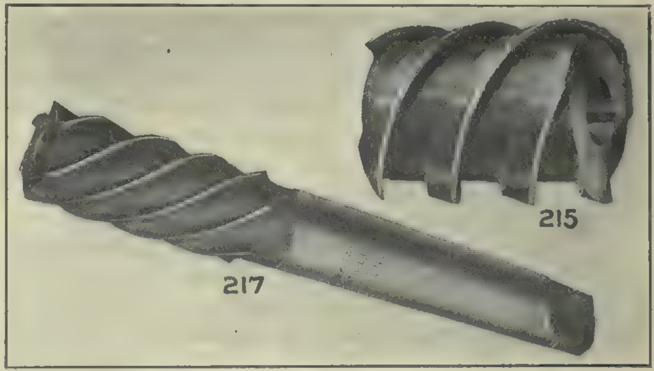


FIG. 215. A HELICAL CUTTER. FIG. 217. AN END MILL OF SIMILAR TYPE

Of these items, the first one is by far the smallest when an ordinary tool is used. To show how little work is required for the separation of the chip from the metal, we will assume a set of conditions and calculate the power required for the separation of the chip if no useless work at all is done. We will take a test piece 1 in. square in section and 2 in. long and pull it apart in the testing machine. We will assume that the material is machine steel of a tensile strength of 60,000 lb. per square inch, an elastic limit of 36,000 lb. per square inch and a coefficient of elasticity of 30,000,000. When the pull has reached the elastic limit, the elongation will be 36,000 divided by 30,000,000 or 0.0012 in. The total work done will be 36,000 lb. times half the elongation at that point equals 21.6 inch pounds. We will further assume that this material shows an elongation of 20 per cent. All of this 20 per cent elongation takes place, practically speaking, between a pull of 36,000 and 60,000 lb.; so that the average pull is 48,000 lb. The elongation being 0.4 in., the total work done between the elastic limit and the breaking point is 19,200 inch pounds equals 1,600 foot pounds. The total amount of work done before the elastic limit was reached is so small that we can neglect it in this calculation. We find, then, that the total amount of work done for the breaking of our 2-in. test piece was 1,600 foot pounds, or less than 1/20 hp.

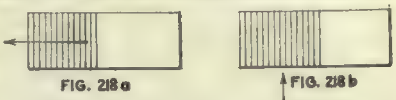


FIG. 218. CONTRASTING ACTIONS OF PLAIN MILL AND HELICAL CUTTER

If our aim were merely to separate 1 cu.in. of metal from our piece of work, less than 1/20 hp. would be required. The fact that we do not separate a chip in this manner does not alter the other fact that only 1/20 hp. is required for the separation of the chip. The rest of the power required was needed on account of the different method we employed to separate the chip, and is therefore lost power.

In making chips on the lathe we would need approximately ¾ hp. per cubic inch of metal removal; on a milling machine we would need approximately 1 hp. under the very best conditions and as a rule from 1¾ to 2 hp. or more. Taking the figure for a lathe, we see that 14/15 or more than 93 per cent of all power is wasted. It is used for overcoming friction and for breaking-up and deforming the chips. All the power so wasted is transformed into heat which destroys the tool. The rubbing of the chip over the tool also tends to destroy it by wearing it away. If we succeed in reducing this wasted power we will accomplish a number of desirable results at once: we will be able to run at a very much higher speed because the tool is not heated; we will wear out the tool much less by abrasion; we will heat the work less; and we will cause less spring, so that it will be possible to produce work which is more nearly round and of even diameter than we can hope to do with the ordinary tool. Further, as the amount of power is less, there will be less tendency for the chip to tear out of the work and leave a rough surface.

All these results were actually obtained with the tool illustrated in Fig. 211. The tool itself, *A*, was a disk 4 in. in diameter and ground on the outside so as to give the proper amount of clearance and on the inside to give the desired amount of rake. The hardened steel bushing *B* was pressed into the disk to give more length of bearing on the stud *C*. The end thrust was taken up by the ball bearing *D*. The sketch shows only the essential details and not such details as oil holes and grooves or cover over ball bearings and the like. Stud *C* was forced into a heavy gray iron casting which was mounted on the toolslide of a lathe. Originally a washer and nut held the bushing *B* on the stud, but this was found to be unnecessary and might have been foreseen, as all the pressure is toward the ball bearing, tending to keep the tool in place.

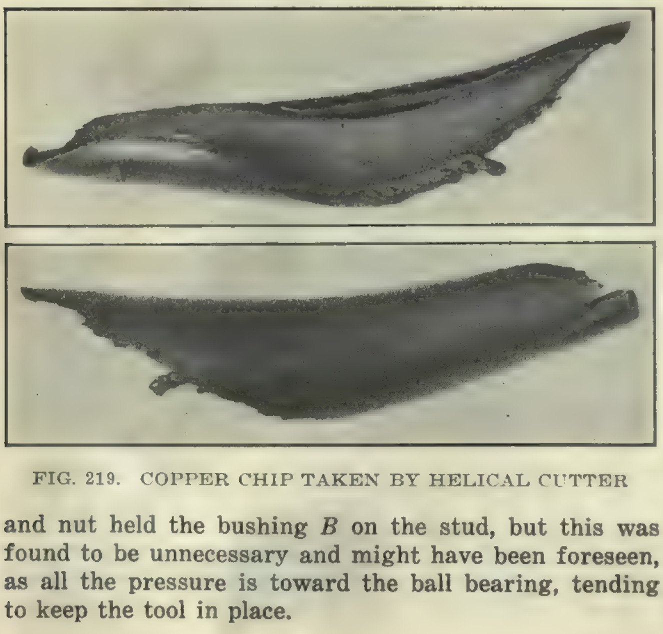


FIG. 219. COPPER CHIP TAKEN BY HELICAL CUTTER

The work was a bar of 0.20 carbon steel 7 in. in diameter, about 5 ft. long.

The cutting was done dry.

Depth of cut was 3/32 in. and feed 1/12 in. per revolution.

Number of r.p.m. of the spindle 363.

Surface speed 665 ft. per minute.

Feed of tool along the work 30 in. per minute.

Metal removed per minute 61 cubic inches.

Notwithstanding the extremely high speed and notwithstanding that a very large amount of metal was removed per minute, neither tool nor work nor chips were heated, nor even warm, and it was possible to hold the chips in the hand as they came off the lathe. The chips had the appearance shown in Fig. 212, which is an enlarged photograph of one piece of a chip. These chips came off in the form of continuous ribbons or bars, curled up to a radius of from 1 to 2 feet.

The fact that the chips were almost as rigid as the original material made the operation somewhat dangerous, and it was soon felt that it was necessary to break them up. Fortunately during one of the tests a tool fell on the concrete floor and was nicked. This accidental nick acted as a chip-breaker and thereafter tools were provided with nicks which were properly ground in. A little lump shown in Fig. 212 is the place where the chip-breaker failed to cut the metal in the previous convolution. At that point the previous convolution had been broken up. As one chip-breaker was ground in the tool and as the tool was 4 in. in diameter, the chips would come off in lengths of approximately 12½ inches.

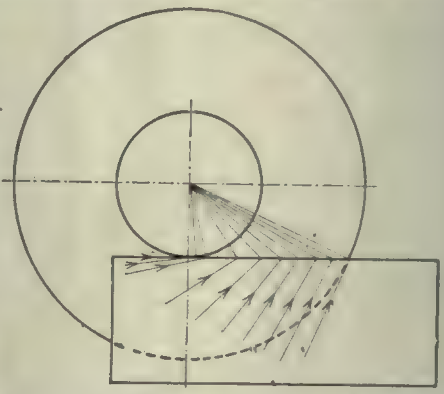


FIG. 220. EFFECT OF RELATIVE DIAMETER OF WORK ON SHEAR TOOL ACTION

The same tests were repeated with cast-iron bars 7 in. in diameter and the same feeds and speeds were employed without harming the tool. It was apparently possible to employ much higher speeds but the lathe was not capable of speeds higher than 363 r.p.m. It was further found that the lead screw thrust bearing became quite hot. This was due to the fact that the feed per minute was very much greater than is ordinarily used and that the pressure was greater than when using the ordinary shape of lathe tool. The entire tests showed very clearly two things: that with proper design of tool it is possible in some way or other to obtain very much higher cutting speeds than have been used so far; and in the second place, that in order to get satisfactory results with a rotary shear tool the lathe should be constructed along different lines.

In subsequent tests, carried out under conditions which were not favorable for making proper records and with considerably reduced depth of cut and feed, a cutting speed of 1,425 ft. per minute was reached. The tests described here have no immediate practical application. They do show, however, that there is a wide field left open for improvements and for increased speeds.

When the rotary tool was used with lower speeds, though still much higher than ordinary speeds go, a very beautiful and glossy finish was produced; but when the extreme speeds were employed the finish showed chatter marks. This might have been expected, for in order to avoid possible burning out of the tail center it was necessary to mount the work rather loosely on centers and depend on some heavy grease for preventing undesirable movement. This heavy grease, however, would melt at the high speeds and leave the work free to chatter.

With a cut $\frac{3}{32}$ in. deep a round nosed tool, or for that matter any other roughing tool used, would have a length of active cutting edge of a little over $\frac{3}{32}$ in. The rotary tool had a length of active cutting edge of more than 12½ in., or more than 130 times as much as that presented by an ordinary tool. This made it possible to do much more work before resharpening was required. Not only was there more length of cutting edge, but no single point of the cutting edge was held for an appreciable length of time in the cut, so that it was not heated up. The little heat it received was dissipated during the large part of the complete revolution when it was out of the cut.

The value of these experiments lies in the fact that they establish the possibility of employing any cutting speed desired, provided it is possible to prevent any point of the tool from heating up beyond the point where the temper is drawn.

At the present time shear tools are used very little, but it is the writer's belief that they could be used extensively to good advantage. A case in which, to the writer's knowledge, they are never used is the boring of holes. Yet it seems that a shear tool might be constructed for that purpose which would have several advantages. Fig. 213 shows such a tool in its simplest form. It is merely a tube of tool steel set at an angle with the axis both in a horizontal and vertical plane. The front end of the tube is ground conical as shown. The advantages of such a tool would be that a cutting compound or oil may be introduced through the center of the tube or, if a deflector were attached to the front end of the tube, the chips might be forced out through the hole. When a part of the tool is worn out a new part can be brought into play by turning it around its axis, and without requiring measuring of the hole or any further adjustments. The grinding or resharpening also would be a very simple matter.

One of the disadvantages would be that, on account of the double angle at which the tool is set, it would not be possible to bore a long and relatively small hole and that even for relatively short holes the tube would have to be of much smaller diameter than the bore of the hole. However, this would not be a serious handicap for holes of relatively larger diameter and short length, such as the bore of gears.

To overcome the disadvantage mentioned, the tool might be constructed as shown in Fig. 214. It would, of course, be equally possible to have a hole through the tool and bar for a lubricant. It would even be possible, under certain conditions, to use a rotary shear tool, though such a tool would not have any particular advantages unless a lathe were constructed with the idea in view of using such tools.

The use of the shear tool in the planer has already been mentioned. It is perhaps the only tool of this class which so far has found practical application. The finish produced on steel by such a planer shear tool is incomparably better than that produced by the ordinary planer finishing tool. It is a very simple matter to produce such a tool out of a square piece of steel. The grinding also offers no difficulties and the writer can see no reason why this tool is not used more extensively except on account of the fact that it is not generally known.

The helical cutter shown in Fig. 215 is nothing else but a shear tool used as a milling cutter. This same tool is shown divisioned and partly in section in Fig. 216. The angle which the spiral makes with the axis is 69 deg., so that the cutter corresponds to a shear tool set at that angle with its direction of motion. Fig. 217 shows an end mill of the same general construction. Unless the depth of teeth should be made quite small it would not be possible to make a spiral of an angle of 69 deg. on an end mill, so that it becomes necessary to use a gentler spiral on cutters of smalled diameters and particularly on end mills.

Using a cutter as shown in Fig. 215 means that there will be considerable end pressure and it was thought at first that this end pressure might be of such magnitude that a single helical mill could not be used for heavy slabbing and that it would be necessary to make such mills interlocked with right- and left-hand spiral. As a matter of fact, the first tests with the helical mill as regards heavy slabbing were made with such interlocked cutters. Later tests showed that the effect of the end thrust was not as serious as was expected. Using a pair of interlocking cutters a cut was taken which required 80 amp. Taking a similar cut with a single helical mill required 85 amp., showing that the end thrust was not of enough importance to bear up with the inconvenience of using interlocking cutters.

One advantage of the helical cutter is that a very fine finish is made, even when the depth of cut is quite considerable. A very beautiful finish could be obtained with a depth of cut of ⅜ in. and even ½ in., using a cutter of 3½ in. diameter.

A second result was that a coarser feed could be taken and yet obtain the same grade of finish as with the finer feed with an ordinary cutter. This is due to the fact that the ordinary cutter makes revolution marks, that is, a ridge for every revolution and not for every single tooth; whereas the helical mill makes a ridge for every single tooth. As a result a three times coarser feed can be used with a helical mill with three teeth than is possible with an ordinary spiral mill.

Still another peculiarity of the helical mill is that there is practically no spring in the arbor. This is due to the fact that the cut is taken crosswise of the piece of work. In Fig. 218-A a piece of work is shown with the ridges caused by the revolution of the cutter. The arrow shows the direction of the feed. If a plain mill were used we would first meet an upward thrust while a tooth in trying to penetrate into the work, as has been explained before, and, unless the depth of cut is quite considerable, this upward thrust remains during the entire cut.

With the helical mill a chip is removed in the direction of the arrow (see Fig. 218-B) and once the tooth has entered, there is no tendency for upward thrust as the angle of rake of the cutter fully compensates for any tendency of the cutter to slide over the work. If we should take a cut with a plain mill or a spiral mill over a piece of steel and then should move the table and the work back under the cutter, we would find that the cutter takes another chip which may be several thousandths of an inch in thickness. This is due to the fact that the arbor has sprung. If, on the other hand, we take a cut with a helical mill we can pass the finished work under the cutter without any chip being taken.

We can feed a piece of work under the cutter and stop the feed when the cut is halfway completed, leaving the cutter to rotate over the work; and if we then throw in the feed again we will barely be able to discover the spot where we had stopped the cutter. This makes such a cutter particularly adapted for cuts where we have to change from horizontal to vertical feed, and where we do not wish to have a mark at the point where this change of feed took place.

All these features speak in favor of the helical mill. However, there are other features which are against it. A helical mill should not be used, in fact, cannot well be used, unless the teeth have considerable rake: 15 deg. having been found to be most suitable. This makes the tooth rather sharp and makes it unfit for cast-iron work or any other metal of a brittle nature. On the other hand, it works particularly well in soft metals and is much to be recommended for slabbing copper. Fig. 219 is a photograph of a copper chip. The smooth appearance of the back of the chip should be noted, as this shows that the metal was not torn up. The chip illustrated here was taken on copper commutator bars with a great depth of cut and very heavy feed.

Another point against the use of helical cutters is the fact that they cannot be used where there is a shoulder sideways in the work; in other words, they cannot be used in gangs for surfaces which adjoin each other.

Altogether, the helical cutter is of limited use but will perform certain functions better than other cutters. It is very well possible, for instance, to run a helical cutter into solid metal and it is actually used for cutting out blocks in the heads of connecting rods.

In general, shear tools have certain advantages and certain limitations not common to ordinary tools. In Fig. 220 a simple type of lathe shear tool is shown. The cut is quite deep and the various points of intersection of the tool with various points of the work are projected, showing that this straight-sided tool will produce a fillet in the work, so that it is not possible to use such a tool for shoulder work. In Fig. 220 radii are drawn to the various points of intersection between tool and work and the tangents at these points are shown by arrows. These arrows, then, represent the direction in which a point of the work approaches the tool. We see clearly that there is a decided shear action at the small diameter, whereas at the large diameter the piece of chip to be removed approaches the tool almost at right angles. This happens to be so because the outside diameter is much greater than the diameter of the remaining or finished part of the metal. In other words, such a tool works only as a shear tool when the depth of cut is small compared to the diameter of the work. If such a tool were used on a piece of work 1 in. in diameter which must be reduced to ½ in., it would have the shear tool effect only at those parts of the tool which are close to the finished diameter. But if a depth of cut of ¼ in. were taken on a piece 4 in. in diameter, all the points of the tool in contact with the work would act as shear tools.

Even though the outside diameter of the piece may not get the advantage of the shear, yet the finished diameter will always have that advantage and a better finish will be produced, though the added advantage of less power consumption will be partly lost. This condition is illustrated in Fig. 220.

Reference was made to shear tools when a shaving tool was illustrated. The foregoing will show why such a tool is really a shear tool. A spiral milling cutter also is a shear tool; but even with an angle of spiral of 25 deg., the effect of the shear is so small that it acts, to all purposes, as an ordinary tool.

Getting Outsiders' Views on the Factory

By Frank H. Williams

In the very nature of things the superintendents, foremen and workers in a plant who are thoroughly familiar with the physical appearance of the plant, the manner of doing the plant's work and the tools and appliances for doing this work, cannot see the opportunities which exist there for shortening processes and saving time and labor. Since this is the case, it does seem as though it would be the best sort of policy for almost any plant to secure the slant of an outsider on the concern's factory activities every now and then.

But with most plants there is no desire on the part of the executives to spend money for expert advice along this line. But there is a way around this difficulty which, it does seem, should be taken advantage of more extensively than is now the case. This method is by interchanging executives and skilled workers from plant to plant, where the plants are not engaged in the same line of manufacture and therefore in no way compete with each other.

Suppose, for instance, that there are three or four, or seven or eight, or more plants in any one city. Suppose that the superintendent of plant *A* goes into plant *B* and there looks through the plant carefully, noticing the way in which the plant puts through its work, and always watching for methods by which corners could be cut and the work speeded up. The superintendent of plant *A* would have a fresh slant on plant *B*. He wouldn't see things in the old familiar way in which the real superintendent of the plant has always looked at them. Extra long benches which make it difficult for workers to pass by would stand out and attract his attention. It would be a simple matter for him to make a note of the long benches, and to suggest that they be cut shorter in the interest of efficiency. He would have an outsider's and therefore a fresher slant on the problems of assembly. He would, for instance, see where production could be speeded up very materially by assembling some classes of work on low-wheeled platforms instead of carrying the job around on wheelbarrows or rolling it from place to place on the round base of the job. He might also see ways of simplifying the records kept in plant *B*, and might suggest other things which would be of real value to plant *B*.

After there had been this exchange of superintendents between the two plants for a period long enough to allow them to look around and see what was what and suggest better ways of doing things, the two plants might exchange foremen for a period of two or three days. If the foremen who were exchanged were live wires who thoroughly understood what was expected of them and who, perhaps, were given a little more incentive by the promise of a bonus for all good suggestions made by them and adopted by the plant to which they were sent, then it would be pretty certain that they would do something worth while.

Gould & Eberhardt Method of Hobbing Worms

Worms Cut with a Hob Having a Broaching Action—Short Hob Permits Cutting Worms Having Shoulders at Both Ends

SPECIAL CORRESPONDENCE

THE screw or worm and its mating gear constitute an extremely ancient combination. The compactness and simplicity of design, and great speed reduction attainable with the use of worm gearing, make it peculiarly applicable to many types of mechanism. When rigidly mounted and properly lubricated, such gearing is noiseless and one of the most efficient means yet developed of transmitting power between shafts lying in different planes.

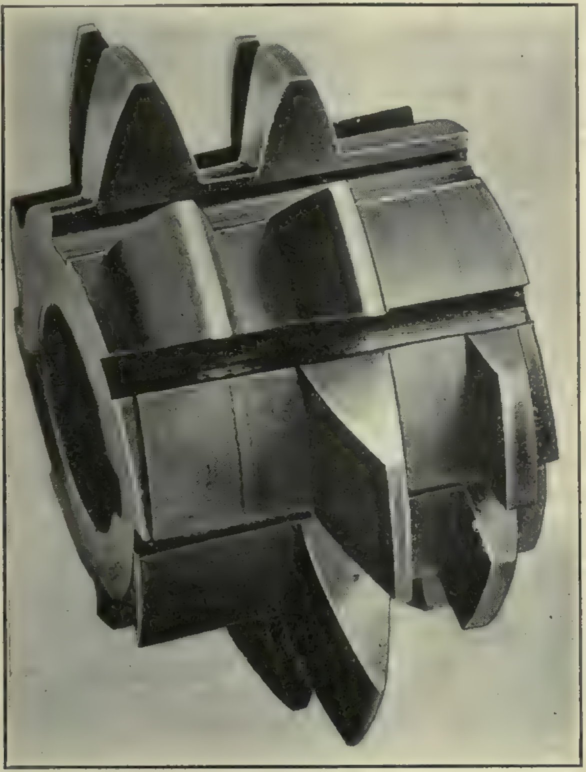


FIG. 1. GOULD & EBERHARDT WORM HOB

Worm gearing has not been used in the past to as great an extent as its merits would seem to indicate. This has been due principally to two reasons: First, the difficulty of producing correct multiple-threaded worms, and worms with an excessive helix angle; second, the inability to successfully produce correct worm gearing of small velocity ratio, approaching one to one.

Most worms are made with helicoidal teeth, and this article will deal with worms having teeth of that contour. The axial plane of a helicoidal worm is a plain involute rack section, and the teeth of the mating gear, at the central plane, will have involute curves thereon, unrolled from the basic rack.

A single-threaded worm having a moderate helix angle, can be successfully threaded in the lathe. The top of the lathe tool used can be set parallel to the axis of the worm or can be set normal to the tooth helix. In the first case, it would be necessary to reverse the worm after finishing one side of the thread, and then cut the opposite side, due to the impractical cutting angles otherwise obtained on a double-sided cutting tool. When a straight-sided tool is set normal to the tooth helix of the worm, a modified form is produced in an axial plane, and the hob used to cut the mating wheel must be changed to correspond.

With the evolution of the machine tool industry and the development of machines which in production far outstripped their predecessors, the process of milling worms with a disk cutter was originated. This method answers very well for single-threaded worms, and is much faster than cutting the threads in a lathe.

To obtain a worm with true helicoidal teeth, with straight sides on the linear or axial section, it is necessary to correct the shape of the disk cutter, owing to the interference of the cutter and the helicoidal surface on the worm tooth. This is done by forming a lead or cast-iron disk to the proper contour, and using it as a template in making the cutter.

If the above process is not employed, the advantage of having a basic rack section and conjugate teeth on the mating wheel, unrolled therefrom, is lost. Such a formed cutter, of course, can only be used to thread worms for which its tooth contours were intended. Worms of different diameters, threads, or linear pitches require cutters made specially therefor.

The Gould & Eberhardt Co., Newark, N. J., after extensive research and numerous experiments, has developed a novel method of hobbing worms. The production of multiple-threaded worms by the lathe or thread-milling process, necessitates intermittent indexing motions, either hand or automatic, with their inevitable resulting inaccuracies. The hobbing method, with progressive and continuous indexing, entirely eliminates this feature.

In the hobbing of worms, either single- or multiple-

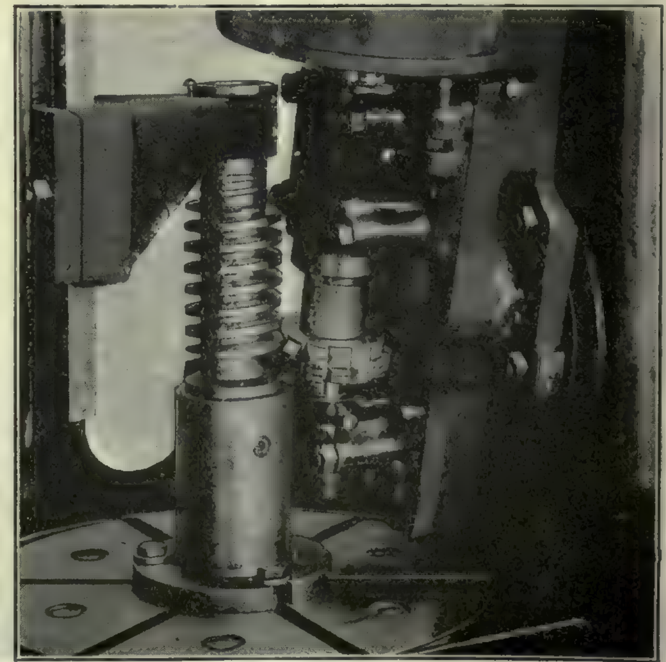


FIG. 2. HOBBING A SINGLE THREADED WORM

threaded, a hobbing machine is used with the gearing ratios throughout so chosen that a velocity ratio of one to one is readily obtainable between the cutter and work spindles and the machine operated just as when cutting helical gears.

One of the novel features of this method of hobbing worms is the helicoidal cutter employed, permitting worms to be hobbed which have a shoulder on either or both ends.

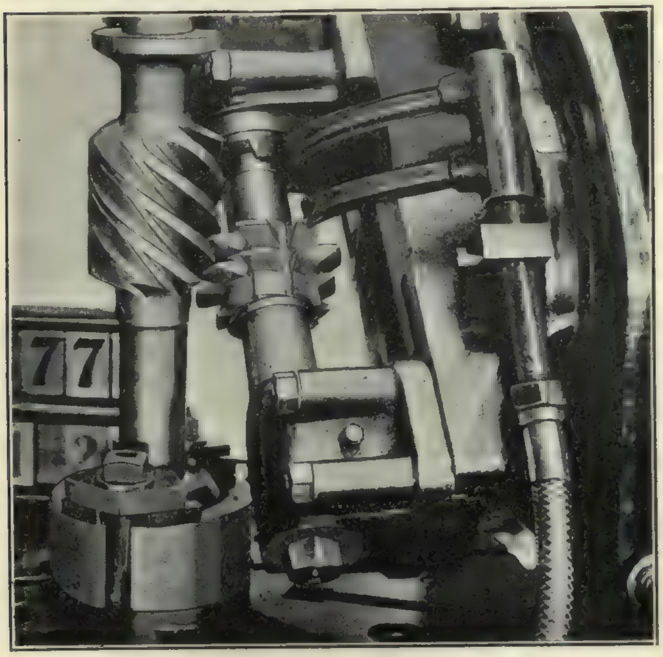


FIG. 3. HOBBING A 7-THREADED WORM

The hob is illustrated in Fig. 1. The teeth are arranged in a helical formation similar to gear hobs. There are about fourteen roughing and three finishing teeth. It will be noticed that there are only about one and one-half convolutions of teeth, thus making this hob much shorter than gear hobs, the length being about twice the normal circular pitch of the worm.

The action of the hob is in the nature of a progressive roughing and finishing operation. The roughing teeth have their tops and sides reduced in regular decrements, starting with the last finishing tooth and ending with the first roughing tooth. This portion of the hob has somewhat the appearance of a spiral. The lowest tooth is made high enough to cut into the periphery of the worm as far as its center line, while each succeeding tooth takes out a little more metal, ending with the finishing teeth which smooth and complete the worm tooth shape. The arrangement of teeth just described and the cutting action secured thereby, make this hob analogous to a broach coiled around a cylinder. The removal of metal is progressive and distributes the cutting action over all teeth.

If the hob is made in the ordinary manner it will be found that the following sides of the hob teeth will, if uncorrected, cut away a part of the worm tooth from the pitch line to the outside diameter of the worm.

This necessitates a different lead on the two sides of the teeth, the leading side being made to the basic load calculated from the normal circular pitch. The following side is recut to a shorter lead, sufficient to clear the theoretical contour of the worm tooth.

When the machine is set up, the middle finishing tooth is centered with the axis of the worm. The roughing teeth lead, and the finishing teeth follow, in the direction of hob rotation.

The production and accuracy attainable with any worm threading process are, to the practical man, the outstanding features by which the merits of a given method are mainly judged.

The production possible with the hobbing method is much greater than is possible with the lathe or disk cutter method. This is especially true of multiple-thread worms, as the machine is geared for the number of teeth, just as in hobbing helical gears. This obviates the necessity of indexing by hand and taking a fresh cut through the worm for each tooth, which must be done with a lathe tool or disk cutter.

The accuracy of worms produced by the hobbing method as outlined results because the cutting action is progressive and continuous and produces accurately spaced multiple-threaded worms which is an essential feature in efficient and successful worm drives. The cutting action is a result of the generating characteristics of the machine and not dependent upon other devices which may be inaccurate or inaccurately operated.

The amount of feed to the cutter and worm blank relatively to each other in an axial direction, is dependent upon the helix angle of the worm. That is to say, the greater the helix angle of the worm with the axis, the less the axial feed.

The hobbing method is also adaptable for roughing worms which are subsequently heat-treated and then ground. In roughing with this system the amount of metal remaining to be removed by grinding is uniform and also the spacing of teeth on the worm is very accurate, permitting a high degree of accuracy in the final grinding.

The fixture for holding the worm blank should be of a very rigid design with powerful means for driving, because the strains on this mechanism are severe. Fig. 2 shows one of the hobs mounted in a gear generating machine, finish threading low-carbon steel worms, single threaded, 2.7 in. pitch diameter, 0.666 linear pitch, with an output of 17 minutes each, floor to floor.

Fig. 3 shows the hobbing of a worm having seven threads.

Machining and Inspecting Transmission Cases

Fixtures Hold Aluminum Cases Without Springing — Drilling and Tapping Operations—Inspection Gages that Insure Accurate Alignment

BY FRED H. COLVIN
Editor, *American Machinist*

THE transmission unit of a passenger car can do much to make or mar its reputation for quiet running. Much depends upon the accuracy of the alignment of the gear shaft and the ability of the transmission case to resist distortion. The latter depends on the design and the material used, but the former is largely a question of fixtures, tools and gaging. The way in which these problems are handled in the shop of the Peerless Motor Car Co., Cleveland, Ohio, is shown herewith.

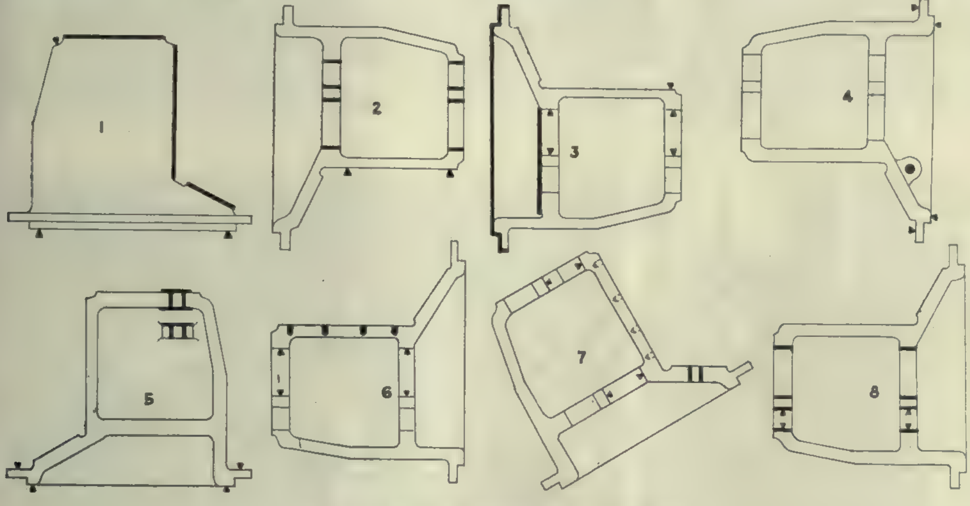


FIG. 1. TRANSFORMATION SHEET

The sequence of operations is shown in the transformation sheet, Fig. 1, the figures corresponding to those of the other illustrations. The first operation is the milling of the ends, tops and the angular surface for the hand plate. These three surfaces are milled at one setting by means of a special cutter head, which carries the three cutters in the proper positions as shown in Fig. 2. The fixture fastens to the head and front slide of the No. 4 Cincinnati milling machine shown. The fixture is made double, as can be seen in Fig. 3, and provides for practically continuous milling. The details are shown in Fig. 4, this illustration being necessary to show just how the case is located and clamped in position. It is positioned from the flange at the three points *A*, *B* and *C*. The clamps are of special interest and are shown in detail in Fig. 4.

The points *A*, *B* and *C* are three levelling points which make a three-point bearing. Points *D* and *E* are adjustable locating points. The screw *E* may be screwed in or out, according to variations in the castings. At the point *D* it will be noted that the lower part of the lever is worked with a spring which forces the casting back to the point *E*, point *E* therefore being the stopping point.

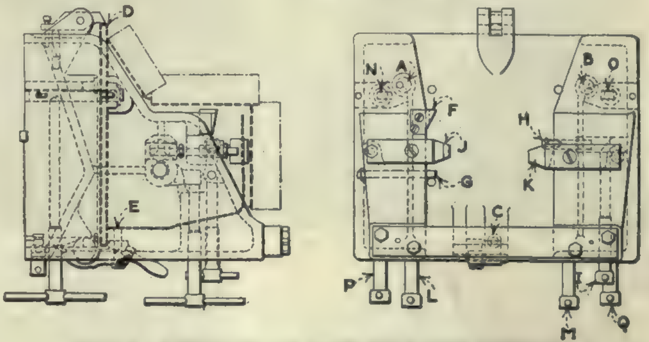


FIG. 4. DETAILS OF THE MILLING FIXTURE

Points *F* and *G* are the side locating points. The casting is forced against these two points by means

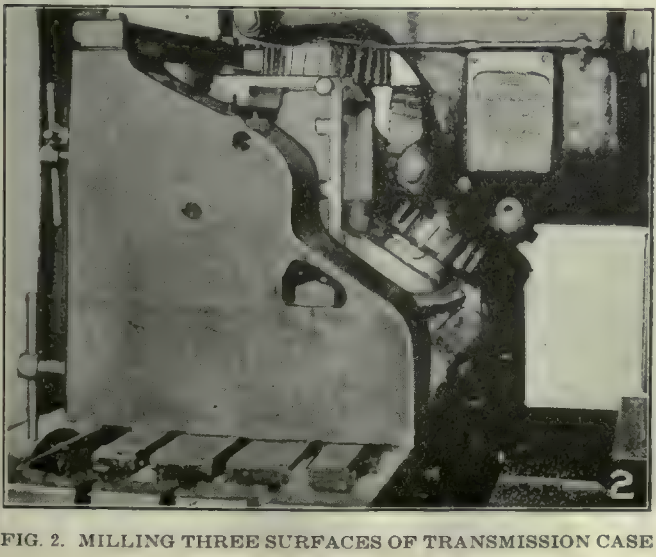


FIG. 2. MILLING THREE SURFACES OF TRANSMISSION CASE

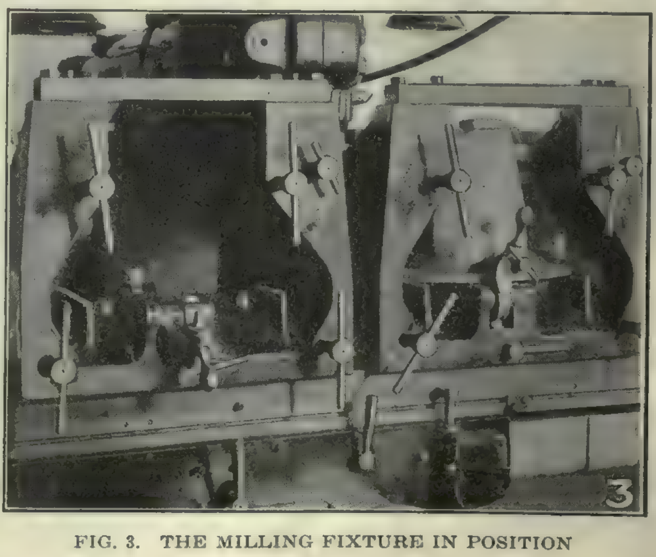
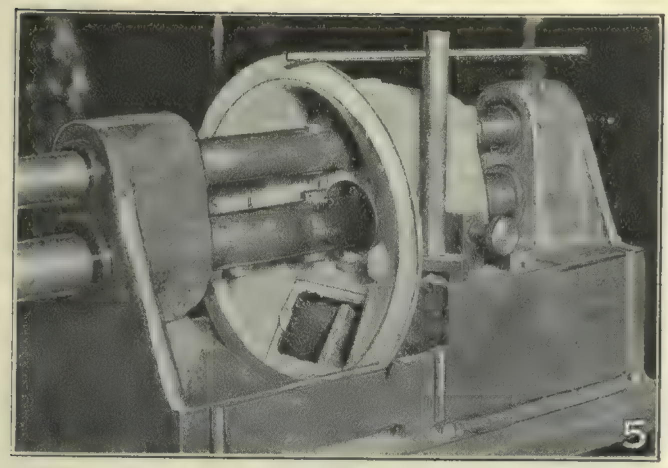


FIG. 3. THE MILLING FIXTURE IN POSITION



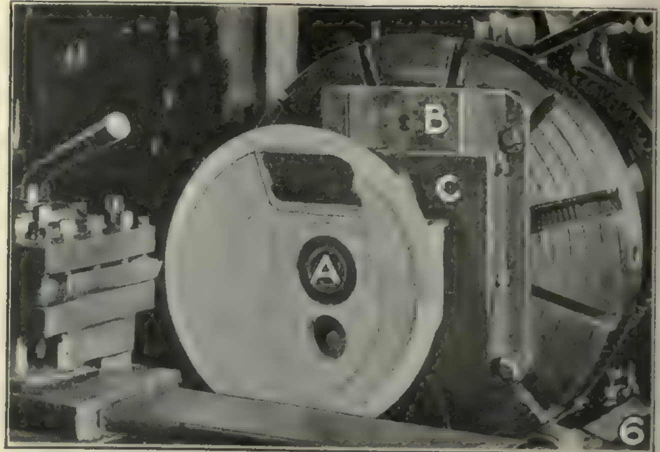
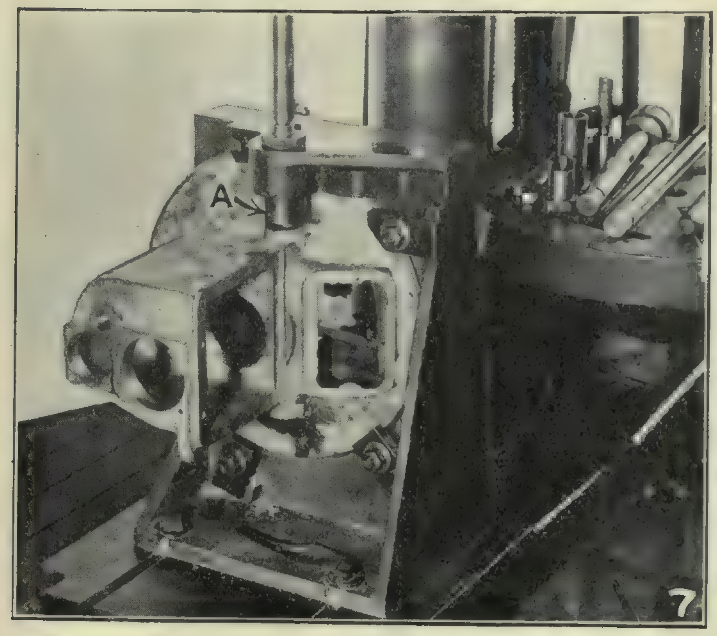


FIG. 5. BORING THE FOUR BEARING HOLES. FIG. 6. FACING THE FLANGE



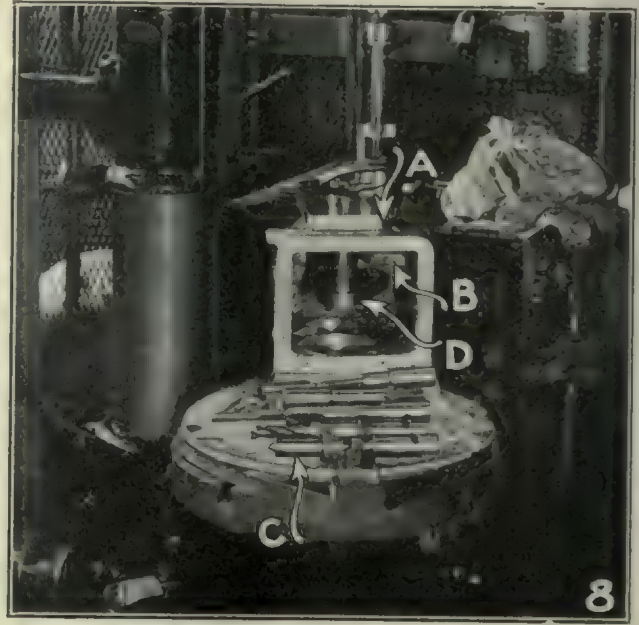
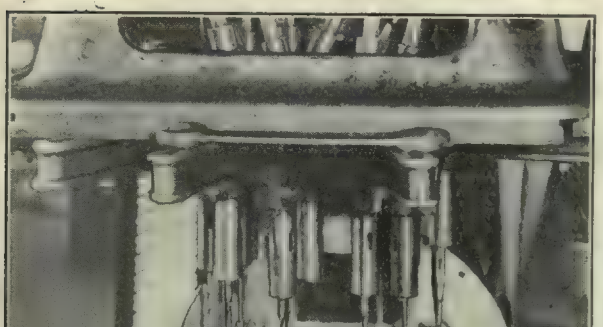


FIG. 7. DRILLING AND FACING CLUTCH SHAFT HOLES. FIG. 8. DRILLING FOR REVERSE GEAR SHAFT



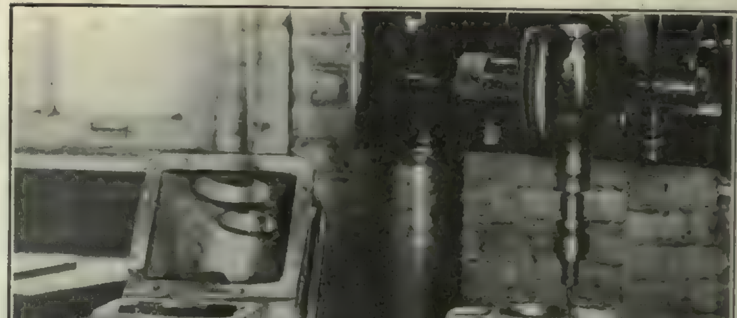
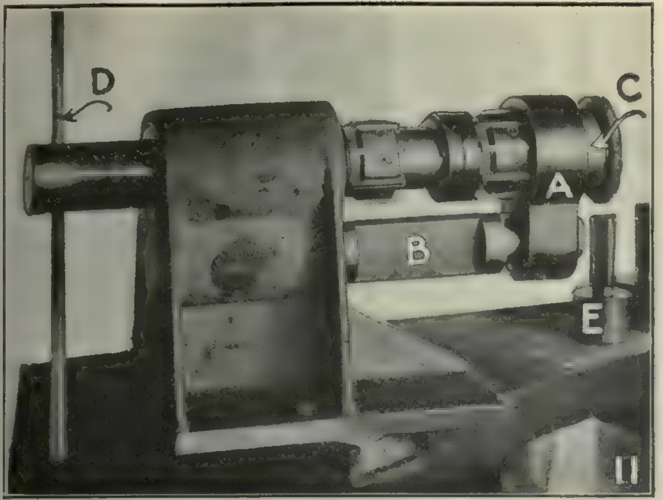


FIG. 9. DRILLING FOR COVER. FIG. 10. TAPPING TRANSMISSION CASE HOLES



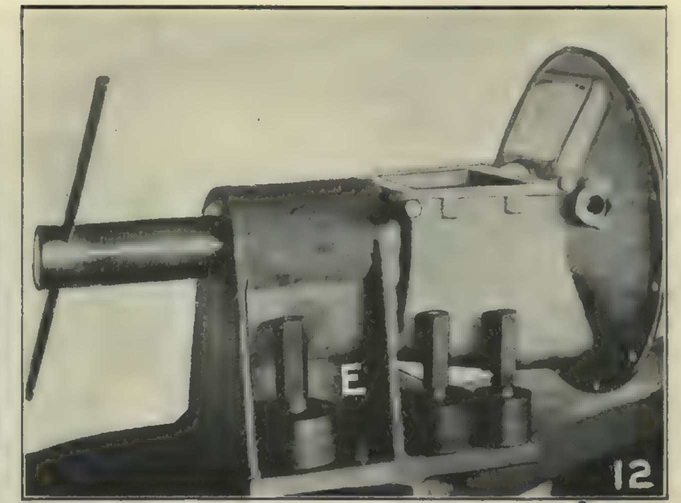


FIG. 11. THE REAMING FIXTURE. FIG. 12. TRANSMISSION CASE ON REAMING FIXTURE

of screw *I* which forces a wedge shaped plunger against one side of the case and the other side against the two points *F* and *G*. The two clamps *J* and *K* are then clamped down by means of screws *L* and *M* pushing a bell crank lever and clamping points *J* and *K* down on to the case. The two clamps *N* and *O* are operated by means of wedge shaped plungers and screws at *P* and *Q*. These four clamps hold the case down in position while the milling is going on.

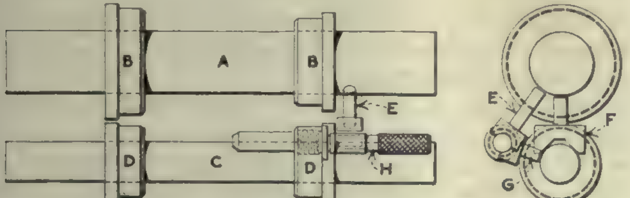


FIG. 13. GAGE FOR LOCATING REVERSE-GEAR HOLES

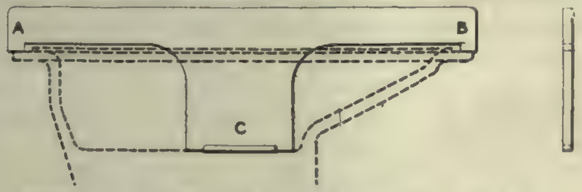


FIG. 14. GAGE FOR LARGE BEARING HOLE

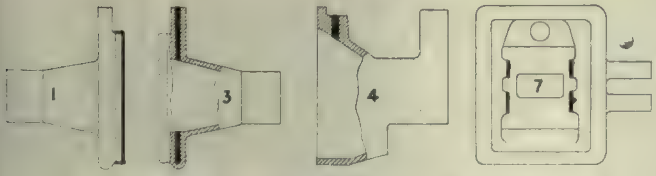


FIG. 15. TRANSFORMATION OF COVER

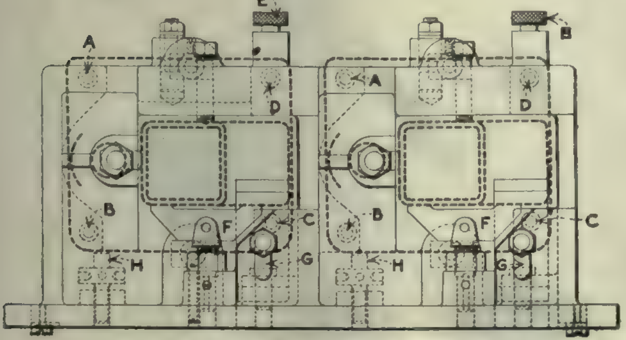


FIG. 17. SIDE VIEW OF FIXTURE

The next operation is to bore the four bearing holes for the shafts which support the gearing in the case. This is done in a special fixture mounted on a Rockford horizontal drilling machine, the fixture being shown in Fig. 5. This fixture guides the boring bars which are driven by the drilling machine. The transmission case is supported by the top or cover surface and located and

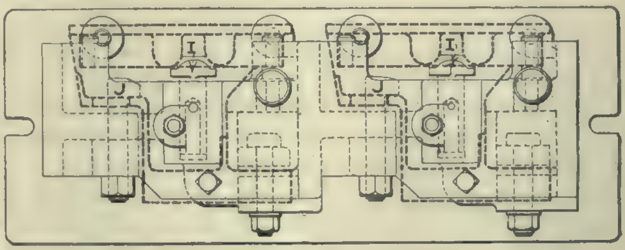


FIG. 18. TOP OF FIXTURE

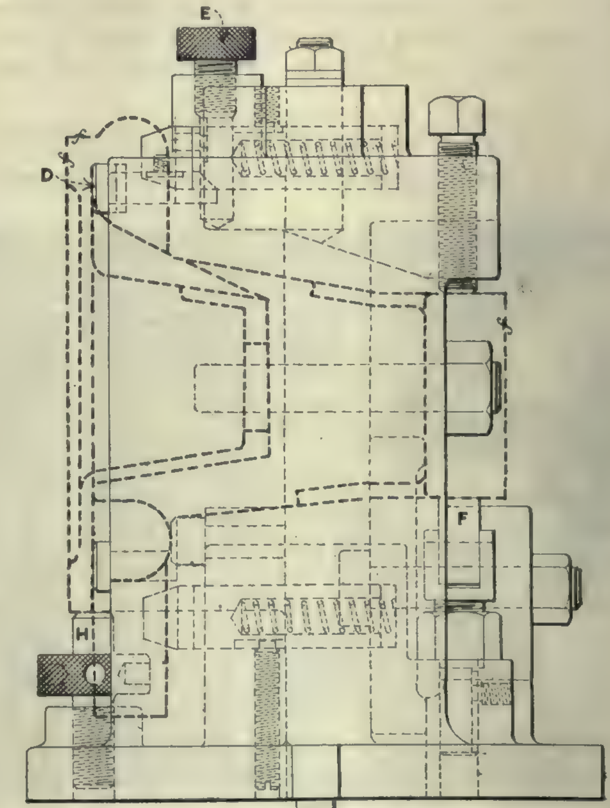


FIG. 19. END OF FIXTURE

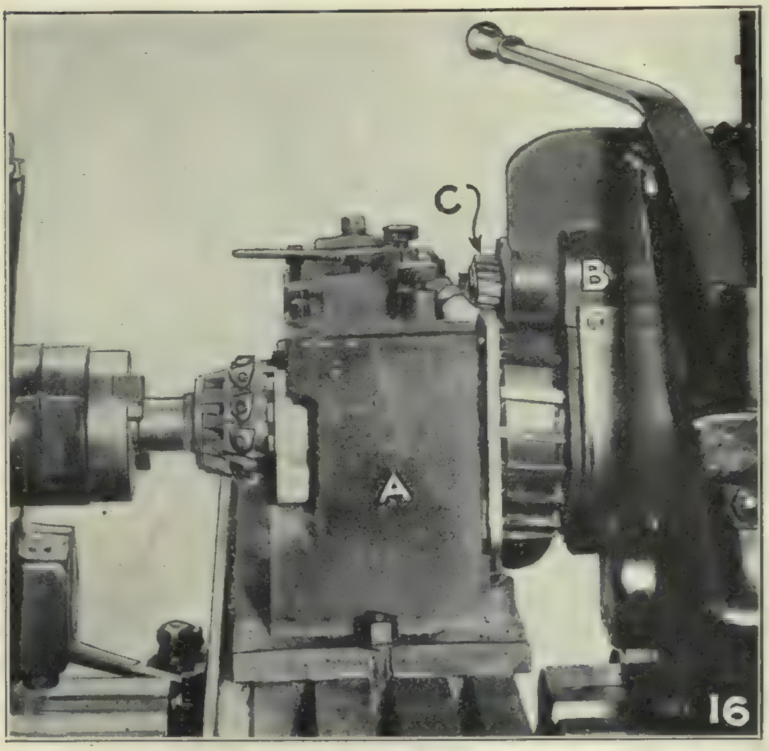


FIG. 16. MILLING ENDS AND FLANGE

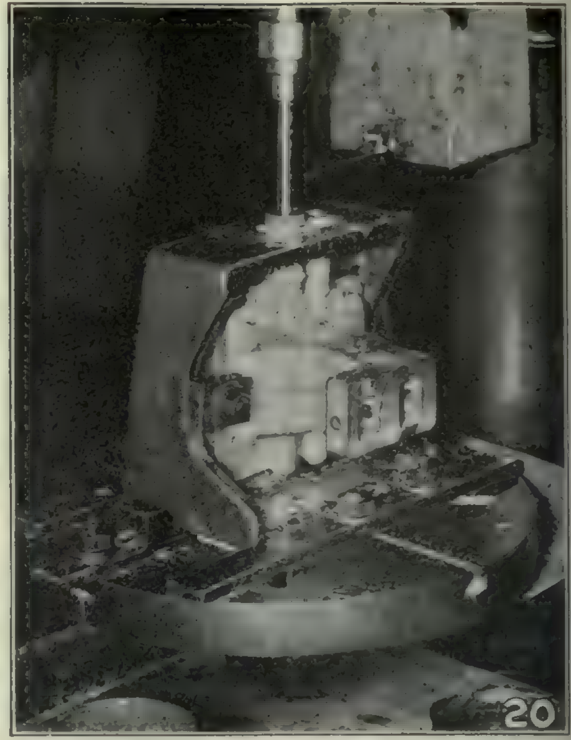


FIG. 20. DRILLING SHIFTER ROD HOLES

held down by the clamps shown. This view also shows the kind of boring cutters used for this work.

Next comes the turning and facing of the bell flange on a 28-in. lathe as shown in Fig. 6. The case is located on the pilot *A*, which fits into the large hole. The flange is faced and turned to the proper diameter and length and then faced off around the center bearing on the inside. The case is then shifted on the fixture *B*, which is bolted to the faceplate, by moving the slide *C* so as to bring the lower hole in the center position. The surface around this hole is then faced off in a similar manner and the case is ready for the next operation.

Drilling the crosshole for the clutch shaft is accomplished on the 21-in. Cincinnati drilling machine as in Fig. 7. The housing is clamped to the angle plate shown, the flange locating it so that the hole will come in the proper position with relation to the bushing *A*. The method of locating and clamping can be very clearly seen from the illustration.

The reverse shaft hole is drilled with the fixture shown in Fig. 8. The flange of the housing is clamped to the table and the drilling bushing is carried in the block *A* located on the end of the transmission case by means of the holes already bored. In drilling the hole in the projection *B*, the drill is guided by the long bushing *C* which supports it clear to the point to be drilled. In reaming and spot facing, the reamer and cutter bar are guided at the lower end by a suitable bushing in the plate *D*. The drilling of the holes for the transmission case cover is done in the box jig shown in Fig. 9, under a Baush multiple spindle drilling

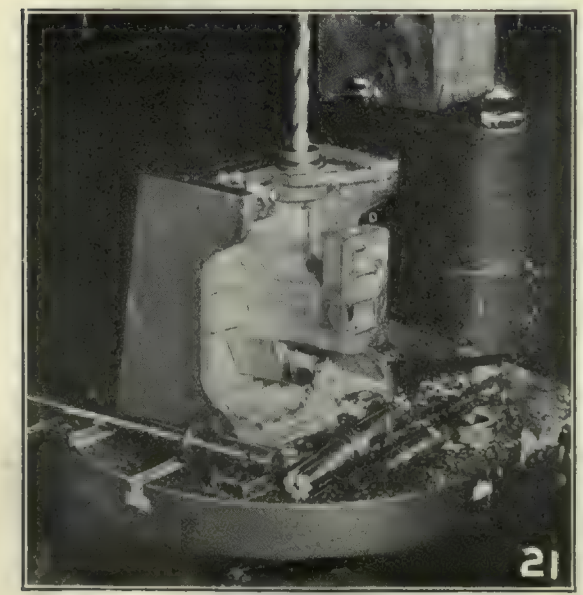


FIG. 21. DRILLING THE CROSSHOLES

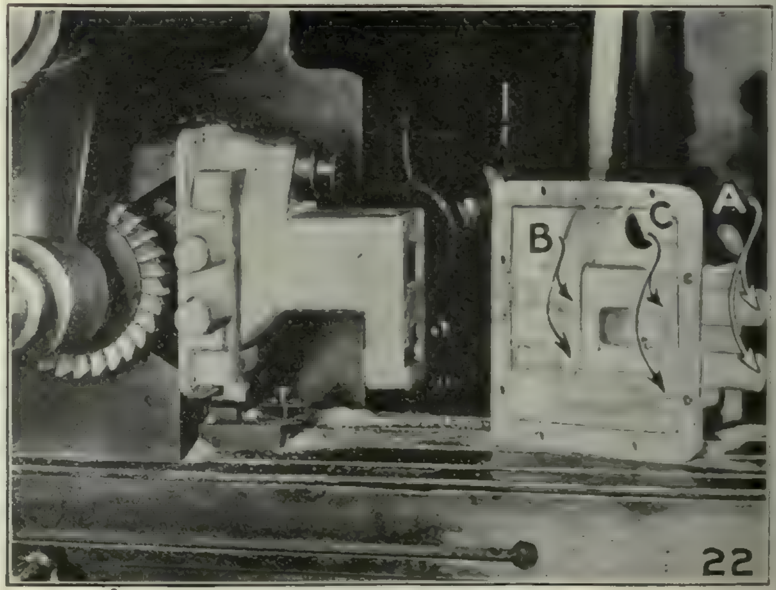


FIG. 22. FACING THE BOSSES

machine. There are eleven holes in all. The two holes for the hand hole cover, are drilled in a similar way, but in a different fixture.

There are numerous holes to be drilled in the flange and in both ends, as well as drilling and tapping the two ½-in. holes in the bottom of the case and spot facing the twelve flange holes and the hole for the clutch shaft.

Then comes the tapping of the various holes in the case, twenty-nine in all, twenty-four of them being ⅜-in., sixteen-thread, holes. These holes are tapped on a Rickert-Shafer tapping machine of large size, as shown in Fig. 10, which also shows the types of fixtures used, the one at the left being at the proper angle so as to tap the hand-hole plate square.

Next comes an inspection and line reaming operation as shown in Figs. 11 and 12. The hand reaming fixture is shown in Fig. 11, the binder *A* being removable so as to allow the transmission case to be slipped in place as in Fig. 12. The binder is placed in the position shown, so as to insure that the reamer will be guided parallel with the lower holes, which are located over the plug *B*. The bushing *C* guides the outer end of the reamer which is turned by hand, by means of the bar *D*. The plug gages are shown at *E*. An interesting gage for checking the location of the holes for the reverse shaft, is shown in Fig. 13. The bar *A* with its sliding collars *B* and *B*, fits in the upper hole and the bar *C* and collars *D* and *D*, in the lower hole. Projecting from *A* are the V-blocks *E* and *F*, while a third V-block *G*, with these collars in place, verifies the location of the hole for the reverse shaft. The plug *H* tests the location of the hole for the reverse gear shaft with relation to these holes as also the tap holes at the outer end as can be seen at the right or end view.

The gage shown in Fig. 14 tests the location of the face of the large bearing from the end of the bell flange of the transmission case. The outer ends *A* and *B*, fit over the bell flange, while the projection *C* tests the surface of the large bearing-hole boss, as can be seen.

THE TRANSMISSION COVER

The transmission cover which carries the shifting lever and the rods and forks that operate the transmission gears from one position to another, has a number of interesting operations. The transformation sheet is shown in Fig. 15 and the principal operations follow:

The first machining is shown in Fig. 16, the cover being held in the fixture *A* so as to leave both ends free. The machine used is an 18-in. Cincinnati duplex milling machine with a special attachment at *B* for driving the third cutter *C*. This cutter mills the upper edge which becomes a locating point for future operations.

In Fig. 17 is shown the construction of this milling fixture. There are three fixed seating points, *A*, *B* and *C*, while the fourth point *D* is adjustable by means of the screw *E*. Details of this can be seen in Fig. 19 which shows the use of steel pins having angular points. The lower side of the casting is supported by the equalizer *F* while the flange rests on the point *G* and the adjustable stop *H*.

The other clamping methods are shown in Fig. 18, which gives a plan view and shows how the cover is centered sidewise, by means of the wedges *I* that fit between the shifter fork rod. Fig. 18 shows the hook bolts *J*, which hold the case firmly against the flange stops, *A*. *B*, *C* and *D*, Fig. 17. The three views show the construction very clearly.

Drilling the holes for the shifter fork rods is shown in Fig. 20. The cover is held against the milling surface on the angle plate shown. This operation includes drilling, reaming, spot-facing, and tapping two holes about $\frac{11}{16}$ in. in diameter. Two $\frac{13}{16}$-in. crossholes are drilled, faced and tapped in a similar manner, and on a similar fixture to that shown in Fig. 21. The bosses on the inside of the case are then faced with a pair of milling cutters as shown in Fig. 22, the front cutter facing the outer end of the projection at *A*, while the other cutter mills the inner surfaces at *B* and *C*.

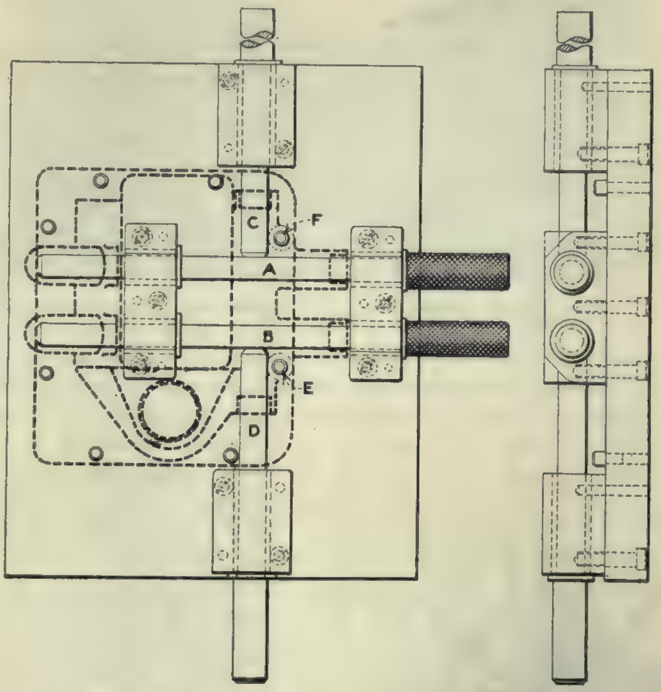


FIG. 23. GAGE FOR SQUARENESS OF HOLES

The gage used for checking the squareness of the holes, with relation to the bottom flange of the cover, is shown in Fig. 23. Bars *A* and *B* slip into the shifter fork rod holes, and *C* and *D* into the crossholes. As the transmission cover is located by dowels through the holes in the flange as at *E* and *F*, the squareness is easily tested.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Milling Peripheral Cams on a Lathe

By Ethan Viall

Where a comparatively few cams are to be machined at infrequent intervals, it doesn't pay to buy a special cam-cutting machine. In the shop of Wappat Bros., Pittsburgh, Pa., a lathe has been fitted as shown in Fig. 1, to mill some large peripheral cams of irregular outline that must be accurately machined. In this illustration, the cam to be milled is shown at *A*, and two master cams at *B* and *C*. The object of using two master cams is to steady the work and the cutter spindle. As can be seen, the master cams are so placed as to have one on each side of the lathe cross-slide where they come in contact with rolls on the cutter spindle. The cutter spindle is driven by means of gears from the belted pulley *D*. The master cams and the cam to be machined are driven from the lathe spindle, which is set to run at its slowest back-geared speed. As the work slowly revolves, it is milled by the cutter *E*.

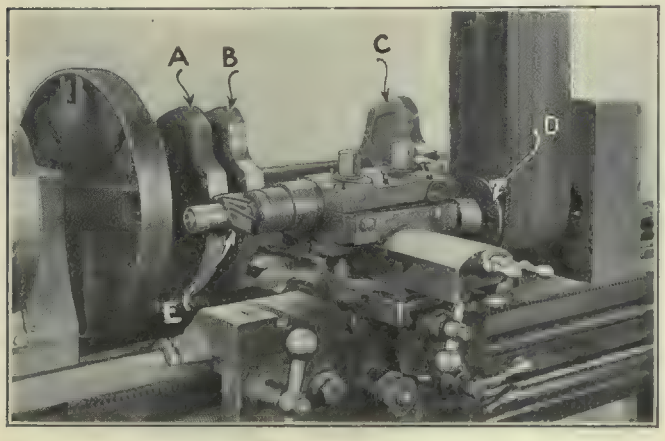


FIG. 1. LATHE FITTED FOR MILLING PERIPHERAL CAMS

A back view of the apparatus is given in Fig. 2. This illustration shows how the master-cams are kept in constant contact with the cutter-spindle rolls *F* and *G*, by means of the weighted cable *H*, which runs over the grooved pulley *I*. The whole apparatus is so made as to be easily removed from the lathe.

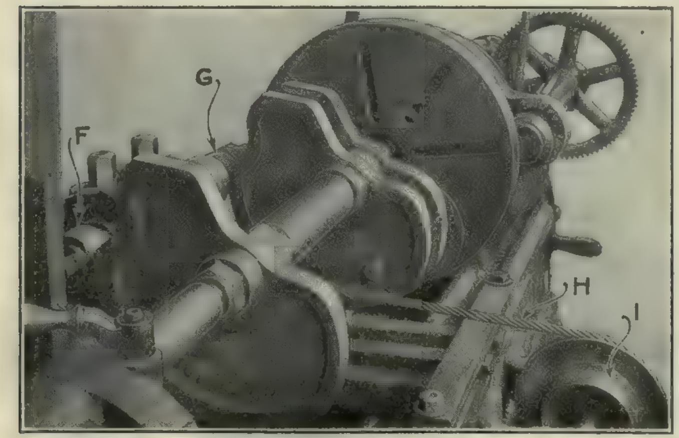


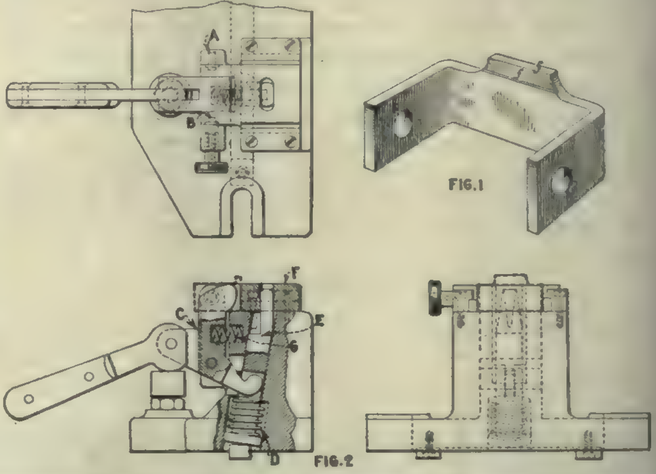
FIG. 2. BACK VIEW SHOWING MEANS OF KEEPING MASTER-CAMS IN CONTACT WITH THE ROLLS

Milling Fixture with Floating Clamp

By Lester Ferenci

We were recently called upon to design a milling fixture to finish surfaces of the stamping shown in Fig. 1. Ordinarily a simple fixture clamping against the inside surface of the part would have served the purpose, but we had a very accurate dimension between one finished surface and the center line of the holes to contend with, and the necessity for having the other finished surface absolutely parallel with some center line.

The clamping device had to be so designed that it would adjust itself to hold irrespective of any variations in the distance between the center line of the holes and the clamping faces. This obstacle was overcome by designing the fixture shown in Fig. 2. I may add that this fixture has been giving satisfactory service ever since it was made up.



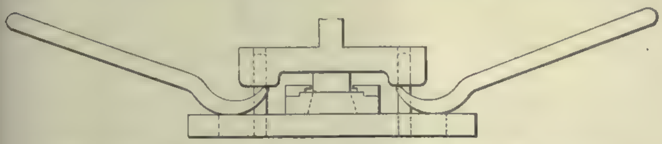
FIXTURE FOR LOCATING AND HOLDING PECULIAR PIECE FOR MILLING

The operation of the fixture is as follows: When loading, the part is slipped over the stationary gage pin *A* and the other hole located by the spring plunger *B*. When the cam lever is tightened it tends to close the clamp *C*, rotating the tail of the clamp downward. The spring *D* pushes the plunger *E* downward, which in turn brings the clamp block *F* against the face of the work, whereupon clamp *C* closes against it. The slot in the plunger for the tail of the clamp *C* is made long enough to allow a distance of about $\frac{1}{16}$ in. between the top of the slot and the tail of the clamp, thus allowing the clamp block *F* to close against the work before the clamp *C* comes in contact with it. When the cam is released, the spring *G* forces the clamp *C* away from the work, which movement lifts the plunger and opens the clamp block *F*.

A Handy Tool for Taking Dies Apart

By Chas. Kanderer

The accompanying sketch shows an ordinary set of press tools with the punch and die in place; also a very handy tool for taking them apart, which can be made at a very small expense. The cost of this tool will be saved in a short time and the disfiguring of dies by the use of a hammer will be eliminated.



TOOLS FOR TAKING APART A LARGE PUNCH AND DIE

The sketch needs no explanation. It can readily be seen that great leverage can be attained by this tool as well as a lift of from one to four or six inches as desired.

In large sectional blanking or forming dies its use is invaluable owing to the trouble experienced at times in taking them apart as the corners have a tendency to bind. The tool is ordinarily made of square iron or cold-rolled steel.

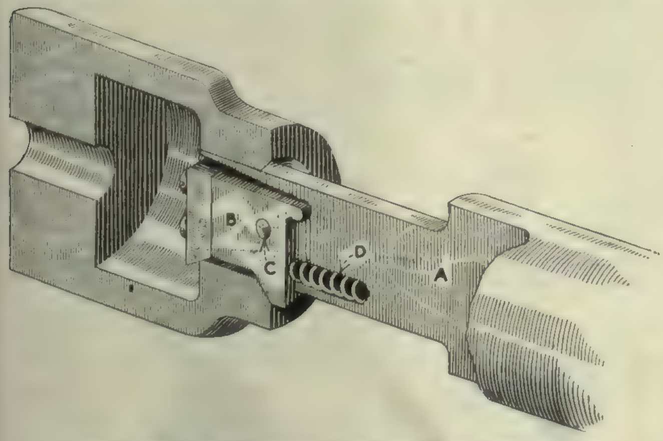
A Chamfering Tool for the Turret Lathe

By Harry Moore

The tool shown in the accompanying sketch may be useful to some of your readers who find it necessary to chamfer the inner edge of a reamed hole. The work is a small casting of iron, used in the manufacture of electric lamps. The requirement is a reamed hole having a slight conical seat or chamfer on both ends.

The pieces are machined in an ordinary screw machine and are chamfered on the outer end with the tool that bores the hole previous to reaming. The inner end is chamfered with the tool as described below.

The shank *A* is turned to fit the turret at one end and slotted at the other for the tool *B*, which is in two parts, only the cutting end being of tool steel. This allows the part to be renewed cheaply. The tool is pivoted on the pin *C*, and a hole is drilled in *A* for a spiral spring *D*. With the turret set to a stop, the tool is fed into the hole in the work, and when it strikes the part already chamfered, it forces the cutting edge down on the inner corner.



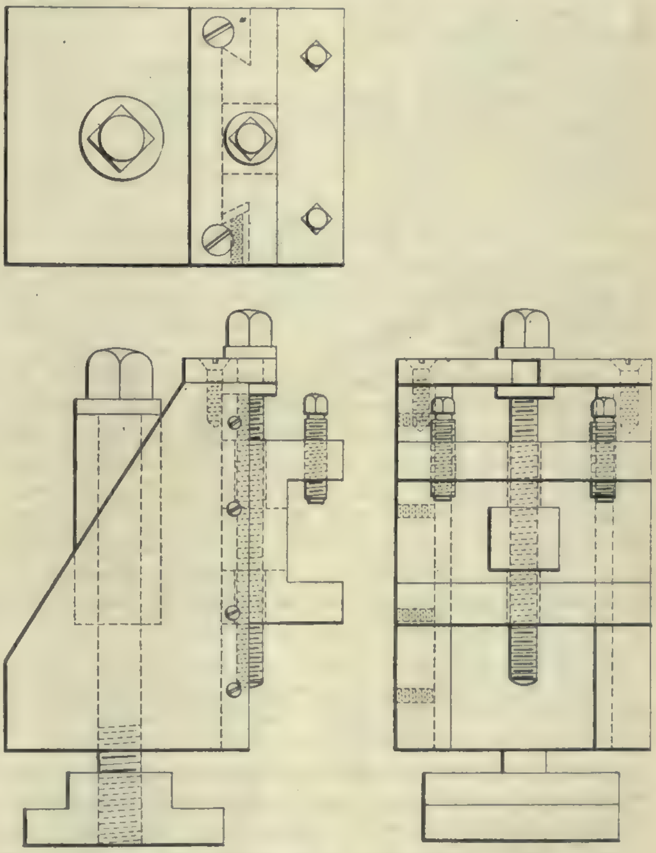
TOOL FOR CHAMFERING INNER END OF HOLE

Adjustable Toolpost for a Lathe

By H. L. Wheeler

This toolpost was designed by the writer for some very old lathes having a high toolpost and was later modified to suit more modern lathes.

The old lathes stood a much heavier cut with this toolpost, and it also was of advantage in boring with the Armstrong type of barholder, which could not be used at all with the old tool post. It can readily be set to any angle without disturbing the tool setting.



ADJUSTABLE TOOLPOST

The main body is made of cast iron. All other parts are made of steel except the nut, which is made of bronze. The binding screw and the adjusting screw are made of tool steel, and the tool support of machine steel, pack hardened.

Using a Rope to Join Link Belt

By L. Reichold

The little trick illustrated in the sketch might be appreciated by a man who is not in possession of a chain clamp or who has the job of joining a sprocket chain over the sprockets single handed. The principle involved is that of the block with moving sheaves. A piece of rope, possibly greased, is the only tool required.

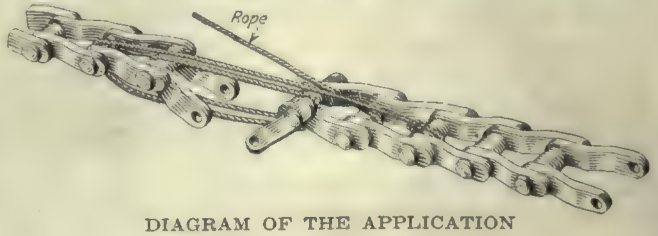


DIAGRAM OF THE APPLICATION

Support Your Cutting-Off Tool Solidly

By A. J. Cawse

John P. Wheeler, in his article on page 881, Vol. 54, leads off by stating that he has noticed the difficulty the average toolmaker has in using a cutting-off tool in a lathe and he relates his experience in finding a remedy. I will narrate an early experience of mine in the same line, and tell what I found out.

Just twenty years ago I walked into a fine toolroom as a brand new journeyman toolmaker. The first job that was handed me was the making of twelve large milling cutter blanks about 5 in. in diameter. It seemed like a simple job; all I had to do was to cut the disks off the bar, face 'em off, drill, bore, recess the hole—all dead easy. The toolroom was crowded and the only available machine was an old Brown & Sharpe lathe—12-in. swing, I think, very light for the job. I chucked the bar, centered it and drew up the tailstock center. Then I secured a cut-off tool with a blade about 2 in. long and $\frac{3}{16}$ in. wide, set it in the toolpost to the proper height and was ready to begin work. Up to that point I had lost no time.

I threw in the back gears, started the machine and proceeded to attack the work. Trouble was immediate. The tool dug and jumped, slipped and stuck. I tried pulling the belt by hand with little better results. After stewing around for about an hour with practically nothing done, I happened to glance at an old-timer with white whiskers, who was doing the same kind of a job that I was trying to do. He was sitting down to his work allowing his cut-off tool to feed in by power while he was feeding plenty of oil to the tool.

He had rigged up just as I had *only* he had a piece of sheet tool steel, on edge, wedged under the blade of his cut-off tool. The sheet steel piece rested on the top of the cross-slide and furnished a solid support for the tool. I wasted no further time—I made up a sheet steel piece and fitted it under my cut-off tool and my troubles were at an end. Many times since that day I have passed along the trick to toolmakers who were sweating over their cut-off tools.

Combination Press Tools

By Frank W. Curtis

The accompanying illustrations show a set of combination blanking, forming and piercing tools which are somewhat unusual and vary from the average style of such tools.

In Fig. 1, *A* shows a piece of work to be made of No. 29 gage tin. A glance at this part will show the operations which are to be performed.

Fig. 2 shows the die in an open position. The stock is fed into position against the stop *B*. The punch *C* blanks the stock to size as it passes through the die *D*. The stock is held by an upper pressure ring *E* and lower pressure ring *F* which avoid wrinkling during the forming process. The forming die *G* is held in position by coil springs which transmit the pressure through pins *H*. This spring pressure must be strong enough to hold *G* in the position shown until the work is completely formed, then as the punch travels downward the forming die *G* is carried down, allowing the piercing punch *J*, which is held stationary in the die shoe, to pierce the $\frac{3}{16}$-in. hole as it passes through the die in punch *K*.

The die is shown in a closed position in Fig. 3. The ejector *L* is shown in the upper position and when the punch is raised, throws out the pierced portion of the work. The work is ejected by means of the ring *F* against the flanged portion. In using ribbon stock the stop *B* locates it from the hole left by the blanking operation.

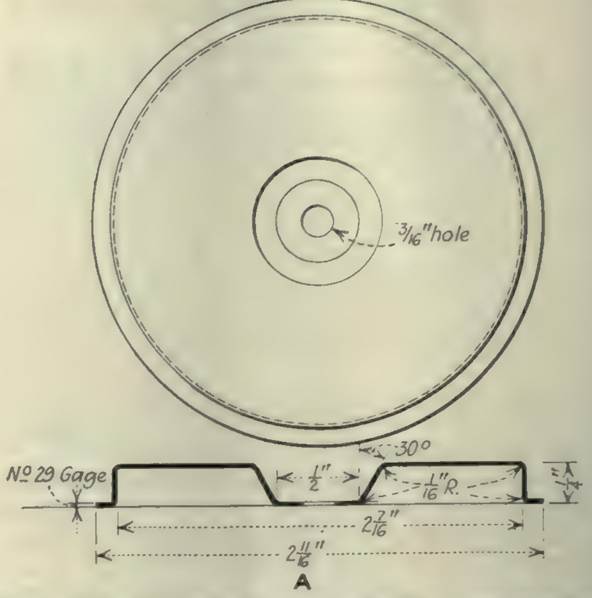


FIG. 1. WORK TO BE BLANKED, FORMED AND PIERCED

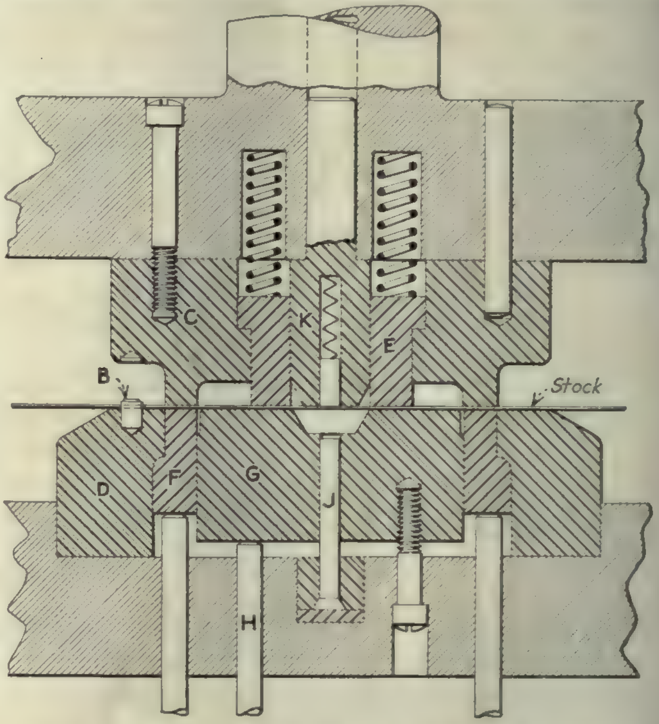


FIG. 2. SECTION OF PRESS TOOLS IN OPEN POSITION

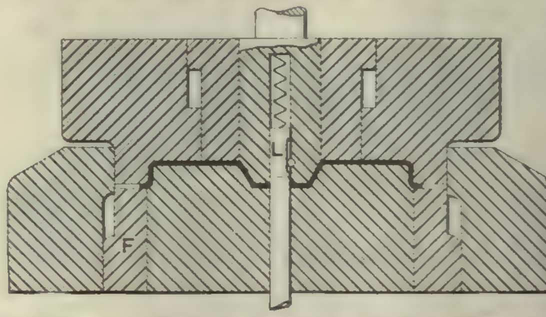


FIG. 3. SECTION OF PRESS TOOLS CLOSED

Re-Turning a Large Crankpin

BY A. JOHNSTON

The illustrations show an extremely interesting job in the shape of re-turning a large crankpin with a broad faced turning tool and apparently proving conclusively that this method can be employed on almost any crankshaft of ordinary dimensions.

The tool shown was made by the Sawyer-Weber Tool Manufacturing Co., Los Angeles, Cal., and is similar in design to the ones made by the company for turning automobile crankpins. The crankpin illustrated, however, is 11 in. in diameter and 12 in. long.

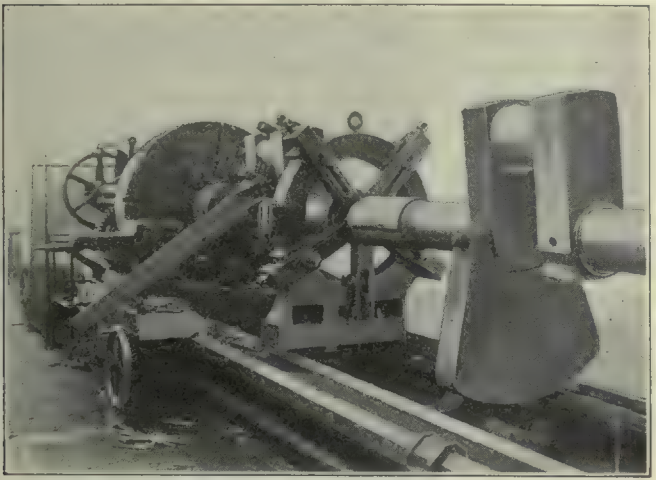


FIG. 1. RETURNING 11-IN. CRANKPINS

Owing to the fact that the pin was badly grooved as well as being out of round, it was necessary to reduce the diameter about ⅛ in. in order to secure a perfect pin. This made it necessary to guide the handle of the tool in order to make the pin square and bring it in line with the journal bearings. The tool was about 11 ft. long over all and the handle naturally moved sideways at the beginning. But by guiding it so as to correct the irregularities, the handle moved in a vertical plane only while the finishing cut was being taken.

The crankshaft belonged to a 4,000-hp. oil engine used by one of the large irrigation companies for supplying water to the farms in their district. The engineers in charge considered various means of re-turning this crankpin, but, after carefully considering the matter, it was decided to use the tool shown.

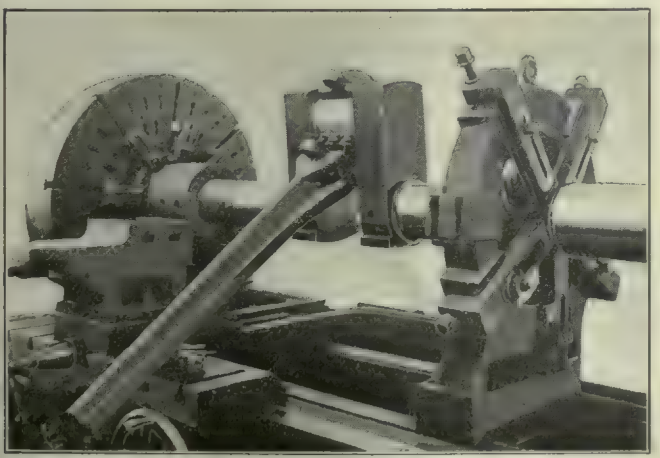
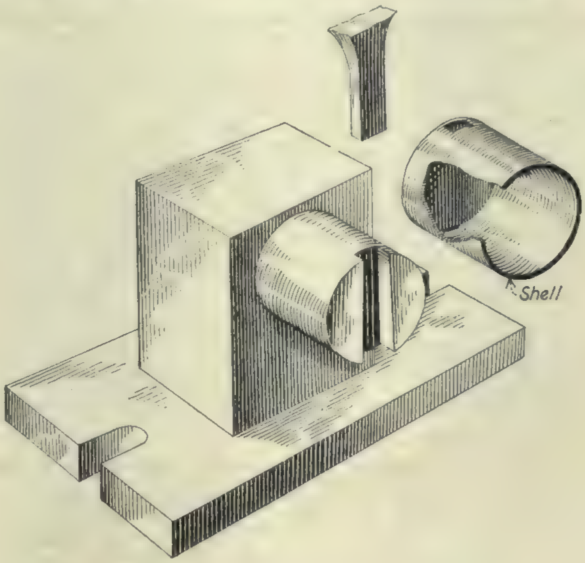


FIG. 2. A CLOSE VIEW OF THE TURNING TOOL

Slotting Shells Flush With Inside of Bottom

BY H. R. HOLBROOK

It is often desirable to punch shells on the side, flush with the inside of the bottom, and this can readily be done by placing the shell on a horn die with an open slot in the end as shown in the sketch; the bottom of the shell acting as one side of the die and giving a clean slot without throwing up a burr on the outside of the shell.

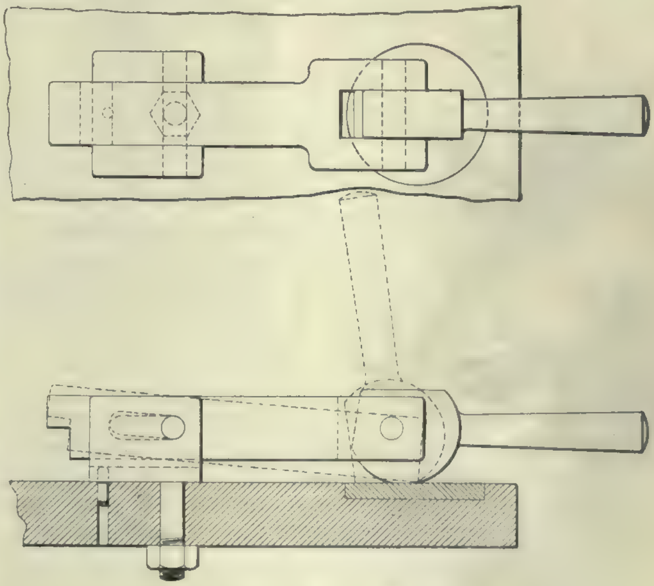


SLOTTING WITH AN OPEN END DIE

Quick Acting Jig or Fixture Clamp

BY C. J. HARTMANN

The accompanying sketch shows clearly a practical and simple clamp for use in a jig or fixture where quick action and a firm grip of the work are of prime importance. The drawing needs no description, as both locked and unlocked positions of the clamp are shown. The proportions should be made to suit the requirements of the work upon which the fixture is to be used.



QUICK ACTING CLAMP

IN THIS ISSUE

MASSES rotating at high speed must not be out of balance, for very obvious reasons, so much attention has been given toward the design and development of balancing machinery and to the working out or balancing methods. In the first article of this issue, "Balancing High-Speed Rotors," A. Schein explains what he terms a very simple method that can be used when the number of elements to be balanced is small. He tells of some very big rotors, for example one weighing 58,000 lb., to run at a normal speed of 1,150 r.p.m., balanced within ¾ oz. on a 4-ft. radius. Mr. Schein says that the remaining unbalance was equivalent to shifting the center of gravity not over 0.00004 in. and that the centrifugal force in this unbalance, running at 1,150 r.p.m., was 84 lb. There are many other statements just as unusual and just as interesting. The article is somewhat out of the beaten track and for that reason, if no other, should prove attractive.

Very meaty is this week's installment of Tool Engineering, beginning on page 226. It is the second dealing with the design of milling fixtures and is a treatise on the subjects of locating and supporting work, special forms of clamps, methods of clamping, locating points, applications of the lever, the design and use of the hook bolt, and others. It is gratifying to note that the authors call attention to the necessity, in design, of paying attention to making all parts of the fixture easily accessible for the purpose of cleaning. Not only do they point out the value of this feature, but their own examples always provide for it. The fixtures being described and the points being covered are becoming more complex as the series moves on. We are glad that we have noticed no abatement of interest among our readers.

Coming Features

An article of importance in our next issue will be the first of a short series, "Incentive or Production Basis of Wage Payment" by Henry H. Farquhar.

There will be another of the plant design series by Colvin, this one showing the layout of the Foote-Burt plant.

We expect to run next week the first of three articles by I. W. Chubb, Editor, European Edition, on Machining the Wrigley Automobile Transmission Gear.

The series now under way will be continued, next week's issue including the second of Leach's Organization and Management of the Small Shop; the fifteenth of Tool Engineering (Dowd and Curtis), and the nineteenth of Modern Production Methods (Basset).

There has recently been some discussion as to how good present-day mechanics are, and we have seen the statement that there are no real mechanics now being made. Of course, whether or not this is true depends to a large extent upon the definition of a good mechanic or a real mechanic but we venture to say that in the several plants whose apprentice or training courses we have described there are many real and good mechanics being turned out. Many of these articles on apprenticeship and training have been written by J. V. L. Morris. His fourteenth is in this issue, beginning on page 131. It details both the apprentice and training courses in use at the plant of the Winchester Repeating Arms Co., New Haven. This article is of particular interest because it tells how a company which had been devoting all its efforts to manufacturing a very special product has reorganized its personnel and is training its executives, foremen and workmen to take up a line of manufacture almost entirely different.

We unhesitatingly recommend the thirteenth of A. L. De Leeuw's series on Metal Cutting Tools, which begins on page 134. To us it is probably the most interesting of the group. It is devoted entirely to shear tools. It does not confine itself to recapitulation of what is already known about shear tools and what has been done with them, but what is equally important, indicates some of the future possibilities. After furnishing the results of a number of tests Mr. DeLeeuw says "the value of these experiments lies in the fact that they establish the possibility of employing any cutting speed desired, provided it is possible to prevent any point of the tool from heating up beyond the point where the temper is drawn" and further that "at the present time shear tools are used very little but it is the writer's belief that they could be used extensively to good advantage."

Gould & Eberhardt are now introducing a method of hobbing work that employs a hob on which the arrangement of teeth and the cutting action secured thereby, make it analagous to a broach coiled around a cylinder. The article starts on page 141 and includes illustrations of the hob and set-ups.

Colvin, page 143, tells of the machining and inspection methods used by the Peerless Motor Car Co. in producing its transmission cases. The article is a continuation of the automotive group begun months ago.

The Stevenson Gear Co., of Indianapolis, Ind., has recently completed the design of a multiple-gear shaper, which introduces innovations in cutting spur gears. This machine is described on page 154.

EDITORIALS

The German Reparations

IT is an unfortunate truth that most persons consider the problem of the German reparations as purely a political one which does not concern engineers, industrials nor those engaged in international commerce. There is probably no other group of persons so directly interested in the affair as the three mentioned.

As a pure problem of engineering, there have been few in the history of the world so great as that of reconstruction of northern France. An enormous amount of money must still be expended to replace the physical property, including the industrial establishments, mines, houses and public work. There are many estimates of the cost of this work but it is sufficient to say that it will be thousands of millions of francs. This means employment of great numbers of foreign laborers in France because nearly half of her men from twenty to thirty years of age have disappeared. No work of this magnitude can be carried out in any one country without affecting the entire world.

Until very recently, France has not been willing to have this work done by German labor and material, but it is obvious that Germany cannot pay the sums required in gold nor merchandise. They have tried to pay in gold, and caused one of the most serious fluctuations in exchange rates known since the armistice. This fluctuation in pounds sterling from $3.80 to $4.00 and back to $3.70 all within a fortnight, almost paralyzed international commerce.

The necessity of meeting large reparation payments in gold or bills of exchange has forced German industrials to offer their products to the world below the cost of manufacture and at the same time reduce imports to the minimum. It forced the Germans to sell coal so cheap that the English and Welsh coal mines had to reduce wages and caused the strike that almost destroyed the English industries. One can readily conceive the effect on all other industrial countries if Germany should be forced to adopt such low standards of living as to be able to manufacture and sell enough merchandise in competing markets to meet the total reparation payments. Twenty years of such practice would drive competition from even their own domestic markets or reduce labor to living conditions that would be comparable only to those of the coolies of the East.

Germany desires to rebuild northern France with her own labor and material because she can pay in her own depreciated currency and keep her people contented. It would make the problem of reparations a purely domestic one in Germany and would not affect other countries. France, Belgium and Great Britain could devote their attentions to other problems that require immediate attention and the whole world return more promptly to a normal basis.

Someone has said that all men have two countries, their own and France. No one would see France suffer any more than she has, but it is highly essential to the prosperity of the whole world, including France and Germany, that Germany be allowed to reconstruct northern France with German labor and material.

The Sentiment Toward Disarmament

MUCH more or less futile argument has been indulged in over the subject of disarmament. Pacifists of one idea have plead for immediate exposure of the country to the mercy of whichever militaristic power happened to feel inclined to attack us first. Equally ardent militarists have urged that it will be time enough for us to disarm when everybody else has done so, and that the best safeguard of peace is preparedness for war.

There is something to be said for both parties—neither is wholly right nor entirely wrong. But there must be a middle ground somewhere upon which all can meet and arrive at some arrangement which will lift the staggering burden of the cost of past and future wars from a struggling world.

The most encouraging sign of an awakened public sentiment on this momentous question is the way in which the House of Representatives acted when the resolution favoring a disarmament conference was upon the floor. Carried almost by acclamation it would seem to indicate that we are at last convinced that something must be done to reduce the large proportion of the national expenditure which now goes to pay for differences of opinion between nations.

Congress may not always reflect the attitude of the country at large but in this instance the feeling was so intense that it cannot be looked upon as other than significant.

The New Immigration Law in Operation

"THE best laid plans of mice and men" is an ancient saying which might be applied to the immigration law under which we are now suffering, except for the fact that it would be an undeserved compliment to call that piece of legislation a well-laid plan. At the time it was under consideration we, among many wiser ones, suggested that more mature deliberation than it received would have been advisable.

Here is the way it works according to the *New York Tribune*, of July 12. "The operation of the new restrictive immigration law hit a snag yesterday when fifteen alien first-cabin passengers on the French liner "La Savoie" from Havre were informed by the immigration officials that they could not land.

"N. D. Jonovitch, who was at one time attached to the Serbian legation in this country, came here to buy machinery. He said his visit here would not be longer than five weeks, and that if he had known of the treatment he was to receive from this Government on his arrival he would have gone to England instead.

" 'Reputable visitors are welcome in England,' he said, 'and machinery can be purchased as quickly and as reasonably as here.' "

Foreign buyers of machinery are so scarce that it seems rather a pity to treat them so inhospitably when they come to buy from us. It might not be a bad idea to let your representatives in Washington know how you feel about it.

The Stevenson Multiple Gear Shaper

Tools Placed Radially—Work Reciprocates Vertically—Blank Indexes Between Each Stroke—Movements Operate Automatically—Large Variety of Work Possible

SPECIAL CORRESPONDENCE

THE Stevenson Gear Co. of Indianapolis, Ind., has recently developed a type of gear-cutting machine known as the Stevenson multiple shaper. The machine differs from the usual type of gear-cutting machine in that it cuts all or a large proportion of the teeth in a gear, or similar product, at one operation. This is accomplished by a special tool-head, which consists primarily of a series of radial tools spaced about the circumference of the blank to be cut. The machine operates in the same manner as an ordinary vertical shaper, except that the tools are held stationary and the gear blank is moved past the tools. The machine shown in Fig. 1 is 7 ft. high, weighs 17,000 lb. and when operating to full capacity is driven by a 100-hp. motor. It will cut gears up to 12 in. in diameter, 6 in. face, and 4 diametral pitch.

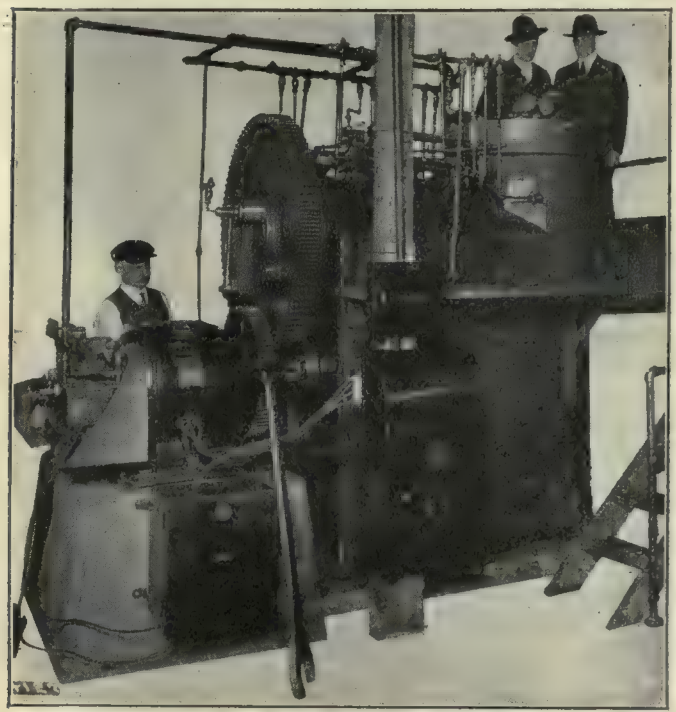


FIG. 1. STEVENSON MULTIPLE SHAPER FOR GEAR CUTTING

The mechanism of the machine consists essentially of a ram *A*, Fig. 2, carrying a blank-supporting mandrel *B*, and the multiple-tooled head *C* for operating upon the blank or blanks. The frame of the machine is a casting of rectangular box section with a vertical cylindrical portion at one end. The ram is in the center of this cylindrical part of the frame, and the tool-head is mounted above the ram. The crankshaft *D*, which drives the ram, is journaled near the top of the rectangular section, is provided with an adjustable crankhead at the end next to the ram, and is driven through back gears by an individual electric motor. The mandrel which carries the gear blanks fits in a spindle inside the ram, and is free to rotate independently of the reciprocating motion imparted to it by the ram. An indexing movement is imparted to the spindle after each cutting stroke by an intermittent gear train.

The Multiple-Tool Head

The toolhead, shown bottom side up in Fig. 3, consists essentially of a flat steel disk 36 in. in diameter, provided with a hole at the center and having a number of radial grooves cut in its face. These grooves carry the toolbits, which are arranged like the spokes of a wheel. Successive feeding movements are imparted to the tools by an annular sectional cam ring *A*. As the gear blank is reciprocated past the cutting tools, the tools are gradually fed in by successive cuts to the full depth of the tooth. At the completion of each stroke of the ram and before the next cut begins, the gear blank is indexed a space equal to one tooth, thereby presenting a different tool to each tooth with every cut.

After the tools have been fed in to full depth, they are held in that position while the cutting process continues, until the gear has indexed one complete revolution, giving each tool an opportunity to take one last cut on each tooth. This is done to insure a uniformity of spacing of the teeth in the gear equal to that of the indexing mechanism. Uniformity of the tooth form is secured even though the tools themselves may be far from uniform, for if any tool is longer or wider than any other tool, that portion will take one last cut on the corresponding portion of each tooth in the gear, thereby eliminating any variation which may have been caused by previous cuts.

Two toolheads are provided for each machine and while one is in use on the machine, the tools of the other are being sharpened and re-set ready for use after the tools in operation begin to dull. The tool-

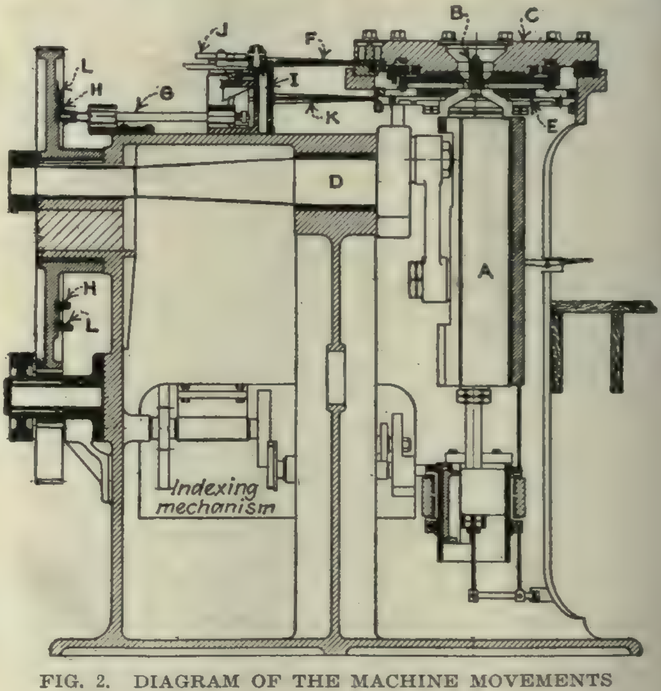


FIG. 2. DIAGRAM OF THE MACHINE MOVEMENTS

head is held in place by eight studs and nuts. When it is desired to set up a new job or to sharpen the tools, these nuts are taken off and the toolhead is lifted off the machine bodily and replaced by the other toolhead. This arrangement permits the machine to operate practically continually with very little loss of time on account of setting up and sharpening tools.

THE CUTTING TOOLS

The toolbits shown are rectangular in section, except at the lower side which is in the form of a V in order to center them when clamped for cutting. The gear tooth profile is formed at the inner ends of the tools and is backed off to permit sharpening without changing the form. The outer end of each tool rests against a spiral cam surface *B*, Fig. 3, and is ground to this exact radius. A small pin near the back end fits in a groove which has an opposing spiral surface, and it retains the tool in close contact with the main cam surface at all times, as well as withdrawing the tool to its starting position after the cut is finished.

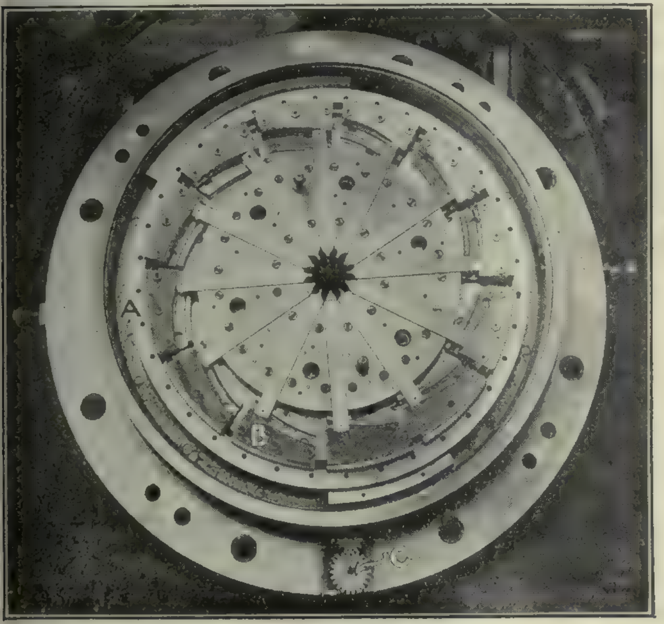


FIG. 3. LOWER SIDE OF TOOLHEAD

The individual cam lugs *B* are mounted on a large ring which encircles the toolbits and spacing plate, and are held down by bolts which fit in a circular T-slot in the ring. The toolbits are adjusted for depth independently by moving any cam lug along the T-slot relative to the cam ring and to each other, by a small pinion wrench. Simultaneous feeding movements are imparted to the cam ring through the two idler gears at *C*. The final depth to which the tools are fed is determined by an adjustable stop which limits the rotary feeding movement of the cam ring. This feed mechanism being spring actuated, the position of the depth-controlling stop can be varied within reasonable limits without re-setting the feed mechanism. This saves time in cases where the tools may not have been set to exactly the right depth, or where the keen edge wears off of the tools and they begin to cut gears that are uneven or oversize before they are actually dull.

In order to provide relief for the tools on the back stroke of the ram, a reverse feeding movement is imparted to the cam ring. Before the beginning of the cutting stroke, the forward feeding movement of the cam is made great enough to compensate for the slight retraction for relief and also to provide the necessary additional feed for the depth of the next cut. This is done by the segment arm *F*, Fig. 2, which has a slight movement due to the bar *G* being moved by a cam *H* on the large gear. This action moves an eccentric stud *I* and the arm *F*, which fulcrums against the feeding and throughout cam *J*.

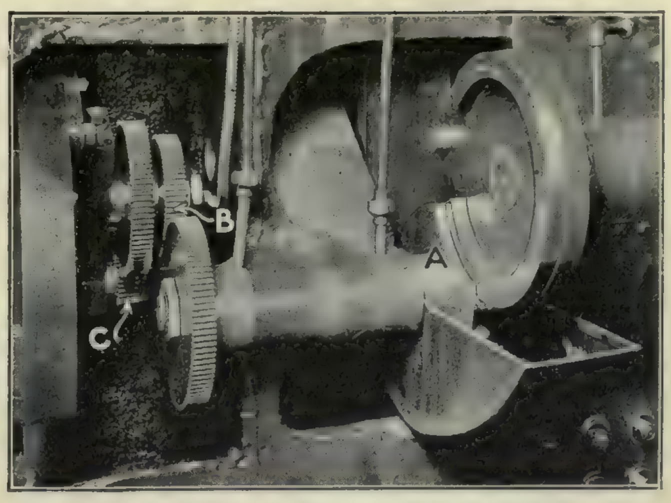


FIG. 4. INDEXING MECHANISM

The large gear and plate shown at *E* are used to intermittently clamp and release the tools during the cutting and feeding operation. Each tool is independtly held by two screws but all are clamped and released simultaneously. The clamping plate *E* is threaded and is turned by the segment arm *K*, which is moved by means of a bell crank, by the other cam in the gear *L*.

INDEXING MECHANISM

The indexing mechanism consists of a split bushing guide, one-half of which is attached to the ram spindle, the other half being attached to a revolving drum on which is mounted a worm gear driven by a worm and an intermittent gear train. The intermittent indexing movement is derived from a Geneva wheel *A*, Fig. 4, and is transmitted through a set of change gears *B* to the worm, driven by gear *C*, and wormwheel. By varying the ratio of the change gears in the train, indexing movements for any desired number of teeth may be obtained. Minute angular adjustments of the spindle position varying by one second of arc, for locating keyways, teeth of cluster gears, etc., are obtained by means of a differential clutch between the worm and wormshaft.

The main crankshaft is connected to the large back

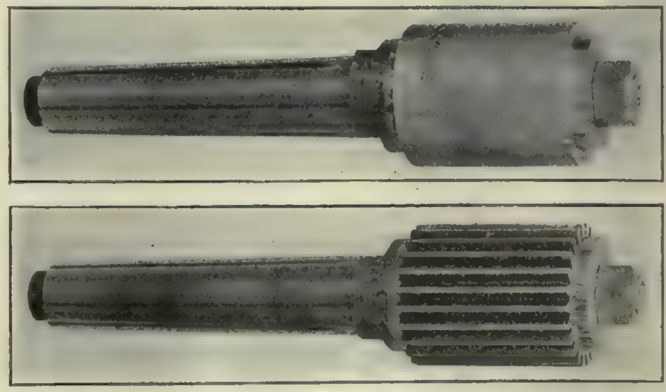


FIG. 5. MANDRELS USED FOR HOLDING GEAR BLANKS

gear by a quick return crank of the drag-link type. The driving motor is mounted on a sliding base and drives through a single set of speed change back gears. The drive for the indexing mechanism is taken direct from these gears. The pump for circulating the cutting oil is driven from a small sprocket on the end of the motor shaft opposite the driving pinion. The motor is controlled by a push-button switch, automatic compensator and solenoid electric brake, as seen in Fig. 1.

The work mandrel used is shown in Fig. 5. It has a taper shank and thrust collar and fits the socket in the ram spindle. The thrust collar prevents the taper shank being forced too tightly into the socket. After loading, the mandrel is dropped into the taper socket in the ram spindle and the thrust of the cut forces the taper back into the socket until it strikes the shoulder of the mandrel. As soon as the gears in the machine are cut, the operator stops the machine and presses a conveniently located foot pedal, which loosens the mandrel of completed gears. The entire operation of stopping the machine, of changing the mandrels and starting again, occupies less than one-half minute.

The tooling up of a job on this machine offers unlimited opportunities for ingenuity. In cutting some gears, it is desirable to use as many tools as there are teeth in the gear. In others it is more practical to use only half or a third as many tools as there are teeth. A toolhead equipped with any number of tools could cut gears having any number of teeth which is a multiple of the number of tools used. A spacing plate having ten tools could be made to cut 10, 20 or 30 teeth, etc. Or if it is desired to cut a number of teeth greater than the number of individual toolbits which can conveniently be placed within the space, a gang toolbit is used in which each tool cuts two or more teeth. This arrangement is particularly advantageous in cutting gears having a large number of very fine teeth. Where it is desired to cut a gear having an odd number of teeth and it is not practical to use a tool for every tooth, as in the case of a 29-toothed gear for example, ten tools might be used. Nine of the spaces between tools would be equal to 3/29 of a circle each and a tenth space equal to 2/29. While the work of one tool would be slightly less than that on each of the other nine, the difference would be scarcely appreciable.

In some cases, it is desirable to make every other tool in the form of some sort of a roughing tool, either a square-nose gashing tool or a stepped roughing tool of the usual type and so adjust them that they will remove most of the stock from the tooth space. The alternate tools are then made in the usual type of finishing tools and take the last few finishing cuts. In other cases a special cam is provided, so that one tool is held back during the stock-removing cuts and is then suddenly fed forward ahead of the other tools to take the finishing cuts on all of the teeth. These various arrangements show only a few of the possibilities.

The machine is also adapted to the production of all cylindrical products having teeth or grooves, such as sprockets, splined shafts, reamers, taps, milling cutters, saws, ratchets and knitting machine rolls. This machine using formed tools as it does, is able to cut an endless variety of toothed forms. In fact, it is stated that it will cut any toothed form which can be cut by any formed cutter.

An advantage of the multiple tooling is that the thrust on the blanks being cut is balanced, as it comes from all sides. The cutting of gangs of gears with small holes is made much easier in this way. The fluting of slim reamers and taps, of small splined shafts and the like, comes under the same head. An advantage also appears in heavy work, where a number of rough stocking cutters of different shapes are used before the final finishing cutter. The various roughing tools used can all be set in the same toolhead in a convenient arrangement and feed in successively and in proper sequence, so as to take the various roughing and finishing cuts as a continuous and uninterrupted process.

Running at 50 strokes per minute, the following data show some of the performances claimed: 24-tooth, 10-pitch, ½-in. face gears, cut 6 at once in 2.4 min. or 0.4 min. each; 1-in. machine reamer, 8 teeth, 1.04 min. each; 3-in. milling cutter, 12 teeth, 8 at once in 2.9 min. or 0.36 min. each; slitting saw, 72 teeth, cut 120 at once in 1.3 min. or 0.01 min. each.

These machines will be built, the maker states, in various sizes and models according to the size and nature of the product to be handled, whether it be a watch pinion or a large circular saw.

Our Business Has a Future

By J. Bainter

"Will business ever pick up?"—is a wail that now comes from many a business man. Let's investigate the matter.

But few people would say that the volume of business now being transacted is as large as it should be, and, especially, as we wish it to be. There are many industries much busier than our own, and yet we are far from dead. What many of us need is a more optimistic —or rather philosophic—viewpoint.

The really big men of business don't believe that the country is dying, and it seems wise to copy their ways. They go on playing a little golf, as usual, and spreading optimism—and scratching a little harder for business.

But, aside from spasmodic actions, business is steadier and larger than it was for a time; and people generally don't show that panicky, uneasy feeling that they did a few months ago. The bottom being passed, we are now at the beginning of a period of gradually increasing business.

Looking back, why should we call business bad today, and good in those boom times, such as the year 1918? Then, money was scarce; and to obtain a loan a big premium was demanded. Profiteers ran rampant in most lines, so that the salaried man found his income ever decreasing in buying power.

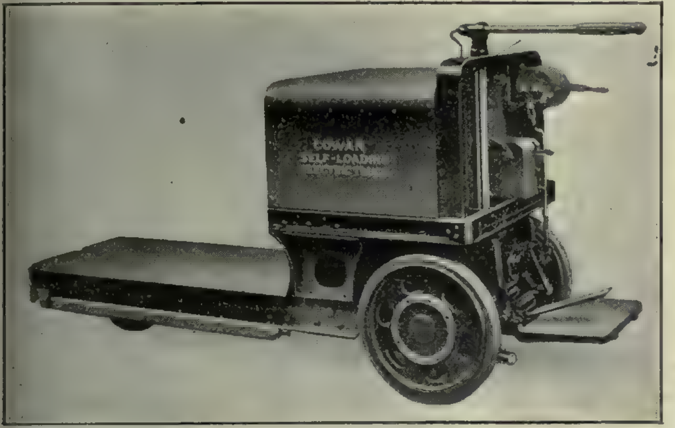
Good times, indeed. Labor continuously demanded higher wages, to keep pace with the soaring H.C.L. The demands were granted, but the prices of commodities were always raised simultaneously, so that no relief seemed in sight. Then, too, the existing market, with goods selling themselves, brought on many unwholesome business conditions.

The crisis has been weathered without a panic. We should be conscious of our strength and be preparing for the next move. Goods have to be *sold* now, and the man with courage and a go-get-it spirit will be the one who sells them.

Shop Equipment News

Cowan Electric Industrial Truck

An electric industrial truck of the self-loading, elevating-platform type, shown in the illustration, has recently been placed on the market by the Cowan Truck Co., Holyoke, Mass. In design the truck is said to have been greatly improved over the former machines of the same type made by the concern.



COWAN ELECTRIC INDUSTRIAL TRUCK

Specifications: Capacity, 5,000 lb. Driving Motor, G.E., 24 volt, 50 amp., 1,500 r.p.m. Elevating Motor, G.E., 24 volt. 35 amp., 1,800 r.p.m. Worm-Gear Reduction, 17½. Speed, loaded, 1 to 5 miles per hour. Wheel size: power end, 20 x 3½ in.; trailing end, 10 x 4 in. Loading Platform, 55 x 26 in. Elevation of platform, 4½ in. Height of platform elevated, 15½ in. Overall Length, 102 in.; with step folded, 91½ in. Width, 36 in. Height: over battery box, 43 in.; over steering-shaft head, 51 in. Wheel base, 59¾ inches.

The truck shows great flexibility in operation, since it has three speeds in either direction and steers upon all four wheels so as to give a turning radius for the extreme outside point of the truck of 7 ft. 5½ in. It can operate in intersecting aisles 57 in. wide. The platform lifts vertically, having a capacity of 5,000 lb., and requires but five seconds to rise to its full height. It may be stopped at any point and reversed, if desired, no matter in which direction it is traveling. All of the controls are conveniently centralized, so that the operator may face in any direction that he desires.

The maker emphasizes the safety feature of the machine. In order to operate it, the foot pedal must first be depressed, closing the circuit and releasing the brakes. The circuit breaker will close only when the controller is in neutral position, and it is necessary that the machine be started in first speed and that the speed be increased progressively to that desired. Upon the release of the pressure on the foot pedal, the circuit is broken and the brakes applied automatically, so as to stop the truck immediately. The controller handle is removable, so as to prevent meddling.

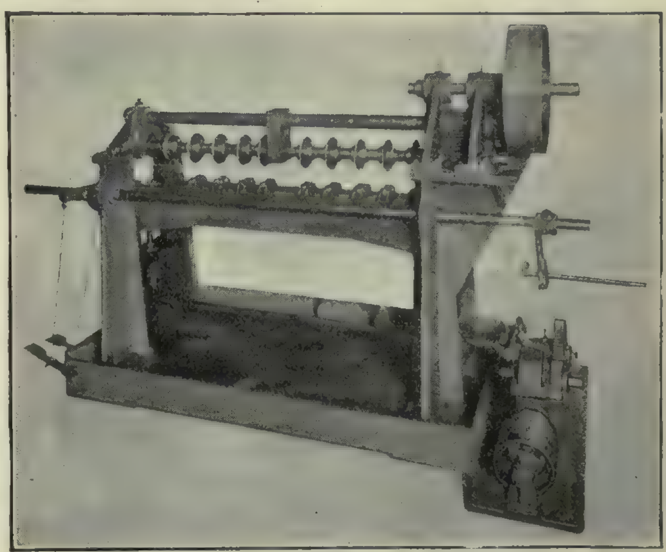
In order that steering may be made more easy, an "anti-kick" device is provided to take the jar from the wheels off the steering handle. Springs under the batteries prevent injury to the cells from vibration and shock. The center of gravity of the truck is said to be very low. The batteries, the controller, the lifting mechanism, the motor and all other parts are readily accessible for inspection and oiling. Simplicity of the mechanism as well as sturdiness of construction are claimed for the device, the parts being interchangeable between different machines.

The frame is made of a heavy steel channel and castings, hot-riveted together. A draw-bar attachment is provided so that the machine may be used as a tractor to pull trailers. A heavy bumper at the rear end of the truck is provided to take up accidental shocks. The foot pedal and the steering lever may be folded out of the way vertically, so as to shorten the over-all length, as when the truck is placed on an elevator.

The driving motor is series wound and horizontal, and connected to the driving mechanism through worm gears. The drive shafts themselves carry no weight. S.K.F. ball bearings are used throughout the power unit. A drum-type controller is used. The current is furnished by either 12 cells of "Exide-Ironclad" batteries, or 21 cells of "Edison" A-6 batteries. The batteries are easily removable, so that two sets may be used alternately where 24-hour service is desired. The lifting mechanism is operated by a separate series-wound motor, the mechanism being of the bellcrank type. An automatic trip is provided to stop the load platform when it has been fully elevated or lowered.

Fretter Multiple Tube Cutting-Off Machine

The illustration shows a machine recently placed on the market by Nathan F. Fretter, 9113 Columbia Ave., Cleveland, Ohio, for cutting long pieces of pipe or tubing into a number of short pieces at one operation. A number of rotary cutters are mounted on a shaft, which is driven through back gearing and a driving pulley. The cutters can be readily taken off the shaft by removing the bracket in front of the machine. They are sharpened by using an electric grinder while they rotate on the machine.



FRETTER TUBE CUTTING MACHINE

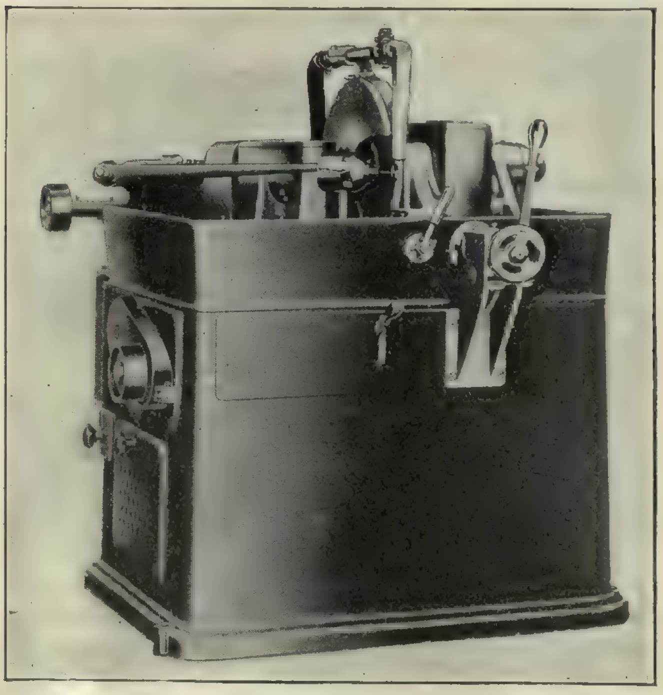
The table has a dove-tail groove, in which slide roller tube rests or holders, each adjustable to correspond with the positions of the cutters, are clamped in the desired position. The table height can be adjusted to suit different diameters of tubes and to take up the wear of the cutters by turning a crank in front of the machine. The table is raised to feed the work, by means of cams located on the shaft at the bottom of the machine. This shaft is rotated one revolution through a clutch operated by the treadle in front of the machine where the operator stands.

The operator places a long length of tube on the machine table, operates one treadle for the work stop, and then the other treadle to actuate the clutch. After the tube has been cut, the short pieces are pushed off the machine when a new piece of tubing is pushed in place. The machine has a large capacity, according to the number of cutters used, and will cut tubes 2½ in. outside diameter having a wall 3/16 in. thick.

Fitchburg Poppet Valve Seat Grinding Machine

A floor type grinding machine intended for grinding the seats on gas-engine poppet valves has been placed on the market by the Fitchburg Grinding Machine Co., 76 Winter St., Fitchburg, Mass., and is shown in the accompanying illustration. The valve being ground is held in a collet chuck, which can be swung to any angle and which is operated by the lever shown at the side of the workhead. The head carrying the chuck has an automatic reciprocating movement parallel to the wheel spindle, so as to feed the work across the wheel. For the purpose of holding the valve on centers while grinding the seat, a special workhead can be furnished.

The wheelhead has a cross movement and is operated by the vertical lever directly in front of it. The handwheel on the cam bracket at the front of the machine is provided for taking care of the wear of the wheel, and has a micrometer dial. The small lever shown in front of the wheel is for operating the diamond tool when truing the wheel. The small lever below it is used for starting and stopping the workhead. The machine is self-contained, and is operated by a 3-hp. motor in the base. The weight, including the motor, is approximately 2,500 pounds.

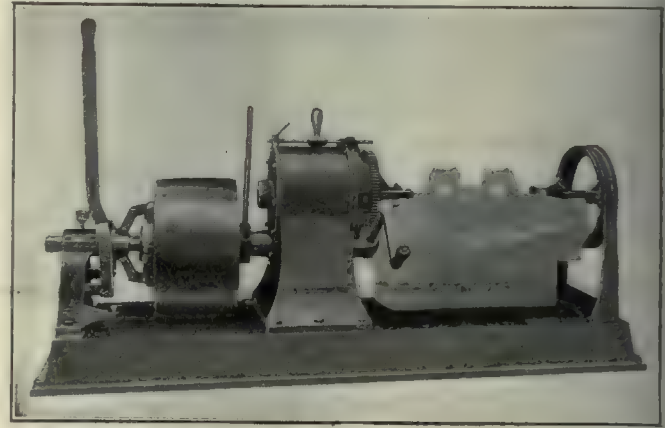


FITCHBURG VALVE GRINDING MACHINE

Besides grinding valves, the machine can be adapted to a large variety of small parts. However, it is essentially a large production tool and it is necessary that it be kept busy on one particular part for a considerable length of time.

Jansen Universal Burning-In and Running-In Machine

The Theodore W. Jansen Machine Co., 739 Twenty-First St., Des Moines, Ia., has recently placed on the market for use in the repairing of automobile engines the Universal burning-in, running-in and testing-out machine shown in the illustration. The machine is designated as No. 560, Type J, and is compact, low and heavy in construction. It is driven by means of a belt on a 16-in. wide-faced pulley, a lever-operated friction clutch being incorporated in the drive. Steel back gears running in oil are provided, thus giving two speeds, the ratios of reduction being 3¾:1 and 1½:1.



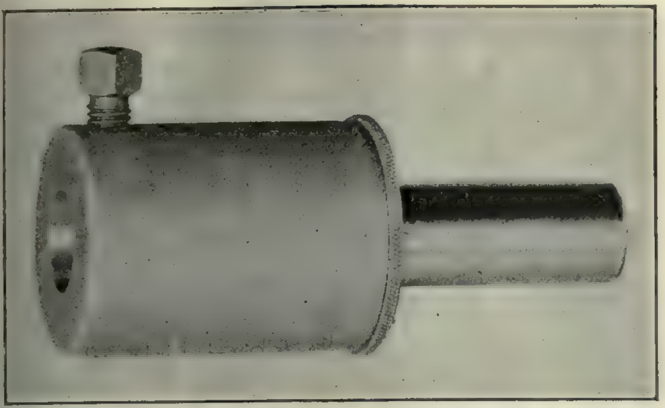
JANSEN BURNING-IN AND RUNNING-IN MACHINE

It is stated that the machine will hold all types of motors without special blocking or fixtures. The work is mounted on the stand by securing it at each end to pivoted holders, so that the motor can be rotated about its shaft and held in any position desired. Consequently, the stand can be used to hold motors when doing other work besides burning-in. Eight to 15 hp. is said to be sufficient to operate the machine.

Warner & Swasey Clutch Tap and Die Holder

The Warner & Swasey Co., Cleveland, Ohio, has recently placed on the market the clutch type of tap and die holder that is shown in the illustration. The tool differs from the old model of holder made by the same concern in the fact that it is greatly simplified, only eight parts being used, while twenty-three were used in the old model.

The tool is capable of holding either right- or left-hand dies or taps. To change from one direction of rotation to the other, a screwdriver is required to release one tightening screw, and the rest of the operation can be performed by the hands. The difference in the tool when used for right- or for the left-hand work is in the position of the pawl. To change the direction of rotation, the pawl is turned half-way



WARNER & SWASEY CLUTCH TAP AND DIE HOLDER

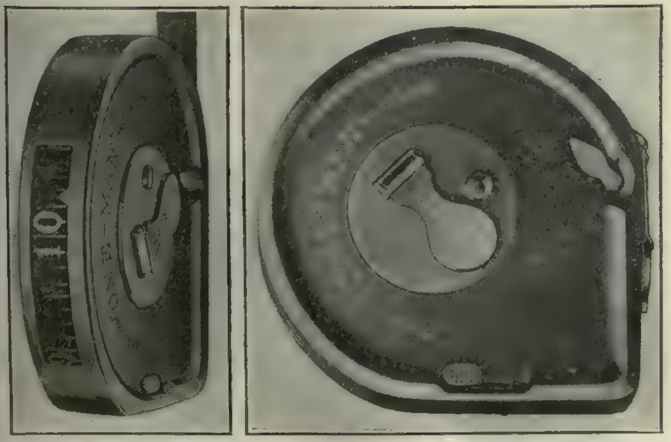
around in its hole, and a small pin is used to hold the pawl in the position required.

When threading is being done, the pawl holds the tool rigid by a metal-to-metal contact, until the turret stop is reached. The head of the holder then moves forward on the work, and pulls the cam over the pawl, thus releasing the head and allowing it to revolve freely. A spring is used to cushion the pawl, so that the release occurs without jar and is practically noiseless. The tool is said to be exceedingly adaptable, and especially useful in brass shops. On account of its simplicity, it may be easily cleaned and oiled, and is claimed to have a long life.

Union "One-Man" Steel Tape

A form of steel tape and case, styled the "one-man" tape, has recently been placed on the market by the Union Tool Co., Orange, Mass. The tool, two views of which are shown in the accompanying illustration, has several distinctive features, which include a hook on the end of the tape, a heel on the case and a locking device which holds the reel in position after a measurement has been taken. The feature contributes to the ready applicability of the tool, by enabling one man to make measurements ordinarily requiring two men.

A measurement is taken by hooking either the free end of the tape or the heel of the case, as may be desirable, over the edge of the object to be measurd, running out the tape to the length required, and then reading the measurement through the window in the top of the case. The amount there indicated will be the actual distance from the end of the hook to the square corner of the case. Because of this feature, interior as well as exterior measurements may be taken.

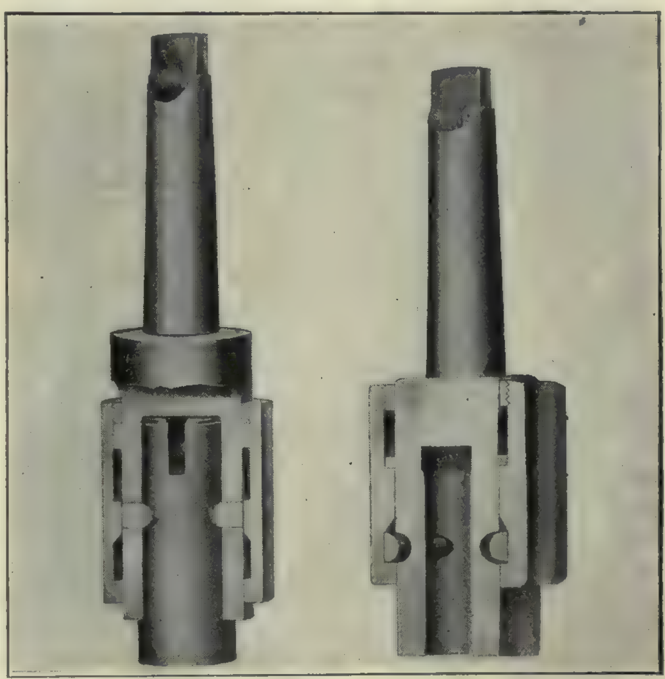


UNION "ONE-MAN" STEEL TAPE

American Equipment Co. "Rapid" Slip Drill Chuck

A slip-collet type of drill chuck that permits of the rapid insertion or removal of a drill while the spindle of the machine is running, has recently been placed on the market by the American Equipment Co., 5928 Second Blvd., Detroit, Mich. Drills, reamers, counterbores and taps may be held in the collets, which can be put in or taken out of the chuck by one hand, it being necessary only to raise the outer sleeve. There are no projections from the chuck, the exterior being smooth.

The main feature of the device is the use of two driving keys, which prevents crowding to one side and gives a balanced drive in either direction, making the chuck available for tapping as well as drilling. These keys are hardened and ground to resist wear, but can be readily replaced by removing the outer sleeve, this being done by unscrewing the annular nut at the top. The two keys present a large amount of driving surface, which eliminates practically all of the lost motion and prevents burrs from being raised on the side of the collet. The accompanying illustration shows the chuck in both the released and the driving positions.

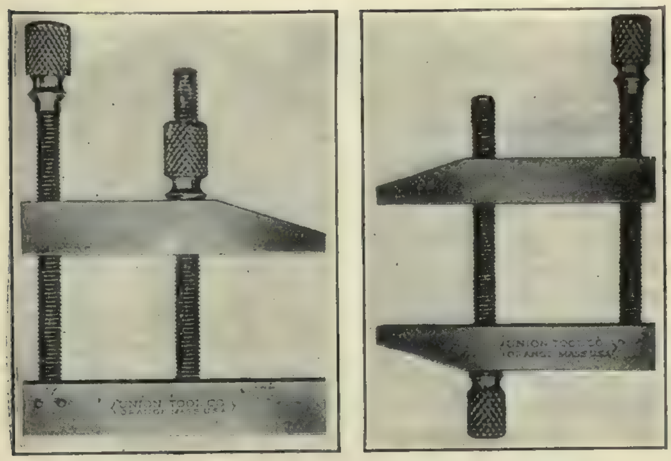


AMERICAN "RAPID" SLIP-COLLET DRILL CHUCK

The chuck is made in five sizes, having outside diameters from 1½ to 3⅝ in. Any type of shank can be furnished, although Morse taper shanks from No. 1 to 5 are standard. The collets vary from ⅝ to 2⅜ in. in diameter and can be furnished for either straight or taper shank drills, Morse taper holes from No. 0 to 4 being standard. Either slotted or blind-head collets can be furnished to enable the removal of the drill.

Union Toolmakers' Parallel Clamps

Two forms of toolmakers' parallel clamps recently placed on the market by the Union Tool Co., Orange, Mass., are shown in the accompanying illustrations. In each case the outer screw, which has a step bearing in the lower jaw, is held to that jaw by two steel pins that enter a groove in the end of the screw, thus



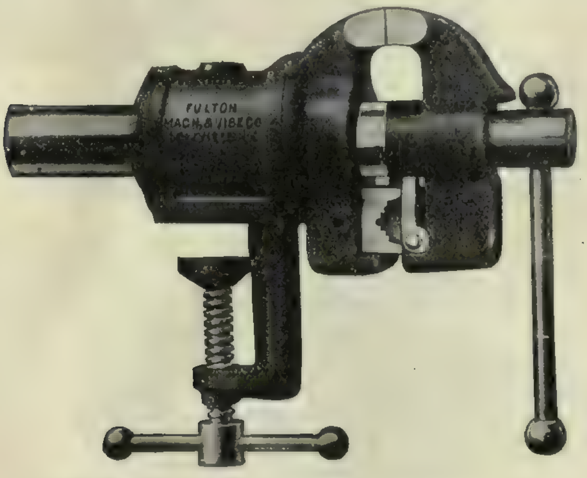
TWO FORMS OF UNION PARALLEL CLAMPS

preventing the latter from slipping out of its bearing and allowing the upper jaw to swing around at a critical moment when the user has his hands full.

One of these clamps is arranged to have both screws project from the same side, so that the lower jaw may be used as a parallel. As the clamps are usually used in pairs, this arrangement enables the toolmaker to set up his work on a pair of parallels and clamp it in place without necessitating the use of extra bolts and straps. All parts of the clamps are hardened and the straps are ground accurately square and parallel.

F. & R. Combination Special Vise

The illustration shows a vise intended for general use, both as a machinist's vise and as a pipe vise. The tool is sold by the Boker Cutlery and Hardware Co., Inc., 101 Duane St., New York, N. Y., and is made by the Fulton Machine and Vise Co., Lowville, N. Y. The vise is fitted with two sets of jaws, one being placed on each side of the operating screw. The jaws can be swung about the axis of the screw so that either set may be at the top, or at any angle desired, a locking device holding them in place. The No. 3-S vise has jaws 3 in. wide and capable of opening 3½ in., while the pipe jaws can hold pipe up to 1 in. size and round stock up to 1⅜ in. in diameter.

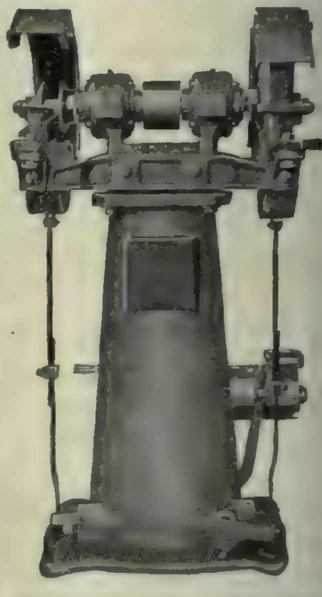


F. & R. COMBINATION VISE

As can be seen in the illustration, a shear blade is placed back of the moving pipe jaw, so that bars up to ¼ in. in diameter can be placed under it and cut by turning the tightening screw. The clamp is suitable for holding the vise on a bench from ¾ to 3 in. in thickness. The tool is said to be particularly adapted to the needs of the automotive and hardware trade, because of its general utility. It is finished in gray enamel. The net weight is 36 lb., while the shipping weight is 42 pounds.

Wheeler Ball Bearing Grinding Machine

The Wheeler Co., Railroad, Pa., has recently placed on the market the tool grinding machine shown in the illustration. The machine is similar in construction to the ball bearing polishing machine made by the same concern, its chief feature being the fact that ball bearings are employed for all the running parts; that is, for the spindle, the countershaft and the loose pulley. The use of the ball bearings is said to result in a saving of power, to eliminate vibration and wear on the bearings, and to reduce the maintenance cost and the time required for repair work on the machine. Double felt washers are provided to prevent dust and dirt from coming in contact with the bearings.



WHEELER BALL BEARING GRINDING MACHINE

The machine is made in units, each complete in itself. The head alone can be used on a bench or mounted on the pedestal. The countershaft assembly is mounted at the rear of the pedestal, and is fitted with a shifter operated by means of a pedal at the front of the machine.

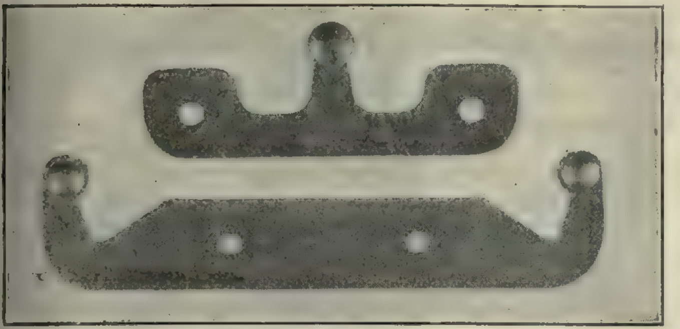
The head is built in two sizes, one for wheels 10 in. in diameter and 1½ in. thick and the other for wheels from 12 to 14 in. in diameter and up to 2 in. in thickness. The spindle is 18 x ¾ in. in size for the 10-in. machine and 24½ x 1¼ in. for the 14-in. size. The flanges holding the wheels are fitted on the tapered ends of the shaft and secured by keys. The head can be furnished either with or without wheel guards, and with either a straight-face, a corner, or a side rest.

For use when wet grinding, a water tank can be fitted below the wheel, and raised to the wheel or lowered by means of a pedal, thus quickly putting it either in or out of use. A small water box can be hung on the front of the pedestal for use in cooling small tools. The center of the spindle is 37 in. above the floor when the head is mounted on the pedestal. The floor space is 21 x 18 in., and the weight of the complete machine 415 pounds.

Detroit Stamping Co. One-Piece Card Clips

The Detroit Stamping Co., 3445 West Fort St., Detroit, Mich., has recently placed on the market some one-piece card clips of the type shown in the accompanying illustration. The clips are especially adapted for use where cards have to be changed frequently, as is the case of time cards, stock-bin records, bulletin boards and scheduling boards.

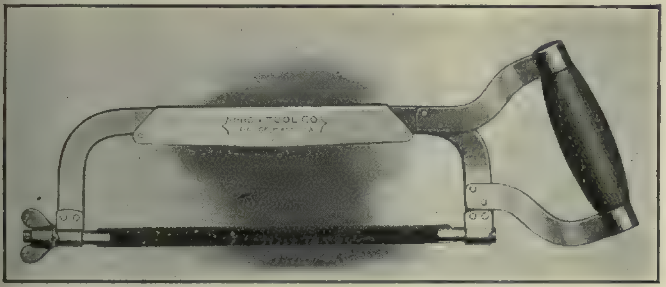
The clips are fastened in place by two screws or tacks, and can be used in any position, so that the card may be inserted from the top, bottom, or either side that is required. The holders are ordinarily made of untempered sheet steel. The holding points or lobes are spherically shaped, so that the cards may be easily inserted under them. The style "E" clip shown at the top has but one lobe and is 2 in. in length, while the style "C" shown at the bottom and having two lobes or contact points, is 3 in. long.



DETROIT ONE-PIECE CARD CLIPS

Union Adjustable Hacksaw Frame

An addition to the line of hacksaw frames made by the Union Tool Co., Orange, Mass., is shown in the accompanying illustration. The frame is made of cold-rolled steel of heavy section and the minor parts are steel stampings. The channel which forms the back of the frame is made truss-shaped, to withstand the bending strain imposed by too great tension on the blade.

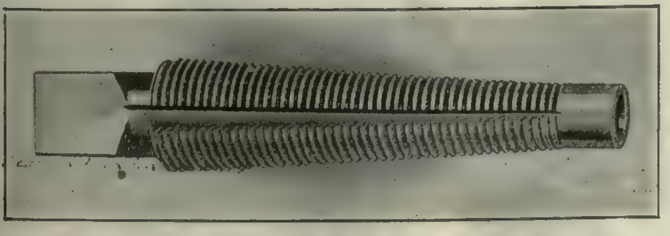


UNION ADJUSTABLE HACKSAW FRAME

The position of the handle enables the operator to secure a firm grip and protects the hand against injury when the piece is cut off. The frame will take blades from 8 to 12 in. inclusive in length.

Conant & Donelson Bushing Extractor

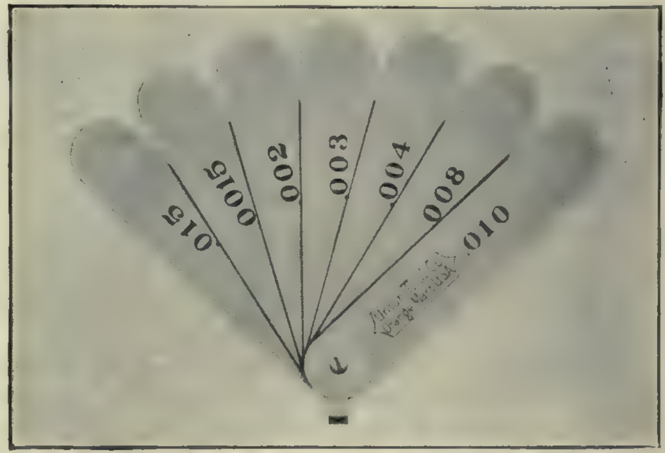
A tool for extracting the soft bushings used in connection with ball bearings on automobile work has been placed on the market by Conant & Donelson, of Conway, Mass. It is made of carbon steel and is hardened. A 16-pitch "saw-tooth" thread is cut over the entire length of the tapered portion, as shown in the accompanying illustration. For extracting a refractory bushing, the extractor is screwed into the bushing a turn or two, and the bushing driven out by tapping on the small end of the extractor with a mallet or soft hammer. The tapered portion is so designed that the tool can be used to extract bushings from ½ to 1 in. in diameter.



BUSHING EXTRACTOR FOR GARAGE USE

Union Thickness or Feeler Gage

A thickness or "feeler" gage for the use of garage repair men has been placed on the market by the Union Tool Co., Orange, Mass. The tool is compactly arranged and is held together by a ring, by which it may be conveniently atached to a key chain, thus enabling the user to carry it in his pocket and be assured that it is always available when wanted.



UNION THICKNESS OR FEELER GAGE

There are seven of the leaves, the thicknesses of which are calculated to provide combinations to any number of thousandths up to 0.043 in. Many half-thousandth combinations may be obtained. The leaves are spring tempered to prevent undue wear, but are not hard enough to be easily broken. The thickness of each leaf is plainly etched upon it in conspicuous figures so that a measurement may be made in comparatively dark places. The tool is especially serviceable in setting the valves and making other adjustments around an automobile engine.

If You Have Faith—Show It

There's a lot of weak kneed faith just now among machine builders of all kinds. All pretend to believe that they know business is improving, that it must come back, and that we must have faith.

But many of those who talk about the need of faith in the future are like the colored congregation we have all heard about. They are ready to pray for rain but have not faith enough to carry an umbrella. The kind of business umbrella needed is to get ready for business, to go out after it and not wait for it to come asking you to take it.

Faith in the future can best be shown by doing something to help bring business back. Have you drills and taps enough to handle a job if it came in? Have you scrapped that old machine that ought to have been melted up long ago? Or, are you hanging on to everything that is old and waiting for the other fellow to start buying first?

Trade Associations and the Law

Suggestions on the Timely Subject of What Activities These Organizations May Undertake Legitimately, and Where They Encounter the Displeasure of the Government

By FRANK K. NEBEKER
Former Assistant to the Attorney General, in Charge of Anti-Trust Matters

During the war the formation of trade associations in this and other countries was greatly stimulated, due in part to the general demand for industrial efficiency and in part to the adaptability of such organizations to the war-time needs of the respective governments. It is estimated that at the present time there are more than one thousand of these associations in existence in this country, and at the rate at which they are now being formed, it is only a matter of a short time until every branch of industry will have its representative association. It is not surprising, therefore, that the attention of the public is being increasingly focused upon these organizations, and it requires no gift of prophecy to foresee that the time is approaching when they will be called upon to "show cause" before the tribunal of public opinion.

That this is so, needs no further assurance, indeed, than the fact that President Harding saw fit to make pointed reference to organizations of this character in his initial message to Congress, and the further fact that only a few days ago both the Department of Justice and the Department of Commerce issued official statements concerning them.

There can be no doubt that if trade associations succeed in securing the approval of public sentiment, they must not attempt to stifle intelligent and wholesome competition; for if they do this, the great consuming public will naturally assume toward them the same antagonistic attitude it has always presented toward trusts and monopolies. The fact must not be overlooked that public policy in this country as indicated in the various anti-trust statutes—both Federal and state—calls for the free play of competition in industry.

Trade associations are strongly suspected of contravening this policy and it must be admitted that in some instances the suspicion is not wholly unfounded. The temptation to control production and fix prices is ever present and for that reason those who have the destiny of these organizations in their keeping should make a special effort to keep them so far within the pale of the law as to remove all grounds for suspicion. That certain trade associations have by combined action of their members arbitrarily restricted production and fixed prices, will scarcely be denied by anyone familiar with the subject; and it goes without saying that wherever and whenever they do this with respect to any commodity which is the subject of interstate commerce, they lay themselves liable to indictment and prosecution.

The erroneous impression seems to be somewhat prevalent, even in certain official quarters, that with respect to the law all trade associations belong in the same category. Nothing could be further from the truth. Probably there is not a single association in the country which because of its structure alone could be said to be an unlawful organization *per se*. In the eyes of the law, therefore, each association stands on its own bottom.

The impression has become somewhat prevalent that production may be curtailed and prices arbitrarily fixed so long as this is not the result of express agreement. This, of course, is a fallacy for which there is little excuse in light of the decisions. If, perchance, the activities of the association are of such character and the relationship of the members so intimate as to enable them by means of a "wink or a nod" to secure a result that would be unlawful if obtained by express agreement, the legal consequences are the same in the one case as in the other.

It is elementary law that a conspiracy may be established without proving an express agreement. It is sufficient if the "circumstances" justify the inference that a conspiracy exists. So that all trade associations may as well, once and for all, abandon the idea that they can surreptitiously and by indirection do that which would be unlawful if done openly and by express agreement.

If, in good faith, these organizations duly recognize this, there can be no doubt that their dominating position in the industrial system is assured. When properly conducted it combines the strength derived from co-operative effort with the benefits resulting from the free play of individual initiative. It recognizes the independent existence and local autonomy of each enterprise in the association in much the same way as local political autonomy is recognized in our scheme of government.

While trade associations have multiplied with great rapidity within the last few years, it would be an error to assume that the theory of their organization is a new one. The co-operative instinct was early exemplified in such organizations as the "guild merchants" and "guild crafts" of England and the Hanseatic League in Medieval Europe. Typical trade associations began to appear in this country many years ago, as witness: The Carriage Builders' National Association, founded in 1872; the American Paper and Pulp Association, in 1878; the Laundrymen's National Association of America, in 1883; and the Association of Brass Manufacturers, in 1886.

Most trade associations deal with commodities which constitute the subject of interstate commerce; therefore, the question naturally arises as to the status of those organizations under such statutes as the Sherman Anti-Trust Act, the Clayton Act and the Federal Trade Commission Act. This article is not intended as a legal brief on the subject and no attempt will be made to draw any close legal distinctions. It will sufficiently serve present purposes to point out some of the activities which clearly are, and others which clearly are not, within the prohibitions of those statutes.

Reprinted from *The Nation's Business*, published by the U. S. Chamber of Commerce.

It will be noted that the Sherman Act denounces all contracts, combinations and conspiracies in restraint of trade in interstate commerce. It is well settled that price fixing by agreement, combination or conspiracy, with respect to commodities in interstate commerce, constitutes a violation of this statute. It is equally well settled that restriction of production by this method is also unlawful. It matters not how ingenious the means may be for the accomplishment of these purposes, an association is simply guilty of self-delusion if it resorts to subterfuges in this connection.

DON'T HAVE TO PUT IT IN WRITING

For instance, in a certain association which shall be nameless, it was the practice for the members to exchange information concerning prices already adopted. On a certain occasion one of the largest members of the organization, within five days after raising certain prices, notified the secretary thereof in the usual way. In less than a week thereafter practically all of the other members gave notice that they had made identical price advances.

Another practice which has been found, and one which should not be tolerated, is that of a secret combination between trade associations and trade unions whereby unreasonably high prices are made possible by an artificial curtailment of production. Ostensibly this result is produced by the union alone, acting in its own interest; whereas, the fact is that the association is a willing but silent partner in the enterprise. The trade union, however, assumes full responsibility because of its supposed immunity from prosecution. Aside from the reprehensible character of such a scheme, it is suggested that in the light of the Duplex Printing Press Co. case, recently decided by the Supreme Court, it is a mistake to suppose that it is one which derives any appreciable amount of saving grace from the fact that one of the parties to the combination is a trade union.

As an economic proposition, it may be a debatable question whether the law should not be amended to give greater freedom of action with regard to the establishment of prices and the control of production, but that is another story. Certain it is that if the law should ever be amended in those particulars, Government regulation of some kind must be provided in order to safeguard the interests of the consuming public. This thought is well expressed by the *American Contractor* in the following language:

"If we are to be consistent we must be for competition or against it. If, after all, we believe in monopoly, then we must be reconciled to very stringent regulation of monopoly business by Government agencies. The time is approaching rapidly when business must make a final choice between competitive conditions and monopolistic conditions, and if the latter is accepted the public will insist, eventually, on thorough and effective Government supervision. We only kid ourselves if we ignore the fact."

Looking at the other side of the question, it can be safely asserted that most of the really important activities of trade associations are innocuous; for instance, there can be no possible objection to the fact that the association affords an opportunity for the members to become better acquainted. It is no concession to mere sentimentality to say that the encouragement of friendly social relations among competitors is of no small value in industrial operations. Every up-to-date business man is more or less familiar with the law of action and reaction in its application to human relations and realizes that the man who is jealous and suspicious of others will be the object of jealousy and suspicion himself; that an unfair competitor will become the victim of unfair competition; on the other hand, that friendship, candor and frankness react in kind. An appreciation of this law is of prime importance in the psychology of trade associations.

Through centuries of training the Anglo-Saxon business man has developed the competitive instinct, at the expense, nevertheless, of the co-operative instinct. The time has arrived, however, when a larger degree of co-operation among the producing and distributing forces of American industry is indispensable if this country is to secure and hold its share of the world trade.

There are other activities carried on by trade associations which are equally unobjectionable. There can be no objection, for instance, to the adoption of adequate methods of cost finding and accounting. Indeed, it is desirable from every point of view that all manufacturers should have full and complete information concerning costs; and yet, until recently, anything like an accurate system of cost finding and accounting was unknown to the average business concern. This is due in large part to the happy-go-lucky methods which have prevailed as a result of the large profits which have generally rewarded industry in this country. As a general proposition a mere approximation with respect to costs has fully sufficed for all practical purposes. As a word of caution at this point, let it be said that in no case should an association encourage the adoption of arbitrarily assumed elements of cost.

For example, if insurance rates at the various factories differ because of varying degrees of risk, it would be wrong for members of the association to adopt as an element of cost a uniform insurance rate. The tendency of such a practice would be the establishment of uniform prices.

The trade association should also be an information bureau concerning such matters as grading, classification and conservation of raw materials; standardization of processes and products, and of packing, shipping and marketing. Involved in these activities are such important ones as research work, waste elimination, experimentation, improvement of working conditions, and encouragement of friendly and sympathetic relations between employers and employees.

TO COPE WITH FOREIGN COMPETITION

The point that deserves special emphasis is that trade associations when properly conducted make for efficiency without taking on any of the objectionable qualities peculiar to trusts and monopolies. Efficiency in industry is needed now as never before in the history of the country. Our national prosperity will not be of an enduring character unless the manufacturers here are able to cope with those elsewhere in the contest for business in foreign markets. To do this, the standard of efficiency in our factories must obviously be equal to those of their foreign competitors.

It is a well-known fact that in England and Germany, and to some extent in France and Italy, co-operation in industry has been more fully developed than it has in this country. The trade associations in England and the cartels in Germany, under the fostering care of those governments, respectively, have become powerful industrial agencies. Those countries have perceived the necessity of consolidating their national financial, industrial, and commercial forces in such a way as to enable their business concerns to present a solid front to their competitors in the markets of the world. A number of examples of trade associations which have attained great size and power in England could be cited.

While the Sherman Act is supposed to be based upon the English common law relating to trusts and monopolies, it would be a mistake to assume that the attitude of government in England toward those institutions is as unfriendly as the Government attitude is in this country. To illustrate, it was held in England, in the Mogul Steamship Co. case, that it was not a violation of law for several steamship companies to agree to give rebates to shippers loading cargoes at Hankow, even though the effect of such practice was to prevent plaintiffs from conducting the tea-carrying trade between China and England. It is true that this decision was characterized by Sir Frederick Pollock as embodying "an act of judicial legislation far more important than most statutes"; nevertheless this decision has not been overruled nor has Parliament seen fit to enact any legislation to the contrary. It has resulted from this liberal view that British combines need have little fear of prosecution if on the whole the consequences of combination are not clearly harmful from an economic point of view.

The Use of Salt Baths in Heat-Treating

BY MAJOR A. E. BELLIS

The primary advantage of using salt baths in the heat-treating processes is that we are dealing with a liquid medium which gives an opportunity for getting real equilibrium between the heating medium, the material being heated, and the temperature measuring instrument. In the open fire or muffle type of furnace or in "packed" work, there is always a variation of temperature in the different sections of the furnace, and even of sections of the pieces being heated.

This is obvious when consideration is given to the different lengths of time it takes to get the pyrometer fire ends and their protection tubes to indicate average temperatures of different sections of an oven type or muffle furnace, and the length of time necessary to get a massive tool or box of packed work heated uniformly to the temperature of the furnace. It will be found practically impossible to get an entirely satisfactory equilibrium or proper uniformity of heat between the varying masses heated under these conditions. In the liquid medium, however, even heating is possible and equilibrium can be reached, for the heat stored in the bath can flow evenly from all directions into the steel being treated. In the open fire the heat has to be pumped into the steel at points of solid contact or by radiation through an oxidizing and poorly conducting gas.

In heating in the open fire it is customary to have a furnace hotter than the work and to leave pieces in the fire for the shortest possible time required to harden the cutting portions of tools. A very small piece in a very large furnace will come nearest to giving a satisfactory flow of heat into the steel when a muffle furnace is used, but unfortunately such a condition can rarely be maintained in the ordinary run of work. When pieces have to be heated in contact with a poorly conducting packing material the difficulty of getting uniform heat or equilibrium is increased.

The several advantages suggested above as applying to the heating of steel can be obviously applied to quenching. It is, of course, desirable to have a uniform flow of heat from the steel into the quenching medium. When water or oil is used for quenching, the vapors that form upon contact with the heated pieces, being poor conductors of heat, prevent this uniform flow.

As it is the rate of cooling through the critical range that fixes the degree of hardness of the steel, the properties of the quenching medium are the essential factors in determing the hardness. This is particularly apparent on considering the effect of quenching high-speed steel in a fused salt bath at 1,150 deg. F. Compared with oil as a quenching medium the volatility, viscosity, heat conductivity and specific heat are all greatly in favor of the salt bath. The volatility is practically negligible with fused salts as compared with oil and the danger of nonconducting vapors forming around the steel is eliminated. The fluidity of the salts is much greater than that of lead at these temperatures and comparable with that of oil.

The heat conductivity and specific heat of the salts also make them much more efficient in promoting rapid and uniform cooling through the critical range than any other quenching medium. The difficulty of the formation of a layer of charred oil is avoided, and this, together with the non-scaling condition of heating, results in a perfectly clean surface when tools are heated and quenched by the salt bath method.

The fact that the uniform flow of heat into the steel on heating, and out of the steel on cooling, gives the conditions required to minimize distortion is of great importance when fine threading dies, reamers, drills and such tools are being treated. Moreover, the physical strain and tendency to breakage is avoided by quenching at temperatures around 1,000 deg. F.; which temperature also develops the "secondary hardening" property required for maximum performance.

In order to maintain the high heat necessary for hardening high-speed steel with the greatest economy of equipment and fuel and to give the longest possible working life to the crucibles containing the salts, special furnaces and crucibles have been developed. The crucible for the high-speed salt is constructed as a double crucible with a non-porous metallic liner which is inert to the action of salts under continued use at high temperatures.

The exterior crucible is made from a refractory material such as graphite or carborundum which offers maximum resistance to the flame and heat of the combustion chamber. The combination of a chemically inert liner and refractory exterior increases the life of the crucible many times.

The most efficient form of furnace is constructed as a triple unit in which the exhaust gases from the high heat chamber provide sufficient heat to maintain the proper temperatures in the preheating and quenching baths. This results in great fuel economy for by proper design of the connecting flues and by proper regulation of dampers it is possible, with a high-speed bath temperature of 2,300 deg. F., to maintain 1,400 to 1,600 deg. F. in the preheating bath and 1,000 to 1,200 deg. F. in the quenching bath without the use of auxiliary burners.

NEWS SECTION

Coal Operators as an Aid to Hoover

The National Coal Association has given its president, J. G. Bradley, full authority to use his own judgment in negotiating with the Secretary of Commerce as to what statistics the association will furnish voluntarily in the matter of production, distribution and average sales realizations. The only limitation placed on Mr. Bradley by the board of directors was that he obtain assurance from the Government that these voluntary reports will not be considered as violating the Sherman Law.

Acting under the authority reposed in him, Mr. Bradley and J. D. A. Morrow, the vice-president of the association, plan to discuss the matter with Secretary Hoover in the near future.

Secretary Hoover stated on July 18, that he contemplates making request of the operators to furnish voluntary statistics. He said that the new coal commodity division would get its figures as to production from the U. S. Geological Survey. As to price information, he stated that he prefers securing it from sources other than the operators since it would be regarded by the public as more authentic when obtained from sources other than those who produce the coal. Mr. Hoover made it clear that this was no reflection on the operators, as it is natural that prices emanating from them would be given the same weight as would those that could be collected otherwise. In addition, Secretary Hoover expects to collect data as to stocks, in which matter the operators could not be of assistance.

◆

Demand for Hemp Machines in Philippines

Many hemp-stripping machines of a simple type are in operation on the hemp plantations of the Davao Gulf region of Mindanao, and two 3-horsepower oil engines connected with sets of four stripping machines each have recently been installed in that region, states the Bulletin of the Philippine Government Commercial Agency. The machines pull the hemp over a knife in much the same manner that it is cleaned by hand. They are comparatively inexpensive and are operated by one man. With the aid of one of these machines one worker can strip a picul (about 140 pounds) of fiber in a day, which would be a large amount of work for one week if done by hand. Water power is readily available on the plantations and adds to the economy of using the machines for which there is a growing demand.

◆

New Oxygen Plant for Canada

In these days of general industrial improvement it is refreshing to note the spirit of optimism evidenced in the announcement recently authorized, that the Dominion Oxygen Co., Ltd., will break ground this month for a new quarter-of-a-million-dollar oxygen plant at Montreal, which will double the company's present capacity. The building will be 100 x 100 ft., and will be substantially a duplicate of the company's Toronto plant, which until now has supplied oxygen to Canadian industrial users through five district distributing stations. The Montreal plant will be the second of five producing plants projected at the time the company was organized last year.

Chickasaw Car Plant Completed

The new car plant of the Chickasaw Shipbuilding and Car Co., at Fairfield, Ala., has been completed, and the company has started operations on an initial order of 300 cars of the mill type, 100,000 pounds capacity each, for the Louisville & Nashville Railroad, and 300 coke rack cars for the same company. The first of these cars has already been turned out at the new plant.

Work on the plant was begun in August, 1920, and almost a year required to complete it. The capacity is 15 to 25 pressed steel freight cars per day, and everything entering into their manufacture is made at this plant with the exception of the wheels.

◆

Davey Passenger Plane Building at New Britain

The Davey Aero Co., of New Britain, Conn., has entered the field of commercial aviation with the announcement of plans for building a monster passenger air boat.

The company is now working on an 18-passenger hydroplane, which as far as is known by the builders, will be the largest of its kind in the country.

When completed the machine will weigh seven tons, including a 400 gallon gasoline tank and the passengers. It will have a wing spread of 128 ft. and a total lifting surface of 2,500 sq.ft. The machine will be driven by three hydro-glycier motors which are expected to develop 300 horsepower each.

When asked about it, Mr. Werdelin, secretary of the plant, said that the machine will probably be ready in the fall and a trial flight will probably be held somewhere along the Connecticut river. When asked if the company intended using the machine for commercial purposes, Mr. Werdelin said: "If the machine proves to be a success we intend to make flights between the more or less important sea towns of the New England states. Passengers will be taken up and regular routes worked up."

It was at first thought that the company intended to fly between New Britain and New York and possibly other cities. As explained by Mr. Werdelin, however, it will be impossible as there is no river or lake in New Britain where the machine can land, and it must have a body of water. There was some talk of seeking the use of Shuttle Meadow reservoir, but the owners of the plant have long abandoned that idea in as much as Shuttle Meadow is not open to the public and is the source of the city's drinking water.

◆

Foundrymen's Association Abandons Fall Meeting

According to an announcement made by the American Foundrymen's Association, the next convention and exhibition will be held in April or May, 1922. Originally the meeting was scheduled for the fall of this year. However, when the committee on conventions and exhibits met in March, it was found that in none of the eight cities considered was it possible to find during September or October adequate hotel accommodations and exhibition facilities to care for such meetings properly. Therefore the board of directors decided to postpone the meeting until next spring and again to follow the custom which existed prior to 1912.

McCarty Elected Vice-President of Chicago Belting Co.

Vance McCarty, formerly vice-president of Edward R. Ladew Co., has joined the forces of the Chicago Belting Co., as vice-president in charge of sales in the Eastern district.

Mr. McCarty has been identified with the belting industry for a number of years. His experience in this line goes back twenty-two years when he worked as a belt maker in a plant in New York City.

◆

Wage Increase in German Metal Industry

The Union of German Metal Workers is the largest trade union in Germany and includes more than 1,600,000 members. This union has a statistical bureau which has collected statistics of wages and of cost of living in the metal industry, including in its investigation not only the members of its union but many other workers in the metal industry, so that the investigation covered a total of about 2,300,000 workers. It has published the results of its investigation in the *Metallabeiter*, which is the organ of this union.

According to the statistics of this union about 63 per cent of these workers are receiving wages which are more than 800 per cent greater than those of 1914, about 36 per cent are receiving wages from 500 to 800 per cent greater than in 1914, and the remainder are receiving wages which have not increased as much as 500 per cent since 1914. It is impossible from these statistics to arrive at an average wage increase for the whole of this group of workers.

The trade unions estimate that the entire cost of living for a family of four has increased about 1,550 per cent since 1914, while Calwer's Bureau (a private statistical bureau), which usually makes use of official statistics, estimates that the cost of food alone for a family of four has increased about 1,470 per cent since the year 1914.

◆

Durant Orders 50,000 Continental Motors

In a recent news dispatch it is reported that the Durant Motors, Inc., has placed an order with the Continental Motors calling for the delivery of 50,000 motors. Delivery of the contract is expected to begin as soon as the Continental Motors Company is equipped to carry out the contract, which is expected to be by Aug. 1. Shipments are expected to be made at the rate of 150 daily, and will be delivered to the Durant plants at Lansing, Mich., Long Island City and Oakland, Cal., as well as other plants of the new company.

◆

Swasey Gets French Honors

A recent cable from France announced that Ambrose Swasey, president of the Warner & Swasey Co., of Cleveland, Ohio, had been elected to honorary membership in the Society of Civil Engineers of France, and also an officer of the Legion of Honor. These honors come on top of those of a week ago when Mr. Swasey was elected to honorary membership in three British engineering societies.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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An autumnal shortage in many lines of manufactured goods is indicated as a result of the industrial underproduction during the last few months. There is, for instance, plenty of raw sugar but a scarcity of the refined article which has in consequence advanced to 5.90 cents a pound, while the Federal Refining Co. admits that it is oversold and cannot for the present accept further orders. At the convention of the National Canners Association, in Chicago, the opinion generally expressed was that canned goods, including particularly tomatoes, peas, corn and salmon, would be much higher because the summer's pack was far below normal.

The bulletin of the U. S. Potash Producers' Association warns consumers of this important chemical that stocks are so low that higher prices seem inevitable. Secretary Hoover confirms what I said last week regarding coal in a letter he has written to the public utilities companies warning them that there is every indication that there has "been undue slackness in the purchase of coal which may accumulate to large demands in the autumn." He adds that he is convinced that "the price of bituminous coal at the mines is not too high at present."

In the textile trade the improvement noted last week continues and at the "opening" of the Amoskeag Co.'s spring line of cotton goods last Monday the response from buyers is described as being "one of the most remarkable known in dry goods history, as before noon it became apparent that the company's whole spring product would be under order by the end of the day because cutters were ordering three to four times the quantity taken a year ago." Well-informed merchants say that they expect equal eagerness to buy at the opening of the American Woolen Co.'s spring lines next week. In the ready-made clothing market similar conditions are reported. A buyer from Billings, Mont., whose liberal purchases attracted attention, explained that "our stock has been reduced to nothing."

Silk is firm and in good demand. The trade reports notice a hardening tendency in the tea market. Hides and calf skins are higher. The improvement in the shoe industry continues and even the supply of Christmas toys with which forehanded department stores must now provide themselves is said to be altogether inadequate. In the steel industry the business being booked is still small but the *Iron Age* is encouraged by "the ready response of buyers to the price cutting in progress" and there is very little doubt that there is a large vacuum, to fill which large orders will be placed when prices have been stabilized at the lower levels generally expected.

Copper and building materials, including lumber, are almost the only articles of importance for which a better demand cannot be reported, but copper is quite steady at 12¾ cents and it is not to be expected that the commercial recovery that is now so evident will find expression in the building trade until later on when contractors will commence to buy against the construction work that will probably be undertaken next spring unless some unforeseen setback should occur.

With such cheerful reports from the commercial markets it is not surprising that the stock market should have been steady and that some of the industrial stocks, including the securities of the sugar companies, should have advanced. Speculation has, however, been dull, for many of those who might make it active are away.

There has nevertheless been some quiet buying of the railway stocks for the improved conditions in the transportation industry are daily becoming more evident and the indications are that its entire capacity will soon be profitably employed in moving the maturing crops and the commodities for which their proceeds will be exchanged. It is not, however, to be expected that the railroad presidents will admit prosperity until the $500,000,000 that they expect to get from the Government is safely within their coffers. It is, however, possible that Henry Ford may force their hand by his action in reducing freight rates by 20 per cent and raising the minimum wage to $6 a day on his Detroit, Toledo & Ironton Railway. Whatever may be thought of Ford's political and social philosophy it must be admitted that he knows how to "play a lone hand" in business.

A distinct improvement in the demand for the securities of public utility companies is also to be noted now that fares are up and wages are coming down. In the market for bonds, which is non-speculative, the improvement in investment conditions is more definitely manifest than in stocks. Prices are gradually creeping up and the supply of bonds that can be bought upon better than a 7 per cent basis is being rapidly depleted.

The news from Washington, though tranquilizing, is not stimulating, as there is as yet nothing to indicate that Congress is bestirring itself to readjust the burden of taxation that is so galling. There are, however, some indications that even the most tariff-bound Republicans are revolting against the absurdities of the Fordney bill. The valuation clause is being ridiculed by many of the staunchest party newspapers. The duty on petroleum has been rejected by the House. Ex-Governor Douglas of Massachusetts, himself a shoe manufacturer, points out that 40 per cent of the hides consumed in the United States are imported while the remaining 60 per cent are produced by the packers, and asks for whose benefit a duty on hides that will increase the cost of shoes is proposed. In answer to this question the House has put hides on the free list.

Perhaps in time we shall get a reasonably sane tariff bill, but the pity of it all is the time that it will take and there are many Republicans who are now demanding that the whole measure shall be sent back to the Ways and Means Committee for repairs and that Congress shall in the interval take up the infinitely more pressing question of taxation.

Meantime and probably because it is plain that we shall have little or no import trade if the Fordney bill passes foreign exchange is sharply lower. Sterling has declined to $3.57½ and continental bills are down correspondingly.

The weekly statement of the Federal Reserve System shows a gain of $16,000,000 in its stock of gold and a reserve ratio of 62.5 as against 61.6 per cent a week ago. The New York, Boston, Philadelphia and San Francisco Banks have reduced their rediscount rates to 5½ per cent, thus responding somewhat tardily to the criticism that has been provoked by the high rates previously exacted. The agrarian leaders of the West and South are meantime demanding an investigation of the charges of favoritism and extravagance in the management of the Federal Reserve Banks that ex-Comptroller John Skelton Williams made in his recent speech at Augusta, Ga., and Mr. Williams himself is to be heard by the joint Committee on Agriculture of the House and Senate on Tuesday, July 26. At this hearing it is expected the fur will fly for the ex-comptroller has declared that he intends to fight with both fists.

The money market, as might have been expected, is easier since the reduction in rediscount rates was announced, but even the best commercial paper has not yet sold below 6 per cent. A lower rate is not to be expected as long as Liberty Bonds and Treasury Certificates can be bought to yield 5¾ per cent or more.

The Bureau of Internal Revenue has published an interesting list of the American expenditures for taxable luxuries in 1920. Here are some of the more important items: Theaters, including moving pictures, $1,000,000,000; tobacco, $900,000,000; ice cream, soda water, etc., $500,000,000; candy and other confections, $400,000,000; perfumes and cosmetics, $50,000,000; diamonds; jewelry and watches, $220,000,000; club dues, $50,000,000; bowling alleys, pool rooms, etc., $50,000,000; playing cards, $11,000,000; chewing gum, $50,000,000; musical instruments, $220,000,000; toilet soaps and powders, $67,000,000; furs and fur trimmings, $150,000,000; pleasure automobiles and accessories, $2,000,000,000.

Including all items the list totals over $5,000,000,000 and from it some idea may be had of the economic slack that the people of the United States can take in before they become really hard up.

The news from abroad is nearly all encouraging. The Irish problem is not yet entirely solved but the conferences being held in London are slowly bringing the dissident elements into agreement. The diplomatic correspondence regarding the disarmament congress called by President Harding is like all diplomatic correspondence —rather cryptic, but it is impossible to conceal the fact that public opinion favors the movement so strongly that no one power will dare to thwart it. The announcement that Lloyd George will visit this country as one of the conferees is enthusiastically received. British trade is better. The London markets are "quietly firm" and the Bank of England has followed the example of our Federal Reserve Banks in reducing its rediscount rate of 5½ per cent. Bernard Baruch, who has been in conference with Hugo Stinnes in Berlin, says that Germany will recover rapidly because the Germans are working. Henry E. Cooper of the Equitable Trust Co., just returned from France, makes an optimistic report of conditions in that country. Dr. Frank Crane describes Belgium as highly prosperous.

The news from Mexico which has been called America's Ireland, is, however, still inconclusive. The conflict between the Tampico oil men and the Obregon government is not settled and conditions elsewhere as far as known are unsatisfactory. It is said that the population of the City of Mexico has been increased to over a million by the influx of those who formerly lived in the rural districts where life has become unsafe.

Viewing the outlook comprehensively the intelligent observer can hardly fail to agree with the National Bank of Commerce in New York whose report, dated July 21, says: "The United States is practically through the period of violent business disturbance which began in May, 1920. We will from time to time have visible evidences of the distressing conditions through which the country has been passing, but these occurrences should be regarded not as indices to forward conditions but as relating to the past. The main requisite for a return toward normal conditions is the will to try for business on a level where it can be had. The period of general liquidation of the raw material markets of the United States has passed."

	End of Last Week	End of Previous Week	Last Year
Bank clearings (Bradstreets)			
In thousands	$6,239,069	$6,132,997	$8,159,061
Business failures	441	310	144
Security prices, N. Y. Stock Exchange:			
20 Industrials	68.11	67.85	90.74
20 Railroads	71.90	70.96	73.45
40 Bonds	76.76	76.73	73.71
Commodity prices:			
Wheat, No. 1 spring	$1.60	$1.64½	$3.15
Corn, No. 2 yellow	.79⅜	.80½	1.76
Beef, good dressed steers	15.00	15.00	24.00
Pork, mess, bbl.	24.00	24.00	39.00
Sugar, refined	.0590	.0550	.21
Coffee, Rio No. 7	.06 7/16	.06⅝	.12½
Cotton, middling	.1295	.1245	.4375
Print cloths	.04⅜	.04¼	.14½
Wool, domestic average	.4000	.4020	......
Silk, No. 1, Sinshiu	5.85	6.00	6.00
Rubber, crude, plan	.15	.15½	.31½
Hides, Pack. No. 1	.14	.13	.30
Iron, No. 2, Phila	21.85	25.50	48.50
Steel billets	33.00	33.00	65.00

Russia Needs Outside Capital

Referring to the belief of some people that a resumption of trade relations with Soviet Russia is the panacea for many of the world's economic ills, R. Poliakoff, who acted for the Russian Zemstvos Union in the United States during the early part of the war, cites the following:

"From 1881 to 1890, Russia supplied almost two-thirds of the entire importation of wheat into Great Britain from Russia, Canada, Australia and Argentina. From 1910 to 1913 her share diminished to one-sixth and the share of Canada, Australia and Argentina increased to five-sixths. During the year just before the war, Russia's share fell even more, amounting to only one-twelfth.

Does England Need Russian Grain

"During the war, the productive capacities of Canada, Australia and the Argentine, stimulated by the war demands, increased, as did also consumption in Russia herself. Let us further recall also that the steamers of the English marine which were carrying soldiers and war materials during the war reverted once more to commercial purposes to a considerable extent after the armistice. Can there be any doubt that England can get all the grain she needs from Canada, Australia and the Argentine, and forget about Russia entirely? England does not need Russian grain and can go on comfortably without it. Certainly, I do not mean by this that Russia will not export her grain to Great Britain when conditions favor such exports. Russia will be only too glad to sell and Great Britain will be equally glad to buy such grain. But what I wish to imply is that the cry raised in Great Britain, and picked up from there, that she cannot sustain herself without Russian grain was unwarranted, and was perhaps raised for a number of reasons, but not on account of actual need.

"If we analyze pre-war conditions, it will be seen that Russia's yearly foreign trade from 1909 to 1913 was about 1½ billions of gold rubles in exports, and in imports about 1 billion gold rubles, or about 1¼ billion dollars in all; that it amounted to only 3.6 per cent of the world's trade; that compared with it, Austria-Hungary's share was about the same; and Switzerland's whose population was only 2 per cent of Russia's, about half of this figure. This, without mentioning such countries as the United States of America, Great Britain, Germany and France, whose respective ratios to Russian trade are: Russia, 1; Great Britain, 5; Germany, 4; France, over 2; United States, over 3.

"The total export trade of Great Britain in 1913 was about 3 billion dollars, out of which Russia consumed 85 million dollars worth or 3 per cent. The export trade of Germany in 1913 was about 2.6 billion dollars, out of which Russia consumed about 200 million dollars' worth, or less than 8 per cent. The export trade of France in 1913 was 1⅓ billion dollars, out of which Russia consumed 20 million dollars' worth, or 1½ per cent, and the export trade of the United States of America in 1913 was 2½ billion dollars, of which Russia's share was only 26 million dollars, or 1 per cent. With regard to the latter figure, it is sometimes pointed out that the export trade of the United States to Russia had a value of more than 26 million dollars, since some of the American goods found their way into Russia via Germany; but this circumstance would change the result very little.

"If such were the conditions before the war, how were conditions changed by the war? The productive capacities of the industrial countries have considerably increased, as a result of all the circumstances created by and during the war, whereas the paying and productive capacities of Russia have considerably decreased and are at present of little consequence.

Russia Needs Goods—and Credit

"Russia needs and will need all kinds of goods for a long time to come but these will have to be either imported by her without payment, i.e., on long-term credit, or manufactured in Russia. In order to do the latter, capital also will have to be imported.

"In either case it means that outside capital will have to be supplied to Russia to enable her to get from the industrial countries or through them what she needs. Whether such capital will be supplied—and in case it will—whether it will help to stabilize the trade conditions of the world is another question. The fact remains that the settlement of world trade conditions will be more easily forwarded by forgetting about Russia for the time being and stabilizing outside of her, thus indirectly helping her in the most efficient manner."—*Wall Street Journal.*

Report of Railway Association on Freight Loading

Owing to the observance of Fourth of July throughout the country, there was a falling off of 135,110 in the number of cars loaded on American railroads with revenue freight during the week which ended on July 9, compared with the previous week, according to reports just received from the rail carriers by the Car Service Division of the American Railway Association.

The total for the week was 639,698 cars which was a decrease of 156,493 cars compared with the corresponding week last year and 170,147 cars compared with the corresponding week in 1919.

Reductions, compared with the week before, were reported in the loading of all commodities, the greatest being in merchandise and miscellaneous freight which includes manufactured products, coal and forest products. Because of the holiday in the week of July 9, however, comparisons with the preceding week in which there were six full working days are out of line.

Loading of merchandise and miscellaneous freight totaled 389,787 cars, which was 80,000 less than the preceding week, while 126,331 cars were loaded with coal compared with 157,265 cars during the week before, or a reduction of 30,934 cars. There were also 57,796 cars less coal-loaded during the week of July 9 than during the corresponding week last year and approximately 65,000 less than during the corresponding week in 1919.

Reports showed 34,356 cars loaded with forest products, compared with 47,542 cars the week before, or a difference of 13,186. Ore loadings totaled 26,312 cars, or a reduction of 4,000, compared with the previous week, while live stock fell off 3,856 cars to a total of 21,067 cars. Loading of grain and grain products totaled 38,015 cars, or 2,532 less than were loaded during the week of July 2, and coke loadings decreased 524 cars to a total of 3,830.

Except for grain and grain products, the loading of all commodities during the week was less than during the corresponding week last year.

Comparisons by districts also showed that the number of cars loaded during the week was not only less than during the preceding week but also during the corresponding week in 1920.

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Automobiles and the Tariff

The lower automobile duty in the proposed new tariff bill will aid American foreign trade, even though the act itself may need revision in the way of excessive duties on raw materials, is the opinion of J. Walter Drake, chairman of the Foreign Trade Committee of the National Automobile Chamber of Commerce. Exports of motor vehicles and parts in 1920 headed the list of manufactured articles, with a valuation of $289,219,875, and were exceeded only by raw cotton, wheat and coal.

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New Steel Works in New South Wales

A new steel works is to be established at Port Kembla, a new port 60 miles south of Sydney, New South Wales. A large breakwater is now nearing completion, which will considerably enhance the natural facilities of the port and provide the required accommodation for the largest vessels trading with Australia. The port is in the center of a large coal-mining district, and it is anticipated that when the works are in operation many subsidiary industries, depending upon the free supply of iron and steel, will be established. It is stated that the outlay on the works will be in the neighborhood of £2,000,000. The same company is now operating large iron and steel works at Lithgow, which is 100 miles inland from Sydney, states the *Canadian Weekly Bulletin of Trade and Commerce.*

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German Tools in Japan

Prices from 30 to 50 per cent lower than American quotations are being offered by Germans bidding on contracts for machines, tools, etc., in Japan, according to reports to the Department of Commerce.

It is provided, however, that the consumer must agree to pay any export tax levied by the Allies, even though such tax is as great as 25 per cent.

It is stated prices of German materials in Japan will be less than for similar articles of American manufacture.

Washington Notes

By Paul Wooton
Washington Correspondent

A bill providing for the compulsory use of the metric system, after a period of ten years, was introduced in the Senate on July 18 by Senator Ladd, of North Dakota. The bill is identical with that introduced in the House on April 11 by Representative Britten, of Illinois. In connection with the introduction of the bill, Senator Ladd authorized the issuance of a publicity statement under his name. This statement was made abundantly available to the press. In it, nine reasons are set forth to indicate the interest being manifested "in the effort to have Congress carry out the only duty given it by the constitution, which it has failed to exercise, namely, 'to fix the standards of weights and measures'." The nine reasons are as follows:

The 103,000 petitions on file with the Department of Commerce; the petitions of various state legislatures; reported intention of agricultural group of Senators to support metric legislation; the action of directors of the Chamber of Commerce of the United States in appointing a special metric system committee; endorsement by more than 100 national organizations; the use of the system by most countries; enactment of a metric law by Japan; endorsement by several specified companies; the fact that certain concerns are manufacturing entirely on a metric basis.

Senator Ladd also quoted statements by Chairman Lasker, of the Shipping Board, Admiral Sims and Elwood Haynes, endorsing the system.

The Stanley patent bill, requiring foreigners taking out American patents to undertake manufacture within the United States, was reached on the Senate calendar July 18, but was not considered, due to objection on the part of Senator Smoot, of Utah. Senator Smoot said that he had taken up some phases of this legislation with the Commissioner of Patents and is awaiting a reply. Pending receipt of that reply, he asked that consideration of the bill be postponed.

Despite the industrial depression, applications for patents during the first six months of 1921 broke all records. Applications for patents during that period numbered 45,005. This is nearly 300 more applications than the best previous half-year period. During the same period, there were 8,369 applications for trademarks, which also is a new record. With the demands on the Patent Office increasing the capacity of the office is limited to the volume of business of 20 years ago. There is pending in Congress a bill providing for some additions to the force and for some increases in salaries. This bill probably will pass in the near future, but it will not meet the exigencies of the situation. It seems probable that applications will continue to accumulate until the pressure becomes sufficiently great to induce legislative relief. The failure to provide adequate machinery to handle promptly all applications for patents is particularly difficult to understand, since the office is more than self-sustaining.

By an overwhelming vote in Committee of the Whole, the House of Representatives overruled its committee on Ways and Means on the matter of a duty on crude petroleum and fuel oil and transferred that item to the tariff bill's free list. In similar fashion, the committee was reversed in the matter of hides, which the House voted to make dutiable; in the matter of long staple cotton, which also was made dutiable, and in the matter of asphalt, which went to the free list after the Committee had recommended that it be dutiable at $1.50 per ton. The Committee was upheld in its dye schedule, which provides a type of embargo, to be exercised by the Federal Trade Commission, against certain dyes and dyestuffs. It was only on these five items that a separate vote was allowed. The Senate is expected to make very material changes in the bill, but there is no reason to anticipate that there will be a change in the paragraphs covering machine tools, tractors and other classes of machinery.

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What Increase in Pay Did

The gun factory at the Washington Navy Yard has been put on a five-day basis. To prevent the discharge of some 1,000 mechanics the plan of having a forced holiday each Saturday was adopted. It was made necessary by the reduction in appropriation and the increase in the rate of pay.

Business Items

The Automotive Products Co., Warren, Ohio, has been incorporated with $25,000 capital stock by Edward Geissman and R. I. Bock, and others.

The Alco Foundry and Machine Co., Wellston, Ohio, has purchased the property of the Hamden Foundry Co. and is making alterations for the production of gray iron castings.

The quarterly dividend of 2 per cent has been declared by the Carroll Foundry and Machine Tool Co., Bucyrus, Ohio.

The Meldrum-Gabrielson Corporation, Syracuse, N. Y., manufacturer of milling machines, plans the erection of a two-story machine shop, to cost about $200,000.

The Gairing Tool Co., Detroit, has increased its capital stock from $50,000 to $100,000.

Upon recommendation of the directors stockholders of the Hydraulic Steel Co., Cleveland, rejected the plans proposing a merger with the Detroit Pressed Steel Co. Stockholders also decided to drop the contemplated issue of preferred stock and to give up an option on the Detroit concern.

The Trenton Chilled Die & Casting Co., Trenton, N. J., recently organized has located in a plant at the foot of Houghton Avenue, which is fully equipped for the production of its products. Officers of the company are: President, John H. Conover; treasurer, R. B. Newton, and secretary, B. N. Rich.

Tools for use in garages will be manufactured by the Stafford Appliance Co., Benton Harbor, Mich., recently incorporated with a capital stock of $50,000. In addition the company will manufacture automobile accessories. No building operations are contemplated at this time. Officers are: President, Herbert A. Thomas; vice-president, Abe Stafford; treasurer, Harvey A. Hridley, and secretary, Leonard R. Henoch. The main office of the company is in the First National Bank building, La Porte, Ind.

Erection of a factory building is planned by the Everhold Brake Appliance Co., Inc., Gloversville, N. Y., which was incorporated some time ago. At this time the company has not completed its plans and therefore is not in a position to make known its needs in the way of equipment, etc. Officers are: President, Emanuel Zannetti; vice-president, Harry Zannetti; secretary and treasurer, Cosimo Di Mezza and general manager, H. S. Cromwell

J. F. Davis & Sons Co., Chicago, has been organized with a capital stock of $500,000, and has purchased the entire plant, machinery and equipment of the De Pere Manufacturing Co., West De Pere, Wis. The new company will build boilers, tanks, special steel plate construction and fabrication. Officers of the company are J. F. Davis, president, and J. E. Davis, secretary.

The Link Belt Co., Chicago, Ill., has increased its capital stock to $9,750,000.

The Daniels Manufacturing Co., Boston, Mass., has been incorporated with $600,000 capital stock to make automobile parts and accessories. H. L. Donohue, C. T. Mackay and E. T. Giblin form the board of directors.

The William E. Quinn Co. has been organized at Northampton, Mass., to manufacture tools and machinery. D. W. Long, H. M. Chamberlain, W. E. Quinn and A. G. Beckman are mentioned as directors.

Hamilton Brothers Inc., Boston, Mass., has been organized, capital stock $100,000, to build motors.

The Converse Tire Co., Malden, Mass., has been incorporated with a capital stock of $1,000,000, to build automobiles and manufacture auto supplies. M. M. Converse, H. Bullock and F. R. Goodell are named as directors.

The Henry & Wright Manufacturing Co., of Hartford, Conn., manufacturers of drilling machines, has recently filed a certificate for the increase of its capital stock from $80,000 to $230,000, consisting of 700 shares of preferred and 800 shares of common stock, with $100 per value.

The Atlas Die Casting Co., of Worcester, Mass., recently incorporated with a capital stock of $200,000 and has leased factory space in the Mercantile Bldg., at 41 Jackson St., that city.

The Ralph E. Barrity Co. has been incorporated at Wheeling, W. Va., to deal in machinery.

The Marion Motors Co. has been organized with a $40,000 capital. L. G. Roop, J. B. Moore and J. R. Cole are included in the directorate.

The Industrial Casting Co., Hamilton, Ont., Can., has increased its capital stock to $75,000.

The Nitro Foundry Co., Nitro, W. Va., has been organized and incorporated with a capital stock of $50,000. M. S. Aldrich, R. Mathews and W. A. O'Neill, all of Charleston, are directors.

Loss amounting to almost $150,000 resulted when fire recently destroyed the plant of the Jaffe Iron and Metal Co. at Birmingham, Ala. The fire was caused by lightning during an electrical storm. The company plans the immediate construction of a new building on the same site.

The Allied Machinery Co. of America, 51 Chambers St., New York City, has been appointed foreign representative in all countries except Canada, for the Universal Crane Co., of Cleveland, Ohio. The Universal Crane Co., manufactures a 3- to 4-ton portable gasoline or electric locomotive crane.

The Bacher Machine and Grinding Co., Wilmington, Del., has been incorporated under the laws of the State of Delaware. G. J. Bacher, F. S. Bunting and H. G. Eastburn form the directorate.

The Hoosier Rolling Mill Co., Terre Haute, Ind., has increased its capital stock from four to seven million dollars.

After a thorough reorganization the Immel Company, Columbus, Ohio, will resume the manufacture of automobile bodies as soon as an inventory is completed.

The Koehler Machine and Tool Co. has been incorporated at Newark, N. J., to manufacture machinery. Directors are Henry Koehler, Joseph Klopak and John J. Evans.

The Bishop-Blaney Corporation has been organized at Paris, Ontario, Can., to manufacture machinery, etc. The company is capitalized at $5,000,000 and directors named are A. W. Clysdale, D. Sedgewick and R. M. Glover.

The New Britain Machine Co., New Britain, Conn., has increased its capital stock to $1,713,300.

Announcement has just been received of the passing of the grinding and polishing stand and the accessory department of the Webster & Perks Tool Co., Springfield, Ohio, into the hands of the Hill-Curtis Co., Kalamazoo, Mich. The sale was consummated on July 18.

Barbour, Love & Woodward, Inc., machine tool dealers, formerly of 149 Broadway, New York, have now moved from a temporary office and warehouse at 131 Washington St., to new offices and showrooms at 45 West 18th St. Surplus stock will be carried in the building for the convenience of those desiring to inspect machines.

W. V. Faunce Motors Corporation, Wilmington, Del., has been organized and incorporated to manufacture automobiles. S. E. Dill, M. A. Bruce and C. H. Maxwell are the directors named.

The Amsterdam Machine and Motor Corporation, Amsterdam, N. Y., has been incorporated under the laws of New York. The board of directors includes N. Schotte, A. E. Radichel and F. H. Blase.

Announcement was made recently that the Matthews Engineering Co., Birmingham, Ala., had received an order from the Government for 110-volt, 5,000-watt generating sets, the order totaling $35,000.

The Corbin Screw Corporation, New Britain, Conn., resumed operations on July 18, working a 55-hour week with 1,200 men employed. The company makes screw machine products, ball bearings and coaster brakes.

The Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has announced a reduction in the prices of its products of approximately 10 per cent. The cut became effective July 14.

The Sethford Manufacturing Corporation, New Bedford, Mass., has been incorporated with a capital of $50,000 by S. M. Cambral, E. Amaral and L. A. Dias. The new company will build engines and machinery.

The Robbins Machine Co., Portland, Oregon, has been organized with a capital stock of $50,000.

Personals

John D. Hurley, president of the Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago, Ill., sailed from New York City on the steamship "Olympic" on Saturday, July 16, for an extended trip through Europe. Mr. Hurley will make his trip one of combined business and pleasure.

S. V. McLeod has been appointed purchasing agent of the Algoma Steel Corporation, Ltd., Sault Ste Marie, Ontario, Canada. He takes the place of L. L. Jacobs who recently resigned.

John D. Nicklis has been appointed manager of the supplies and purchases department of Manning, Maxwell & Moore, Inc., of New York.

T. L. Wickenden, of Cleveland, Ohio, formerly with the Republic Iron and Steel Co., Cleveland, is now Cleveland representative of the Iron Trade Products Co., of Pittsburgh, Pa. Mr. Wickenden has been connected with the Cleveland office of the Lackawanna Steel Co., at Buffalo, and later was affiliated with the Cleveland-Cliffs Iron Co., at Cleveland.

Robert D. Black, who was formerly assistant sales manager of the Black & Decker Manufacturing Co., Baltimore, Md., has been appointed manager of the company's Philadelphia branch office, with headquarters at 318 N. Broad St. Mr. Black succeeds W. C. Allen who has been made a special factory representative with headquarters at the company's Cleveland branch office.

Stanton Griffith has recently been appointed foundry superintendent at the plant of the Gilbert & Barker Manufacturing Co. in West Springfield, Mass. For the past two years Mr. Griffith was assistant to the vice-president of Harley Company, Springfield, Mass.

Obituary

Charles F. Barnhart, 55 years old, part owner and manager of the Barnhart Davis Co., operator of a machine shop and foundry at Warren, Pa., was drowned June 30 while bathing in the Conewango creek near his cottage at North Warren.

Charles T. Beaman, of Brooklyn, N. Y., died recently at Omaha, Neb. At the time of his death he was traveling in the Western States in the interests of the Adriance Machine Works, Inc., of New York. He has been connected with the sheet metal business for some years and was employed for thirty-two years with E. W. Bliss Co.

John Jernberg, for the past thirty-nine years instructor in forge practice at the Worcester Polytechnic Institute, Worcester, Mass., dean of the instructors and considered to be one of the most expert metallurgists in this country, died suddenly in Sweden, recently. He was sixty years old. He left Worcester in perfect health for a visit to his old home, and died from a paralytic shock. Mr. Jernberg was to have been retired on a pension under the Rockefeller Foundation this fall. One of his three sons, Henry Jernberg, is manager of Fairbanks, Morse & Co., New York, builder of engines, while another is editor of the publications of the American Steel and Wire Co., in the Worcester district.

Forthcoming Meetings

The third annual convention and exhibition of the American Society for Steel Treating will be held in the Manufacturers Building, State Fair Grounds, Indianapolis, Ind., during the week of September 19 to 24 inclusive.

The annual congress of the National Safety Council will be held at Boston, Mass., during the week of September 26. C. W. Price, 168 North Michigan Ave., Chicago, Ill., is general manager.

A joint meeting of the American Society of Mechanical Engineers, the Society of Automotive Engineers and the Army Ordnance Association will be held at Aberdeen, Md., Friday, October 7.

The National Machine Tool Builders' Association will hold its Fall Meeting at the Hotel Astor, New York City, October 18, 19 and 20.

NEW *and* ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Mass., Worcester—The United States Screw and Stamping Co., H. Beland, Genl. Mgr.—equipment for the manufacture of screw machine products and stampings.

Md., Baltimore—C. G. Sargent & Son, 2017 East Chase St., manufacturers of chair reinforcements, C. G. Sargent, Purch. Agt.—small woodworking machinery, including power drills, cutting off saws, sand belts, etc.

N. J., Burlington—G. H. Tillinghast, 425 Wood St.—one 12 or 14 in. Monarch lathe, used, in good condition.

N. Y., Albany—C. L. Cadle, Supt. Pub. Wks., will receive bids until Aug. 17 for two 3 ton electric semi portal revolving jib cranes for barge canal terminal, Gowanus Bay, Brooklyn. Estimated cost, $30,000.

N. Y., New York—Expo Camera Co., 241 West 23rd St.—one 12 in. and 14 in. Independent 4 jawed chucks of cast iron and steel.

N. Y., New York—Lincoln Institute for Vocational Education, 694 Bway.—one 13 in. x 5 ft. geared head motor driven lathe.

N. Y., New York—P. Pryibil Machine Co., 512 West 41st St.—one 9 in. and one 11 in. "Star" screw cutting engine lathes.

N. Y., Wilson—A. H. Hinchliffe—shafting, hangers and friction clutch, $2\frac{15}{16}$ in.

Pa., Philadelphia—G. Williams, 828 North Hancock St.—one 20 in. drill press.

La., Abbeville—A. O. Landry—machinery for digging gravel running from 75 to 90 ft. below surface and from that depth to 200 to 300 ft. deeper.

N. C., Winston-Salem—Liberty Baking Co., P. O. Box 1675—complete baking equipment.

Tenn., Knoxville—White Oak Corp., H. T. Spencer, Pres.—one light 4 side planer and matcher, 6 x 15 or larger, one light 3 side planer and matcher, one circular resaw, one 4 in. sticker, small scraper (Whitney) preferred, and two belt sanders.

Va., Richmond—Auto Radiator and Fender Co., 1031 West Broad St., J. James, Purch. Agt.—sheet metal folder, drill press and lates, (new or used in good condition).

Va., Richmond—Bohanans Auto Repair Shop, 722 West Broad St., J. K. Bohanan, Purch. Agt.—medium size lathe.

Va., Richmond—Clarks Welding Shop, 311 North Gelmore St., R. A. Clark, Purch. Agt.—complete mechanical outfit including drill press, lathe and auto wrenches.

Va., Richmond—J. D. Fecklin, 1205-07 West Broad St.—lathes and drill press, new and used.

Va., Richmond—Gregory Wire Wheel Service Co., 517 West Broad St., L. B. Gregory, Purch. Agt.—lathe and drill press (new or used), grinder and buffer.

Va., Richmond—C. Williams, 416 Brooke Ave., circular and band saw, joiner, drill press, stock and dies for wheelright shop.

W. Va., Williamson—Waugh Fdry. & Machine Wks., J. R. Hill, Mgr.—machinery for repairing mining equipment.

Ill., Aurora—The Natl. Brush Co.—punch press.

Ill., Chicago—Passmore Novelty Co., 1322 West Congress St.—tinners folder and squaring shear.

Mich., Iron River—Iron River Creamery Co.—refrigerating and creamery machinery.

O., Canton—The McKinley High School—four 14 x 6 and seven 12 x 13 in. lathes; two 16 in. shapers; one 3 ft. radial drill; one 10 x 30 in. universal grinder; universal milling machine, vertical milling machine, universal tool room grinder, portable hoist, 20 in. upright drill, 6 x 6 in. hack saw, wet tool and drill grinder, two arbor presses, motor driven dry grinder, two electric breast drills, 2-ton elevating truck, lathe chucks, dogs, taps, wrenches, reamers and miscellaneous tool room equipment.

O., Cleveland—The Star Machine & Tool Co., 433 Champlain Ave.—punch press, similar to No. 20B Bliss 3 in. stroke, (used).

O., Columbus—Colgan Limestone Products Co., New Hayden Bldg., F. Colgan, Purch. Agt.—complete equipment for stone crushing plant to be erected on Fulton Lane, near Zanesville.

O., Columbus—Shepard Paint Co., 19 East Long St., A. J. Shepard, Pres. and Genl. Mgr.—complete machinery for new paint factory at 231 West Mound St.

Wis., Antigo—J. F. Jeske—cheese making machinery, belt driven.

Wis., Elcho—C. W. Fish Lumber Co.—saw mill machinery for mill at Crandon.

Wis., Kenosha—F. Krah, 904 Park St., (automobile repair shop)—repair machinery, including suitable drill press.

Wis., Madison—The State Bd. of Control, Capitol—equipment for laundry at Delavan.

Wis., Sauk City—The Sauk City Canning Co., (vegetable cannery)—canning and can-making machinery.

Wis., Tomahawk—The Tomahawk Steel & Mchy. Co., manufacturer of structural steel, etc.—traveling crane.

Wis., Westby—G. Skolos, (machinist)—one engine lathe.

Wis., Wisconsin Rapids—The Consolidated Water Power & Paper Co., G. Mead, Pres.—traveling crane.

Ont., London—F. Watson, Wharncliffe Rd. and Dundas St.—equipment for repair shop and garage.

Ont., Mossley—R. F. Rath, R. R. 1—equipment for modern cheese factory to be erected at Gladstone.

Ont., Penetanguishne—Donaldson & Lefaire will receive bids until Aug. 15 for complete equipment for aerated water, soda and gas manufactory. Estimated cost, $12,500.

Ont., Strathroy—Hodgins & Laughton—equipment for repair shop and garage. Noted May 26.

Metal Working Shops

NEW ENGLAND STATES

Me., Greenville—The Great Northern Paper Co., Exch. Bldg., Bangor, is having plans prepared for the construction of a 2 story machinery repair shop, here. Crowell & Lancaster, Exch. Bldg., Bangor, Engrs. and Archts.

Mass., Brighton—F. Diliberto, 34 School St., Boston, has awarded the contract for the construction of a 1 story, 85 x 180 ft. and 40 x 40 ft. garage and repair shop on Brighton Ave., here. Estimated cost, $80,000.

Mass., Dorchester—Berch & Cadigan, 130 Shawmut Ave., Boston, have awarded the contract for the construction of a 1 story garage on Norfolk St. Estimated cost, $85,000.

Mass., Pittsfield—R. M. O'Connell, 328 North St., has awarded the contract for the construction of a 1 story, 60 x 232 ft. and 20 x 47 ft. garage and service station on South St. Estimated cost, $75,000. Noted June 9.

Mass., Springfield—The City plans to build a 2 story garage on Summer St. Estimated cost, $75,000. Private plans.

Mass., Springfield—A. Freedman, 27 Church St., plans to build a 1 story machine shop. Estimated cost, $20,000. Private plans.

Mass., Springfield—O. P. Thompson, 145 State St., does not plan to build an 8 story, 100 x 190 ft. garage and repair shop on Dwight St. as stated in our issue of July 21.

MIDDLE ATLANTIC STATES

Md., Baltimore—The Church Home and Infirmary, North Bay., is having plans prepared for the construction of machine and repair shops on Bethel St. Wyatt & Nolting, Keyser Bldg., Archts.

Md., Baltimore—M. L. Himmel & Son, 107 North Frederick St., manufacturers of office and bar fixtures, are having plans prepared for the construction of a 5 and 7 story, 100 x 400 ft. factory on Frederick and Warwick Aves. Estimated cost, $150,000. O. G. Simonson, Maryland Casualty Bldg., Archt.

N. Y., New York—S. S. Brooks, 342 West 56th St., is having plans prepared for the construction of a 2 story, 75 x 100 ft. garage at 793 11th Ave. Estimated cost, $65,000. J. H. O'Brien, 1123 Bway., Archt. and Engr.

Pa., Pittsburgh—Oberndorf Mfg. Co., 7509 Thomas Blvd., manufacturers of plumbing supplies, is receiving bids for the construction of a 1 story, 160 x 200 ft. factory on Thomas Blvd. and Richland St. Estimated cost, $90,000. W. G. Wilkins Co., Westinghouse Bldg., Archts. and Engrs.

SOUTHERN STATES

Va., Richmond—The Amer. Locomotive Wks., Blvd. and Fair Grounds, will build a 1 story, 42 x 85 x 162 ft. factory. Estimated cost, $25,000. Private plans.

W. Va., Wheeling—The Twelfth Street Garage Co. has awarded the contract for the construction of a 5 story, 80 x 125 ft. garage on 12th and Main Sts. Estimated cost, $150,000. Noted Feb. 19.

THE WEEKLY PRICE GUIDE

This Week's Market

Demand for steel is still lacking, and prices are the same in both New York and Chicago warehouses, with Cleveland apparently cutting under. Sheets are down ½c. per lb. in Chicago, while the market for shop supplies is softer than ever. Babbitt metal is down in Cleveland.

The metal market remains dull, with tin down 1¾c., zinc, ¼c.; antimony, ½c. Copper sheets and rods are a little cheaper in New York than a week ago. Chicago reports a further falling off in the price of old metals, but this market is the next thing to dead, everywhere.

Linseed oil has advanced 4c. per gal. in New York, 3c. in Chicago.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.80
Northern Basic	25.50
Southern Ohio No. 2	25.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	32.26
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75	27.26
Virginia No. 2	*27.00
Basic	†25.00
Grey Forge	24.40
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern, sil 2.25@2.75	28.67
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	24.96
Basic	23.46
Bessemer	24.96

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$3.03	$2.89	$3.03
Soft steel bars	2.93	2.79	2.93
Soft steel bar shapes	2.93	3.48	2.93
Soft steel bands	3.58	....	
Tank plates	3.03	2.89	3.03

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.20
Warehouse, New York, delivered	2.93
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	3.68	3.40	3.68
No. 12	3.15	3.73	3.45	4.18
No. 14	3.20	3.78	3.50	3.78
No. 16	3.30	3.88	3.60	3.88
Black				
Nos. 17 and 21	3.75	4.30	4.05	4.70
Nos. 22 and 24	3.85	4.35	4.10	4.75
No. 25 and 26	3.90	4.40	4.15	4.80
No. 28	4.00	4.50	4.25	4.90
Galvanized				
No. 10 and 11	4.00	4.50	4.25	5.70
No. 12 to 14	4.10	4.60	4.35	5.80
Nos. 17 and 21	4.40	4.90	4.65	6.10
Nos. 22 and 24	4.55	5.05	4.80	5.75
No. 26	4.70	5.20	4.95	5.80
No. 28	5.00	5.50	5.25	5.90

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb.	$4.43	$4.63	$4.00
Flats, squares and hexagons, per 100 lb.	4.93	4.63	4.50

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	55%
Cleveland	55%
Chicago	50%

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 3/32, 8½c. per lb.; ⅛, 7.15; 5/32 to ¼, 6.75. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	5.00	6.50	8.25
Spring steel (light)	8.00	6.50	10.50
Coppered Bessemer rods(base)	8.00	8.00	6.20
Hoop steel	4.03	3.44	3.83
Cold rolled strip steel	7.50	8.25	7.90
Floor plates	5.00	3.09	5.78
Spceial best cast steel	....	15.00	....

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of July 7, 1921:

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
BUTT WELD					
1 to 3	64½	52	¾	33½	18½
			1 to 1½	35½	20½
LAP WELD					
2	56½	44	2	30½	16½
2½ to 6	60½	48	2½ to 4	34½	22½
7 to 12	57½	44	4½ to 6	33½	21½
13 and 14	45	37	7 to 8	24½	12½
15	42½	32	9 to 12	19½	7½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	62½	51	1 to 1½	35½	21½
2 to 3	63½	52			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	54	43	2	31½	18½
2½ to 4	58½	47	2½ to 4	34½	22½
4½ to 6	57½	46	4½ to 6	33½	21½
7 to 8	53½	40	7 to 8	24½	12½
9 to 12	48½	35	9 to 12	19½	7½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	13@13½
Tin in 5-ton lots	26.75
Lead	4.75
Zinc	5.75
ST. LOUIS	
Lead	4.35
Zinc	5.35

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	20.50	21.50	23.50
Copper wire (carload lots)	15.50	16.50	19.50
Brass sheets	15.75	18.00	10.75
Brass pipe	16.50	22.00	23.50
Solder (half and half) (case lots)	20.00	23.50	16.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	13.75
Cleveland	16.00
Chicago	18.00

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel

Ingots and shot	41
Electrolytic	44

Monel Metal

Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots.................... 10.00

	Warehouse	
	In Casks	Broken Lots
New York	11.50	12.00
Cleveland	11.15	11.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	5.50
Chicago	6.00
Cleveland	6.75

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	9.50	9.50	$10.00
Copper, heavy, and wire	9.00	9.00	8.25
Copper, light, and bottoms	7.50	7.00	7.00
Lead, heavy	3.25	3.50	3.00
Lead, tea	2.00	2.50	2.00
Brass, heavy	5.00	5.00	7.25
Brass, light	4.50	4.00	4.25
No. 1 yellow brass turnings	5.00	4.00	4.50
Zinc	3.00	2.50	2.75

ALUMINUM—The following prices f. o. b. shipping point in cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	25.00	25.00@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	19.50
Chicago	23.00
Cleveland	22.00

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	38.50	35.00
Commercial	30.00	13.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

This market is very soft, and our quotations for the present are useful only as a guide.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	2.00	$2.25	3.00
Hot pressed hexagon	2.00	2.25	3.00
Cold punched hexagon	1.50	2.25	3.00
Cold punched square	1.50	2.25	3.00

Semi-finished nuts, $\frac{9}{16}$ and smaller, sell at the following discounts from list price:

	Current
New York	75%
Chicago	50%
Cleveland	80%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in.	50%	60–10%	50–5%
1⅛ and 1¼ in. by 3 in. up to 12 in.	40%	50–5%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York...... $3.00 Cleveland...... $4.50 Chicago....... $4.00

For cast-iron washers, ¾ and larger, the base price per 100 lb. is as follows:

New York...... $4.25 Cleveland...... $3.75 Chicago....... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	50%	60%	55%
Larger and longer up to 1 in. by 30 in.	45%	50–10%	50–5%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40–10%	10%
Chicago	net	net
New York	50–10%	25–10%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel $\frac{7}{16}$ and smaller	50–10%	60–10%	45%
Tinned	50–10%	60–10%	30%

Structural, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:

New York...$4.40 Cleveland...$3.90 Chicago....$4.88 Pittsburgh..$2.90

Boiler, same sizes:

New York...$4.50 Cleveland...$4.00 Chicago....$4.98 Pittsburgh..$3.00

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	19.00	24.00	25.50
Brass	16.50	22.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in., inclusive in rounds, and ⅛-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$6.85 per 100 lb.; New York prices is $7.50.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	7.50@10.00	12.00	14.25
Colored mixed	5.50@ 9.00	9.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.00
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$2.75@$3.00
Prompt foundry	4.00@ 4.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.80	$0.83	$0.87
5-gal. cans	.83*	.98	1.12

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.25
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.[illegible]	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount. Business is good in white lead.

MIDDLE WEST STATES

Ill., Chicago — Dubin & Eisenberg, Archts., 14 West Washington St., will soon award the contract for the construction of a 2 story, 50 x 75 ft. addition to sheet metal factory, for the Briskin Mfg. Co., 215 South Hayne Ave. Estimated cost, $25,000.

Ill., Chicago—M. Fesel, 2136 Wilson Ave., has awarded the contract for the construction of a 1 and 2 story garage on Montrose and Western Aves. Estimated cost, $60,000. Noted March 30.

Ill., Chicago—M. H. Spades, c/o D. S. Klafter, Archt., 64 West Randolph St., has awarded the contract for the construction of a 1 story, 70 x 125 ft. auto sales and service station, on Bway. and Berwyn Ave. Estimated cost, $80,000.

Ill., Greenville—The Duty Motor Co. plans to build a 1 story, 250 x 250 ft. factory. Estimated cost, $75,000. Architect not selected.

Ill., Winthrop Harbor—Badger Concrete Mixer Co., 221 Grand Ave., Milwaukee, Wis., will soon award the contract for the construction of the first unit of its factory, here, 1 story, 80 x 258 ft. Estimated cost $60,000. E. McVicker, Mgr. Private plans.

Mich., Adrian—The Utility Compressor Co., 1161 East Harger Ave., Detroit, has awarded the contract for the construction of a 1 story factory on Treat St., here, for the manufacture of iceless refrigerators. Estimated cost, $40,000. Baxter, O'Dell & Halpin, 1024 Hammond Bldg., Detroit, Archts. Noted May 12.

Mich., Ecorse—The Hinkley Motor Corp., 3420 West Fort St., Detroit, has awarded the contract for the construction of a 1 story, 250 x 340 ft. factory and power house on Cicotte Ave., here. Noted July 14.

O., Cleveland—The Apex Spring Cover Co., 6508 St. Clair Ave., has awarded the contract for the construction of a 1 story, 30 x 38 ft. factory. Estimated cost, $20,000. Private plans.

O., Cleveland—The Bryant Automobile Co., 3191 West 25th St., will soon award the contract for the construction of a 3 story, 80 x 180 ft. garage on West 25th St. near Clark Ave. Estimated cost, $100,000. P. Matzinger, Caxton Bldg., Archt. Noted Feb. 3.

O., Massillon—The Ladel Co. has awarded the contract for the construction of a 1 story 90 x 300 ft. factory. Estimated cost, $150,000. Private plans.

Wis., Edgerton—The Highway Trailer Co. plans to build a 1 story, 180 x 900 ft. assembling plant to replace the one which was destroyed by fire. Estimated cost, $200,000. Architect not selected.

Wis., Milwaukee—Sommers & Sons Co., 3032 Galena St., manufacturers of condensed milk machinery, has awarded the contract for the construction of a 1 story, 40 x 118 ft. foundry on 31st nd Burleigh Sts. Estimated cost, $40,000. Private plans.

WEST OF THE MISSISSIPPI

Minn., Minneapolis—The Haas Plumbing Co., 723 6th Ave., N., is having plans prepared for the construction of a 5 story, 117 x 120 x 168 ft. factory on 7th St., N., and Bradford Ave. Estimated cost, $150,000. D. Haas, Pres. Liebenberg, Kaplan & Martin, 617 McKnight Bldg., Archts.

Minn., Minneapolis—D. C. Thwing, 945 Andrus Bldg., has awarded the contract for the construction of a 2 story, 70 x 152 ft. garage at 1315 LaSalle Ave. Estimated cost, $60,000. Noted May 19.

Minn., Montevideo—The Bonde Garage Co. has awarded the contract for the construction of a 2 story, 100 x 100 ft. garage. Estimated cost, $65,000. Noted Feb. 3.

Mo., Kirksville—The Automatic Self Leveling Clock Co., c/o J. T. Dodd, plans to build a 2 story factory. Estimated cost, $100 000. Architect not selected.

Mo., Ozark—The Bain Mining Co. plans to build an iron oar mill. Estimated cost, $40,000. J. Denton, c/o owner, Engr

Mo., St. Louis—The Usona Mfg. Co., 826 South 18th St., manufacturer of wire, has awarded the contract for the construction of a 1 and 2 story, 100 x 150 ft. factory on Chouteau and Spring Sts. Estimated cost, $50,000. F. C. Long, Pres.

Mo., Springfield—The Martin Motor Co., 318 McDaniel St., will build a 2 story, 50 x 235 ft. garage and machine shop. Estimated cost, $30,000. T. D. Martin, Pres.

CANADA

Ont., London—F. Watson, Wharncliffe Rd. and Dundas St., plans to build a repair shop and garage. Estimated cost, $25,000.

Ont., Strathroy—Hodgins & Laughton are building a repair shop and garage. Estimated cost, $25,000. Noted May 26.

General Manufacturing

NEW ENGLAND STATES

Conn., Hartford — The City Health and Charity Dept. will soon award the contract for the construction of a 2 story, 43 x 63 ft. central heating plant and laundry on Holcomb St. R. D. Kimball Co., 6 Beacon St., Boston, Mass., Engr.

Conn., Middletown—The Millbrook Dairy Co., 4 Main St., has awarded the contract for the construction of a 3 story, 50 x 60 ft. dairy and ice cream plant, on Church and Broad Sts. Estimated cost, $40,000. Buck & Sheldon, Inc., 60 Prospect St., Hartford, Archts. and Engrs. Noted July 7.

Conn., New Haven—T. E. McAuiney & Son, 187 Columbus Ave., have awarded the contract for the construction of a 2 story, 65 x 80 ft. candy factory on Columbus Ave. Estimated cost, $20,000. Private plans.

Conn., Thompsonville — The Bigelow-Hartford Carpet Co., 58 Main St., plans to build a large cotton and jute mill on North School, Tariff and West Sts. Engineer not announced.

Mass., Boston—M. J. Mastrangelo, Archt., 369 Hanover St., will soon award the contract for the construction of a 1 story, 85 x 161 ft. factory on Ashmont St., for the Royal Curtain Mfg. Co., 111 Summer St. Estimated cost, $40,000.

Mass., Framingham — The Lake View Press has awarded the contract for the construction of a 2 story, 52 x 141 ft. printing plant. Estimated cost, $45,000. Private plans.

Mass., Lawrence—D. Brown Co., Market St., has awarded the contract for the construction of a 2 story, 40 x 100 ft. factory addition on Foster St., for the manufacture of spools, bobbins and shuttles. Estimated cost, $40,000. Private plans.

Mass., Springfield—F. O. Platt, 1159 State St., will build a 1 story dye house on State St. Estimated cost, $22,500. Private plans.

Mass., Worcester — M. J. Whittall and associates, Brussells St., manufacturers of carpets, have awarded the contract for the construction of a 1 story, 80 x 200 ft. weave shed. Estimated cost, $75,000.

N. H., Epping—The Overland Shoe Co. has awarded the contract for the construction of a 1 story, 40 x 300 ft. factory. Estimated cost, $40,000.

R. I., Phenix—The Pawtuxet Valley Dyeing Co. has awarded the contract for the construction of a 1 story, 50 x 200 ft. dye mill. Estimated cost, $75,000.

MIDDLE ATLANTIC STATES

N. J., East Orange—The Ward Baking Co., Southern Blvd., New York City, has awarded the contract for the construction of a 5 story bakery and garage here. Estimated cost, $500,000.

N. Y., Amsterdam—F. P. Sheldon & Son, Archts. and Engrs., R. I. Hospital Trust Bldg., Providence, R. I., are receiving bids for the construction of a 6 story carpet mill addition for the Mohawk Carpet Mills Inc., 57 Lyons St. Estimated cost, $300,000.

N. Y., Brooklyn—M. Cohn & Co., Inc., 218 West 26th St., New York City, manufacturer of corset stays, has awarded the construction of a 3 story factory on Evergreen Ave. and Cook St., here. Estimated cost, $200,000.

N. Y., Brooklyn—Cushman Sons, Inc., 49 Manhattan St., New York City, have awarded the contract for the construction of a 4 story, 50 x 200 ft. bakery on Atlantic Ave. near Troy Ave., here. Estimated cost, $250,000.

Pa., Altoona—J. Kazmaier, Germania Brewery, 1808 9th Ave., is having plans prepared for the construction of a 2 story, 50 x 60 ft. and 80 x 80 ft. ice manufacturing plant, 100 ton daily capacity. Estimated cost, $75,000. Miller & Rider, 1510 18th St., Archts.

Pa., Philadelphia—A. T. Abbott Co., 23 East Allegheny Ave., manufacturers of upholstery goods, will soon award the contract for the construction of a 5 story, 73 x 170 ft. mill. Estimated cost, $100,000. U. E. S. Dyer, Land Title Bldg., Engr.

Pa., Williamsport—C. A. Reed & Co., Laurel and Willow Sts., manufacturer of paper and novelties, purchased a ten acre tract east of here and plans to build a plant.

SOUTHERN STATES

Miss., Magee — The State Bond Impvt. Comn. of Mississippi, P. O. Box 636, Jackson, will receive bids until August 8 for the construction of a laundry building at the tuberculosis sanatorium, near here. T. C. Link, Superv. Archt.

MIDDLE WEST STATES

O., Cleveland—J. Spang Baking Co., 2711 Barber Ave., will receive bids until Aug. 3 for the construction of a 2 and 3 story, 78 x 113 ft. plant. Estimated cost, $100,000. E. Huberty, 8017 Whitethorn Ave., Archt.

O., Dayton—The Refiners Oil Co., 315 South Main St., is having plans prepared for the construction of a 2 story 100 x 150 ft. laboratory and mixing plant on Perry St. Estimated cost, $50,000. Gebhart & Schaeffer, 1402 U. B. Bldg., Archts.

O., Lakewood (Cleveland P. O.)—The City Ice and Fuel Co., Cadillac Bldg., Cleveland, has awarded the contract for the construction of a 1 story, 34 x 129 ft. ice plant at 2266 Warren Rd. Estimated cost, $40,000.

Wis., Delavan—The State Bd. of Control, Capitol, Madison, will receive bids until Aug. 16, for the construction of a 1 story, 32 x 65 ft. laundry, at School for Deaf, here. A. Peabody, Capitol, Madison, Archt.

Wis., Madison—The 3-F Laundry Co., 731 East Dayton St., will soon award the contract for the construction of a 2 story, 17 x 24 ft. and 30 x 65 ft. laundry addition. Estimated cost, $40,000. F. L. Kronenberg, Slichter Bldg., Archt.

Wis., Neenah—The Valley Paper Mills, East Wisconsin Ave., is having plans prepared for the construction of a 1 and 2 story, 80 x 555 ft. paper mill. E. A. Wettengel, 578 Pierce Ave., Appleton, Archt.

WEST OF THE MISSISSIPPI

Ia., Bellevue—The H. G. Johnson Piano Co. has awarded the contract for the construction of a 1 story, 80 x 600 ft. factory. Estimated cost, $100,000. Private plans.

Mo., St. Joseph—The Central West Grease Co., 212 North 5th St., plans to build a 2 story factory. Estimated cost, $50,000. A. B. Snoddy, Pres. Architect not selected.

Mo., St. Louis—The Continental Bank Supply Co., c/o H. K. Rolf, Secy., 1515 Pine St., plans to build a 1 story factory. Estimated cost, $50,000. Architect not selected.

Mo., University (St. Louis P. O.)—W. K. Williamson Advertising Co., 6501 Delmar St., St. Louis, plans to build a 1 and 2 story, 200 x 300 ft. printing plant on Maple and Olive Sts. Estimated cost, $100,000. Architect not selected.

S. D., Redfield—The State Bd. of Charities & Correction, Sioux Falls, will receive bids until Aug. 2 for the construction of a 2 story service station, at the State School for Feeble Minded here. Estimated cost, $85 000. C. M. Day, Secy. C. H. Johnston, 715 Capital Bank Bldg., St. Paul, Minn., Archt.

CANADA

Ont., Gladstone—R. F. Rath, R. R. 1, Mossley, is receiving bids for the construction of a cheese factory, here.

Ont., Guelph — The Ontario Agricultural College has awarded the contract for the construction of a 2 story dairy. Estimated cost, $60,000. Noted March 10.

Que., Montreal — The Dominion Oxygen Co. will soon award the contract for the construction of a 100 x 100 ft. plant. Architect not announced.

American Machinist

Volume 55 NEW YORK, AUGUST 4, 1921 Number 5

Incentive or Production Basis of Wage Payment

I. Constructive Preparation Necessary—Effect of Working Conditions on Mental Attitude—Elements of Scientific Management—Determining the Standard Production Time

By HENRY H. FARQUHAR

THE manufacturer is today confronted by an unrelenting taskmaster—Price. In order to keep our heads above water during this period of readjustment it is necessary that materials, men, and money be utilized to the utmost. In a search for practical measures to meet this situation through cheaper production, many manufacturers are making the error of trying to shift an undue portion of the burden to the shoulders of the workmen. In their endeavor to increase profits, they are installing a great variety of methods of paying operatives based on what is produced, without appreciating the fact that production payment is a means that can be safely used to induce the workmen to help meet the situation *only* when the management does its part.

Incentive payment is, I believe, unquestionably a good thing provided it is not a one-sided affair. The particular system of payment, however, is comparatively unimportant if it rests on an adequate foundation for the general administration of the productive activities of the workmen which it is supposed to stimulate. In a poorly managed plant even the best scheme of payment may do more harm than good. A manager of my acquaintance became enthusiastic some time ago about the savings secured in his neighbor's plant after a new method of payment was put into effect. He forthwith proceeded to put the same method into his own factory. He awoke some six months later to find that some of his men has been earning such exceptional wages that the other workmen in the plant had been led into voting for a strike in order that they also might receive equally high wages. Having heard nothing of such labor troubles in the other plant he decided something must be wrong. Upon investigation he found that his friend had been laying the foundation for incentive payment during the preceding two years.

Points for Consideration

It would have been helpful if, before installing a stimulative wage plan, this manufacturer had considered the many prerequisites to incentive payment. Fairness as well as good business would have dictated that he consider first of all his own and his executives' part in the *administration of work*—the management's responsibility in planning and scheduling what is to be done; second, the various questions covering the character of the *standards of accomplishment;* third, the type and amount of the *reward for standard accomplishment;* fourth, the principles to be observed in *assigning and recording production;* fifth, the choosing of the *period over which performance is to be determined;* sixth, the question of *sharing the reward by the supervisory force;* and finally the *method of pay* itself. It would, of course, be claiming too much to say that all of the provisions set down in succeeding discussions are imperative in every case for arriving at the answer to all problems of method of payment; they are more in the nature of guides, differing in importance with different circumstances, which experience has proved should be departed from only after a very careful analysis of local conditions.

The Administration of Work

The incentive method of wage payment is essentially an appeal to the workman to put forth his best efforts toward high production. In essence, it is saying that the management proposes to pay him not simply according to time put in, but primarily for amount of work turned out. To get maximum results from this appeal, it follows first that facilities in the shop must be such that he *may* (if he desires) produce a big day's work, and second that he be in a frame of mind where he will *want* to produce. Bringing both of these conditions to pass is distinctly a management duty, and until the management has seen to it that its part is fully played, the incentive appeal will meet only half-hearted and temporary response and can at best be only partially effective.

An incentive payment system to operate successfully, must be based on the following rules: (1) *The management must assume responsibility for high production, high wages, and low cost, commensurate with that expected of the workman.*

Any other foundation for an incentive payment method is but "passing the buck" to the workmen and is quickly recognized as such. The attempt to secure the "individual initiative" of the workman sometimes made through such methods is entirely sound in principle and constitutes a valuable feature of these plans if given its proper place and weight. The initiative of the workman, however, can function only through the initiative of the management, as the operative can have little direct effect upon the preliminary steps that must be taken in order to make his work effective and on the day-to-day measures necessary to keep it so.

Six Major Administrative Functions

Thus, the volume of work put through any given shop depends directly upon the care which is given to *standardization, planning, preparation, scheduling, production*, and *inspection*—six major functions of the administration of work in process. Of these, five—or all but the actual production—from their very nature fall almost solely upon the management, and the importance of these five far outweighs the importance of the one element—incentive pay—contributing to the one remaining function of production. Only a brief indication of the scope of each of these functions and of the management's duty as regards them, can be given.

Standardization: This term is used in its broadest sense to mean determining the best method of doing work and adhering strictly to that standard until a better one is developed. Specifically it means that materials and the material routine be scientifically studied and systematically governed[1]; that machines be overhauled, with particular reference to the work they are called upon to perform, as regards power, drive, speeds, gear ratios, tools and appliances, and all other factors affecting the amount and accuracy of work put through them; that processes, both hand and machine, be constructively studied and brought to the most efficient stage; that methods of delivery and removal of materials and product, and in general of the administration of all work of the establishment, be similarly scrutinized and standardized, and finally that all such standards be systematically maintained up to the goal set. The advantages of such standardization and maintenance are too obvious and too well known to require discussion, but it must be recalled that such work is entirely outside the province of the workman although his productivity on the job depends largely on how effectively it is carried out by the management.

Planning: For each piece of work entering the shop, modern requirements demand that before processing starts, a determination be made of what is to be done, of how it is to be done, of where it is to be done, of when it is to be done, and finally, of who is to do it. The first three of these constitute planning proper, and between these three and the actual doing of the work falls the preparation of materials, tools, and instructions, and the determination of times and personnel or scheduling.

Planning, therefore takes care of the provision of bills of material and drawings; of the indication of the character and quality of all materials required, and of the operations to be performed on each part; of the machines of other work-places where each operation is to be performed; and of the manner in which, in the assembling operations, all of these parts are to be brought together and assembled into the finished product. The degree to which such plans may be blocked out in advance varies in different industries and under different conditions, but such planning is probably the most characteristic feature of modern as against old-style management. No competent engineer would think of starting the erection of a bridge without first going through these preliminary steps with utmost care, yet many plants today do this planning on the run, as work progresses.

Preparation: Preparation must then be made so that the plans as made may be properly carried out. This function therefore, consists in supplying the right quantity of the right materials when needed, in providing the requisite number of standardized machines, the proper tools and appliances, detailed instructions for each operation or process, the necessary men, and all of the pieces of paper needed in transmitting orders and recording progress and cost of performance. In other words, it sees that everything which is needed to put the work through when the time comes, is on hand ready for use.

Scheduling: Scheduling of work then takes care of the time element through designating the starting and finishing times for each process on each part, considering proper sequence in relation to assembly and delivery dates and the balance between machines and departments of the plant as a whole. Depending on the value of the product, on the degree of standardization, on the adeqaucy of maintenance, on the accuracy of time studies, and on the mechanism for correlating and adjusting frequently inconsistent time requirements, the accuracy of scheduling may vary all the way from that of the Ford or the Franklin companies to that of the jobbing shop. As a general rule, however, it may be said that the more diverse the product the greater need there is of detailed scheduling, and the greater benefits there are to be derived from it.

Production: Production consists in transforming raw into finished materials and products.

Inspection: Inspection determines whether a given material or part conforms to specifications and drawings. This is an adaptation of the functions of management as developed at the Winchester Repeating Arms Co., New Haven, Conn.

Such, briefly, is the foundation for the administration of work in process upon which any incentive method for the payment of wages must be reared. It has been the general experience of those who have had most to do with developing high production management in various industries, that of the increases in production resulting from modern methods upwards of 75 per cent of the pick-up comes through just such thorough standardization, detailed planning, careful preparation, and accurate scheduling. while ordinarily only 25 per cent or less is secured through additional effort on the part of the individual operatives themselves. It follows that "soldiering" is not so common as is sometimes intimated, and that to go after the 25 per cent without first getting the 75 per cent is not only the lazy way but also the dangerous way, in that even the 25 per cent may be withheld by the workmen due to lack of confidence thus created.

THE STANDARDS OF ACCOMPLISHMENT

We have now outlined the major duties of the management in the operation of a production system whereby the work of the shop may be systematically administered, and it will be noted that at no point do these measures intimately touch or concern the workman except in the broad sense that any measures of standardization and of routing indirectly affect, either for good or for evil, the work and sentiments of the man at the machine. The upkeep of the shop and the methods of getting work to and away from the workman are to him primarily the management's affair and only secondarily his in so far as they affect his state of mind as regards his work, for under any specific set of conditions a workman might feel with perfect justification that he was delivering "a fair day's work" in time and effort although he might know that were those conditions improved he could produce much more in the same time with the same amount of effort.

When we get to the next step, however, in paving the way for possible production payment, that of establishing standards of accomplishment by which the worker's performance may be translated into resulting earnings or otherwise used to measure his efficiency or stimulate his ambition, we are dealing with a question which touches him intimately (through the pay envelope or through his sense of workmanship) with every job that comes to him. There are consequently numerous points as regards standards of accomplishment which experience has proved must be carefully considered.

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[1] See articles by the writer in the *American Machinist*, page 1338 of Vol. 52 and on pages 101 and 151 of Vol. 53.

(2) *The Standard should be on a basis which does not vary with changing conditions; it should be adapted to the type of work and to the character of the workmen, and it must be such that the workmen readily understand it.*

There is one and only one yardstick for measuring efficiency of performance of the individual workman which is absolutely unvarying under changing conditions; namely, time. Total volume of production may change; costs—either direct labor or prime or total, and no matter whether "standard" or actual—are constantly fluctuating with every change in process or rate of wages; overhead ratios ordinarily indicate nothing at all; dividends are unsafe and earnings are unstable guides—all of these may and usually do bob up and down regardless of whether the workman continues to perform at 100 per cent. In addition to this, and of more importance, the worker does not understand such bases and ordinarily has no means of checking his performance against them if he did. On the other hand, *time*—the time in which a man performs whatever work is given him—is the one constant and unvarying measure in the great majority of cases for determining efficiency of operating, and one which every worker understands and constantly uses as a measure of his work.

Although of course time is directly convertible into earnings so that the latter basis may be used with equal accuracy, it is nevertheless true that individual or group earnings vary with every change in piece or hourly rates of pay, and that therefore constant revision is necessary if a standard based on earnings is to mean the same thing throughout all the ups and downs of the market.

TIME-STANDARD IS CONSTANT

A standard expressed in time, however, requires revision under only one condition: a change in method. The volume of work, due to conditions beyond the control of the operative, may drop to one-half normal; wage rates, costs, overhead, and profits similarly have only a distant relation to the work of the individual at the machine; but a lot of fifty pieces in eight hours means exactly what it says day in and day out regardless of how many of such lots may be available for the man to process or what the material in them may have cost the purchasing agent, and so on. I have had several interesting sessions with managers who had some one of these other bases in mind, convincing them of the permanency and simplicity of time as a measure for the performance of workmen under widely varying conditions.[3] There are of course some processes where time is of decidedly secondary importance, such as maintaining uniform pressure or temperature, and in such cases the standard would be based on the maintenance of such factors within predetermined allowable ranges.

NECESSITY OF MOTION-STUDY

The next rule logically follows if the standard is to be serviceable and if trouble is to be avoided: (3) *The standard must be accurately determined and properly used.*

This involves careful time (including motion) study to analyze each operation into its elements, to study those elements separately and to discard wasteful and to substitute economical methods, and finally to determine once and for all for each job, what a fair time allowance for its completion should be. The details of these methods cannot be discussed, but if the results of time study are to be permanent and worth the considerable cost of obtaining them, the work should be undertaken only under the supervision of men experienced in this specialized and somewhat explosive field.

Granted that the results of time study are adequate, however, (and the determination of their adequacy at any particular stage calls for lots of (un) common sense and perspective), it is equally important that they be put to a proper use, for I have seen some very shortsighted practices installed under the scientific guise of "time study." I refer particularly to the form of payment with which they are used, where the studies themselves may be correct but where the method is wrongly chosen. This point is brought out at various places in succeeding discussions.

(4) *The standard should be high but within the reach of any one who is fitted for the class of work to which it applies.*

The fact must not be lost sight of that the possible value of a performance standard may be lost through making it either too high or too low. Both are equally shortsighted, for in the one case the operative will become discouraged in his attempt to reach it, and in the other case he will lose interest when it fails to call forth his best efforts Although it is usually desirable, for reasons which need not be discussed here, to use the best men available for the purpose of securing information on which the standard is set, the standard itself should be based neither on the work of the poorest man nor on that of the pace setter. Just where the line should be drawn must be determined in each case; where many workmen are engaged on the same operation the standard may be correspondingly high and may reasonably be such that even the average worker can reach it only after the period of training and instruction without which the maximum production is impossible.

ANOTHER POINT NECESSARY TO SUCCESS

To check the fairness of the standard and to secure the confidence and co-operation of the workers whom it is to affect, another point should be observed: (5) *The standard should be agreed to by those to whom it is to be applied, with provision for readjustments when mutually desirable.*

The foreman particularly should approve all standards before they are announced to the men, and ordinarily the men should be given an opportunity to express themselves as to the justice of what is being asked of them. If the proposed standard is not so unreasonably high that it no longer appeals to their ambition and sense of fair play, nothing is to be lost by putting it up to them; on the other hand any valid objections they may have had much better be brought out before than after it is announced. This policy of consulting the men does not mean of course that scientifically set standards of work must be compromised for every objection which they may bring forward, but the refusal to compromise must be backed up with a demonstration of the reasonableness of what is asked.

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[3] Although a consideration of profit sharing does not strictly fall within the scope of this paper it may be remarked parenthetically that one of the chief shortcomings of this plan for stimulating workmen on direct production is indicated in the preceding discussion, in that profits are not sufficiently closely related to and dependent on the performance of the individual at his daily work.

In this connection a definite provision for changes in standards with changes in method should be made. A standard when once fixed and agreed upon must not be changed upon the whim either of the workmen or of the management (in the latter case usually the foreman), but only after an investigation as thorough as that from which the original standard was derived. A change in methods is ordinarily the only excuse for an upward revision of standards, and even then the previous earnings should always be allowed, for standards should not be announced until the management is ready to stand back of them; in other words, if a mistake is made in favor of the workman, the management should stand the loss, while mistakes unfavorable to the workman should be corrected by a downward revision. In any event a joint machinery for the consideration of contemplated changes should be set up at the time of investigation.

The measures discussed in the foregoing topics form the basis of all worth-while management whether or not one agrees that incentive pay is a good thing. As indicated previously, in the average shop much more is to be gained through the management's assuming these burdens than can be obtained through asking the individual workman to assume the burden of doing the relatively insignificant amount which he, unaided, can accomplish in increasing production. There is much evidence to show that in many cases with proper standardization, planning, scheduling, and so on, plus the setting and following up of tasks or standards of performance, no additional spur is needed in order to induce men to do what may be reasonably expected of them, and in any event the bonus or other system of incentive pay usually should be and ordinarily is the last thing to tackle in developing scientific management in the factory. The very fact that the management is doing what every workman has a right to expect it to do, calls forth a response from him, and had such standards been generally in effect during the past few years it is safe to say that production would not have decreased in so many cases as wages increased, and that the cost of living would not have mounted to its recent height.

Non-Productive Costs—Discussion

By S. Owen Livingston

There was an interesting editorial in the *American Machinist* a short time ago, provoking thoughts on the subject of "Non-productive Costs."

While it is undoubtedly true that labor must come down—if indeed it has not already come down—to something approaching pre-war levels, and I believe this is true whether we like it or not, it still remains, as your editorial points out, an indisputable fact that the greatest opportunity for economy in manufacturing is to be found in careful regulation of non-productive costs.

Take the matter of small tools, such as milling cutters, reamers, twist drills, taps, chasers, etc. These represent no inconsiderable element of non-productive cost in most plants. Who has not seen production of such tools more than doubled by the simple expedient of properly grinding them? The direct labor cost can usually be cut by virtue of the fact that a perfectly ground small tool will stand more rapid production speeds. The non-productive cost entailed in regrinding, which involves not only the actual grinding time but the stoppage of production as well, will be materially reduced by the use of properly ground tools.

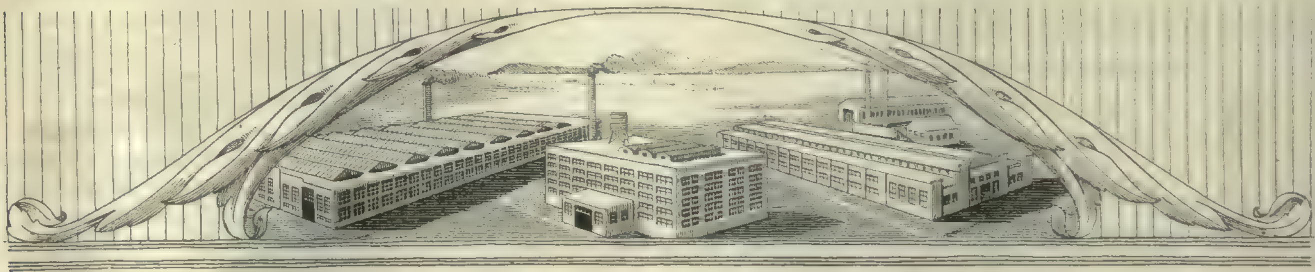
Another element usually charged as a non-productive cost is spoiled work. Particularly in the case of taps, chasers, and formed cutters, this feature of spoiled work is quite an item, and it can be almost totally eliminated by properly ground tools.

Then comes the actual saving in the tools themselves by reduction in breakage. Properly ground tools will stand with safety speeds and feeds that would be suicidal with tools not properly ground.

Of course for the most satisfactory drilling work a high-grade drilling machine is necessary, and it must be equipped with good twist drills. For milling work a high-grade milling machine and a cutter of proper design and high-grade material are necessary. The same is also true as to both machine and tap in the case of tapping work, and machine, die, and chasers for threading work. But, granted all these, and given an imperfect job of grinding the small tools, and your hoped-for efficiency vanishes. Indeed a mediocre machine and inferior tool *properly* ground will give better results than a faultless machine and a faultless small tool *imperfectly* ground.

I feel sure that the above facts cannot be gainsayed, and yet how often do we find careful investigation as to the relative merits of various makes of machines and small tools with the idea of producing efficient operation, and the expected efficiency allowed to slip through the fingers of the purchaser because he does not realize that a chain is no stronger than its weakest link, and that the grinding of the small tools is as important as any other link in the chain. A difference in price of hundreds of dollars is often gladly paid in order to obtain a higher grade milling, drilling, or other machine, and then its performance is reduced to mediocrity by failure to properly provide for grinding the small tools used with it.

If America is to meet German competition in the markets of the world, with the present difference in exchange, we must awake to the fact that it not only takes sharp tools to cut costs, but it takes *properly* sharpened tools, and the old-fashioned hand grinding of such tools must be discontinued. There have been some rapid strides made in the last few years, but there is room for much improvement along this line.



The Layout of a Modern Machine-Tool Plant

Layout of the Foote-Burt Shop—Receiving Material and Shipping Finished Machines—Crane and Monorail Transport—Overhead Hot-Water Heating System

By FRED H. COLVIN
Editor, *American Machinist*

THE layout of the Foote-Burt plant has a number of interesting features as shown in Fig. 1. The building is rectangular and of the general dimensions given on the plan view which shows the layout of the different departments. A spur track from the New York Central Railroad runs between the boiler house and the shipping department and presents a convenient method of both receiving and shipping material. The chip storage bins are conveniently arranged; for the importance of rapid and economical handling of material has been carefully considered as can be seen both from the layout of the plant and the illustrations showing the cranes and other methods of handling.

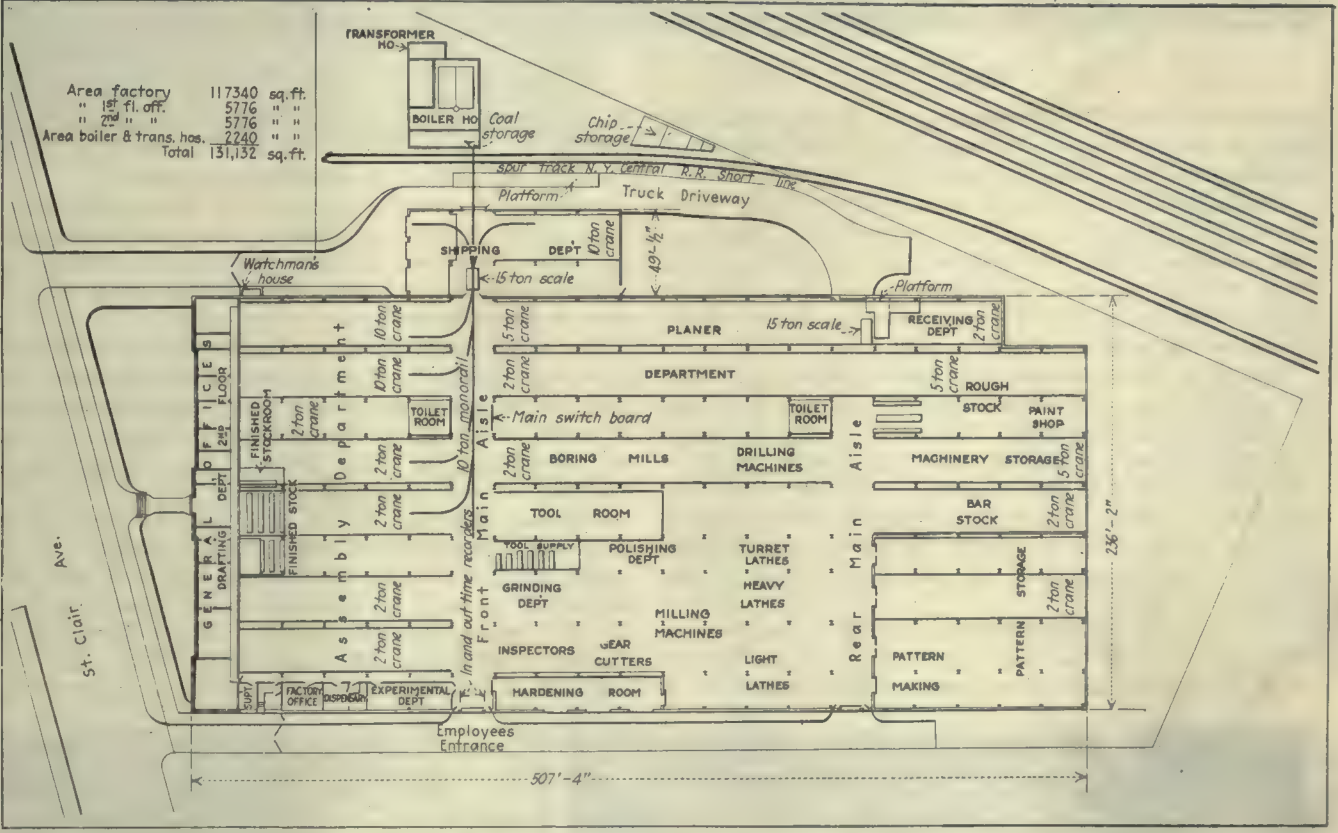


FIG. 1. LAYOUT OF FOOTE-BURT SHOP

In Fig. 2 is shown a view in the shipping department showing the platform, which is of the proper height for loading trucks. Overhead is a substantial mono-rail with a carrying capacity of ten tons, and provided with two 7½-ton electric hoists. This monorail extends out of the shipping department, across both the platform and the spur track and is supported at its outer end just outside the coal storage. In this way it can handle incoming material from the car to the first shop bay where a 5-ton crane can carry it to the receiving department, or it can load finished machines either on a truck or train.

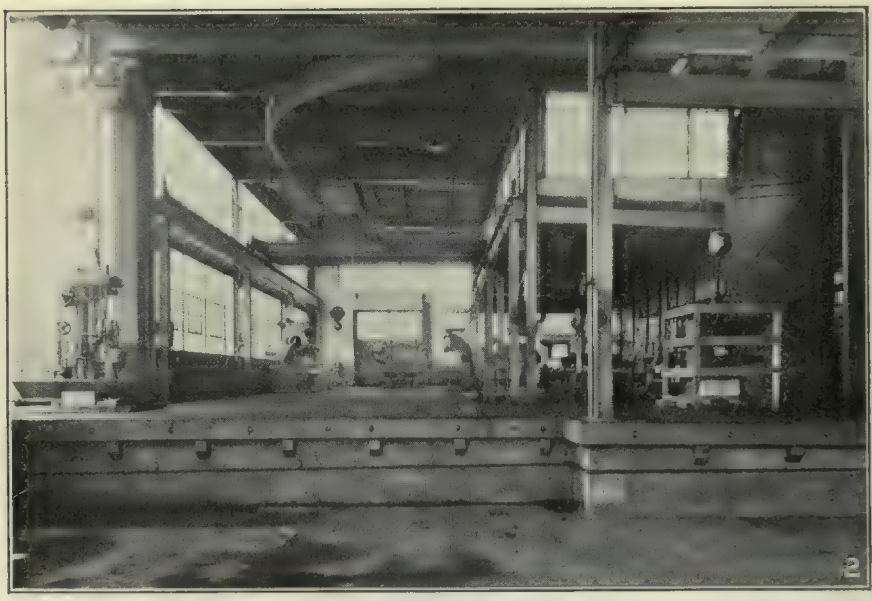
Material delivered to the plant by truck goes around the driveway beside the railroad and is delivered to the platform in the receiving department. The platform is of truck body height and has a ramp so that the small electric shop trucks can handle the material to the rough stock and storage department. Scales weighing up to 15 tons are provided in both the receiving and shipping departments so that both the weight of the raw material and the shipping weight of finished machines can be easily and accurately secured.

Castings that require planing, are handled by the cranes direct to the planer department, the four cranes in this bay handling everything up to front main aisle. Adjoining the planer department are the boring mills and drilling machines, operations on which usually follow that of planing.

Next to this bay is the toolroom and adjoining it the tool supply or toolcrib which is centrally located considering the demand for tools. The space near the toolroom is occupied by turret lathes, milling machines, engine lathes, gear cutting and grinding machines.

The departments are so arranged that the work goes from the stores, through the various departments in as steady a flow as possible. The variety of work makes it impossible to avoid all back-tracking, but this is reduced to a minimum by the layout shown.

The inspection department is near the hardening room and just across the aisle from the assembly department, which runs across the whole front of the shop, directly



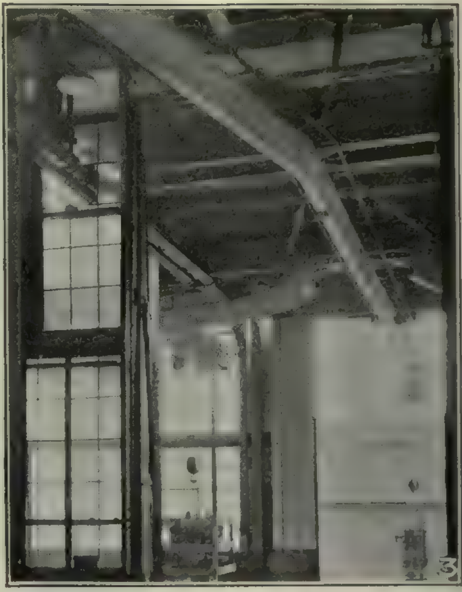


FIG. 2. THE SHIPPING PLATFORM. FIG. 3. HANDLING MACHINES FOR SHIPMENT

behind the offices. This department also contains the finished stock, from which completed units and other materials can be drawn for assembly.

The assembly department is served by four 2-ton cranes for the smaller machines. The heavy machines are assembled under the high bay just across the front main aisle from the planer department. Here one of the runways has two cranes, a 2-ton and a 10-ton, while the other has only one 10-ton crane.

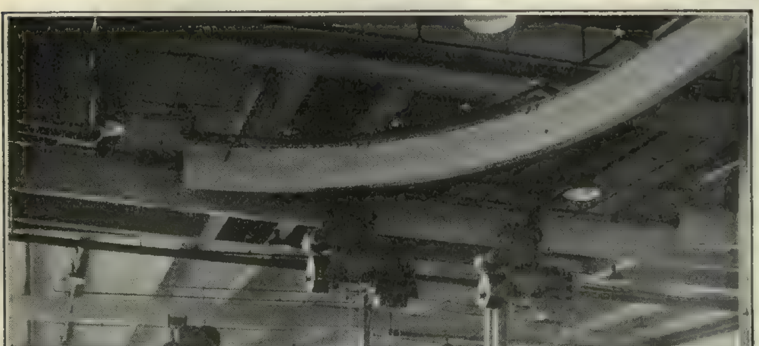
The shop layout shows how the overhead mono-rail serves the front main aisle and also four of the front low bays in the assembling department. Fig. 2 shows the large crane in the shipping department together with both of the 7½-ton monorail hoists in use. One has just carried a machine mounted on skids to await the arrival of a flat car while the other has just deposited a crated machine on the 15-ton scale in the shipping platform.

In Fig. 3 the uncrated machine is still in the doorway but the crated one has been run around the curved rail so as to be easily loaded on a motor truck backed up to the platform. Fig. 4 shows the monorail and crane equipment just inside the shipping room door, in the high bay containing the planer department.

There are four cranes serving this department, two of 2-ton and two of 5-ton capacity. Three of these cranes and the two monorail hoists are shown in the foreground, the 2-ton crane in the small bay being over the receiving department.

The front main aisle, as viewed from the shipping platform, is seen in Fig. 5. This shows the scales, the monorail, and the heavy doors which close the shop away from the shipping department. It also shows a few lockers, sloping on top which prevents the accumulation of dirt and articles of various kinds.

Further reference to the shop layout in Fig. 1 will show the arrangement of the different departments, the rough stock, machinery storage and bar stock occupying adjoining space. The bar stock racks shown in Fig. 6 are all made so that the uprights can be moved to any desired position on the base rail. The height and strength of the pipes forming the racks are proportioned



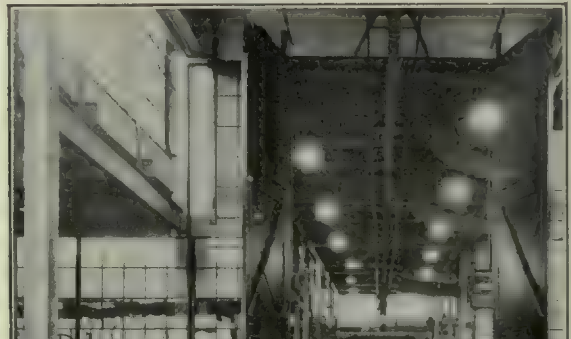


FIG. 4. WHERE CRANE AND MONORAIL MEET. FIG. 5. THE FRONT MAIN AISLE

to the load they are to carry. The height of the pipes is limited so that it is impossible to overload any rack.

The shop is heated with a hot water system having a forced circulation. The radiators, however, are so carefully concealed by the crane runway gearing as to be almost invisible. They can be barely seen at *A* and *B* in Fig. 4, just beneath the windows and between the crane-ways. The temperature is controlled by the engineer in accordance with the accompanying table. It will be seen that this table takes into consideration whether the plant is running or not, and also the condition of the weather as to wind.

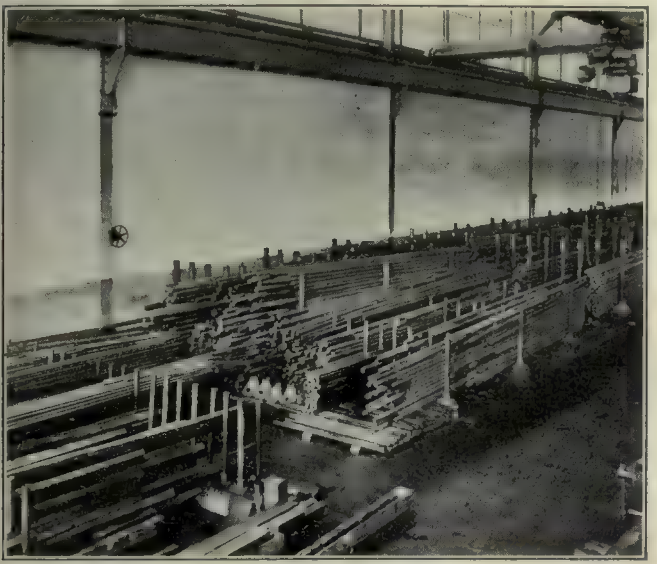


FIG. 6. THE BAR STOCK RACK

TEMPERATURE OF WATER FOR HEATING SYSTEM AT VARIOUS OUTDOOR TEMPERATURES

No. of Boilers			Water Temperature	
Factory Running	Factory Shutdown	Outside Temperature	Factory Running	Factory Shutdown
1	1	65	70	...
		60	75	...
		55	85	70
		50	90	75
		45	100	85
		40	110	95
		35	120	105
		30	130	115
		25	135	120
2	2	20	150	135
		15	160	145
		10	170	155
		5	180	165
		0	190	175
		−5	200	185
		−0	210	195
		−15	220	205

Note.—In very windy weather carry temperature of water 10 deg. higher than table.

Taken altogether this plant is very complete. One of the outstanding features is that it is of standard construction so as to allow necessary changes to be readily made from time to time. Being laid out with this in view, it could be readily adapted to any other type of machine work or any modification of its present product.

Thoughtlessness in Design of Auto Details

By Frank C. Hudson

If Prof. Sweet had driven an automobile his list of "Things That Are Usually Wrong" would have been much longer. The main "thing" however seems to be the designer who delights in seeing how "close" he can locate nuts and bolts and still get them in—while the body is off and the next piece hasn't been put in place. After the car is assembled you can't always even see where they are. And when something breaks while you are driving with your best girl and your Sunday-go-to-meeting-clothes, you're out of luck. If you said the things you feel, you'd probably be minus a girl, too.

The other Sunday, my clutch decided to reform and give up its fast and loose ways. I tried to release it in traffic and found it had decided to stay right where it was. A little quick action, double-handed work with ignition and brake, kept me out of jail, but left me twenty miles from home. After an hour's tinkering I coaxed it back into action by a temporary repair and started home—and then my real troubles began.

A clevis pin had worked out because the cotter points broke off and I had to find a substitute. I first spied a similar pin in my emergency brake connection and thought I'd steal that, drive slowly and depend on the service brake. But the designer had very thoughtfully prevented this by making this pin ⅛ in. too short for the clutch clevis. He was some little preventer, but it caused me a lot of trouble because he'd made the clearance so small that you had to find just the right shaped bolt to go in.

Another cause of the trouble was the working loose of the clutch arm on the shaft because some garage man had left the key out and depended on a clamp bolt. This had been strained so that the head came off when I touched it, and this had to be drilled out. Of course it was the inside arm on the clutch shaft at *A*, Fig. 1, which meant that the bracket *B* had to come off to get the arm itself off.

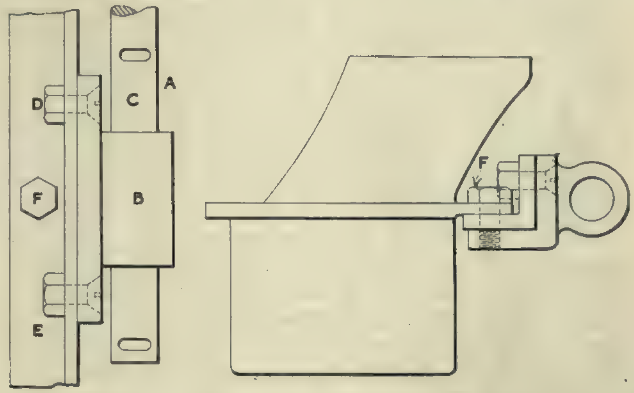


FIG. 1 FIG. 2

FIG. 1. THE WAY IT LOOKED IN THE BOOK. FIG. 2. THE WAY IT REALLY WAS

The instruction book showed just how the bracket was held, see Fig. 1. It looked easy even if the clutch shaft *C* prevented getting at the conehead screws *D* and *E*. And the book quite forgot to show that the upper part of the transmission case, which was fastened to the same crossmember, covered the capscrew *F* most effectively.

A little gentle persuasion with a not-too-sharp cold chisel of long and narrow proportions finally loosened the capscrew *E*, and after many trials and tribulations the job was done. But it could have been made very much easier by a little forethought on the part of the designer. If the designer of this had to do the same job, he'd get a better appreciation of real designing than he seems to have at present.

Machining the Wrigley Automobile Transmission Gear

I. Modern Production Methods in an English Plant—How the Progressive Operation System Works in This Shop—Forms Necessary for Accurate Record-Keeping

By I. W. CHUBB
Editor, European Edition, *American Machinist*

E. G. WRIGLEY & CO., LTD., Soho, Birmingham, Eng., in the production of gear cases, back axles, etc., which it provides for the Angus-Sanderson motor car, has adopted a progressive machining system, put in under the supervision of F. G. Woolard, in which a given part or unit is passed under the operation of a series of machines until the machining on that part or unit is finished.

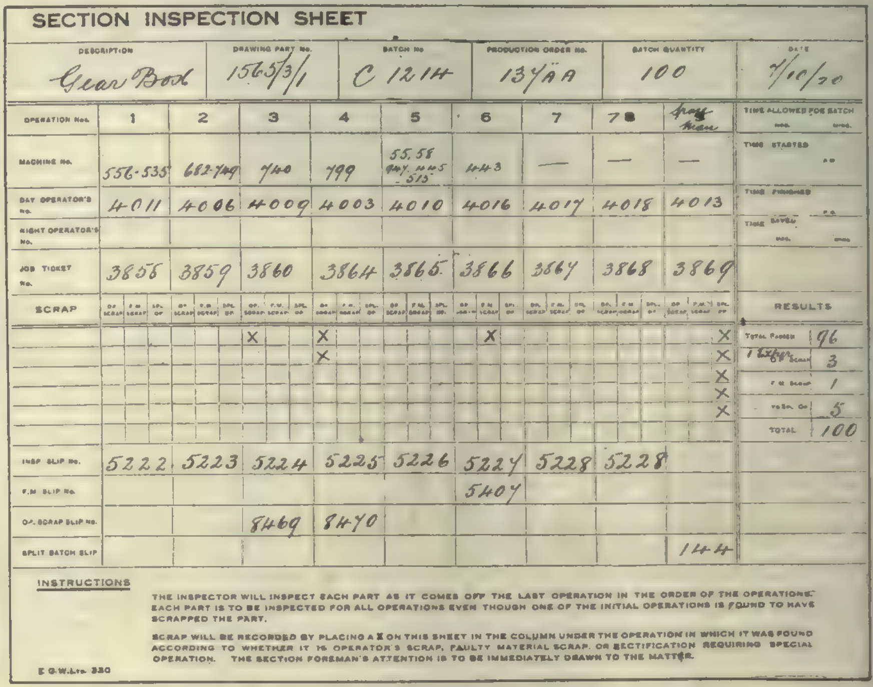
A line of machines is therefore arranged irrespective of class of operation, but so that each operator, whether on one machine or in a subgroup of machines, takes the same time as the man immediately in front of and the man behind him; or if the machining process takes too much time but cannot be divided as a process between two machines, the whole output is divided between two machines so that the output from the line of machines is maintained. In electrical language, the machines are then in parallel instead of in series. But this is exceptional.

One advantage of the system is that the amount of material going through the shops at any time is reduced very markedly. In the case of the firm this is divided by something like 30. Thus, whereas in the ordinary system of machining about 300 boxes would be in progress simultaneously, with the line system only about 10 are going through at the same time. If one machine is stopped owing to breakdown, the whole section stops and clocks off, standing idle. Apart from anything else, this draws forcible attention to the breakdown.

At the beginning, and then only, a number of boxes are part-operated up to each step in the line. Consequently, when operation really commences, each man starts with a single part machined up to the previous operation, except the first operator, who has a complete batch of unworked material. When this operator finishes the last pair in his batch he does not clock off, but waits until the inspector receives the number of completely machined pieces making up the batch. All the men in the section then clock off simultaneously and, a further batch of parts being available, the foreman clocks on the whole section anew.

Time and Cost Keeping by Lots

On reflection it will be seen that the fact that a batch has been completed does not mean that the last piece handled by the first operator has been received by the inspector. As the first operator started with a complete batch the job will, at the moment of completion of batch, be left so that each man except the last man has one piece to which he has just paid attention and therefore available for the next batch. The first operator consequently does not commence the second batch until he has been clocked off the first lot and then clocked on again to the new set. A line section implies the availability of a substitute who can work any one of the machines in the line. He may be a charge-hand or a toolsetter, and he takes the place of an operator who is away from his job for any reason. In such a case the section operator is clocked off and the work he finished entered on his job ticket, the substitute clocking on to a supplementary ticket, which will then show the number of pieces produced by the substitute. As regards pay and penalties for scrap, the substitute is in the same position as the original operator.



SECTION INSPECTION SHEET

DESCRIPTION	DRAWING PART No.	BATCH No.	PRODUCTION ORDER No.	BATCH QUANTITY	DATE
Gear Box	1565/3/1	C 1214	137/AA	100	7/10/20

OPERATION No.	1	2	3	4	5	6	7	78	Spare man
MACHINE No.	556-535	682-749	740	799	55, 58 Pay. 445 - 515	443	—	—	—
DAY OPERATOR'S No.	4011	4006	4009	4003	4010	4016	4017	4018	4013
NIGHT OPERATOR'S No.									
JOB TICKET No.	3858	3859	3860	3864	3865	3866	3867	3868	3869
SCRAP	Op. Scrap F.M. Scrap Spl. Op.	Op. Scrap F.M. Scrap Spl. Op.	Op. Scrap F.M. Scrap Spl. Op.	Op. Scrap F.M. Scrap Spl. Op.	Op. Scrap F.M. Scrap Spl. Op.	Op. Scrap F.M. Scrap Spl. Op.	Op. Scrap F.M. Scrap Spl. Op.	Op. Scrap F.M. Scrap Spl. Op.	Op. Scrap F.M. Scrap Spl. Op.
			Op. Scrap X	Op. Scrap X		F.M. Scrap X			Spl. Op. X
				Op. Scrap X					Spl. Op. X
									Spl. Op. X
									Spl. Op. X
									Spl. Op. X
INSP. SLIP No.	5222	5223	5224	5225	5226	5227	5228	5228	
F.M. SLIP No.						5407			
OP. SCRAP SLIP No.			8469	8470					
SPLIT BATCH SLIP									144

TIME ALLOWED FOR BATCH hrs. mins.

TIME STARTED

TIME FINISHED

TIME SAVED hrs. mins.

RESULTS

TOTAL PASSED	96
1 Extra OP. SCRAP	3
F.M. SCRAP	1
TO SPL. OP.	5
TOTAL	100

INSTRUCTIONS

THE INSPECTOR WILL INSPECT EACH PART AS IT COMES OFF THE LAST OPERATION IN THE ORDER OF THE OPERATIONS. EACH PART IS TO BE INSPECTED FOR ALL OPERATIONS EVEN THOUGH ONE OF THE INITIAL OPERATIONS IS FOUND TO HAVE SCRAPPED THE PART.

SCRAP WILL BE RECORDED BY PLACING A X ON THIS SHEET IN THE COLUMN UNDER THE OPERATION IN WHICH IT WAS FOUND ACCORDING TO WHETHER IT IS OPERATOR'S SCRAP, FAULTY MATERIAL SCRAP, OR RECTIFICATION REQUIRING SPECIAL OPERATION. THE SECTION FOREMAN'S ATTENTION IS TO BE IMMEDIATELY DRAWN TO THE MATTER.

E G.W.Ltd. 330

FIG. 1. BATCH INSPECTION RECORD SHEET

Inspection takes place as the part comes from the final operation and is made in the order of operations. Each part, perfect or otherwise, is in fact inspected for all operations because more than one operation may be a scrap operation, carrying the penalization of more than one operator. Scrap is recorded on section inspection sheets (see Fig. 1) in the column indicating the operation, a cross showing whether it is operator's scrap, faulty material or rectification calling for special operation, and the attention of the section foreman is immediately drawn to the matter so that the remedy also may be noted. Otherwise the whole section must be clocked off and must remain idle until the error, if not arising from faulty material, has been rectified. Scrapped parts, whatever the reason, are piled until completion of the batch and do not pass to the stores until the job ticket inspection slips and scrap slips (referred to later) have been made out. When a batch has been completed, the inspector receives from the section foreman all the job tickets clocked off, the result of each operation then being entered on the corresponding man's job ticket from particulars of scrap previously entered on the section inspection sheet.

METHOD OF FIGURING BONUS

A reference has been made to the section inspection sheets employed. For departmental purposes these sheets are summarized to show scrap, times allowed and taken, and bonus rate paid. This sheet is used by the inspection department to accumulate results of a batch which may perhaps take a week to get through a line section. When the batch is completed, the inspector then makes out an inspection slip (Fig. 2) for each operator. This latter form is in triplicate, of which one copy is passed to the record section of the inspection department while the second copy is passed for checking purposes to the clock office and on to the works office where the progress records are marked up accordingly. The third copy, which consists of a card or tag, is not used by the line section, the finished parts being passed into stores on a stores inwards voucher. The reason for the card copy of the inspection slip is to provide for the identification of the batches after one operation and until picked up on the next operation, where such batches move about the shop and are not handled by the line section method now being described.

The checking of the inspection slip copy with the job ticket is a very necessary operation as this prevents mistakes arising in the payment of bonuses and in the correct recording of progress.

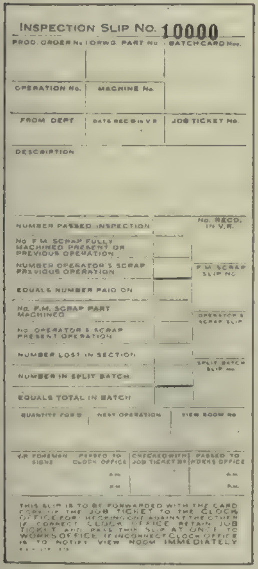
In the case of the job ticket (Fig. 3), one is made out for each man by the progress department and the whole lot are issued to the foreman concerned with the line section. This job ticket consists of two flimsies (thin sheets) and a card, the top half of the flimsy form being a reproduction of the top half of the front of the card down to and including "Timed to start" and "Timed to finish," but below this instructions are given on each flimsy. The flimsies of the job ticket are used for the following purposes: The top one is passed by the foreman to the assistant foreman to enable him to arrange for the necessary material to be available pending the completion of the job then being operated upon. It is subsequently handed to the operator for his information. The second copy of the job ticket is primarily used as a check by being handed in by the foreman to the clock office when the job tickets are withdrawn after being clocked off, to have the particulars of the operation entered thereon. The clock office thus has a direct check of all job tickets which pass out of its possession temporarily.

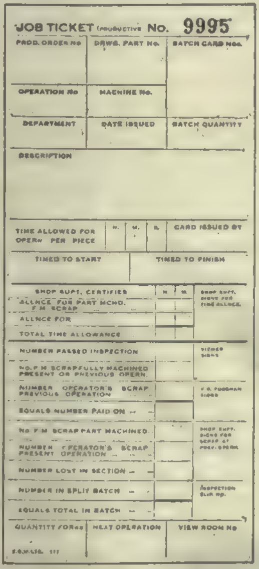
The results entered on the job card by the inspector form the authority for the payment of bonus.

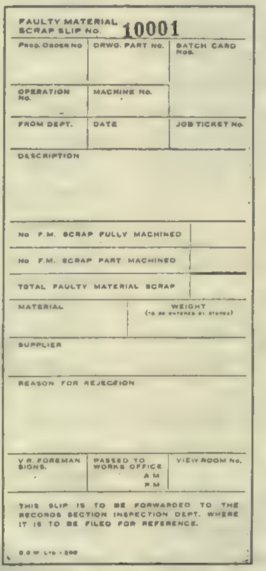
With regard to scrap, when this is due to faulty material, a faulty material scrap slip (Fig. 4) is made out by the inspector on the section. This form consists of two flimsies and a card copy. After being made out and the number of the slip recorded on the inspection slip, the two flimsies are distributed as follows: The first copy is passed to the record section of the inspection department, where it is duly entered up and filed for reference. The second flimsy accompanies the parts returned to stores, forming a stores inwards voucher, and on this flimsy the store keeper enters the weights of such material and passes it on to the stores recording department. The card copy is attached or placed with the goods and remains with them as identification until they are returned to the supplier or otherwise disposed of.

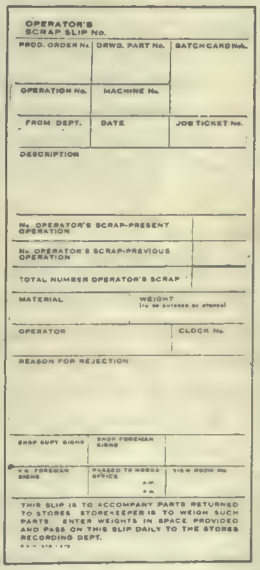
In the case of scrap due to faulty machining, an operator's scrap slip (Fig. 5) is made out. This form also consists of two flimsies and a card copy and the distribution is the same as for the faulty material scrap slip.

When part of a batch requires special operation which cannot be performed upon the line section, a split batch slip (Fig. 6) is made out by the inspector on the authority only of the progress department. This form consists of one flimsy and a card copy, the former being passed to the progress department, giving the number of parts and the reason for having split such parts away from the batch; the second or card copy


INSPECTION SLIP NO. 10000
PROD. ORDER No. | DRWG. PART No. | BATCH CARD Nos.
OPERATION No. | MACHINE No.
FROM DEPT. | DATE REC'D IN V.R. | JOB TICKET No.
DESCRIPTION
NUMBER PASSED INSPECTION | No. RECD. IN V.R.
No. F.M. SCRAP FULLY MACHINED PRESENT OR PREVIOUS OPERATION
NUMBER OPERATOR'S SCRAP PREVIOUS OPERATION | F.M. SCRAP SLIP No.
EQUALS NUMBER PAID ON
No. F.M. SCRAP PART MACHINED | OPERATOR'S SCRAP SLIP
No. OPERATOR'S SCRAP PRESENT OPERATION
NUMBER LOST IN SECTION | SPLIT BATCH SLIP No.
NUMBER IN SPLIT BATCH
EQUALS TOTAL IN BATCH
QUANTITY FOR'D | NEXT OPERATION | VIEW ROOM No.
V.R. FOREMAN SIGNS | PASSED TO CLOCK OFFICE A.M. P.M. | CHECKED WITH JOB TICKET BY | PASSED TO WORKS OFFICE A.M. P.M.
THIS SLIP IS TO BE FORWARDED WITH THE CARD COPY OF THE JOB TICKET TO THE CLOCK OFFICE FOR CHECKING ONE AGAINST THE OTHER. IF CORRECT CLOCK OFFICE RETAIN JOB TICKET AND PASS THIS SLIP AT ONCE TO WORKS OFFICE. IF INCORRECT CLOCK OFFICE IS TO NOTIFY VIEW ROOM IMMEDIATELY


JOB TICKET (PRODUCTIVE) NO. 9995
PROD. ORDER No. | DRWG. PART No. | BATCH CARD Nos.
OPERATION No. | MACHINE No.
DEPARTMENT | DATE ISSUED | BATCH QUANTITY
DESCRIPTION
TIME ALLOWED FOR OPERN. PER PIECE | H. | M. | S. | CARD ISSUED BY
TIMED TO START | TIMED TO FINISH
SHOP SUPT. CERTIFIES | H. | M. | SHOP SUPT. SIGNS FOR TIME ALLCE.
ALLNCE. FOR PART MCHD. F.M. SCRAP
ALLNCE. FOR
TOTAL TIME ALLOWANCE
NUMBER PASSED INSPECTION | VIEWER SIGNS
NO. F.M. SCRAP FULLY MACHINED PRESENT OR PREVIOUS OPERN.
NUMBER OPERATOR'S SCRAP PREVIOUS OPERATION | V.R. FOREMAN SIGNS
EQUALS NUMBER PAID ON
No. F.M. SCRAP PART MACHINED | SHOP SUPT. SIGNS FOR SCRAP AT PREV. OPERN.
NUMBER OPERATOR'S SCRAP PRESENT OPERATION
NUMBER LOST IN SECTION
NUMBER IN SPLIT BATCH | INSPECTION SLIP No.
EQUALS TOTAL IN BATCH
QUANTITY FOR'D | NEXT OPERATION | VIEW ROOM No.


FAULTY MATERIAL SCRAP SLIP NO. 10001
PROD. ORDER No. | DRWG. PART No. | BATCH CARD Nos.
OPERATION No. | MACHINE No.
FROM DEPT. | DATE | JOB TICKET No.
DESCRIPTION
No. F.M. SCRAP FULLY MACHINED
No. F.M. SCRAP PART MACHINED
TOTAL FAULTY MATERIAL SCRAP
MATERIAL | WEIGHT (TO BE ENTERED BY STORES)
SUPPLIER
REASON FOR REJECTION
V.R. FOREMAN SIGNS. | PASSED TO WORKS OFFICE A.M. P.M. | VIEW ROOM No.
THIS SLIP IS TO BE FORWARDED TO THE RECORDS SECTION INSPECTION DEPT. WHERE IT IS TO BE FILED FOR REFERENCE.


OPERATOR'S SCRAP SLIP No.
PROD. ORDER No. | DRWG. PART No. | BATCH CARD No.
OPERATION No. | MACHINE No.
FROM DEPT. | DATE | JOB TICKET No.
DESCRIPTION
No. OPERATOR'S SCRAP-PRESENT OPERATION
No. OPERATOR'S SCRAP-PREVIOUS OPERATION
TOTAL NUMBER OPERATOR'S SCRAP
MATERIAL | WEIGHT (TO BE ENTERED BY STORES)
OPERATOR | CLOCK No.
REASON FOR REJECTION
SHOP SUPT. SIGNS | SHOP FOREMAN SIGNS
V.R. FOREMAN SIGNS | PASSED TO WORKS OFFICE A.M. P.M. | VIEW ROOM No.
THIS SLIP IS TO ACCOMPANY PARTS RETURNED TO STORES. STOREKEEPER IS TO WEIGH SUCH PARTS. ENTER WEIGHTS IN SPACE PROVIDED AND PASS ON THIS SLIP DAILY TO THE STORES RECORDING DEPT.

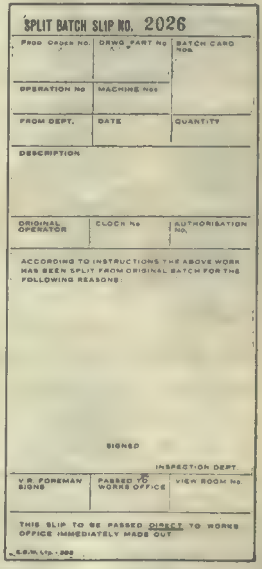

SPLIT BATCH SLIP NO. 2026
PROD. ORDER NO. | DRWG. PART No. | BATCH CARD Nos.
OPERATION No. | MACHINE Nos.
FROM DEPT. | DATE | QUANTITY
DESCRIPTION
ORIGINAL OPERATOR | CLOCK No. | AUTHORISATION No.
ACCORDING TO INSTRUCTIONS THE ABOVE WORK HAS BEEN SPLIT FROM ORIGINAL BATCH FOR THE FOLLOWING REASONS:
SIGNED
INSPECTION DEPT.
V.R. FOREMAN SIGNS | PASSED TO WORKS OFFICE | VIEW ROOM No.
THIS SLIP TO BE PASSED DIRECT TO WORKS OFFICE IMMEDIATELY MADE OUT

FIG. 2. INSPECTION SLIP MADE IN TRIPLICATE FOR CLOCK OFFICE, PRODUCTION OFFICE AND STORES
FIG. 3. INSTRUCTIONS ON THIS FORM MAKE IT SELF-EXPLANATORY. FIG. 4. FAULTY MATERIAL SLIP
FIG. 5. SCRAP SLIP. FIG. 6. SPLIT BATCH SLIP

is attached or placed with the job which is passed to the desired section of the works, where it can be identified and picked up by an additional job ticket issued by the works office.

Returning to the shops, as quantities of the finished parts are available they are passed to the finished stores, each lot bearing the stores inwards voucher which states the section, production order number and symbol batch number, date, part number and quantity. The scrap parts, whatever the reason, are piled until completion of the batch and then sent to the stores, where the inspection and scrap slips are made out. With the last of the batch the inspector receives from the foreman all the job tickets clocked off, and the result of each operation is entered on the corresponding man's job ticket, the scrap made being shown on the scrap section inspection sheet. An inspection sheet is made out for each job ticket and also, if necessary, scrap slips. The appropriate inspection slip is then clipped to the section inspection slip and sent to the works office, the other inspection slip being passed to the clock office with the job ticket.

OVERTIME AND SCRAP

All inspection tallies are passed to the records section of the inspection department. Where rectification is necessary to a part it has to go back to the operator responsible, who works overtime if necessary. Further, if the work accumulates at any given machine overtime may be necessary. It is found, as a matter of fact, that if a man is behind with his work the other men give him a hand. For the premium bonus earnings in a given section the men are limited by the slowest operator, but each individual man concerned is separately penalized for scrap, which does not affect the other men in the section. Whenever an operator works overtime the extra time is clocked on his job ticket and is not booked against permanent order.

In the case of special rectification, operations outside the section may be necessary. The pieces thus to be dealt with are isolated, numbers are entered on the job ticket and the inspection slip giving the number split and a split batch slip are made out. A special job ticket for the split portion is then issued by the works office for the other department of the works. Where the rectification arises from faulty machining, the parts are charged against the operator as scrap, no payment being made. Particulars are entered on the section inspection sheet. Where the special operations arise from faulty material, the work must not be done without direct authority from the works office. The pieces are sent back by way of the stores to the supplies.

How Would You Machine This Disk?

BY SERVICE ENGINEERING CO., INC.

In an article under the above title on page 959, vol. 54, of *American Machinist*, P. Arter asked for the solution of a problem in machining a brass disk.

It appears to me that the quantity in which this disk is to be manufactured largely determines whether it would pay to build a substantial fixture.

In my estimation this is one of the points a designer should know and one that Mr. Arter omitted.

[From the title of the article under discussion, we assume that there was only one disk to be machined.—EDITOR.]

Machine Tool Depreciation

BY ERNEST F. DUBRUL

General Manager, National Machine Tool Builders' Association

On page 49 of the *American Machinist* L. L. Thwing, in discussing the question of machine shop depreciation, seems to miss the point. In the first place, the accounting plan in which the rates were recommended was not presented as a plan for all machine shops. It was presented as a plan for machine tool shops, and this recommendation as to depreciation rates is not intended to cover mere wear and tear, as Mr. Thwing's article indicates as the only element of depreciation.

The rates recommended to the Machine Tool Builders' Association were arrived at after very thorough discussion in five regional meetings, at which representatives of about 130 different concerns were present. It was felt that the machine tool industry must keep itself up to date in its equipment for a number of reasons.

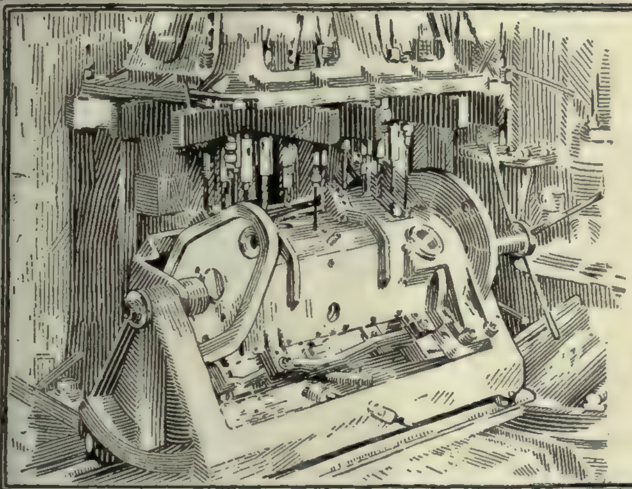
First, because the accuracy of machine tools must be maintained in a machine tool shop to a high degree. Second, the economic conditions surrounding the production of machine tools makes this industry peculiarly subject to fluctuations, and therefore careful management will figure into costs just as much of the experience of the industry as can properly be figured into them. Third, just as a bridge designer does not erect his structure with material only sufficient to carry the theoretical load, but allows a liberal margin in the way of factor of safety for an extra load and also for failure of the material to quite reach the ultimate tensile strength, so it is necessary for an irregular industry like machine tools to figure a financial margin of safety.

A screw planer made in 1844 might conceivably be preserved in a machine-tool shop as a museum specimen, but no machine-tool manufacturer would feel that any but the most modern planers would be suited to machine-tool work. This illustration of Mr. Thwing's is unfortunate in that he cites a lot of plants that are not high production plants—plants in which some old equipment that would be obsolete for their purposes might possibly be worth keeping where they stand. Even Mr. Thwing's citation of the shafting in the packing house states that the demands on his shafting were not very severe, so that the mere existence of this old equipment must not be taken as typical experience. It would not be safe experience in a machine-tool shop.

Shafting, pulleys, etc., are not much of an asset when frequent changes demand removal, and his objection, therefore to the rates recommended falls to the ground in the experience of the machine-tool industry.

It may be that in some other industries shop furniture such as benches and trucks will last as long as twenty years, but this has not been the experience in the machine-tool industry, especially in view of new improvements which will continue to take place.

One must not forget, in discussing the machine-tool builders' plan, that this is intended to provide for obsolescence, and to be in point, all criticisms of the depreciation rates recommended must bear that fact in mind as well as the fact that this is a plan for machine-tool shops. Perhaps if other industries as a whole would make as careful and thorough a study, and discuss their questions from these points of view as the machine-tool builders have done, they would find that many impressionistic depreciation rates are so low as to jeopardize real profits when they are figured into costs, upon which prices, of course, ultimately rest.



Tool Engineering

By

Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Albert A. Dowd Engineering Co., New York City

Milling Fixtures Continued — Supporting and Clamping Thin Castings — Principles and Methods of Pneumatic Clamping — Fixtures for Hand-Milling — Form-Milling Attachments

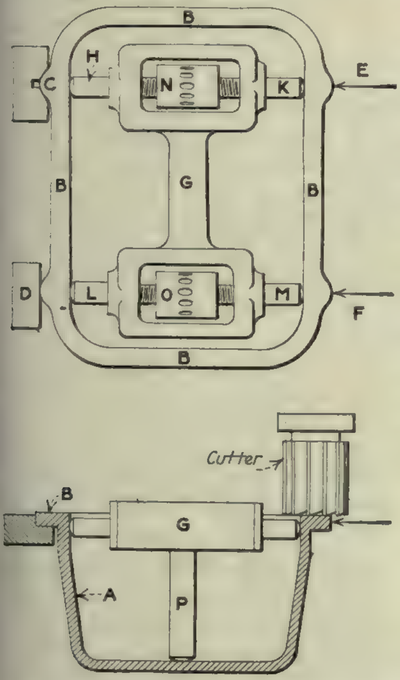


FIG. 132. METHOD OF SUPPORTING AND CLAMPING A THIN CASTING

In milling thin work it is important that it be held in such a way that vibrations will not be set up during the cutting operation. An efficient method of holding a piece of this kind rigidly, yet without distortion, is shown in Fig. 132. The work *A* is a deep, thin bronze casting which is to be milled along the upper part of the flange *B*. The work is located on suitable supports under the flange, in the V-block at *C* and against the locating block *D*. It is clamped as indicated by the arrows at *E* and *F*. The clamping action will obviously tend to distort the sides of the casting and as there are no lugs on the work to which clamps can be applied, the results would be very unsatisfactory. The writers have seen a fixture of this kind in which it was impossible to machine the work without distortion; in fact it was difficult to machine it at all on account of the "chatter" induced by the vibrations of the thin metal walls.

A remedy which was suggested and applied successfully is indicated at *G*. This is a "spider" of aluminum having two supporting studs *P* which rest on the bottom of the casting. At *H, K, L* and *M*, screw jacks are located, directly opposite the outside locating and clamping points.

When setting the work in this fixture the outside clamps are first set up very lightly and locked in position. The spider *G* is then set inside the work and the screw jacks set up tightly by means of the nuts at *N* and *O*. As the jacks are directly opposite to the outside holding and locating points a metal-to-metal contact is obtained which does not distort the work, yet holds it firmly so that all vibrations are "killed" and the piece can be milled with speed and precision.

The principles illustrated in this example can be applied in many similar cases. It is well, however, to note that a much better way of finishing a casting of this sort would be by using a surface grinding machine instead of a milling machine.

An excellent fixture, which was designed for holding the work *A* while milling the circular form *D*, is shown in Fig. 133. The work has been previously finished in the hole *B* and also on the sides *E*. It is evident that the action of a large form cutter such as that used in

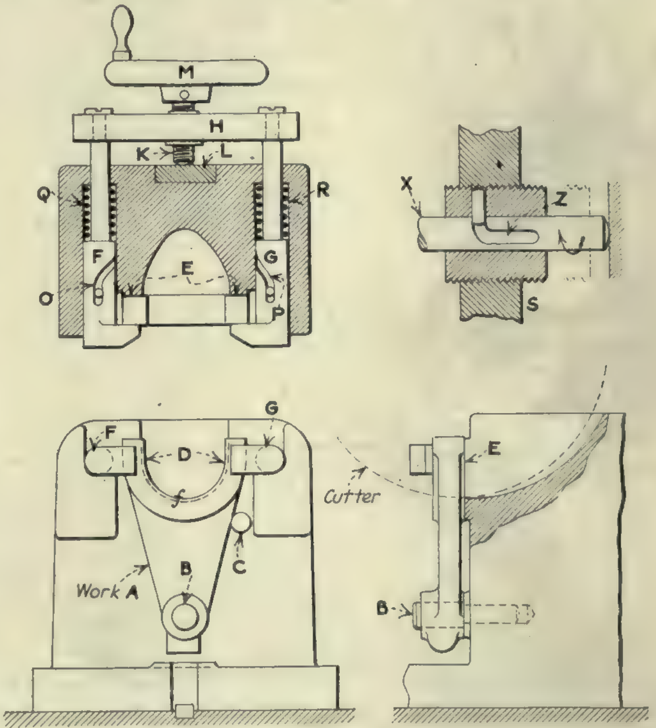


FIG. 133. FIXTURE WITH EQUALIZING HOOK BOLTS

For the authors' forthcoming book. All rights reserved.

milling the contour *D* necessitates exceptionally rigid support for the work in order to eliminate "chatter" during the operation. The work is located on a stud at *B* so that it rests against a solid surface at *E* and is located in the other direction by the pin *C*. It is clamped back against the shoulder *E* by means of the hook bolts *F* and *G*, these being operated by the equalizing bar *H* through the action of the hand wheel *M* and the screw *K*. The latter works against a hardened block at *L*.

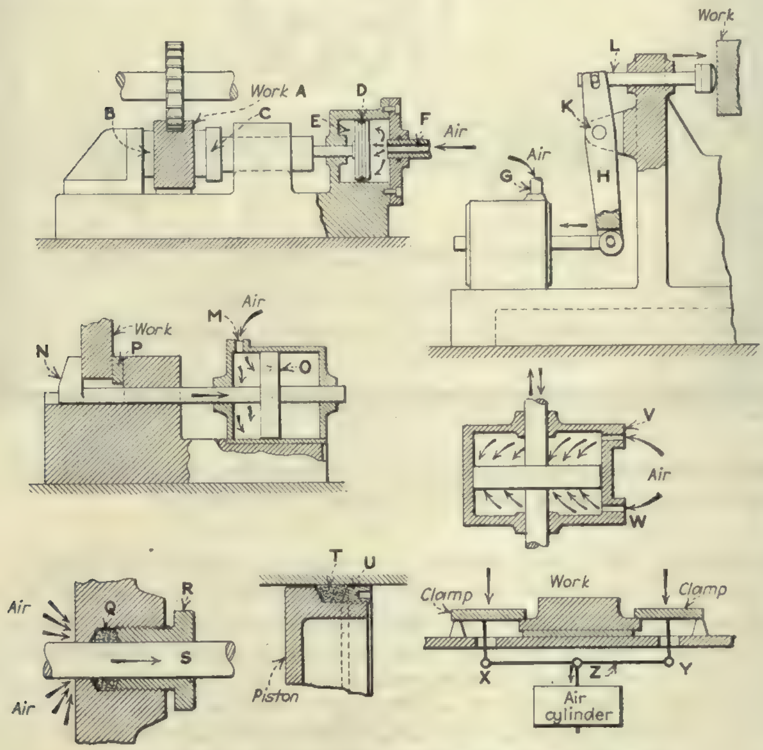


FIG. 134. PRINCIPLES OF PNEUMATIC CLAMPING

The hook belts are provided with camslots at *O* and *P* which are so located that when the pressure of the spring at *Q* and *R* is exerted after the handwheel is loosened, the hook bolts turn 90 deg. and are thus out of the way so that the work can be readily removed. In other words, when the hook bolts are pushed out away from the work by means of the springs, a pin in the campath makes them revolve in the manner noted. An additional refinement can be used as shown at *F*, if conditions warrant it, by mounting the handwheel on the shaft *X* in which a bayonet lock *Z* is cut. A method like this would make the operation of the mechanism somewhat faster than the example previously described. The advantages of this type of fixture are the extreme rigidity that is obtained and the fact that the operator is not obliged to put his hands near the cutter. It is rapid in operation and the construction is such that the upkeep is very economical. The use of air-operated chucks and other clamping devices is becoming more and more general for work requiring careful holding or rapid operation. The majority of present day factories are equipped with air compressors and pipe lines extending to the various departments of the shop. With such equipment, advantage should be taken of the opportunities for using air pressure to operate fixtures of various kinds.

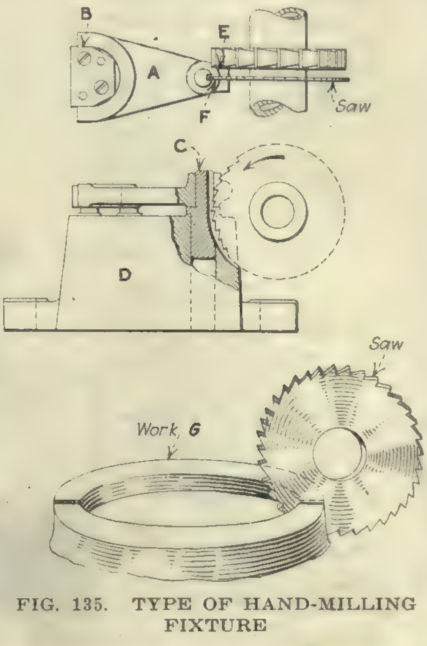


FIG. 135. TYPE OF HAND-MILLING FIXTURE

Fig. 134 shows a few diagrams which will assist the designer in understanding the principles of pneumatic clamping. The work shown at *A* is being held for the milling operation indicated between the jaws *B* and *C* of a pneumatic holding fixture. The air cylinder *E* is a part of the fixture itself. The air enters the chamber at the port *F* and acts upon the head of the piston *D*, which is coupled to the sliding jaw *C*. The operation of the mechanism is very simple as it only requires the turning of a lever to admit or release the air. The amount of power developed is determined by the pressure carried in the pipe line *F* and the diameter of the piston *D*. Increased power can be readily obtained by the use of compound levers, bell cranks or similar appliances.

In another example the air enters the cylinder through a pipe at *G* and acts against a piston connected to the lever *H*. This lever operates a sliding rod at *L*, applying pressure in the direction indicated by the arrow. The amount of leverage obtained is dependent on the position of the fulcrum pin *K*.

Another diagram shows the piston connected to a hook-bolt *N* in order to clamp the work against the locating surface *P*. The air enters the cylinder at *M*, acting against the piston *O*.

A point of great importance in connection with the use of air pressure for operating various devices, is the matter of packing to prevent the escape of the air and consequent loss of holding power. Lubricated asbestos packing is frequently used in connection with suitable glands as shown at *Q* and *R*, the packing being drawn tightly around the shaft *S*. A method of packing a piston is shown at *T*, the packing being compressed by means of an annular ring-nut *U*. It is evident that air must frequently be applied in both directions in order that a piston may operate effectively. The diagram shows two ports at *V* and *W* which can be closed and opened alternately as required, by means of a valve.

Pneumatic clamping can be applied through equalizing devices of various kinds; one of which is shown in diagrammatic form. Here the air acts on the equalizing lever *Z* through the air cylinder in such a way that the pressure acts uniformly at the points *X* and *Y*, thus operating the clamps. To the designer of high production tools the possibilities of air clamping should be given the most careful consideration, and in particular cases where it is desirable to operate a number of clamps simultaneously with a uniform pressure it may often be possible to adapt pneumatic methods to advantage.

Hand-milling fixtures can be used profitably on small light work requiring high production, providing the cuts to be made are short so that the operator is not required to feed the work by hand any great distance. A good example showing the principles of a hand-milling fixture is shown in Fig. 135. The work *A* is located on the half-bearing *B* at one end of the fixture and is supported at the other end on a stud *C* in the body of the fixture as indicated at *D*. No clamps are shown for this piece of work as it is the intention to illustrate here only the principle of down cutting. The work to be done is the facing of the boss at *E* and the cutting of the punch binder slot at *F*. Both of these operations are done at the same time.

When a hand-milling machine having a vertical feed is used, a weight may be hung on the end of the handle so as to make the feeding action automatic. If it is desired to use a fixture of this kind on the other type of hand-milling machine, the work can be fed against the cutter horizontally. An example of a piece of work suitable for a hand-milling fixture is shown at *G*. The work is a ring which is to be cut in two by a narrow saw cut as indicated. Rings of this kind can be cut either singly or in multiple, depending upon their thickness and the method of holding.

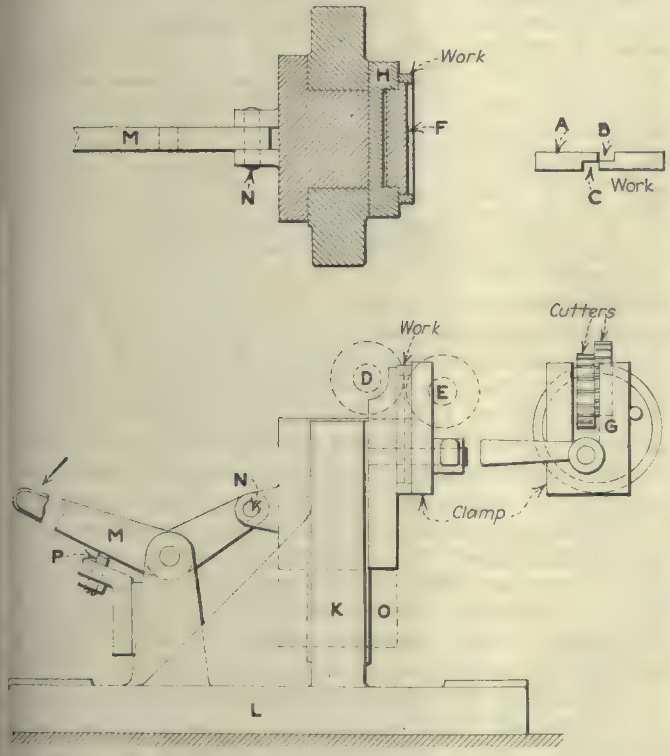


FIG. 136. FIXTURE FOR MILLING A LAP-JOINT PISTON OR PACKING RING

Cutting a Lap-Joint Packing Ring

The work shown at *A* in Fig. 136 is a lap-joint packing ring which has been turned to a sufficient diameter to allow for the cutting out of the portion *B* and *C*. In order to do this work as rapidly and economically as possible a fixture was designed to be used on a light plain-milling machine in connection with a special head carrying two cutters mounted as shown at *D* and *E*. One of these cutters is mounted slightly below the other so that the cutter teeth will not interfere with each other in their action. The work is mounted on a locating plug shown at *F* and is clamped in place by means of a screw lever on the U-washer *G*. This washer is so located that it will always bear the same relation to the cutters in order to avoid interference with them. The stud *F* is mounted in a slide *H* which is fitted to the vertical member *K* on the fixture base *L*. A bell-crank lever *M* is attached to the slide by means of a pin *N* in a lug at the back of the slide. Suitable gibs should be provided on the slide to take up wear. In operating the device, the work is placed in the fixture when it is in the position shown by the dotted lines at *O*, then it is fed up past the cutters until the lever *M* strikes the stop pin *P*. The pin may be adjusted to permit the proper movement.

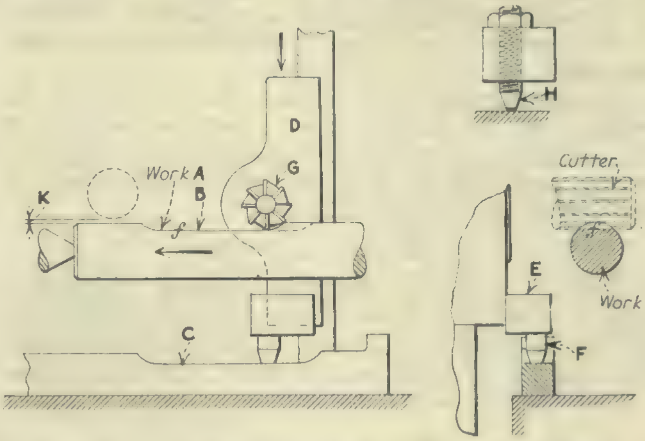


FIG. 137. AUTOMATIC FORM-MILLING ATTACHMENT

This fixture requires in connection with it a special design of milling head to carry the two cutters *D* and *E*, but as an arrangement of this kind can be easily made there is no objection to its use when the occasion warrants it. It is well to note at this point that when it is necessary to design sliding fixtures which are in continual use, provision should always be made for adjustment of the slide by means of suitable gibs.

Form-Milling by Means of a Special Attachment

A special form can be easily cut on a hand-milling machine by the use of a forming attachment such as that shown in Fig. 137. The work *A* is a shaft having a flat milled on it as indicated at *B*. In order to do this work easily and automatically, a form-plate *C* can be applied to the table of the milling machine in such a way that it will control the movement of the slide *D* by means of the block *E* in which is mounted a forming pin *F*. This pin rides along the form shown at *C* and the cutter *G* being mounted in the head *D* naturally

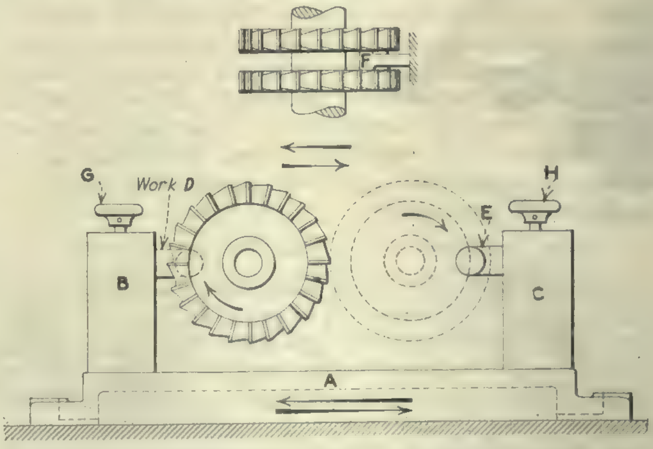


FIG. 138. RECIPROCATING MILLING FIXTURE

follows the outline required. If the head *D* is fed downward by means of a weight, it is only necessary for the operator to place the work in position and operate the feed handle for the table. It is advisable to make the forming pin with an adjustment as shown at *H* in order to take care of variations in the cutter diameter.

The forming plate *G* is so made that it will lift the cutter above the surface of work as indicated at *K* at the completion of the cut. Attachments of this kind can be made cheaply and will handle many kinds of work where a form cut is required.

RECIPROCATING FIXTURES

It is often found an advantage to make up duplicate fixtures which can be so arranged on the milling-machine table that the operator can load one fixture while the cutter is operating on the other. In this manner a great deal of time is saved and the operation is almost continuous. Fixtures of this kind can be applied to a great many kinds of work and are particularly useful for straddle or slot milling.

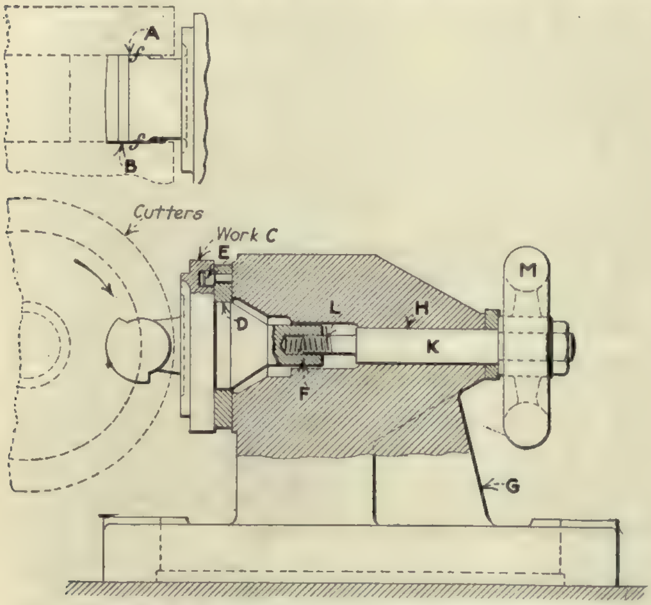


FIG. 139. HIGH PRODUCTION STRADDLE-MILLING FIXTURE

A very good example is shown diagrammatically in Fig. 138. Two holding fixtures *B* and *C* are set at opposite ends of the fixture base *A*. The work *D* is shown in process of machining while the piece at *E* is being removed. The cutting action on this piece is shown by the diagram at *F*. The work is held by means of thumb-screws *G* and *H* which operate binding shoes. This particular example is only intended to show the principles involved in the design of reciprocating fixtures, not details of construction. Care must be taken that fixtures of this kind are placed far enough apart so that the operator is not endangered when replacing or removing work.

HIGH PRODUCTION STRADDLE-MILLING FIXTURE

Another type of fixture which can be used either singly or in a reciprocating manner is shown in Fig. 139. The operation is the straddle-milling of the surfaces *A* and *B* on the work *C*, which has been partly finished in a previous operation. It is located in the hardened ring *D* and its radial position is determined by means of the pin *E*. The end of the work is threaded at *F* and this fact is utilized in order to obtain a positive method of holding it in position.

The fixture base *G* has a long bearing at *H* in which the rod *K* is a running fit. The end of the rod is threaded at *L* to fit the end of the work and the hand wheel *M* is used to draw the work back firmly into its seat. This fixture is very rigid, is rapid in operation and has given excellent service. Chips often accumulate in the locating seats, making it difficult to hold work and causing other trouble. The fixture shown in Fig. 140 was designed to obviate this chip trouble and the idea may be valuable for adaptation to other conditions. The fixture shown is used for milling the slot in the work *A* from beneath. It may be argued that the cutting action in this case is partly against the clamps, but in reality there is very little pressure exerted directly against the clamps as the thrust of the cut is partly against the surface of the holes in which the work locates. The pieces rest in cylindrical pockets *B* in the body of the fixture and are clamped down by means of the double clamps *C*. Four pieces are held in the same fixture, each clamp being so designed that it will hold two pieces at once. In addition to the hold-down clamps, binder shoes are provided for each piece as shown at *D*. These binders are formed at the end to the shape of the work and are prevented from turning by means of the teat-screws *E*. Two of the binders are operated at the same time by means of the equalizing clamps at *F* and *G*, these acting on the ends of the binders.

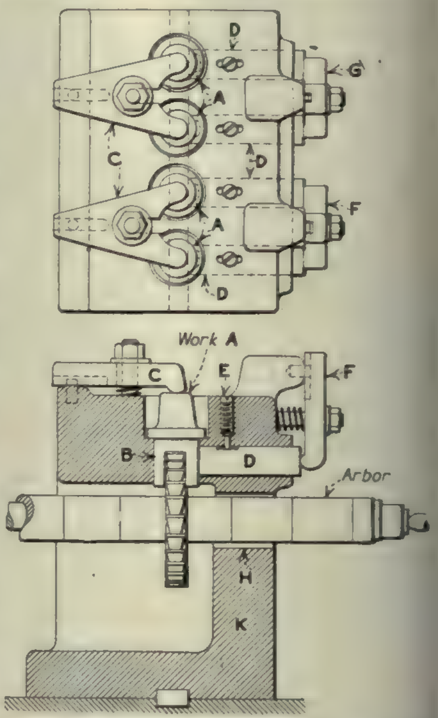


FIG. 140. MULTIPLE MILLING FIXTURE

Attention is called to the way in which the cutter arbor passes through a cored slot in the body of the fixture at *H*. By passing the arbor through the fixture *K* an out-board support is obtained by means of

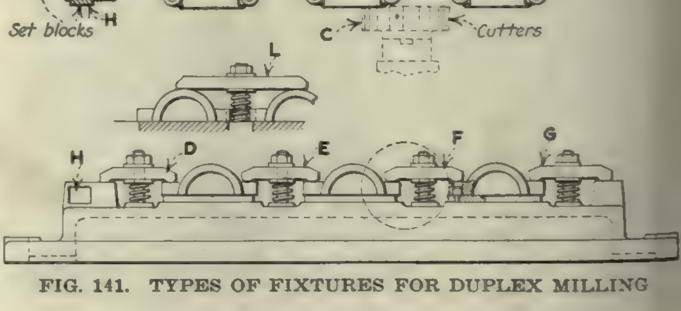


FIG. 141. TYPES OF FIXTURES FOR DUPLEX MILLING

the over-arm on the milling machine, thus making it possible to produce work much more rapidly than could be done with an overhanging cutter. A careful study of this fixture will be of advantage as the principles involved may be found useful in numerous cases where multiple-fixtures are needed. The duplex-milling machine is occasionally used for facing off both sides of work which might also be straddle-milled with large cutters. An example of this kind is given in Fig. 141 and we are citing this case to show the disadvantages and lost time occasioned by a poorly arranged milling fixture. The work *A* consists of bearing caps which are to be machined on each side by the cutters *B* and *C* as indicated. The work is located on a finished surface and on pins in two holes in each cap. Clamps are provided at *D, E, F* and *G* to hold the work down while milling. Set blocks are also located on the fixture at *H* and *K*, which are used with a feeler to set the cutter. Attention is called to the spacing of the work on this fixture, as the pieces are set so far apart that the cutter is "cutting air" about half the time. In order to save time and increase production, the pieces should be set as closely together as possible. There is no reason why an arrangement such as that shown at *L* can not be used, as the only space necessary in this case is clearance for the bolt and the spring. If arranged in this way more work could be placed on a fixture of the same length and each clamp would hold two pieces so that the clamping action would be more simplified and much more rapid.

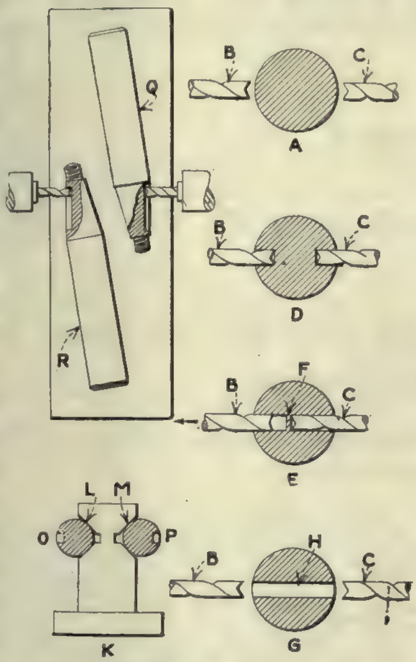


FIG. 142. EXPLANATORY DIAGRAM OF SPLINE AND SLOT-MILLING

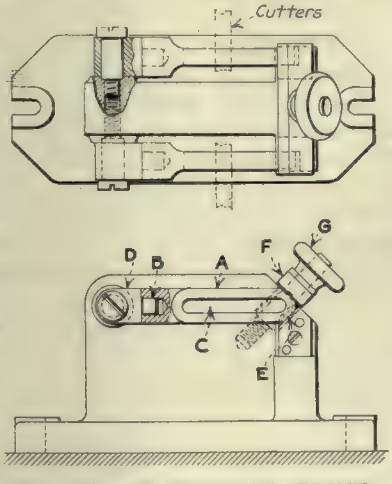


FIG. 143. EXAMPLE OF SPLINE-MILLING FIXTURE

The diagrams shown in Fig. 142 are intended to give the student a better idea of the uses and principles involved in the milling of splines. In designing spline-milling fixtures the first thing for the designer to remember is that the height of the spindle above the table is absolutely fixed and there is no adjustment vertically. Hence the fixture must always be designed to certain dimensions which vary among the different manufacturers.

Several standard fixtures can be purchased as equipment for the machine, these being useful for the holding of plain bars and for flat work. A bushing holder with taper collets to hold standard taper shanks can also be obtained. These fixtures can be adapted for a variety of uses when only a few parts are to be machined, but when a number of pieces of the same kind are to be manufactured, it is usually necessary to design special fixtures in order to obtain uniformity in the product.

ACTION OF CUTTERS

Several diagrams are given in order to show the cutter action when the machine is in operation. The diagram at *A* shows the cutters *B* and *C* approaching the work and ready to cut. Diagram *D* shows both cutters *B* and *C* part way through the work. Diagram *E* shows cutter *B*, which has approached almost to the center line of the work, withdrawing in the direction of the arrow while the cutter *C* continues and takes out the remaining metal at *F*. The diagram at *G* shows the completed slot at *H*.

As it is absolutely necessary that key-ways be located central with the shaft, any method used for location must take this point into consideration. In the example shown at *K* it will be noted that the V-blocks *L* and *M* are arranged so that the center line *OP* is directly in line with the spindles.

When tapered shafts like those shown at *Q* and *R* in the upper part of the illustration are to be spline-cut they may be set as indicated in order to utilize both spindles of the machine. Shafts having single splines should always be cut in pairs, in order that the machine may be worked at maximum efficiency. Generally speaking, spline-milling fixtures are simple in design and it is, therefore, unnecessary to illustrate many types. The principles given are sufficiently clear to enable a designer to make fixtures of this kind without difficulty.

One example of a spline-milling fixture is shown in Fig. 143. The work *A* has been previously milled on the sides and the hole *B* has been reamed as indicated. The slot *C* is to be machined on the spline-milling machine. Two pieces are held at the same time as shown in the upper part of the illustration, each being located on a swiveling stud *D* by means of a pin which enters the hole *B*. The other ends locate on the angular blocks *E*, being clamped in place by means of the equalizing clamp *F* operated by the thumb-knob *G*. This fixture is very clean in its general appearance and is of simple, though efficient, construction.

MODERN PRODUCTION METHODS

By
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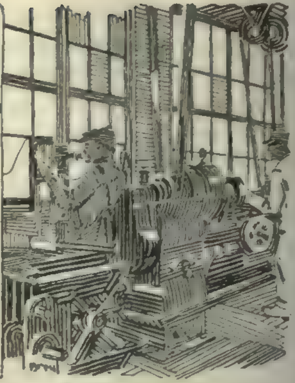


XIX—The Statement of Condition and the Operating Statement

How to Determine Whether the Business Is Gaining or Losing—A Method of Discovering How the Profit Is Made

UNDER the old methods of accounting—which are still far too commonly used—the owner of a business could not know how successfully he was operating without "closing the books"; and "closing the books" was too formidable an adventure, both physically and mentally, to undertake more often than once a year. In the meantime, the business went on hopeful but fearful of what the findings would be when the books were finally closed and the history of the year's operations written.

It would be interesting to describe the cumbersome, laborious process of closing the books—for the sake of ridiculing those old-fashioned methods which gave such meagre information. But those who have been through the process are not apt to forget it.

Now that the way to tie cost accounting into the general accounts of a business has been discovered, it is possible to determine the condition of a business frequently and easily. In fact, the manufacturer can, if he wants, get statements weekly or daily without great effort. But I do not believe they are needed so often. Once a month is, however, not too frequent for an owner or his executives to check up on the activities of a business. The oftener you can check up, the less likely you are to let a loss run on. Too frequent statements, on the other hand, are apt to lack perspective.

TRIAL BALANCE
as of
JANUARY 31, 1921

	Dr.	Cr.
Reserve for depreciation of buildings		$1,319.47
Materials purchased finished	$25,232.02	
Lumber and packing materials	923.80	
Insurance accrued—machinery		112.50
Taxes accrued		183.33
Prepaid insurance—buildings	1,387.80	
Forgings and castings	54,274.62	
General stores	6,126.30	
Selling expense	1,898.45	
Goods finished and in process	26,520.33	
Buildings	452,629.11	
Bar stock	27,341.13	
Hardening and carbonizing materials	4,300.56	
Fuel	5,371.29	
Reserve for depreciation of machinery		3,711.17
Machinery	372.624.64	
Accounts payable		308,214.18
Iron and steel	25,137.47	
Cash	79,204.71	
Accounts receivable	625,326.50	
Real estate	50,000.00	
Surplus		325,966.52
Capital stock		1,000,000.00
Profit and loss due to abnormal expense	2,234.34	
Sales		350,197.20
Cost of sales	229,171.30	
	$1,989,704.37	$1,989,704.37

FIG. 92. TRIAL BALANCE SHEET

This monthly checking up is done by means of two statements, the statement of condition and the statement of operations. The statement of condition is a form in which the assets and liabilities of the enterprise are listed, usually in parallel columns, in that way disclosing the net worth of the business. Since both sides of the account balance, the statement is often referred to as a balance sheet. To my mind, "statement of condition" more accurately discloses the purpose which is to answer the question, "Where do I stand?" The statement of operations in its turn answers the question "How did I make my profit or my loss?"

The statement of condition is in common use, but it discloses the net result of the operations for the period in bulk only. It is superior, but only to a degree, to the method still used by some quite successful business men, who every so often attempt to collect all the money due them, pay all their bills and consider that their bank balance plus their stock of goods on hand is their capital and the amount of that capital in excess of the capital of some other date is the profit made in the interval which has elapsed. The statement of condition gives no inkling as to where or why profits were made or failed to be made. The statement of operations, however, dissects the profit for the period and indicates where policies could profitably be changed.

The statements shown in this article are comparative, as you can see. A single figure standing alone means little. Considered in connection with a previous figure, it achieves a real meaning. It is only in comparing the figures with preceding periods and perhaps with the same period of another year that accurate deductions as to the operation of the business can be made.

Let us first consider how we arrive at the statement of condition. The first step is to take the trial balance of the ledger after all of the journal entries mentioned in preceding articles have been made. This trial balance which is shown in Fig. 92, is not particularly significant because of the illogical arrangement of the items which comes from following the order of the ledger accounts.

Accountants, bankers and credit men have given much study to the form which the statement of condition shall take. The one shown in Fig. 93 is generally accepted as being the clearest and most logical arrangement. We therefore rearrange the trial balance figures in this form.

In order to get the comparison which is of such great value, we show on the single sheet the statement of condition for the current month and for the preceding month.

Before discussing the statement of condition further I want to forestall comments by accountants who may make the startling discovery that the figures shown are ridiculous for any business. For example, they might point out that this concern did not collect during January any of the accounts receivable which were on the books Dec. 31—admittedly not likely even in a business depression.

There are several other figures which to the accountant indicate that the business is poorly run—almost a comic opera business in fact. There are also many items of assets and liabilities which might appear but do not, because they would merely add complications without increasing the value of the discussion. The answer is that no attempt has been made in any of these articles to give figures which reflect the actual transactions of a real business. The aim has been, not to record all of the possible accounting entries, but to give only enough to show the business man *how* figures can help him. No ordinary textbook would be large enough to show all of the entries that might arise.

Therefore I have kept the figures and transactions as simple as possible, and have been content to show clearly, I hope, how the activities of the shop are reflected in the books. I have carefully traced items from account to account; but have not tried to make the size of the entries consistent with those in any real business. I am trying to make cost accounting clear to machine shop executives. I am writing for business men, not for accountants.

Returning to the statement of conditions; you see that in the comparison of the January 31 figures with those of December 31, the increases or decreases in each item of assets and liabilities can be easily determined. The total net increase or decrease in assets and liabilities is in the surplus account on the balance sheet. This increase of surplus, $116,893.11, which is the month's profit, is the balancing figure. It is arrived at also by means of the statement of operation and thus serves as a check on accuracy. It is shown on the statement of operations as "Net profit from operations" for the month ended January 31.

The statement of operations as shown in Fig. 94 is built up for the period to date, which in the case of our

STATEMENT OF CONDITION

Assets	December 31, 1920			January 31, 1921			Increases	Decreases
Current Assets and Inventories:								
Current Assets:								
Cash	$95,127.30			$79,204.71				$15,922.59
Accounts receivable	275,129.30			625,326.50			$350,197.20	....
Total Current Assets		$370,256.60			$704,531.21		$334,274.61	
Inventories:								
Iron and steel	$35,197.60			$25,137.47			....	$10,060.13
Bar stock	40,191.65			27,341.13			....	12,850.52
Forgings and castings	75,128.50			54,274.62			....	20,853.88
Hardening and carbonizing materials	3,502.21			4,300.56			$798.35	....
Materials purchased finished	25,189.20			25,232.02			42.82	....
Lumber packing materials	625.30			923.80			298.50	....
General stores	7,250.90			6,126.30			....	1,124.60
Fuel	5,003.90			5,371.29			367.39	......
Goods finished and in process	187,925.50			26,520.33			....	161,405.17
Total Inventories		380,014.76			175,227.52		....	$204,787.24
Total Current Assets and Inventories			$750,271.36			$879,758.73	$129,487.37	....
Fixed Assets:								
Real Estate	$50,000.00			$50,000.00			....	....
Buildings	452,391.67			452,629.11			$237.44	....
Machinery	370,431.99			372,624.64			2,192.65	....
Total Fixed Assets		$872,823.66			$875,253.75		$2,430.09	....
Less Reserves for Depreciation:								
Buildings				$1,319.47			$1,319.47	....
Machinery	....			3,711.17			3,711.17	....
Total Reserves	....				5,030.64		$5,030.64	....
Net Value of Fixed Assets			872,823.66			870,223.11	....	$2,600.55
Deferred Charges to Operations:								
Prepaid building insurance	....			....		1,387.80	$1,387.80	....
Total Assets			$1,623,095.02			$1,751,369.64	$128,274.62	....

	December 31, 1920			January 31, 1921			Increases	Decreases
Liabilities and Capital:								
Liabilities:								
Accounts payable		$297,128.50			$308,214.18		$11,085.68	....
Notes payable	....			....			....	....
Sundry liabilities	....			....			112.50	....
Insurance accrued	....			....	112.50		....	....
Taxes accrued					183.33		183.33	....
Total Liabilities			$297,128.50			$308,510.01	$11,381.51	....
Capital:								
Capital stock—Outstanding		$1,000,000.00			$1,000,000.00		....	....
Surplus (see Statement of Operations)		325,966.52			442,859.63		$116,893.11	....
Reserve for Federal income and Excess Profits Taxes	....			....			....	....
Total Capital			1,325,966.52			1,442,859.63	$116,893.11	....
Total Liabilities and Capital			$1,623,095.02			$1,751,369.64	$128,274.62	....

FIG. 93. STATEMENT OF CONDITION

STATEMENT OF OPERATIONS

	For Month Ended January 31, 1921	
Sales		$350,197.20
Less returns		
Allowances		
Net sales		$350,197.20
Cost of goods sold		229,171.30
Manufacturing profit		$121,025.90
Less adjustments through abnormals:		
Abnormal manufacturing expense	$2,242.70	
Ccredit abnormal tool room	8.36	$2,234.34
Net manufacturing profit		$118 791.56
Less selling expense		1,898.45
Trading profit—net income from operations		116,893.11
Other income:		
Cash discounts taken		
Interest received		
Miscellaneous		
Total other income		
Total income		$116,893.11
Deductions from income:		
Cash discounts given		
Interest paid		
Miscellaneous		
Total deductions from income		
Net profit from operations		$116,893.11
Unallowable Deductions:		
Reserve for Federal income and excess profits taxes		
Balance, transferred to surplus		$116,893.11
Surplus beginning of the period	$325,966.52	
Deduct dividends paid		
Adjusted surplus		$325,966.52
Surplus at end of period (See Statement of Condition)		$442,859.63

FIG. 94. STATEMENT OF OPERATIONS

hypothetical business is for the month of January which is the first month of the period. In Fig. 95 a suppositious statement as of February 28 is shown. On this the operations for the full period to February 28 are shown, together with the statement for the period ending the preceding month—January 31. The difference between the two sets of figures gives the operating results for the latest month—February.

The final result of correct additions and subtractions will be the profit and loss, first by totals (two, three or four months and so on) and secondly for the current month. It is in this way that the operating statement develops the profit and loss independently of the statement of condition. The figure thus arrived at, added to the amount of surplus at the beginning of the month or period, less any current month's surplus adjustments gives the final surplus which is the balancing or proof figure on the balance sheet.

Thus we have made doubly sure that a profit has been made. But we have not yet learned how and why it was made. Perhaps we lost money on more than half of our lines of product and made a disproportionate profit on the rest. To get a close view of our business adventure we must put each item under the microscope. This we do by analyzing the statement of operations to show the result of our operations in each product. In Fig. 96 we show a statement of operations analyzed by lines of product.

You will note that the first column shows the gross figures for the business as a whole. These are in turn subdivided and carried towards the right-hand side of the sheet by classification of product. The total of the sales by lines must check with the total credit for the month that has been posted to the sales account on the ledger. Underneath the gross sales appears the item "Less Returns and Allowances." For simplicity we are not showing any figures for this deduction for the current month. After making this deduction the result is the net sales for the month or period. Many manufacturers prefer to keep accounts for their many subdivisions, but it is not essential. A subsidiary record can be maintained which will give this information at all times. The best accounting practice of today is to eliminate all details from the general ledger. The general ledger is a controlling ledger and the supporting details are supposed to be carried in subsidiary records.

On the complete operating statement shown in Fig. 95 is an item "Cost of Goods Sold," $229,171.30, which is built up on the detailed statement Fig. 96. One way to do this would be to take an inventory of all materials at the beginning of the period and add all purchases of labor, material and expense and at the end of the period deduct the inventory of all materials on hand. The difference would be the consumption or cost of goods sold. This, however, would require taking an inventory at the beginning and end of the period, which would be out of the question for most concerns. To avoid this laborious and costly detail, we work on the consumption basis, taking into consideration the cost of labor, material and expense which has been expended on the goods actually sold and shipped. This is the reason for developing the "goods finished and in process" account with which we have already had to do. This intermediary account is charged with all labor, material and expense consumed in processing and is credited with the final cost of the goods sold and shipped. Therefore, we build up the cost of sales in exactly this manner, starting first with the amount in the "goods finished and in process" account at the beginning of the month.

The next step is to show in detail the various additions that have been made to the goods finished and in process account. First we add the amounts of each kind of material that has been withdrawn from the raw material inventories and charged to the goods finished and in process account during the month. Next is added the productive labor and then the expense. In the various preceding chapters you have been shown how these have one by one been accumulated. Therefore this statement is not new work—it is merely a compendium of ready figures. In addition to these we also show any abnormal expense that was added to the goods finished and in process, as has already been explained in the article on abnormal expense. The total of all of these consumptive figures is added to the inventory of goods finished and in process at the beginning of the month.

If from the goods in process any partly finished work has been taken or if any items for asset accounts (for example, special machines built in the factory for your own manufacturing purposes) has been taken, these deductions are listed here and are deducted from the total inventories and additions. From this balance we deduct the amount shown in the "goods finished and in process" account at the end of the month. The resulting difference represents the cost of goods sold and shipped.

This cost of sales or goods sold is analyzed by product

STATEMENT OF OPERATIONS

	For Month Ended January 31, 1921		For Two Months Ended February 28, 1921		For Month Ended February 28, 1921	
Sales		$350,197.20		$564,372.89		$214,175.69
Less returns			$4,123.56		$4,123.56	
Allowances			347.50	4,471.06	347.50	4,471.06
Net Sales		$350,197.20		$559,901.83		$209,704.73
Cost of Goods Sold		229,171.30		403,979.87		174,808.57
Manufacturing Profit		$121,025.90		$155,921.96		$34,896.06
Less Adjustments through Abnormals:						
Abnormal manufacturing expense	$2,242.70		$4,157.36		$1,914.66	
Credit abnormal tool room	8.36	2,234.34	8.36	4,149.00		1,914.66
Net Manufacturing Profit		$118,791.56		$151,772.06		$32,980.50
Less Selling Expense		1,898.45		7,485.23		5,586.78
Trading Profit—Net Income from Operations		$116,893.11		$144,286.83		$27,393.72
Other Income:						
Cash discounts taken			$3,451.22		$3,451.22	
Interest received			10.50		10.50	
Miscellaneous			5.00		5.00	
Total other income				3,466.72		3,466.72
Total income		$116,893.11		$147,753.55		$30,860.44
Deductions from Income:						
Cash discounts given			$11,187.29		$11,187.29	
Interest paid			125.40		125.40	
Miscellaneous			3.95		3.95	
Total Deductions from Income				11,316.64		11,316.64
Net Profit from Operations		$116,893.11		$136,436.91		$19,543.80
Unallowable Deductions:						
Reserve for Federal Income and Excess Profits Taxes				22,447.98		22,447.98
Balance Transferred to Surplus		$116,893.11		$113,988.93		*$2,904.18
Surplus Beginning of the Period	$325,966.52		$325,966.52		$442,859.63	
Deduct dividends paid			15,000.00		15,000.00	
Adjusted Surplus		325,966.52		310,966.52		427,859.63
Surplus at End of Period (see Statement of Condition)		$442,859.63		$424,955.45		$424,955.45

* Debit balance.

FIG. 95. COMPARATIVE STATEMENT OF OPERATIONS

in exactly the same way as were the sales. The difference between the cost of goods sold and the net sales gives the normal manufacturing profit. This normal manufacturing must be corrected by adding any profit or subtracting any loss due to abnormal expense, to arrive at the net manufacturing profit for the month.

Having on the detailed statement of operations, Fig. 96, determined the manufacturing profit we turn back to Fig. 94.

From the net manufacturing profit we deduct the selling expense for the month, which gives the trading profit. For the month ending January 31 this is $116,893.11. Sometimes it is well to normalize the selling expense in which event we would deduct from this figure the abnormal selling expense, thus arriving at the final trading profit, or to use the accounting expression the "net income from operations."

This is the profit from manufacturing and selling a product. But very likely the business has other activities which affect the profits and should be separated from the factory operations. For example, such items as interest paid or received, and cash discounts taken or allowed have no relation to manufacturing but result from the maneuvering of capital. If you pay interest it is for the use of more capital than you own, and it cannot justly be charged to manufacturing. When you receive interest, it is because you have excess capital and the income does not reflect manufacturing skill. You allow a cash discount for the prompt return of capital which has gone out of your business in the form of finished goods. These capital charges or credits are added to or subtracted from your trading profit, thereby arriving at a final net profit from all operations.

I do not describe these financial statements in the hope of making accountants out of business men. But I have tried to describe them in such a way that business men will see just how it is that properly assembled statements actually do picture the conditions and operation of the business. Based as these statements are, both upon the general books of account and upon the cost system, they tie together and give close control of the business. In the ordinary machine shop it should be possible to lay these reports upon the executive's desk within three or four days after the close of each month; certainly in no case later than the 8th or 9th—even in plants with a thousand people on the payroll.

DETAILED STATEMENT OF MANUFACTURING OPERATIONS*

	Totals		Grinders	Lathes	Shapers	Milling Machines	Boring Mills
Sales		$350,197.20	$101,011.50	$23,487.20	$26,709.00	$108,000.00	$90,989.50
Less returns and allowances							
Net sales	'$350,197.20	$350,197.20	$101,011.50	$23,487.20	$26,709.00	$108,000.00	$90,989.50
Cost of Goods Sold:							
Inventory of goods finished and in process, beginning of period	$187,925.50						
Additions to Inventory:							
Productive labor	10,615.06	(Detailed figures showing proportions of each of items in first column, are shown here if the executive wishes.)					
Castings and forgings	21,781.38						
Bar stock	13,613.85						
Iron and steel	9,885.03						
Lumber and packing material	2.50						
Materials purchased finished	1,348.18						
General stores	134.86						
Manufacturing expense	10,678.07						
Miscellaneous	157.20						
Total inventory and additions	256,141.63						
Less transfer to selling expense	450.00						
Balance	255,691.63						
Less inventory of goods finished and in process end of period	26,520.33						
Cost of goods sold		$229,171.30	$68,759.00	$26,495.50	$14,925.80	$68,451.00	$50,540.00
Manufacturing profit		$121,025.90	$32,252.50	*$3,008.30	$11,773.20	$39,549.00	$40,449.50

* Loss. Not including "abnormal" charges, which, as shown on Fig. 3, are later deducted.

FIG. 96. STATEMENT OF OPERATIONS ANALYZED BY LINE OF PRODUCT

Facilities at the Puget Sound Navy Yard

Large Gantry Cranes—The Working of a Six-Ton Electric Steel Furnace—Progressive Views of Marine Engine Erection

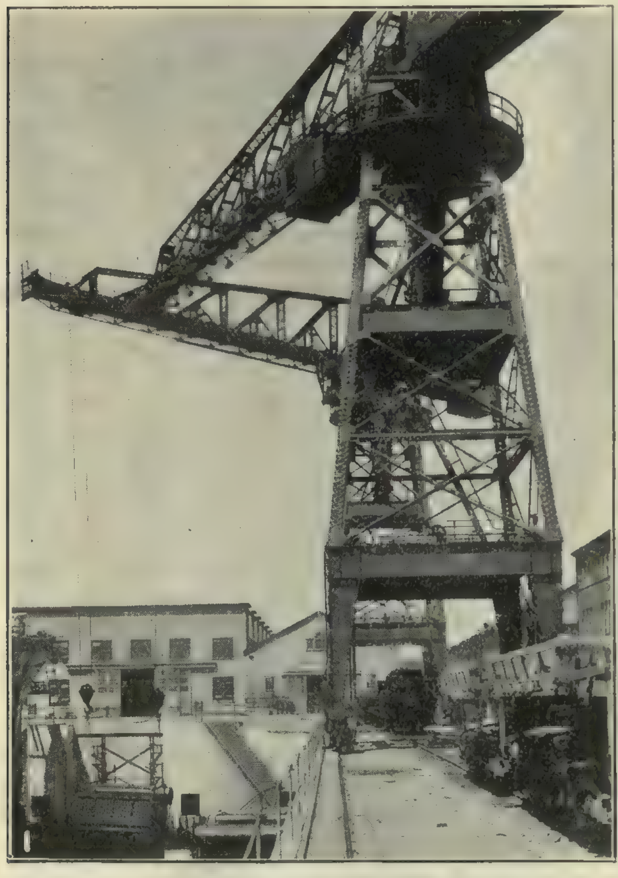
By FRED H. COLVIN
Editor, *American Machinist*

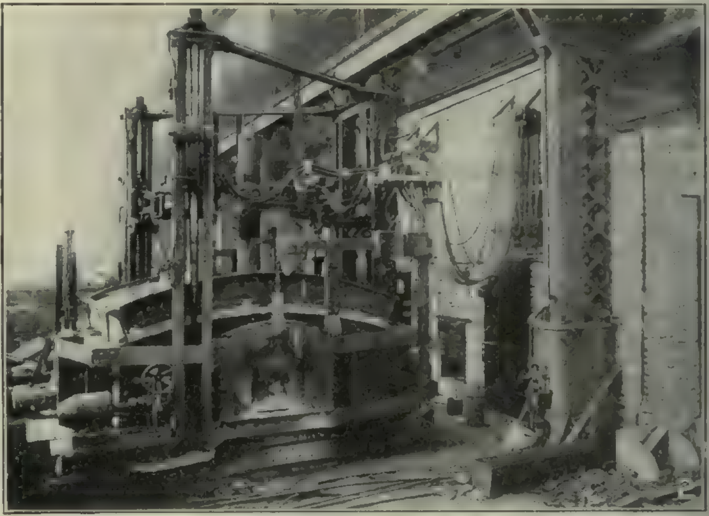
SOME notion of the general facilities at the Puget Sound Navy Yard can be had from the accompanying illustrations. The two large gantry cranes shown in Fig. 1 are particularly valuable in handling material from the yard to the ships or vice versa. In this case, they are hoisting one of the four Babcock & Wilcox boilers on board Ammunition Ship No. 2. The weight of one of these boilers, together with the lifting gear, is 61,320 lb. The cranes were built by the McMyler-Interstate Co., of Cleveland, Ohio, and as can be seen, have a considerable range and capacity.

Part of the foundry equipment is shown in Figs. 2 and 3. These views show a 6-ton electric steel furnace installed by the Electrical Furnace Construction Co., Philadelphia, Pa., and which has been giving excellent satisfaction. Fig. 3 is a closer view of the furnace from the pouring side and shows how the gate is controlled. It also gives a better idea of the large carbons used and shows some of the mechanism by which the furnace is tilted for pouring.

The electric furnace was installed about two years ago at an approximate cost of $60,000. It was a difficult task to find suitable space for a furnace of this size in a foundry already built, it being essential that the furnace should be so located as to have all necessary crane facilities. The floor space needed is 60 x 60 ft. The furnace proper is located nearly in the center of this space and is 12 x 12 ft.

The electric current used is 2,300 volts at the transformers and is reduced there to three different voltages, 100 volts on two carbons for melting, 85 volts on two carbons for refining and two other connections at 60 volts each for holding the heat. It requires about one hour to charge the furnace and four and one-half hours to conduct a heat. The furnace uses 900 kw. per ton of melt. Much better results can be obtained when the furnace is used continually and not allowed to cool before recharging. The carbons are raised when the furnace is charged. The carbons are 14 in. in diameter, 6 ft. long and weigh 550 lb. each. The carbons are water cooled on top of furnace in order that the link chain





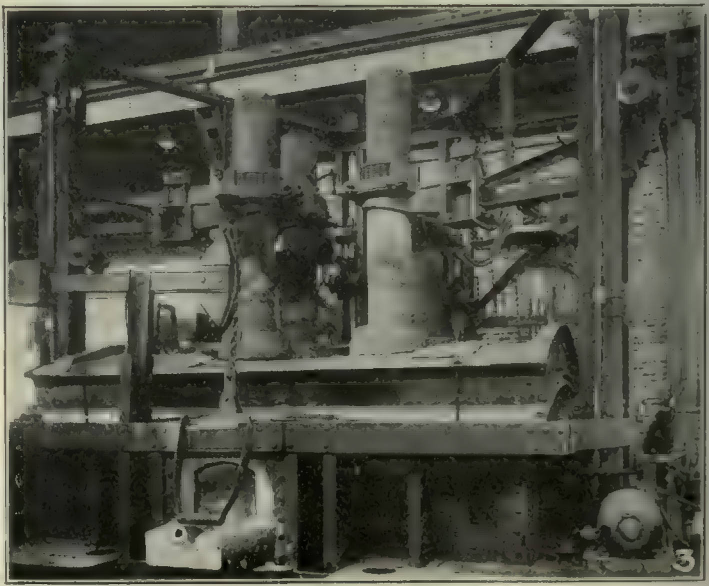


FIG. 1. GANTRY CRANES HANDLING BOILER. FIG. 2. SIDE VIEW OF THE 6-TON ELECTRIC FURNACE. FIG. 3. THE POURING SIDE OF THE FURNACE

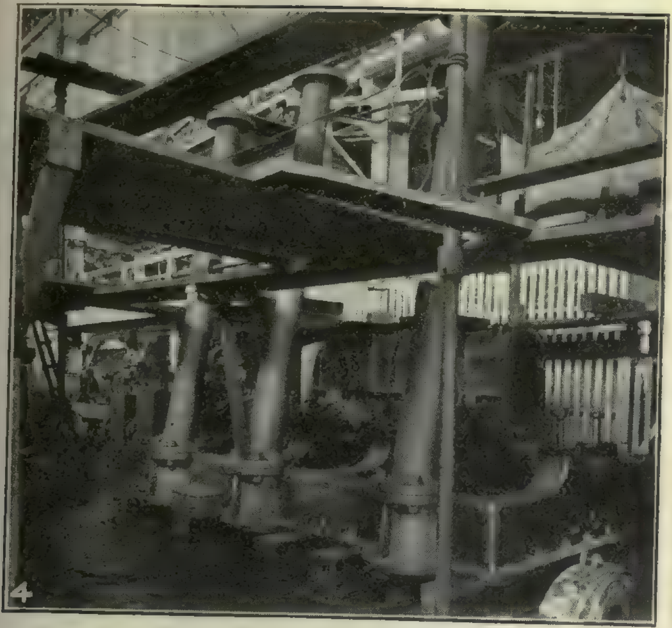
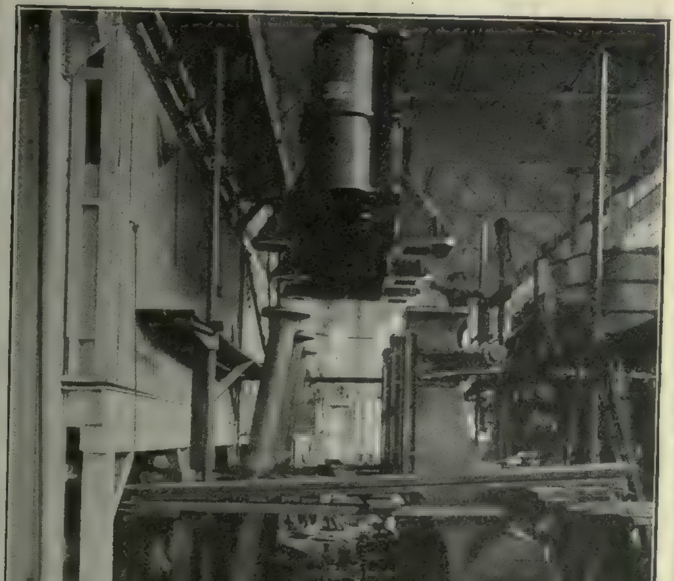
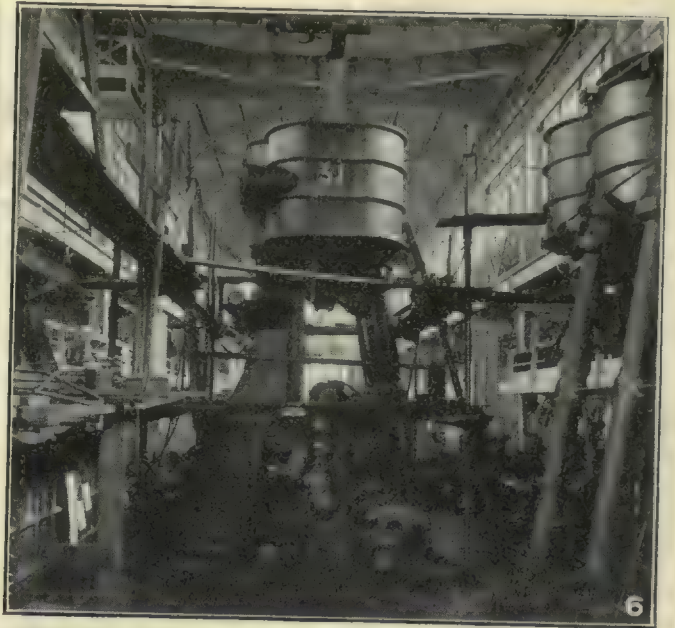


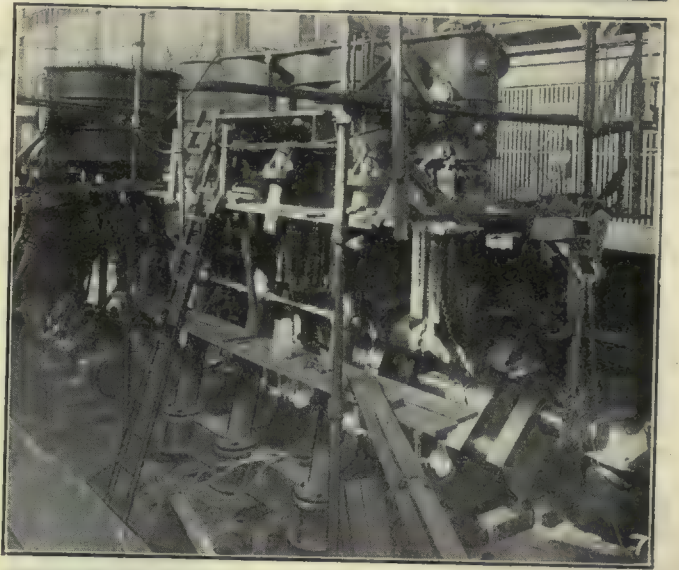
FIG. 4. BEGINNING THE ERECTION OF A TUG ENGINE

can hold them securely. They are automatically lowered when the furnace is in operation, and about 30 lb. of each carbon is used to run a heat. The furnace must be relined after about 170 heats, or when the top shows the first signs of burning through. It requires three men to operate this furnace.

Figs. 4 to 8 inclusive are an interesting series of progress views of the erection of a sea-going tug engine. Fig. 4 shows the front columns and one section of the condenser in place. Fig. 5 is an end view, showing both the front and rear columns erected and the remainder of the condenser in place.







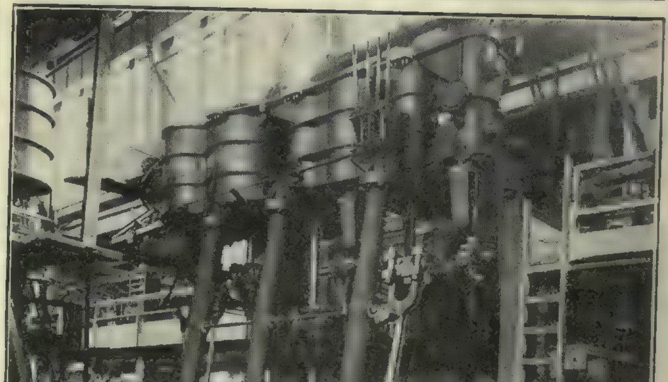


FIG. 5. LOWERING THE CYLINDERS INTO PLACE. FIG. 6. READY FOR THE CRANKSHAFT. FIG. 7. PUTTING THE CRANKSHAFT INTO POSITION. FIG. 8. THE COMPLETED ENGINE

In Fig. 6 the engine begins to assume complete proportions and is all ready for the installation of the crankshaft. This is being swung into place in Fig. 7 which shows the arrangement of slings and hoists at *A*, *B* and *C*. Fig. 8 shows one of the completed engines ready for installation in the hull of the tug.

Organization and Management of the Small Shop

II—How to Analyze Manufacturing and Marketing Problems—A Common-Sense Questionnaire Concerning the Product—Necessity of Definite Information and Objectives

By ELMER W. LEACH

THOUSANDS of men who saw service in the recent war will recall the many interesting hours they spent "playing war" with relief maps for their scene of operations and toy soldiers for their commands. After a long hike with a heavy pack under a hot sun, or after a tiresome morning on the rifle range it was always a welcome order to report for a lesson with the maps and toy soldiers.

With these maps spread out on the floor and regiments of these tin soldiers to move about as desired, whole campaigns were planned and worked out to the smallest detail. The scene of operations was carefully analyzed, the position of the enemy, his probable course of action under the attack, the cost of the operation in money and in casualities, the time when it should take place, the time it would require, the results gained, all those phases of the problem and many more were reduced to an exact science.

Charts, maps, diagrams, drawings, reports, cards, records of all sorts were used in greater proportionate volume than they are employed in most businesses. And was it all worth while? Did it help to bring about the desired victory?

It is not necessary to print the answer to those questions. And yet how many business men there are, and how many men planning on entering business, who can see no parallel in their own personal problems.

When a man received his baptism of fire, he thanked himself religiously for those months of training and study he had been privileged to spend. Not that he would have been afraid to face the fight without that training if need be—but with a praper of thanks for the good old Uncle Sam who had been willing to give him all that training, so that he might go into the fighting with a clean, clear vision of the sort of struggle that waited ahead, and with a firm foundation upon which he might easily afford to wager the possibilities of victory.

Business is a war. I do not mean to suggest that it is that seething, destructive, bloody, hate-breeding tumult that war is to some of us; but I do mean that it is a struggle, a fight.

There are opposing forces in every field of business. There is always competition. Different groups are working for their own personal gain, with no special consideration for other conflicting groups. You must expect to meet resistance from certain quarters. You must count upon an increased activity in competitive spheres aimed plainly and unquestionably at yourself. Do not make the fatal mistake of presuming that because your product may actually be somewhat superior to any other similar product on the market your article will have a 100 per cent consumption and the sales of your competitors' articles will automatically drop to zero when your first piece of advertising makes its appearance. You can never have all of any field entirely to yourself.

Theodore Roosevelt, I believe, is credited with having given this very valuable bit of advice to the world: "Be sure you're right, then go ahead and stick to it." That expression contains the suggestion of the three important phases of your opening days in the business world; first, a careful investigation of the practicability and the possibilities of your idea; second, the courage to actually carry your idea through to a reality; and third, the perseverance and the patience to believe in your idea and in the ultimate sureness of success.

ELIMINATE THE GUESSWORK

The day you enter business for yourself is far more important in its significance than the day you deposited your first dollar in a savings account. But I'll wager that when you did that you inquired whether the bank paid four or four and one quarter per cent interest, and whether it was compounded quarterly or not.

And yet are you thinking of entering business before you know what profit you will realize on your investment and whether your capital will turn over every quarter?

There is really no guesswork in business; at least no successful business man ever employs guesswork. My insurance company does not *guess* that they should charge me $21.20 a year for $1,000 worth of insurance, nor do they *guess* that they should add $1.80 to the premium if I wish the privilege of arranging for my beneficiary to receive double the amount of protection should I be killed by accident.

Those figures have been arrived at most scientifically. They *know* that in the average that is the correct amount to charge. They do not know that I will die by accident. But they do know from investigating statistics over a long period of years that a certain number of men at certain ages are killed each year by accident. They know what percentage of men in different occupations are killed by accident. And so they know the *likelihood* of my suffering that unfortunate experience.

The insurance business, more than any other field, is one in which the problems have been thoroughly analyzed and the guesswork been reduced to facts. And yet this is the most difficult field of all in which to do that thing, for the only materials with which they have to work are human lives, things entirely beyond our own control.

Your manufacturing problems, dealing as they do with iron and steel and material things, can be studied much more definitely and with much greater assurance of correct conclusions.

Therefore, in considering the possibilities of the success of your business venture, correct information is your most essential requirement. Until your decisions are based on certain conditions of fact, they are sheer guesswork and you are risking your money and prestige and the possibility of success.

You are entering into a distinctly new portion of your active life when you establish yourself at the head of your own business. If your idea is at all pretentious, it holds promise of developing an organization in which you will spend your entire business life. The success which you realize and the progress which you make during your first two years in business have tremendous significance in determining your wealth and your standing when you are fifty.

ANALYZE THE PROBLEMS OF YOUR BUSINESS WORLD

Do not then, no matter how sincere the confidence in the certainty of your own suppositions, cast your fortunes into the world of business without a most thorough analysis of the problems about which the world of your business revolves.

The Champion Spark Plug Co. is an excellent example of a successful organization that can well serve as an inspiration to any new manufacturer. Yet I know of a gentleman who conceived the idea of a spark plug which had a small copper ring giving contact at 360 points about the circle, the theory being that the intensity of the spark obtained in this way would make his spark plug superior to any on the market.

He obtained a patent, had a large stock of spark plugs made up, printed stationery, and believed he was ready to figure his profits. However, when the spark plugs were put to the test of actual use it was found that the all-important ring expanded under the heat and dropped out of place, so that the acticle was absolutely worthless.

One would presume that this man would have investigated his product before going to such expense, and yet he is only one individual of thousands. In some instances the business is actually established and operating presumably at a profit before the impracticability of the product is brought to the surface.

Place your product on some stand where you can study it thoroughly. Be sure that no one else is near to prevent you from being absolutely frank and truthful with yourself. Consider its every quality and feature from every possible angle and viewpoint, and then ask yourself if it is really practical.

Does it actually do the work or perform the operation for which it is designed? This is something you cannot determine on paper. You must have a small quantity of your machines or goods made up, try them yourself, test them under all sorts of conditions and in as varied uses as they will be put to by actual purchasers. Possibly, if the nature of your product permits, and if the expense is not too great, you can actually place your machines on approval in the shops or places where they will be used.

Let them undergo the test of actual operation. Learn the opinions of those who have tried them. Collect all possible data about the performance of your product, so that when you are ready to market it you can give facts in your advertising found through actual experience.

Does it do that work cheaper, better, in less time, with less labor, or by using less material than if the work were done by hand? Some companies will claim all those qualities for their product, but usually such claims must be qualified considerably. It is quite unlikely that your product has *all* the possible good features. There will be some particular element in its construction or some special feature of its operation that will be distinctive of your goods. Study the performance of your product, find what that point is, and make it the basis of your appeal for business.

Will your product wear out quickly? This is another phase of the practicability of your product which you can only determine by experiments extending over a long period of time. A high-speed steel drill costs more than twice as much as a carbon drill. If it only lasted half as long as a carbon drill there would be no justification for its use.

Does your product fit into present common practice? Your machine may be impractical because some feature (maybe a point of superiority) or some detail of design makes it necessary to use that machine in a different way than such machines are ordinarily used. In a certain instance it was necessary to change the construction of a machine, because the cost of educating the operators into the proper use of the more difficultly operated article would have been disproportionate to the price of the machine itself.

Does it have an appearance that fits into the place it will occupy? Children like a Christmas tree because of the appearance, and grown people are often swayed by that same thing. Some men will buy an automobile because of the lines of the body without inquiring about the make of the engine or the mileage per gallon of gasoline. Often a product that would not appeal if coated in black enamel will sell readily if it is painted in a light blue and the name of its maker shown on a neat brass plate. A garbage incinerator for the basement of your home can look quite different from one you would want to place in your kitchen. Your product can be impractical from lack of attractive appearance.

What are its defects? Your product is not perfect, of course. In some place it falls down—everything does. Your competitors will pretend to have discovered any number of disadvantages of your goods over theirs. But you should discover those disadvantages first, if they really do exist. If the defects interfere with the operation of the machine, they must be corrected before your finished product is offered to the trade.

Can it be easily adapted to other uses which will increase its demand? I shall take the liberty of drawing an illustration from equipment for shoe repair shops, for that is the field with which I happen to be particularly familiar.

"Skive" means bevel; consequently in a shoe shop a "skiver" is a machine that cuts a bevel on a piece of leather. One shoe machinery company had a skiver in its line of equipment. It had sold thousands of them when one day someone inquired whether the machine would cut a bevel on the fabric of an automobile tire casing.

That inquiry started an investigation which opened up a new field with greater possibilities than their first market; and from the vision which that first suggestion created has now come a complete line of equipment for tire repair shops, from the large five-section vulcanizer to the small hand tools.

Study the varied uses for your product. You may find some adaptation to a new use which had not occurred to you at first that will have a very material effect in fixing your marketing problems.

Will its price be consistent with its performance? I believe that a machine could be devised to lace a person's shoes; but such a machine would surely cost several hundreds of dollars, and I should not care to pay that much just for the privilege of having that task performed automatically.

In designing your product, if it be a machine to replace a former hand operation or to assist a hand operation, it must be confined to a price at which it will eventually pay for itself and prove to be an investment instead of an expense. You must put it out at a figure that will make its installation and its use justify its cost.

If you can prove to your prospects that your machine pays for itself, then it becomes a near necessity no matter what its price may be.

THE RESULT OF YOUR ANALYSIS

The questions I have listed here are suggestive questions which you can ask yourself about your product. If it does not meet your expectations in one or two particulars you need not be discouraged. If it appears vastly superior in some respects do not feel over-confident. For your purchasers will see your product from all viewpoints; they will single out its distinctive features as well as its shortcomings; and upon the average which those good and bad points make—the impression they form of your product as a whole—will depend their demand for your goods.

After you have placed your final O.K. upon the design of your product so that it will be commercially salable, you will probably be required to go over it again, part by part, and make a number of changes to adapt it to quantity production. The moment that your plans for manufacturing your product begin to assume definite shape you will have to concern yourself with the cost of production, for it is upon that figure that your selling price and your profit will depend.

If you intend to equip a shop and do your own manufacturing, you must let your design be determined largely by the amount of capital which you can obtain for your shop equipment. It is hardly likely that you will want to make every part yourself; and so you will want to go over your product carefully and decide what parts of it can best be made by outside companies.

The materials of which your machines are made will have an important bearing upon the extent to which you will want, at first, to call upon outside concerns for work. If you are getting out some small machine on which one or two of the parts require heat-treating, it is improbable that it will be worth the expense to install your own heat-treating equipment. For the first few months when you will want to confine all expenditures for equipment to as low a figure as possible, it will be better for you to turn this class of work over to outside jobbing shops.

And even after your production is up to the point where you prefer to do the heat-treating within your own shop you will find, if you are at all resourceful, that a large part of the necessary equipment can be made by yourself.

It is obvious that if there are but one or two milling or planing operations on all your parts, you could not afford to purchase a miller or a planer when you first equip your shop.

It is surprising what different kinds of work can be done on an ordinary engine lathe when necessary. In our own little business there were a few of our first machines in use that had been made before we organized as a definite manufacturing concern with our own plant. All of the parts of those machines had been made on a small South Bend lathe and a bench drill press.

By putting a cutter on a mandrel between centers and fastening the casting to the compound rest, the necessary surfaces were milled as satisfactorily as though we had used a $2,000 universal milling machine. Gears were cut by holding the cutter between centers, fixing the gear blank in a simple device fastened to the rest, and bringing the work past the cutter by the cross feed.

Such methods, of course, meant that production was very limited; but it is much better that your income be small because of restricted installation of equipment than that your expenditures be unreasonably large because of purchases of machine tools which you cannot at first keep busy up to more than a small part of their capacity.

THE IMPORTANCE OF CONSERVATION

What is worth doing at all is worth doing well; and that applies to the purchase of shop equipment as strongly as to anything else. Be very cautious about installing second-hand machine tools. Remember that someone else felt he had gotten full value out of that milling machine before he offered it for sale to you.

You cannot afford to be extravagant during these early days, and there are any number of tools which would be very desirable and which would surely have a tremendous effect in lowering your costs. But you simply cannot afford some of them, rather, you cannot afford to tie up capital in equipment which could be used so conveniently in furthering the progress of your company through use in other ways.

There are other problems besides purchasing of equipment which will call for careful consideration, such as the advisability of renting or building. One of the good arguments against renting a small building is that shortly after you are well established on a profitable basis you will be obliged to tear up your shop, delay production for a while, and move into a larger location. Moving is an expensive procedure and it always delays continuous operations. However, unless you plan to have more than $25,000 original working capital, I believe you will be ahead financially by renting a building for at least the first year.

Just very roughly, it is possible that you can rent for $50 a month the same space that would cost you $5,000 to duplicate. Rent is an expense, and in a certain sense you have nothing to show for it after it is paid; so that you may question the wisdom of spending $600 in that way during your first year. But by doing that instead of putting up a $5,000 building of your own, you will have $4,400 to use in other ways which will be much more productive during your first twelve months of operation than if you were to put it into your own plant.

Put that extra money into merchandise, or put it into advertising and sales promotion if you choose, and when the time comes that you are pressed for larger quarters, you will be in a good sound position to think about a factory building of your own.

The same sensible viewpoint must be taken in considering expenses for jigs and fixtures. Box tools, automatic die heads, tapping attachments, and special jigs are all conducive to lower production costs; but right now, while you may be working for someone else in some large plant that is a model for efficient equipment, you must remember that your employers have probably been able to have that equipment because of early economies.

A small shop operating at a profit is much better than a large shop operating at a loss. The cost of "getting started" is something which you can predetermine very definitely; but the cost of "keeping going" is a figure on which the most experienced analyst would not venture an estimate.

So many beginners in business estimate, for example, that $5,000 will equip their shop, purchase merchandise, meet the payroll for three months, and put them in a position where their shipments will be $1,000 a month. As a consequence, they believe they have made unfailing plans to be on a profitable working basis in three months.

Even though you may believe that you can arrange such a schedule for your own business, do not plan to have used all your original capital by the time you had *planned* you would be operating at a profit. Cut your equipment appropriation in two, cut your other items down considerably, and retain a good reserve for operating expenses which you were not able to foresee. There will be a surprising number of expenditures to be classified under that heading.

We must all crawl before we can walk. It is no disgrace to start small. The companies which begin in a small way and experience a trying struggle for existence and progress are given a conception of real business problems and an understanding of the serious effort that overcomes obstacles which they can consider one of their very valuable assets and which cannot help but reflect itself in later successes.

Co-operation—What Is It?

By Entropy

It is said of James J. Hill that at a director's meeting of one of his numerous interests that all hands were at loggerheads and apparently could not get together. He called on them to co-operate. One of the directors asked him just what he meant by that, to which he replied, with a blow of his fist on the table for emphasis, "Do as I tell you, and do it d—— quick."

This story could probably be told with equal regard for the truth of many great figures in finance and industry. It is characteristic of many of them. The principal difference is in the expletive, and the degree to which the big stick is allowed to repose out of sight back of the door or whether it is swung in sight of the crowd. In either case it seems to be certain that the best co-operation is found where there is a dominant leader rather than where there is an equality of minds, in which case the co-operation is really the result of all hands following, with more or less reason, the one man and not the result of any marked attempt to co-operate with each other.

It is really a serious question whether such a thing as real co-operation is the practical way in which to do business. We all expect an umpire to settle differences of opinion, and most of us are good enough sports so that we accept his decision with very little grumbling and go at the game again with a will, even though in his fairness he does not give *us* all the decisions. More than that we are, almost all of us, looking for leadership. Not more than one man in a hundred will take command unless he is forced to do so. We may aspire to it, but we are afraid of our own abilities, or else we are so afraid of criticism that we do not dare risk it. A great many of the minor executives in industry, and some that are much higher, are coinciders rather than executives. They transmit leadership, dulled and modest, rather than assume it. They may bluster and show their teeth when they feel that it is safe, but it has to be very safe before they take any initiative.

Human nature does not appear to have undergone any great change for the few thousand years of which we have positive information. If any change has taken place, it appears to be that executives have tended more of late than they did in the time of Julius Caesar to take counsel and advice from others as well as their personal friends. It is really too much to expect that in matters of any great importance people of similar degrees of intelligence will look at the same set of circumstances in the same light. This is notably shown in the psychological tests for association, where the moment the obvious tests like associating snow with winter, fire with warmth and so on are passed, the increase in the variety of associated ideasis in direct ratio to the intelligence of the persons under examination. It is further noticeable in any organization of business men where we find great differences of opinion regarding the simplest matters. This is very plainly shown in the columns of popular reviews of the world's events, where the views of editors the world over show such complete difference of interpretation that it seems hopeless to expect the world to agree on anything whatever beyond the simplest things that are reducible to mathematics, and even Einstein comes along to upset, or try to, all our preconceived notions as to the result of adding two and two.

Knowing then as we do that no two people in any organization of live men are going to see all things in the same light, it appears to be necessary for an agreement to be reached by compromise. Compromise is seldom reached except by leadership. Some one man, knowing in advance the arguments which will be used on both sides, lays out a practical path, which combines as many of the good things on both sides as he thinks it possible to agree on, and proceeds to let the opposing parties exhaust themselves in overcoming each other. When the psychological point is reached, he proposes one after another of his compromises and secures the passage of many of them simply because the opponents are tired out and they welcome a fresh point of view.

When we are considering the co-operation of employees with the management, we only have the same conditions extended to a larger number of people. The man who can handle a small number of directors around a table is not by any means the one who can handle a large meeting and carry his leadership into the larger number with the same effectiveness. Of all the presidents of the United States there have been but few who caught the popular acclaim, who could appeal to the country and yet who were equally happy with a strong cabinet. Lincoln and Roosevlet stand out prominently in our minds as men who were believed in by the great number of voters and who did not suffer from a large labor turnover in their official families. And yet it is undoubtedly true that it is easier to lead large numbers of people of average intelligence than it is to carry a few men of real capacity for thought. The popular mind responds to frankness and to a clear exposition of aims. The moment the masses suspect that something is being kept back from them they are ready to vote against it. In a small board of directors everyone knows, or thinks he knows, the weaknesses of the other members and plays all his cards against those weaknesses. They all suspect the others of holding back something.

Tap Drill Sizes

Elements to Be Considered—What Constitutes the Government Standard—Minimum and Maximum Limits for Tap Holes—Determining the Ideal Drill Size

By COL. E. C. PECK and T. F. GITHENS
Cleveland Twist Drill Co.

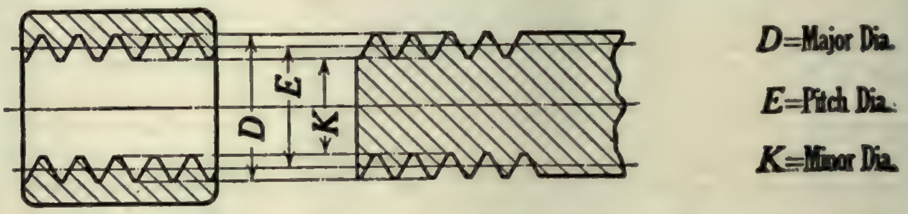
"WHAT size tap drill shall I use?" is the question asked in every shop. This cannot be answered definitely without knowing all the conditions. There never was a table published which satisfied half of the engineers. If the tap drill is too small, we have a large breakage of taps. If the tap drill is too large, we have tapped holes in thin material which do not have sufficient thread to hold anything. It is therefore perfectly obvious that a tapped hole in thick material should be drilled larger for the same tap than one in thin material. Different kinds of material require a different sized tap drill for the best results, due to a difference in the flow of the metal being tapped.

It is suggested that the best size tap drill to use is the one which will drill a hole of such size that after the thread is tapped, the minor diameter will be within the minimum and maximum limits as given in the "Progress Report" of the National Screw Thread Commission.

This report of the National Screw Thread system has been issued and has been approved by the secretaries of War, Navy, and Commerce, and is, therefore, at the present time a standard for all government work. (A copy of this report may be obtained by writing to the Bureau of Standards, Washington, D. C.) It is evident, then, that screw thread products for the government will be gaged according to the dimensions given in the National Screw Thread Commission's report. In this report are described four classes of fits, namely, loose, medium, close and wrench. For the first three classes of fits the minor diameter of the internal thread commonly known as core diameter or inside diameter of the nut is such that the maximum depth of thread is 83⅓ and the minimum depth of thread is 75 per cent. This means that the tolerance given for the holes produced by tap drills will be between 75 and 83⅓ per cent full thread depth. These dimen-

COARSE THREAD SERIES
TAP DRILL SIZES

THE NATIONAL THREAD SYSTEM FOR SCREWS, BOLTS AND NUTS, as recommended by the National Screw Thread Commission in report dated June 19, 1920



The essential thing required of a tap drill is that the holes it produces must be within the limits given in the table below under the heading "Nut Minor Diameter," which have been agreed on as standard by The National Screw Thread Commission. It is necessary that the drill maker must be allowed some manufacturing tolerance or variation in the diameter of the drill. Some allowance must also be made for the drill to wear smaller in diameter, but this is partially offset by the drill cutting oversize due to improper grinding of the cutting edges. Columns showing minimum and maximum diameter under heading "Tap Drills" are the limits of the diameter of drills which The Cleveland Twist Drill Company believes will produce satisfactory results under average conditions, and are based upon the above considerations. The limits given for the diameters of tap drills permit a small variation well within and near the central zone of the tolerance or variation permitted in the Nut Minor Diameter.

Size	No. Threads per Inch	Basic Pitch Diam. Inches	Nut Minor Diam.		TAP DRILLS		
			Min. Inches	Max. Inches	K1 Min. Inches	K2 Max. Inches	Equivalent Regular Size
No. 1	64	.0629	.0561	.0578	.0570	.0575	*
No. 2	56	.0744	.0667	.0686	.0677	.0682	*
No. 3	48	.0855	.0764	.0787	.0776	.0781	5/64 in.
No. 4	40	.0958	.0849	.0876	.0863	.0868	2.2 mm.
No. 5	40	.1088	.0979	.1006	.0993	.0998	No. 39
No. 6	32	.1177	.1042	.1076	.1059	.1064	2.7 mm.
No. 8	32	.1437	.1302	.1336	.1319	.1324	*
No. 10	24	.1629	.1449	.1494	.1472	.1478	3.75 mm.
No. 12	24	.1889	.1709	.1754	.1732	.1738	4.4 mm.
¼ Inch	20	.2175	.1959	.2013	.1986	.1992	No. 8
5/16 "	18	.2764	.2524	.2584	.2554	.2560	6.5 mm.
⅜ "	16	.3344	.3073	.3141	.3107	.3113	7.9 mm.
7/16 "	14	.3911	.3602	.3679	.3641	.3647	9.25 mm.
½ "	13	.4500	.4167	.4251	.4213	.4219	27/64 in.
9/16 "	12	.5084	.4723	.4813	.4768	.4776	*
⅝ "	11	.5660	.5266	.5364	.5315	.5323	13.5 mm.
¾ "	10	.6850	.6417	.6526	.6472	.6480	*
⅞ "	9	.8028	.7547	.7667	.7607	.7615	*
1 "	8	.9188	.8647	.8782	.8715	.8723	*
1⅛ Inches	7	1.0322	.9704	.9858	.9781	.9789	*
1¼ "	7	1.1572	1.0954	1.1108	1.1016	1.1024	28 mm.
1½ "	6	1.3917	1.3196	1.3376	1.3271	1.3281	1 21/64 in.
1¾ "	5	1.6201	1.5335	1.5551	1.5443	1.5453	*
2 "	4½	1.8557	1.7594	1.7835	1.7715	1.7725	45 mm.
2¼ "	4½	2.1057	2.009	2.03354	2.0215	2.0225	*
2½ "	4	2.3376	2.2294	2.2564	2.2431	2.2441	57 mm.
2¾ "	4	2.5876	2.4794	2.5064	2.4929	2.4939	*
3 "	4	2.8376	2.7294	2.7564	2.7429	2.7439	*

FIG. 1. TAP DRILL SIZES, COARSE THREAD SERIES

sions are intended for average work where the length of the hole to be tapped is between one-half and one and one-half diameters of the tap. The dimensions of the minor diameters of the nut, which are given in Figs. 1 and 2, are the minimum and maximum limits referred to in paragraph (2), within which the size of the tap drill hole must be after the thread is tapped.

In order to make this clear, the charts shown in Figs. 3 and 4 have been drawn so that the distance between the base line *B* and the plotted line *A* represents the number of thousandths of an inch tolerance as given for the minor diameter of the nut in the National Screw Thread system for the standard sizes of the thread. Line *A* itself represents the maximum minor diameter of the nut, 75 per cent of the thread depth. The base line *B* represents the minimum minor diameter of the nut, 83⅓ per cent of the thread depth.

The Ideal Tap Drill

It is required, therefore, that the tap drills should produce holes between these two lines. If a drill is selected too near the upper line, there is a danger that it may cut over-size due to imperfect grinding of the point and other conditions. If the drill is selected near the lower line it may wear undersize too rapidly, especially when drilling cast iron. It seems, therefore, that the ideal tap drill would be a size which was located midway between the two lines *A* and *B*, as it would then give the drill a chance to wear from its size to the base line or cut oversize from this line to the maximum size of the hole allowed.

These midway sizes are represented by line *K*1 on the charts and the values of *K*1 are given in Figs. 1 and 2. Twist drills must also have a manufacturing tolerance. The nominal size of the drill is its maximum limit, therefore by taking *K*1 as the minimum size of the drill and allowing a small tolerance value, we obtain the line *K*2 which represents the nominal size of the ideal tap drill. Tap drills within the zone *K*1-*K*2 represent the best size to use.

The chart also shows the position occupied by standard stock size drills and it will be noticed that those recommended in the Cleveland Twist Drill Co.'s list in Figs. 1 and 2 are close to or within the zone of the best size tap drill.

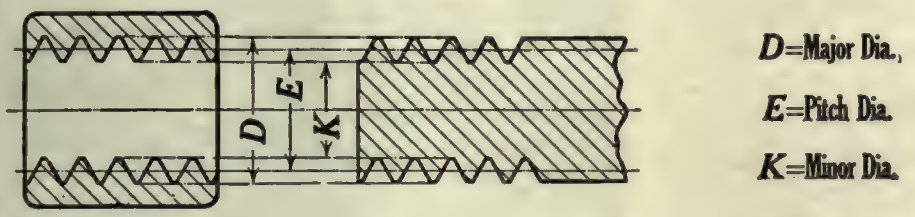
Where no standard drill is within this zone, as for example the 9/16 thread, fine thread series, it is suggested that a new standard size drill will pay for itself if carried in stock, this drill to have the dimension given in column *K*2 in the tables. This drill might be known as 9/16 x 18 N.F. tap drill (N.F. meaning National Fine Thread Series), other standard tap drill sizes being designated in a similar manner.

[Editor's Note.—Since this report was issued, the National Screw Thread Commission has outlined a program for con-

FINE THREAD SERIES

TAP DRILL SIZES

THE NATIONAL THREAD SYSTEM FOR SCREWS, BOLTS AND NUTS, as recommended by the National Screw Thread Commission in report dated June 19, 1920.



The essential thing required of a tap drill is that the holes it produces must be within the limits given in the table below under the heading "Nut Minor Diameter," which have been agreed on as standard by The National Screw Commission. It is necessary that the drill maker must be allowed some manufacturing tolerance or variation in the diameter of the drill. Some allowance must also be made for the drill to wear smaller in diameter, but this is partially offset by the drill cutting oversize due to improper grinding of the cutting edges. Columns showing minimum and maximum diameter under heading "Tap Drills are the limits of the diameter of drills which The Cleveland Twist Drill Company believes will produce satisfactory results under average conditions, and are based upon the above considerations. The limits given for the diameters of tap drills permit a small variation well within and near the central zone of the tolerance or variation permitted in the Nut Minor Diameter.

Size	No. of Threads Per Inch	Basic Pitch Diam. Inches	Nut Minor Diam.		TAP DRILLS		
			Min. Inches	Max. Inches	K1 Min. Inches	K2 Max. Inches	Equivalent Regular Size
No. 0	80	.0519	.0465	.0478	.0472	.0477	1.2 mm.
No. 1	72	.0640	.0580	.0595	.0588	.0593	1.5 mm.
No. 2	64	.0759	.0691	.0708	.0700	.0705	No. 50
No. 3	56	.0874	.0797	.0816	.0807	.0812	No. 46
No. 4	48	.0985	.0894	.0917	.0906	.0911	*
No. 5	44	.1102	.1004	.1029	.1019	.1024	2.6 mm.
No. 6	40	.1218	.1109	.1136	.1125	.1130	No. 33
No. 8	36	.1460	.1339	.1369	.1355	.1360	No. 29
No. 10	32	.1697	.1562	.1596	.1584	.1590	No. 21
No. 12	28	.1928	.1773	.1812	.1794	.1800	No. 15
¼ Inch	28	.2268	.2113	.2152	.2124	.2130	No. 3
5/16 "	24	.2854	.2674	.2719	.2697	.2703	*
⅜ "	24	.3479	.3299	.3344	.3314	.3320	Q
7/16 "	20	.4050	.3834	.3888	.3854	.3860	W
½ "	20	.4675	.4459	.4513	.4486	.4492	*
9/16 "	18	.5264	.5024	.5084	.5054	.5062	*
⅝ "	18	.5889	.5649	.5709	.5679	.5687	*
¾ "	16	.7094	.6823	.6891	.6867	.6875	11/16 in.
⅞ "	14	.8286	.7977	.8054	.8016	.8024	*
1 "	14	.9536	.9227	.9304	.9266	.9274	*
1⅛ Inches	12	1.0709	1.0348	1.0438	1.0393	1.0401	*
1¼ "	12	1.1959	1.1598	1.1688	1.1643	1.1651	*
1½ "	12	1.4459	1.4098	1.4188	1.4143	1.4153	*
1¾ "	12	1.6959	1.6598	1.6688	1.6643	1.6653	*
2 "	12	1.9459	1.9098	1.9188	1.9143	1.9153	*
2¼ "	12	2.1959	2.1598	2.1688	2.1644	2.1654	55 mm.
2½ "	12	2.4459	2.4098	2.4188	2.4143	2.4153	*
2¾ "	12	2.6959	2.6598	2.6688	2.6643	2.6653	*
3 "	10	2.9350	2.8917	2.9026	2.8972	2.8982	*

FIG. 2. TAP DRILL SIZES, FINE THREAD SERIES

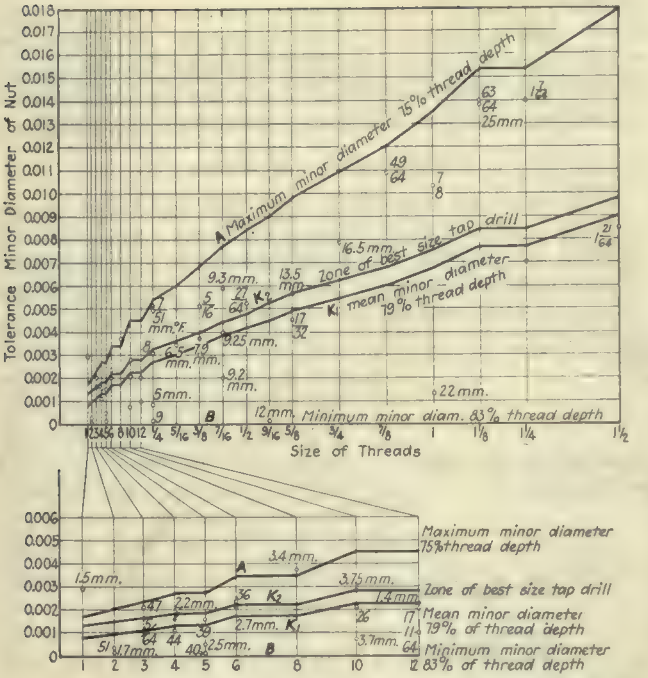


FIG. 3. TAP DRILL SELECTION CHART, COARSE THREADS

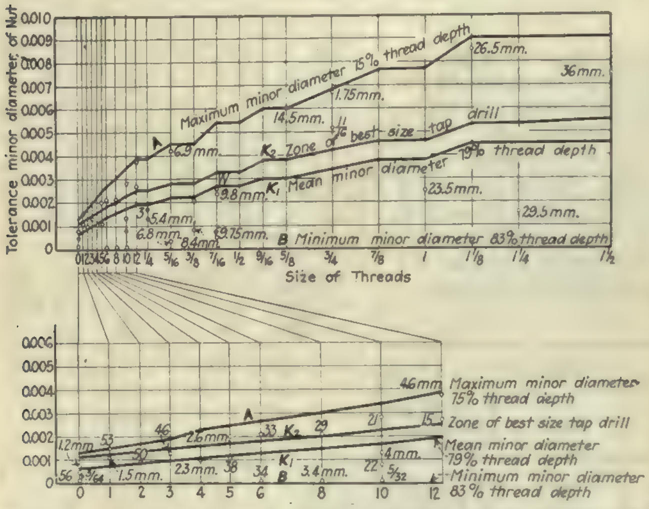


FIG. 4. TAP DRILL SELECTION CHART, FINE THREADS

tinuing its work. The progress report will be augmented to include more information as to the specific class of fit and series of thread pitches to be used under different conditions.]

Decreased Imports Affect Exports

(From the *Guaranty Survey*)

It is, of course, important that the highest possible volume of export trade should be maintained if we are to have normal production in our mines and factories and on our farms, and if we are not to be forced to scrap a large part of our new productive equipment. But an increase in imports does not necessitate a corresponding decrease in exports. It is entirely possible that the present relation between exports and imports may be reversed without in any way decreasing the volume of exports. We can buy more without selling less and thereby enable our European debtors to pay off their obligations without crippling our industries or decreasing our national wealth in order to do so. A study of the development of foreign trade in many European countries will show this to be true.

Quick Removal of a Pavement

By D. E. Dunn

About a year after the armistice was signed many large plants were being remodeled for peace-time production. One large manufacturer of compressed-air machinery had an entire building with many thousands of square feet of floor space devoted to war work. In the remodeling of this building, which was in the Phillipsburg, Pa., plant of the Ingersoll-Rand Co., the floor had to be torn up. An idea of the size of the job can be obtained from Fig. 1.

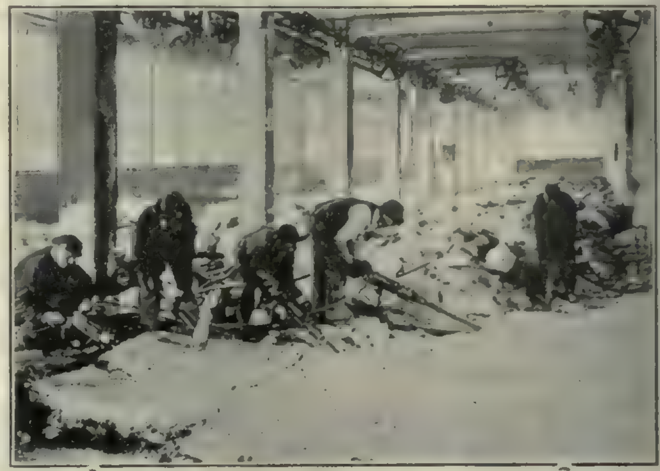


FIG. 1. BREAKING UP FLOOR OF A LARGE PLANT

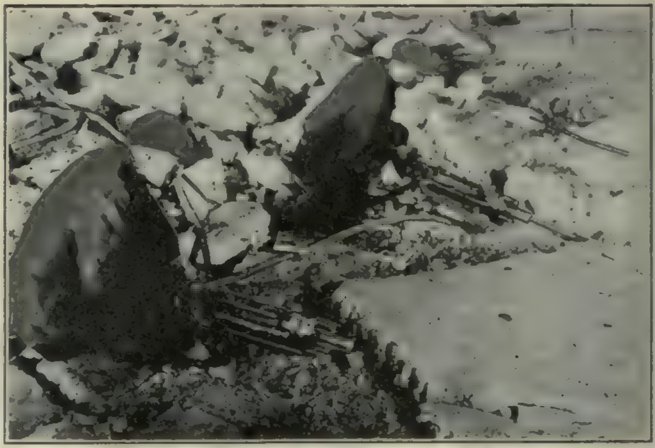


FIG. 2. PAVING BREAKERS AT WORK

Naturally the first thought was to do it by hand, as it had always been done that way. However, some one suggested using paving breakers. These machines are compressed-air operated, one-man tools very similar to non-rotating hand-hammer rock drills; and they are especially intended for concrete, masonry and paving demolition work.

On the job no exact records were kept. However, a fairly accurate estimate showed that two paving breakers broke up about 3,000 sq. ft. of 3- to 7-in. thick concrete in one twelve-hour period. In doing this work it was necessary to exercise the utmost care in some cases to prevent breaking through the ceiling to the floor below. For this reason the greater part of the work was done by driving a chisel-shaped tool under the paving and prying it up, as shown in Fig. 2.

It was estimated that it would take about thirty men using the old hand methods to accomplish in the same length of time the same amount of work as the two machines mentioned performed.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Cutting a Keyway in the Hub of a Large Wheel

By John B. Haberle

I recently had occasion to bore and cut a keyway in a large flywheel that was all out of proportion to any tools in our shop. The wheel weighed 4 tons and was 9 ft. 2 in. in diameter. The hub was 20 in. long with a 9½-in. hole.

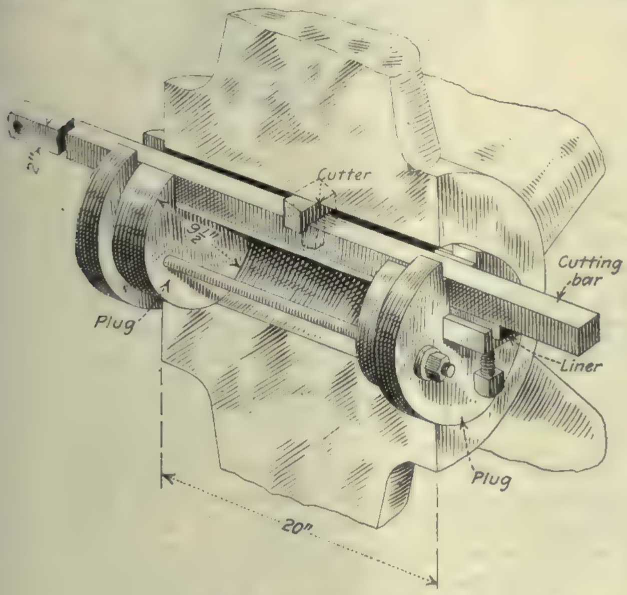


FIG. 1. THE SET-UP

The boring was a comparatively simple matter but the cutting of a keyway 2½ in. wide by 20 in. long, ⅞ in. deep at one end and 1 in. at the other—was a job that required a good deal of thinking. The way it was finally done is shown in the accompanying sketch.

I made two short shouldered plugs to fit the bore, with slots to take a 2-in. square bar of cold-rolled, and held them in opposite ends of the bore with through bolts. The slots in the plugs were deep enough to allow room for the cutting tool, which was set in the bar, and also to accommodate a liner under the bar to take care of the feeding. This liner rested on setscrews, tapped through lugs on the outside of each plug.

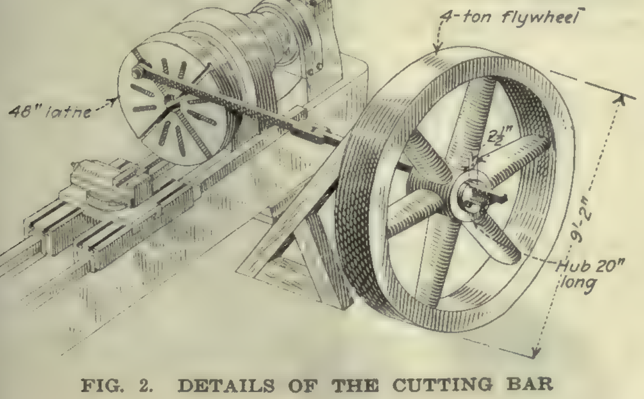


FIG. 2. DETAILS OF THE CUTTING BAR

The wheel was set up and braced before a 48-in. lathe with the wheel hub in line with the faceplate. A pitman, reaching from the end of the cutter bar to a stud in the faceplate, completed the device. I was able, by constant attention to the setscrews, to cut a satisfactory keyway to the required depth in about five and one-half hours. The details of the rig and the manner in which it was set up are shown in the illustrations.

Know Why You Do Things

By Ellsworth Sheldon

A series of articles, started by A. W. Forbes on page 612, Vol. 53, of the *American Machinist,* under the general heading "Know Why You Do Things," and continued by various writers on page 883 of the same volume and pages 72, 229, 238, 367, 565, 657, 832 and 880, of Vol. 54, seems to hinge upon the question of whether a cutting tool in a lathe should be set above, below, or at the same level as the center line of the lathe.

The contention of the writer of the original article was that occasional extraordinary conditions demanded extraordinary methods to meet them and that every lathe operator should study out the reason *why* he did certain things in a certain way in order to know *when* he should depart from his usual custom and do them in some *other* way.

Mr. Forbes' point was well taken but unfortunately illustrated. He chose as his experiment a "chattery" lathe and explained (on page 72, Vol. 54) *one* of the reasons why chatter occurs; showing in outline sketch a condition that would induce chatter, to counteract which he would place the cutting edge of the lathe tool below the center of the work.

The expedient, though doubtless more or less successful in certain cases, was so radical a departure from usual practice that it overshadowed the real point of the original article and became the bone of contention around which succeeding writers built their arguments pro and con; mostly con.

It is my belief, confirmed by a practical experience covering a period of nearly forty years, that the setting of a cutting tool is entirely a matter of rake and clearance angles; and that although chattering may sometimes be reduced or eliminated by changing the position of the tool, the same effect would have been produced by altering the angles by grinding. In other words, the chattering is the result of wrong conditions in which the position of the tool is seldom at fault, and to change it is merely to impose *another* wrong condition to, in a measure, cancel or offset the first.

Mr. Forbes' sketch, reproduced herewith in Fig. 1, shows a faulty tool support, exaggerated for purposes of illustration. The obvious remedy in such a case would be to run the toolblock forward and withdraw the tool to correspond. Moreover, to eliminate the chatter by placing the tool in such position that it would spring away from, instead of toward, the work would necessitate bringing the edge down to the position indicated by x, the point of incidence of the circle of the work and the arc of deflection. And I doubt if even Mr. Forbes would advocate placing it so low.

It has been my experience that chatter is more often counteracted by decreasing the clearance angle than by increasing it; and this means, unless the tool is either reground or tilted, setting the cutting edge *up* and not *down.*

On page 880 appears another proponent of what seems to me to be the wrong idea, and to illustrate his point he shows two tools, reproduced in Fig. 2, both of which to me show the error, the cause of trouble, to be in themselves and not in the manner of their setting. It is hardly necessary to explain to the readers of the *American Machinist* the reason why a springy tool may cause chatter. If the point of resistance, the cutting edge, is so placed in relation to the point of flexure that it occupies a position above a straight line drawn from the center of rotation of the work to the center of flexure of the tool (above being understood to be *against* the direction of rotation), chatter is a natural and inevitable result; but the point of flexure and the point of support of the tool are not of necessity related, and they are distinctly *not* so related in the two tools illustrated.

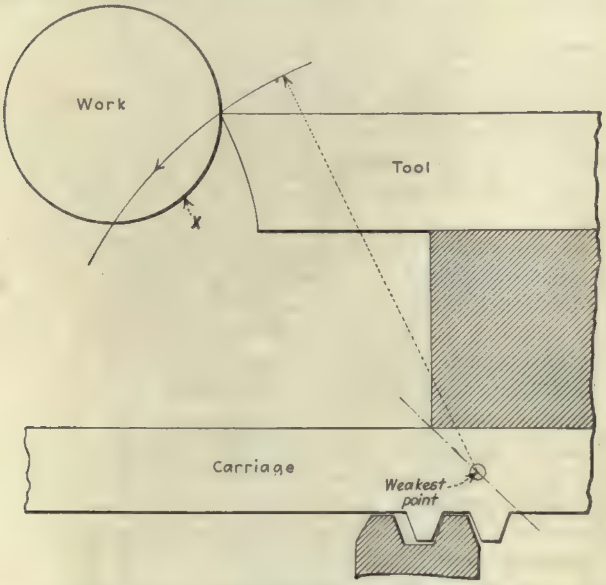


FIG. 1. MR. FORBES' ORIGINAL SKETCH

With a tool ground to so thin an edge as is indicated by the upper of the two tools shown in this figure, the point of flexure is located very close to the edge itself and almost directly under it and it would seem to me to be practically impossible to get a smooth cut with such a tool. In the lower tool an attempt has been made, by introducing the gooseneck, to raise the point of flexure so that the cutting edge falls below the above-mentioned line; which would have been an excellent expedient if the designer had not introduced another, and much less resistent, point of flexure at x which is bound to make trouble unless the tool is so tilted as to bring this point below the line.

If a lathe spindle is properly fitted to its bearings and the lathe itself so proportioned as to impose a proper resistance to the pressure of the cut, the height, relative to the center line, at which the tool is set, will not be a factor at all; the tool could as well be set vertically either directly below or above the center line. But, because the lathe is usually so designed that it best resists a downward thrust and because all movements of the toolslide are in a horizontal plane, it follows that the theoretically proper place to locate the cutting edge is in the same plane relative to the centers.

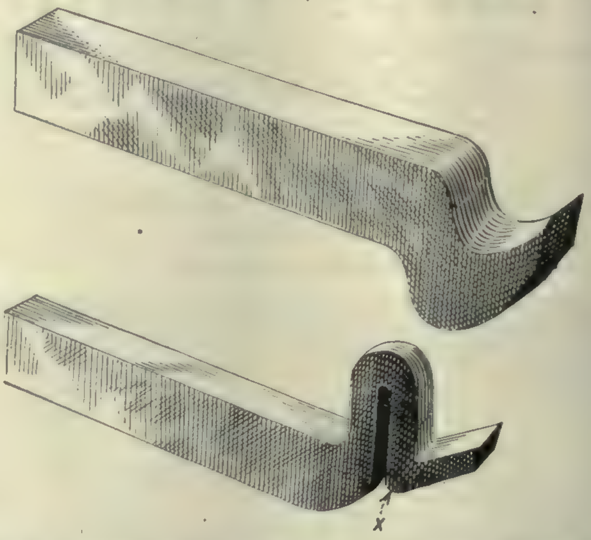


FIG. 2. TWO TOOLS THAT WILL CHATTER ANYWAY

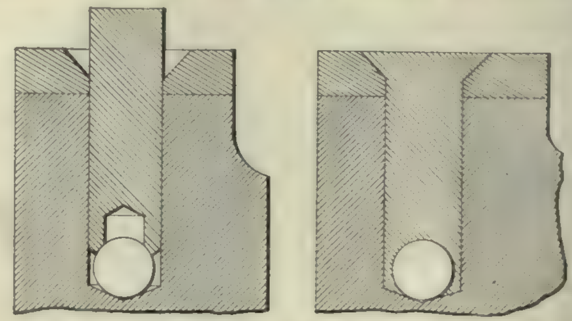
The real reason for raising or lowering a tool point is to change the rake and clearance angles to suit the work and material in hand, and it is more convenient to make the requisite adjustments in this respect with the toolpost wrench than it is to maintain a sufficient assortment of tools to meet all conditions.

My advice to mechanics endeavoring to correct chatter by monkeying with the tool is in effect the same as Mr. Forbes tried to convey in the original article: Find out what causes the chatter and correct it once for all time; then you can put the tool anywhere that may be desirable without reference to the center. For example see any automatic screw machine.

Holding a Rivet in a Blind Hole

By Frank C. Hudson

The use of a ball for spreading the end of a rivet in a blind hole frequently comes in very handy, as shown by F. G. McCormack on page 1095, Vol. 54, of the *American Machinist.* A more solid job can probably be made by using a rivet with a hollow end instead of



RIVET HELD BY A BALL

being split, as was done by the Link-Belt Company back in the early part of the present century.

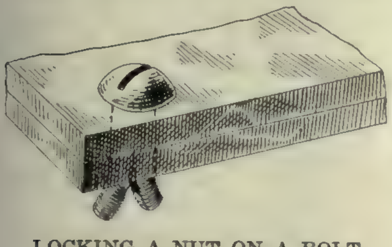
Mr. McCormack will be interested to look back on page 1011, Vol. 32, issue of Dec. 9, 1909, to see the application of this device as practiced by the Link-Belt Company at that time. He will also note that James M. Dodge, then president of the company, gave the use of the device, which they had patented, to anyone who desired to use it.

For the benefit of those who may not have access to the volume mentioned, I am reproducing the method as used by them. Studs of this kind have about the same strength as bolts. Although it might seem that it would be better to undercut the bottom of the hole with a wobble drill, it was not their practice to do so. It can, however, be done should it seem desirable. The illustrations make the method perfectly clear. The proper proportions are given herewith:

	In.	In.	In.
Diameter of stud	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{3}{8}$
Depth of hole	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$
Size of ball	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{9}{32}$
Diameter of center bore	$\frac{1}{10}$	$\frac{5}{32}$	$\frac{1}{4}$
Depth of center bore	$\frac{3}{32}$	$\frac{5}{32}$	$\frac{7}{32}$

A Handy Lock Bolt

By Charles H. Willey



LOCKING A NUT ON A BOLT

The sketch shows a useful kink that may be employed on small screws and bolts where it is desired to keep them from coming loose. Just use a longer screw that will give you a chance to saw a slot in it and spread the slit end apart, as shown. The idea is good on sheet-iron work.

A Handy Rack for Drills and Reamers

By Charles H. Willey

I picked up a rather good idea in a small shop and I have endeavored to show it in the sketch herewith. It was a tray, or rack, for holding reamers and drills and was simply a shallow wooden box lined with a piece of corrugated iron; the corrugations serving to keep each tool separate.

RACK FOR DRILLS AND REAMERS

Grooving a Large Hoist Drum

By C. M. O'Hara

Having a number of large skip hoist drums to groove, and being unable to swing them on our largest lathe, we made use of a 10 to 16 ft. Betts boring mill as shown in Fig. 1. This made a very satisfactory job.

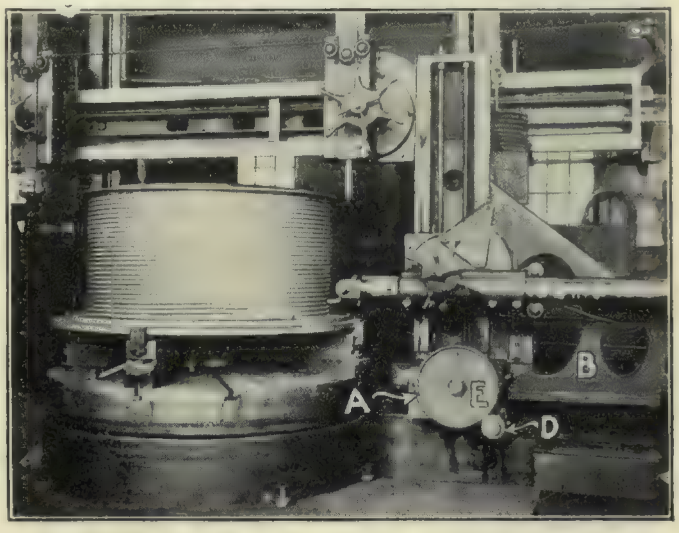


FIG. 1. GROOVING A LARGE DRUM ON A BORING MILL

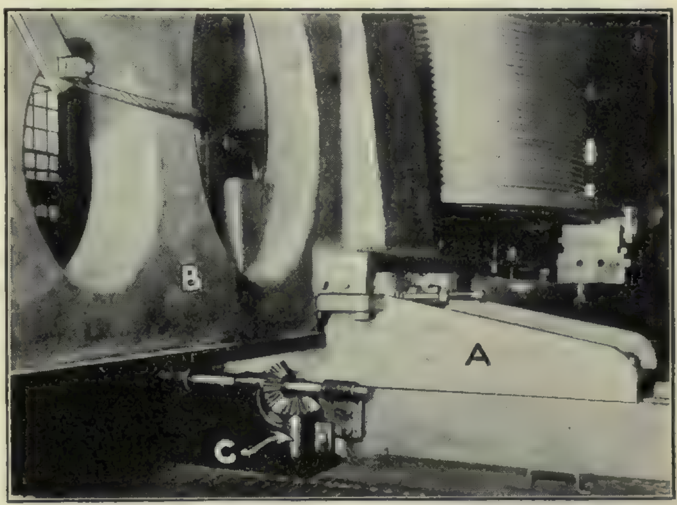


FIG. 2. DETAILS OF FEED MOVEMENT

The upright housings, being movable, were set back about 4 ft. and a base *A*, Fig. 2, made and bolted securely to the part of the ways thus exposed. On this base was fastened the extension arm *B* that is a part of the standard equipment of the mill.

A bracket *C* serves as an outboard bearing for the feed shaft, on one end of which is located a miter gear, meshing with a similar gear, which is the original feed drive for the machine. This same shaft carries on the opposite end the index gear *D*, Fig. 1, used in generating the required lead.

The ratio of travel between the drum and the feed shaft was found to be 16¾ to 1, and knowing the lead of the screw it was an easy matter to figure the gears *D* and *E* to generate the correct lead. By means of compound gearing an almost unlimited number of threads can be chased.

An angle iron bracket, cable and counterweight complete the equipment. The drum shown in the illustration is 69 in. in diameter, 36¼-in. face, 1.1875-in. pitch, 2.375-in. lead, double thread, right hand.

IN THIS ISSUE

WHILE the larger part of the civilized world is house-cleaning after the recent universal fracas, many manufacturing businesses are taking advantage of the lull in production to readjust shop conditions—putting the house in order to meet the keen competition which is inevitable. Firms that have been running along in the same old rut for many years are now able to see that they must introduce practical methods for handling materials and paying the workmen. All of which means that they are at last appreciating the importance and the responsibilities of management. In order to help convince the recalcitrant and to give them guidance once they are converted we have been for a long time very liberal with our management articles. We are encouraged by indications that our work is bearing fruit and continue the drive. There are several articles in this issue that will prove to be of material assistance.

The first article, "Incentive or Production Basis of Wage Payment," by Henry H. Farquhar, takes up six major administrative functions in their proper order and shows of just what each consists. Mr. Farquhar explains what conditions are necessary to the success of any shop system and proves that there is much more to the installation of a system than the holding of a stop-watch. The uses of motion study and time standards are clearly brought out.

The second article, "The Layout of a Modern Machine-Tool Plant," by Colvin, page 173, deals with another phase of modern plant management. It is still necessary to build a plant according to the space available or a given amount of cash. But while so doing it is equally necessary to lay out the operations on the various parts, determine the methods of machining, figure out the number of machines needed, and then adjust the construction to the layout and number of the machines. We shall have more on plant layout in the near future.

The promised series on machining the Wrigley automobile transmission gear, by I. William Chubb, editor of our European edition, begins this week, page 176. The first article describes the system in use in an English plant, with reproductions of the forms in use. His description of the progressive operation system will be very interesting to our American production experts.

Tool engineering continues with the subject of milling fixtures, including this week descriptions of methods of supporting and clamping thin castings and explaining the use of pneumatic clamps. Milling machine work offers great possibilities for originality in the designing of time- and labor-saving fixtures, and the illustrations in this article are fine examples of this class of work. Page 179.

In this, the 19th installment of "Modern Production Methods," page 184, W. R. Basset tells how to determine the condition of a business frequently and easily. Older methods have given place to the newer, in the office as well as in the shop, and the necessity of closing the books in order to find out where the business stood, is also a thing of the past.

Another article by Fred H. Colvin is "Facilities at the Puget Sound Navy Yard," page 188. It includes descriptions of a six-ton electric steel furnace and tells how it is operated. Operations in marine engine construction also are described and illustrated.

Those who read Elmer W. Leach's first article on "Organization and Management of the Small Shop" discovered that Mr. Leach speaks with the assurance of one who is thoroughly conversant with this subject. The second installment, page 190, deals with marketing and manufacturing problems and includes a questionnaire which will help the manufacturer to find out a lot of things about his own product. Mr. Leach gives a lot of good advice concerning expenditures for equipment and tells how he conserved his resources when everything was going out and nothing coming in. Here is a characteristic statement: "In considering the possibilities of the success of your business venture, correct information is your most essential requirement. Until your decisions are based on certain conditions of fact, they are sheer guesswork and you are risking your money and prestige and the possibility of success."

Entropy is back from a somewhat protracted vacation with a refreshing letter on co-operation, page 193. An old subject, co-operation, but never worn out.

Coming Features

The leading article in next week's issue will be devoted to a foundry subject. William H. Parry has written a very comprehensive article on elevated, midway and subway gating.

There will be a railroad shop article, by Fred H. Colvin, on tools for boring and turning locomotive tires. The data were obtained from seventeen railroad shops located in various parts of the United States and Canada. This is the first of two articles.

The sixteenth installment of Tool Engineering will continue the subject of the design of milling fixtures.

There will be two other series articles next week, the third installment of "Manufacturing with Special Machines versus Standard Equipment," by Col. G. F. Jenks, and the fourteenth of DeLeeuw's "Metal Cutting Tools." We shall publish only the first half of DeLeeuw's article. It will be continued in the following issue.

EDITORIALS

Rewards for Suggestions

SUGGESTION systems have many advocates while others have failed to find them of any benefit whatever. As with many other devices and methods, almost everything depends upon the way it is handled. Suggestion boxes can be a source of real improvement but it is usually up to the management more than to the men.

One of the stumbling blocks is the question of reward for suggestions which prove of value. In too many cases an arbitrary amount is named which is usually much too small if the suggestion is of any real use. Sometimes it is doubtless all that the suggestion is worth, but in such cases an honorable mention would probably answer equally well.

Some plants do not find a direct financial reward desirable and use other methods of showing appreciation. But where prizes are offered the reward should be adequate without too much bookkeeping.

In a shop paper published by a large concern we recently saw the announcement of an award of $10 for a device which was proving very valuable in increasing production. How far is such meager recognition going to stimulate the valuable suggestions? What would have been paid to an efficiency engineer for such a suggestion? How much have we paid outside men for ideas which failed to save anything?

It is not an easy task to fix the value of a suggestion fairly. But if it saves money there should be some way of calculating a suitable reward, based on the saving effected.

As with so many other phases of management, this is an opportunity for taking counsel together. All men prefer to have a hand in making a plan rather than in having it handed to them ready-made. They will usually be found amenable to reason if approached in the right way.

The Administration Moves for Better Times

THREE recent moves of the Administration at Washington are full of promise of an improvement in commerce and industry in this country and abroad.

Mr. Harding's call to a disarmament conference was heartily received everywhere. The potential benefits lying in such a conference are almost boundless. Aside from the moral aspects of any agreement that will tend to prevent the settlement of international disputes by force of arms, consider for a moment the stimulus to business of the release of the tremendous amounts of capital now devoted to the military establishment, and their diversion to peaceful ends. And also the reduction in taxation which is sure to follow.

In the second place there are the vigorous efforts of Mr. Harding and Mr. Hoover to hasten the payment of the hundreds of millions owed by the Government to the railroads. Many people feel that the payment of this money would be the one greatest step toward the return of prosperity. Some railroads, it is said, have not paid any bills for a year. As a consequence their creditors have been hard pressed for liquid capital to finance their business and have been quite unable to expand. It does not require a very vivid imagination to foresee the results of what might be called the thawing of five hundred millions of frozen credits.

And then there is the plea for the postponement of bonus legislation. We stand with every other right-minded American in believing that everything possible should be done for wounded and disabled veterans of the war. We feel, however, that this is not the time for passing a cash bonus bill that would add several billions to our national debt. There is even some question among financial men as to whether the bonds to finance a bonus could be sold. The action of the Senate in recommitting the bill will be a relief to many.

Expensive Economy in Buying Tools

THE feeling that money must be carefully spent is to be commended. But too many are not giving due consideration to the real meaning of the word economy. The old purchasing agent attitude of getting whatever can be bought cheapest, is again having its fling. And it is very expensive economy.

The purchasing of milling cutters is a case in point. The price per cutter is of little importance—it is the price per cut that counts.

Many seem to forget that milling cutters are the business end of a high-priced machine and that every minute the machine stands idle the overhead goes up with amazing rapidity. Cutters that will stand up without regrinding for a long period are worth many times their cost as compared with those which require frequent sharpening.

In one case the difference in cost of a part of a machine was almost five to one. One set of cutters made the milling cost ninety-eight cents per piece while with the other and cheaper cutter, the cost was $4.80. The difference was due principally to the time taken to regrind and re-set the cheaper cutters, although the other cutters were also able to stand more feed.

In another case an automobile builder was about ready to put in an expensive grinding equipment to handle some very hard connecting-rod work. A cutter maker, or more correctly speaking a cutter engineer, designed and made some cutters which would do the work and utilize the present equipment. And more than that, they are milling 1,000 rods between grindings.

Every user of cutting tools, and that means every user of machine tools, should study the problems of his cutting tools. Are they doing the best possible work? Are they properly designed, properly made, of the best material? Unless you are sure you know, it will pay to call in cutter engineers and get the benefit of their experience. Don't buy cutting tools solely on a price basis. Buy cutters of all kinds on the basis of performance, bearing in mind especially the cost of idle time on the machines which use them.

The lowered cost of milling or drilling may put you on the right side of the ledger when you begin getting your shop back on a manufacturing basis.

Shop Equipment News

Dalton Combination Lathe, Milling and Drilling Machine

A combination machine, designed primarily for use in garages, on shipboard, and in other places where a rather complete equipment is required and floor space is at a premium, has been placed on the market by the Datlon Manufacturing Co., Sound Beach, Conn. A general view of the machine is shown in Fig. 1, while Fig. 2 is an end view which will give an idea of the completeness of the milling and drilling equipment.

A single hollow spindle serves both the lathe and the milling machine. It has a No. 10 B. & S. taper hole in the milling machine end and a No. 4 Morse taper hole in the lathe end. The lathe swings 13 in. over the shears, and will take 37 in. between the centers. By removing a section of the shears next the headstock, it becomes a gap lathe, capable of handling faceplate work 18½ in. in diameter by 6½ in. long. The block is held in place by a tapered dowel bolt, and may quickly be removed or replaced.

The cross-slide has a travel of 12 in., and is fitted with a compound rest. The head has a three-step cone, and is provided with a single back gear, giving a speed range from 20 to 441 revolutions per minute. The lead screw is 1 in. in diameter, and has an 8-pitch Acme thread. Change gears are provided to cut all standard threads, including 11½, from 3 to 56 per inch. Gears for metric threads can be supplied.

The milling machine table has a working surface of 24 by 7½ in., and a longitudinal feed in either direction of 15 in. The transverse movement is 6¼ in., and the knee can be adjusted vertically through a distance of 13¼ in. A telescopic elevating screw obviates the necessity for boring a hole in the floor. An overarm is provided, the clearance being 5 17/32 in. from the center line of the spindle. There are three changes of table feed, ranging from 0.0058 to 0.098 in. per revolution. A vise is supplied, having jaws 1½ x 3¾ in. and opening 3 inches.

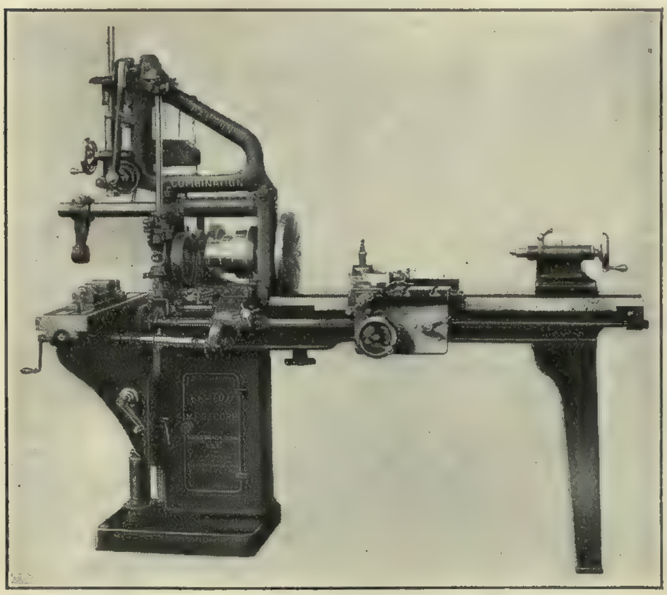


FIG. 1. DALTON COMBINATION MACHINE TOOL

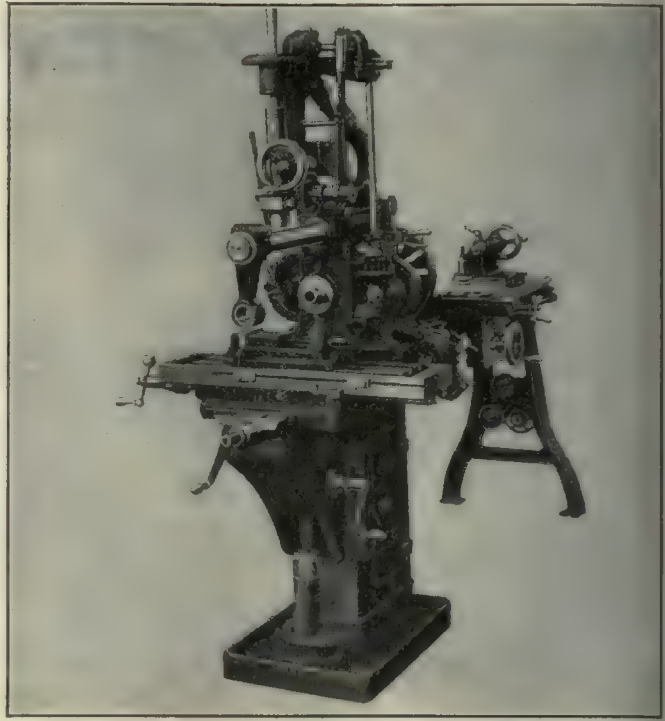


FIG. 2. MILLING AND DRILLING END OF DALTON COMBINATION MACHINE

The drill press can be used only by removing the overarm of the milling machine. A round table is furnished, to be attached to the table of the milling machine. The machine will drill to the center of a 16-in. circle, and the spindle has a vertical travel of 9 in. The maximum distance from the end of the spindle to the milling machine table is 23 in. With the round table in use this distance is 18 in. The spindle can be locked rigidly in any position of its vertical travel, and it then becomes a vertical milling machine, having all the movements of a standard machine. The hole in the spindle is No. 3 Morse taper. Handwheel and worm, as well as lever feed is provided for the vertical movement. The spindle sleeve is 9¾ in. long and 2¼ in. in diameter. The spindle has speeds from 15 to 48 r.p.m. with the back gears in use and from 107 to 331 r.p.m. without them.

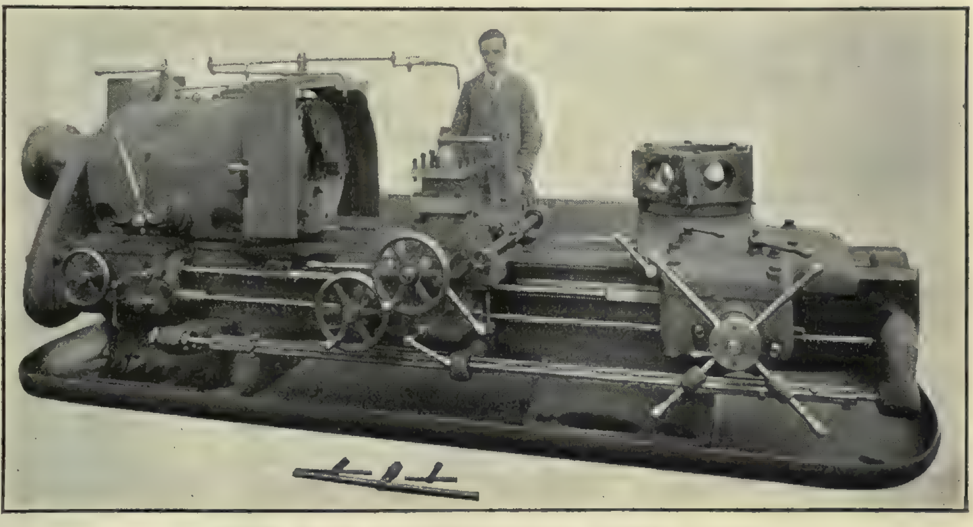
While the lathe and milling machine, or the lathe and drill press, may be used simultaneously, the tool is intended as a one-man machine. It can be set up on a floor space of 40 sq.ft., including the room necessary for the operator to get around it. A reversing countershaft is furnished with the machine, with pulleys 8 in. in diameter by 3½-in. face. The countershaft should run at 250 revolutions per minute, in order to give the proper spindle speeds.

The outside dimensions of the complete machine are: length, 7 ft. 10 in.; height, 6 ft. 5 in.; width, 3 ft. 1½ in. The net weight is about 2,000 pounds.

Alfred Herbert No. 20 Combination Turret Lathe

Alfred Herbert, Ltd., Coventry, England, and 50 Church St., New York, N. Y., has recently added a larger size of machine to its line of all-geared combination turret lathes. The machine is now made with a hole through the spindle to accommodate stock 7 in. in diameter, and is known as the No. 20 model. The largest size formerly made, described on page 1016, Vol. 52, of the *American Machinist*, had a capacity of 4⅝ in. The lathe is intended especially for handling the larger sizes of castings, forgings and bar stock on production work, the making of machine spindles being one application.

It is claimed that the small details have been taken care of, so that the machine is easy of operation. Heavy guards are provided for all gears, so as to lessen the liability of accident. It is stated that the labor of operating the machine has been reduced by such means as a power traverse for the turret, automatic lubrication and large handwheels.


HERBERT NO. 20 COMBINATION TURRET LATHE

The headstock provides sixteen spindle speeds in each direction, the chrome-nickel steel gears running in oil. All the shafts run on ball bearings, a ball thrust bearing being used for the spindle. The 18-in. drive pulley is driven by means of a 5-in. belt at a speed of 400 r.p.m., the shaft running on ball bearings. A friction clutch is incorporated in the drive, although the clutch can be positively locked for taking heavy cuts.

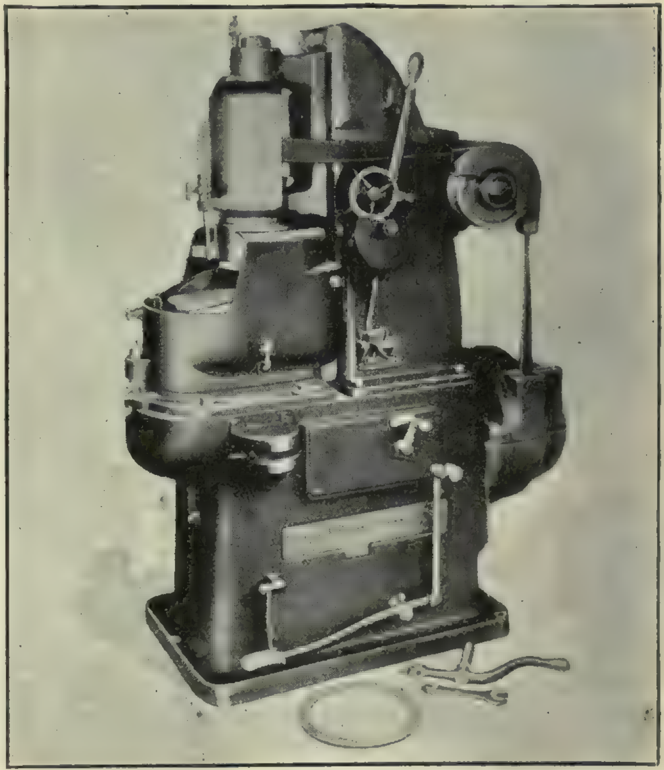
The machine allows a swing of 28 in. over the bed. The maximum distance from the flange of the spindle to the face of the turret is 72½ in. The feed box under the headstock gives eighteen feeds to the turret slide, the changes being made by rotating the handwheel. The feeding and chasing mechanisms are interlocked but independently controlled, the chasing leader and nut being changed to suit the pitch required. Nine feeds are provided for the saddle, which carries a square toolholding turret. The main turret is horizontal, hexagonal in shape and is indexed manually. Two coolant pipes are provided, as well as large guards to prevent splashing.

Pratt & Whitney 8-Inch Rotary Surface Grinding Machine

The Pratt & Whitney Co., Hartford, Conn., has recently placed on the market a rotary-table surface grinding machine having an 8-in. wheel. The machine, shown in the illustration, is intended primarily for the grinding of disks, rings and cylinders requiring flat and parallel surfaces. The maker claims that the sturdy, compact construction permits of heavy cuts, and that the sensitive adjustments provide for rapid production on gear blanks, washers, cutter-hubs, or other work requiring great accuracy. Means are provided for grinding concave or convex surfaces.

The spindle is mounted on ball bearings, which are protected from dirt and provided with adjustments for wear. The wheel is cemented in a holder screwed to the spindle, to facilitate changing, and a band clamped around the wheel guards against breakage. Surrounding the wheel is an adjustable steel guard which automatically covers the entire wheel when it is raised to the idle position, so that chuck work can be handled safely.

The wheel feed is controlled by a lever, as on a sensitive drill press, and a positive stop is provided for grinding to a specified thickness. Fine adjustments are made through a handwheel, which can be locked and used as a feed wheel when desired. Back lash is neu-


PRATT & WHITNEY 8-IN. ROTARY SURFACE GRINDING MACHINE

Specifications: Wheel; diameter, 8 in.; height, 3 in.; thickness, ⅝ in. Chuck to wheel, 0 to 5 in. Table diameter, 10 in. Speeds; wheel, 2,000 r.p.m.; chuck, 50 and 100 r.p.m.; countershaft, 450 r.p.m. Motor (on order), 7½ hp., 1,800 r.p.m. Floor space, 31x55 in. Weight: net, 3,000 lb.: crated, 3.150 lb.; boxed, 3,500 lb. Export box, 80 cu.ft.

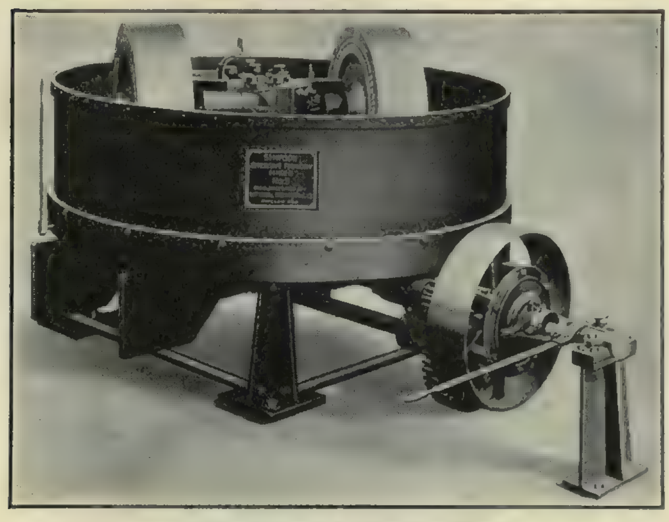
tralized, and the wheelslide is over-weighted for easy control. The rotary magnetic chuck has two speeds, and can be tilted for concave or convex work. This chuck is controlled by a pedal, and a connected brake retards the rotation when stopping. The magnetic chuck is controlled through a switch on the side, which also acts as a demagnetizer.

The machine is equipped with a pump, and the tank is located within the column. Cutting lubricant is supplied to the inside and outside of the wheel, the flow being regulated by valves, and an adjustable hose permits of washing the chuck and work. The shut-off valve is ordinarily controlled by the feed lever, but can be disconnected and operated by a pull knob. The spray is confined by a guard, the front of which can be lowered to facilitate handling the work.

Belt drive is regularly furnished, all necessary guards being provided. The main drive shaft and idler pulleys are mounted on ball bearings and the clutch is mounted on a thrust bearing to take the load. The two-speed gear shaft is mounted on bronze bearings and the gearing runs in oil, the bearings being lubricated by the splash system. A flexible coupling takes care of chuck tilt and alignment. Individual motor drive can be furnished. The standard equipment comprises two wheel mounts, one grinding wheel, a wheel dresser, countershaft, and the necessary wrenches.

Simpson No. 3 Sand Mixer

The National Engineering Co., 549 W. Washington Blvd., Chicago, Ill., has placed on the market a larger size of its Simpson sand mixer, shown in the illustration. It is known as the No. 3 size, and has a pan 8 ft. in diameter.



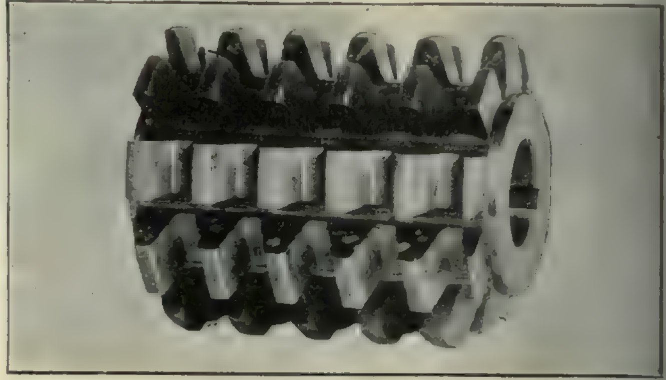
SIMPSON NO. 3 SAND MIXER

The machine has been developed particularly for steel foundry purposes, but it can also be used where large capacities are required in gray-iron, malleable, brass and aluminum foundries, not only for facing and core sand, but for other foundry sand mixtures, as well as for the preparation of daubing for lining cupolas and furnaces. It is claimed that the time for mixing is brought down to a minimum, because of the mixing action, which is done by a combination of plows and mullers. The horsepower is said to be low compared to the capacity, which is increased by the use of the automatic discharge.

Most of the parts are of cast steel. The machine is strongly built and intended to give continuous service with a low cost for maintenance. It is said to work at maximum capacity, with very little labor for the operation of the machine; and to produce the highest quality of mixture, giving uniform results because of the thorough distribution of the new sand or binding element that is to be mixed.

Simmons Method-Hob

The Simmons Method-Hob Co., 2nd St. and Duncannon Ave., Olney, Philadelphia, Pa., has recently placed on the market hobbing cutters that are produced by a method in which the teeth are generated on special machines. The cutter, shown in the illustration, is known as the Simmons method-hob. The hobs are claimed to be mechanically accurate, as they are produced by a generating action, a feature which makes it possible to duplicate them absolutely.



SIMMONS METHOD-HOB

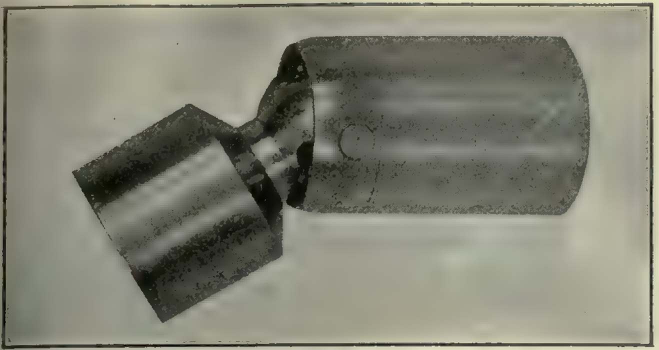
When cutting large numbers of gears of one kind, the hobs, of course, wear out. It is necessary to be able to produce a new hob that is an exact duplicate of the original one when new. This is possible, it is claimed, as each hob is an exact duplicate of the others, because each hob is an original master generated by mechanical means on the same or similar machines and by the identical mechanical movement.

The generating of the hobs is perfectly practical, the maker states, because the method follows "the law of the involute." No forms or templates are used to determine the tooth contour. Hobs for different forms of involute tooth, both standard and stub, can be furnished, the cutter being made to suit the requirements in such matters as pitch, pressure angle and number of threads. The importance of hardening in hob making is recognized, as a special method of hardening is said to be employed.

Apex Screwless Universal Joint

The illustration shows a universal joint recently placed on the market by the Apex Machine Co., Dayton, Ohio. The joint is intended especially for use in driving the spindles of multiple-spindle drilling heads, although it can be adapted to all sorts of light and medium-duty drives. The maker claims that the device will fit all multiple-spindle drilling and tapping machines, and that it will drive with the shafts at angles of 35 deg., or in special cases on light drives at 45 degrees.

The principal feature of the joint is its simplicity



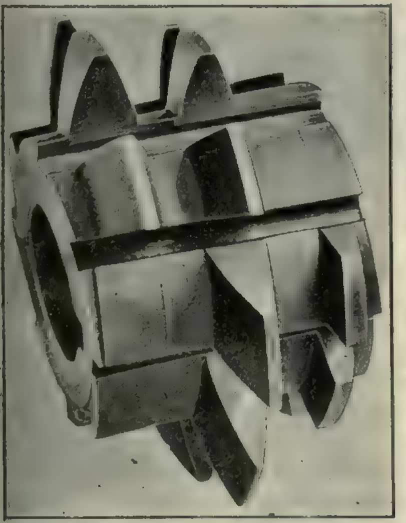
APEX SCREWLESS UNIVERSAL JOINT

of construction, there being no screws used in it. The parts, which are heat-treated and interchangeable between joints, consist of one cup end, one ball end, one journal rocking pin, one driving pin, and one locking ring. The driving pin which passes through both the main members, is pressed into the journal or rocking pin, which can be seen in the ball end, and is held there by the locking ring. By virtue of the two pivots, movement in any direction can be obtained. There are thus no projecting ears or center blocks required, it being claimed that no wedging action can occur and that friction is very slight. The joint is made in all sizes from ⅜ in. in diameter up to any required.

Gould & Eberhardt Worm Hob

In connection with its method of automatically hobbing worms, the Gould & Eberhardt Co., Newark, N. J., has recently developed and placed on the market a hob, which is shown in the illustration.

In this hob the fundamental principle is that of a broach coiled around a cylinder, and it is claimed that the well-known advantages of accuracy and extremely rapid production inherent in the broaching process have been secured. The progressive removal of metal accomplished makes possible the use of heavy cuts and feeds. The hob can be used either to finish the teeth of worms, or for roughing them preparatory to final grinding.



GOULD & EBERHARDT WORM HOB

In the case of multiple threaded worms the accuracy of spacing of the teeth is due to the progressive and continuous indexing characteristics of the hobbing method.

This hob can be furnished to cut worms with teeth of any desired contour. The hob teeth, which have somewhat the appearance of a spiral, have their tops cut down in regular steps, and also have their sides recut to different leads. There are about fourteen roughing and three finishing teeth, which can be made either hooked or radial.

Due to the recuts on the tops and sides of the teeth mentioned above, each hob is suitable only for the worm for which it was designed. Other worms would require hobs designed specially therefor.

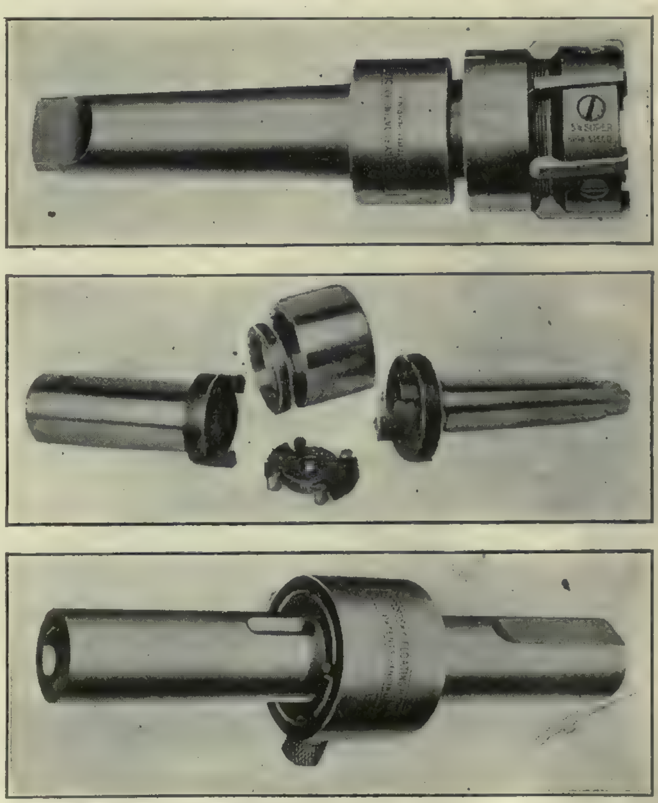
Having a total length of not more than twice the normal circular pitch of the worm, this hob can successfully thread worms having a shoulder on one or both ends, needing very little clearance.

McCrosky Floating Toolholder

The McCrosky Tool Corporation, Meadville, Pa., has recently placed on the market a floating toolholder for the driving of reamers, taps and counter-bores. The holder is intended for correcting for both angular and parallel mis-alignment of the machine spindle with the hole being machined, being adapted to use in drilling machines, boring mills, lathes and automatic screw machines. The device is said to have perfect freedom of action and to be practically free from friction.

The holder is composed of three principal units, a driving member, an intermediate floating member, and a driven member. Two lugs on the driving member interlock with two similar lugs on the driven member, the construction of the parts being shown by the view at the center of the accompanying illustration. Four hardened rollers operate between these lugs and the intermediate floating member, to remove friction between the parts. In the center of the floating member is a hole in which is placed a hardened steel ball. The ball, having a diameter greater than the thickness of the floating member, therefore bears against both the driving and driven members, taking the entire thrust of the cut and acting as a pivot. The housing enclosing the floating unit screws on to the driving member. It has an adjusting collar which bears against the driven member and regulates the amount of float or free motion.

The holder is regularly made in three sizes and both



TYPES AND CONSTRUCTION OF McCROSKY FLOATING HOLDER the driving and driven members are made in different styles and sizes to suit the requirements of the work. The driving member is ordinarily made in diameters of 1, 1⅝, and 2¼ in. when straight, and in Morse tapers from No. 1 to 6. The driven ends can be made to hold reamers from 1½ to 6 in. in diameter, or bored with either a straight hole from ⅝ to 1⅝ in. in diameter or with a Morse taper from 1 to 5, or to fit a shell reamer. The view at the top of the illustration shows a holder carrying an expansion reamer and intended for vertical use.

The holder can be used either horizontally or vertically. For horizontal use, an adjustable spring support bearing against the driven member is added so as to counteract the weight of the toolshank and to hold the toolpoint on center. The view at the bottom of the illustration shows a straight-shank holder bored to receive the cutting tool, and with the adjusting screw on the sleeve, so as to fit it for horizontal use.

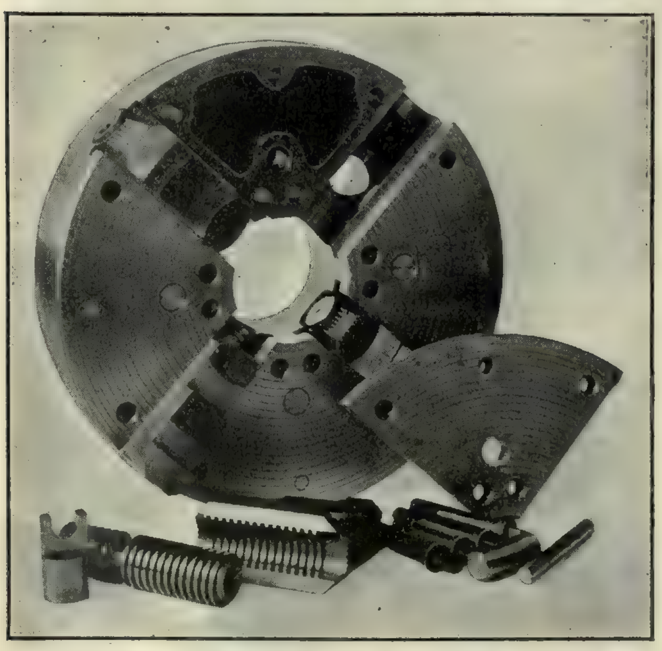
Coventry Four-Jaw Independent Chuck

Alfred Herbert, Ltd., Coventry, England, and 50 Church St., New York, N. Y., has recently placed on the market a line of lathe chucks having four independently operated jaws. The chuck is similar in principle and construction to the three-jaw chuck made by the concern, the strength and long life of the tool being the features emphasized by the maker.

The body of the device is thick and heavily made, so as to prevent breakage due to excessive pressure at the jaws. The front of the chuck is made in the form of detachable sectors secured to the body by means of screws passing from the front to the back. The accompanying illustration shows one of the plates, as well as a jaw and screw, removed so as to show the construction. The chrome-nickel screws are of large diameter, and the jaws and their operating mechanisms are said to be heavy enough to withstand all working strains.

The diameter of the chuck and recess and the tapped holes for the studs at the back of the chuck are identical with the corresponding size of "Coventry" concentric chuck, with which it can be interchanged. On lathes made by the concern, the chuck is attached directly to the spindle flange by studs and nuts. For spindles that are not flanged, adaptors must be used and must be turned up in position on their own spindles before attaching the chuck.

The chuck can be furnished in a range of sizes, but the maker states that immediate deliveries can be made on those of 15½-in. diameter.



COVENTRY FOUR-JAW INDEPENDENT CHUCK

Union Zinc-Covered Tool Chest

The Union Tool Chest Co., Inc., Rochester, N. Y., has recently placed on the market a line of zinc-covered tool chests. The chests are made in a number of styles and intended for the use of machinists, patternmakers, carpenters, electricians, garage mechanics and the like. The illustration shows a general service chest, opening at the top, although side opening chests can also be furnished. The tray automatically raises when the top is lifted, and retains a horizontal position for all positions of the top.

The frame of the chest is made of wood, a lock-corner being used for the joints. The outside is entirely covered with lacquered sheet zinc, which is formed over all of the edges. The chief advantage of the covering is said to be the fact that it will not rust nor corrode. The corners, clamps and other fittings are made of either brass plate or lacquered steel, and riveted in place.

UNION ZINC-LINED TOOL CHEST

The chest can be furnished in various sizes, either with or without trays, ranging in length from 13 to 32 in., and in weight from 5 to 21 lb. The maker claims that the particular advantage is in the strength and durability of the chests, which render them capable of giving hard and continuous service.

Detroit Alloy Steel Center

The Detroit Alloy Steel Co., 1436 Lafayette Blvd., Detroit, Mich., has recently placed on the market a line of centers for lathes and grinding machines. The device is made of a special alloy known as "Diamond H," which is very hard and tough, and also nonmagnetic.

The centers are cast and ground, as the metal cannot be machined in any other way. The advantages claimed are long life and freedom from abrasion of the centers in the work.

NEWS SECTION

Pan American Postal Congress Next Week

The Second Pan American Postal Congress will be held at Buenos Aires on August 10. The First Postal Congress was held at Monte Video in 1911. The provisions of the Universal Postal Union, to which all the leading nations belong provide for lesser unions or restricted congresses.

The countries participating in the Pan American Congress are as follows: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Salvador, United States, Uruguay and Venezuela.

In addition to discussing postal details that will contribute to better mail service of mutual concern to all Pan American countries, the Buenos Aires Postal Congress will consider particularly letter mail, post cards, printed matter, samples of merchandise, and commercial papers, which pass between these countries. It is hoped to develop situations which will aid in improving parcel post and money order facilities.

In connection with the parcel post between these countries it is desirable that uniform customs methods may be adopted so as to avoid irritating delays and exactions. At present each country has its own customs regulations which retard parcel post deliveries between all countries.

The United States Government will be represented at this congress by O. K. Davis, secretary of the National Foreign Trade Council, and by Edwin Sands, superintendent of the Division of Foreign Mails.

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Fordney Bill and South

A congress of representatives of all southern industries has been called for Greensboro, N. C., August 15 and 16, to discuss the effect of the Fordney tariff bill on the South, and to name a committee to represent the Southern Tariff Association before the Senate Finance Committee when it begins hearings on the tariff. Virtually all lines of southern industry are represented in the membership of the Southern Tariff Association.

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Morocco To Purchase Steel Rails in United States

A report from the American consulate general at Tangier, Morocco, says that American firms are invited to submit proposals for furnishing 3,000 metric tons of steel rails and 8,000 pairs of fish plates for construction on the Tangier-Fez Railway. Bids should be addressed to the "Commission Generale Edes Adjudicatio et des Marches," Tangier, and will be opened at a public meeting on Aug. 20.

All bids are to be made in French francs and are to include delivery at the port of Kanatra, delivery to be completed within 80 days after notification of acceptance. The rails required are French standard 36 kilos to the linear meter, 5,200 to be 12 meters in length, 455 to be 11.97 meters, 900 to be 11.94 meters, 160 to be 66 meters, 210 to be 8 meters and 210 to be 10 meters long.

Technical and financial conditions governing this order, together with blueprints bearing the specifications called for have been forwarded to the New York district office of the bureau where they are available for inspection by interested parties.

Better Training for Mechanics

It is proposed to hold a conference in Philadelphia to discuss methods for restoring the apprentice system of training young men in the trades. There is complaint that this system has been greatly restricted by labor organizations and that there is laxity in admitting the untrained to employments for which they are not qualified.

The result has been a deterioration in the quality of output as well as a falling off in the morale of men employed. As a consequence good, well trained mechanics are scarce in proportion to industrial needs, and they are all the time growing scarcer. This is bad for the mechanics and bad for the country. High wages and prospective advancement are the rewards of skill. To the attainment of skill there is no royal road. It is acquired only by conscientious application under equally conscientious instruction.

It is the purpose of those back of the apprentice conference movement to provide ways and means for apprentice training and instruction which shall be thrown open to all, irrespective of any limitations which have been imposed by certain crafts. With more and better mechanics the country's industrial output will be larger and better. On the other hand, ill-directed, circumscribed, haphazard mechanical training of employees, from which our industries have suffered more or less, means a serious national handicap in the sharp world competition ahead.

The matter of improvement in this respect has been taken up by the industrial committee of the Philadelphia Chamber of Commerce. It has interrogated many boards of trade and it has digested a mass of data assembled by experts employed for the purpose. The conclusions reached are that a large proportion of the young men in the various industries merely drift in with wholly inadequate training; that they never acquire skill proportionate to their natural capacities; that, as a consequence, they do not prosper personally as they should and do not produce the wealth the country might expect from them. Some of the experts estimate that 60 per cent of the younger mechanics in this country are thus handicapped.

The responses which have come to the Philadelphia committee have been encouraging. There is distinct promise of valuable results from the proposed conference, and this not merely for Philadelphia but nationwide in inspiring similar efforts in all the great industrial centers.—*New York Herald.*

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Alabama Iron

Alabama's June production of iron was the lowest it has been in ten years, according to a report for the month that has just been issued. The total for the month amounted to 93,224 tons. A comparison of the figures for the past three months with those of the same period in 1920, furnishes ample proof that iron production in the Alabama district has reached a remarkably low ebb.

Month	1921	1920
April	94,910 tons	191,389 tons
May	94,013 tons	212,246 tons
June	93,224 tons	209,087 tons

Furnaces active in June of this year were 9 as compared with 26 in the same month a year ago.

Foremen's Conference at University of Tennessee

The first Foremen's Conference ever held in Tennessee, in the interest of industrial education, has just been adjourned at Knoxville. It was held under the direction of the University of Tennessee and was conducted in connection with the summer school work of the university.

The instructions were under the immediate direction of T. H. Quigley, federal agent for industrial education. The work covered a period of one week and about forty hours were required to finish it. Representative foremen and educators from all parts of the state attended and it was the unanimous opinion that the instruction was very beneficial and it is hoped that more work of this character may be conducted in the future.

This is in line with the promotional work that the University of Tennessee has been conducting for a number of years, the previous work being extension courses in science and the trades.

After concluding his work here, Mr. Quigley left for Minneapolis where a general conference on industrial education will be conducted from July 18 to Aug. 18. He will take an active part in the work of means and methods for establishing continuation schools.

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Questionnaires on Housing

With the appointment of John M. Gries, of the Harvard School of Business Administration, as the permanent head of the new division of housing created by Secretary of Commerce Hoover, the new Government agency is in a position to address itself immediately to its task of encouraging home-building. A questionnaire has already been sent out by Prof. Gries, from the return of which the most acute phases of the housing problem may be indicated. These replies will determine in large part where the main efforts of the division are to be concentrated.

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Automotive Engines Are Built in Argentina

Trade commissioner George S. Brady, at Buenos Aires, reports that there is one factory in Argentina building marine gasoline and oil engines. This factory, which has been in existence for eleven years, is now consolidating its machine shop and foundry and has begun the construction of new buildings to house the plant. At the present time the factory is producing 15 motors per month varying in size from 6 to 60 horsepower. The engines are of two and four cylinders, modeled after English patterns. All parts with the exception of roller drive chains, roller bearings, magnetos, and a few supplies are made in the factory. The company advertises to make a specialty of casting cylinders and apparently turns out an excellent product. It supplies cylinders for the repair of marine, automobile and tractor engines. With the repair work in addition to the regular product, the foundry casts 30 to 50 tons of iron per month. All steel is imported from England. The motors are sold direct to local boat builders, and the present factory capacity is said to be inadequate to supply the demand.

[The name of the factory may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., or the district and co-operative offices upon reference to File No. 46363.]

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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Signs multiply that Comptroller Crissinger was right when he predicted a period of gold inflation. The gold inflow continues in undiminished volume and the holdings of the Federal Reserve Banks at the close of business last Thursday showed an increase of $23,000,000 for the week. As a result the reserve ratio gained nearly 1 per cent and now stands at 63.4, the highest point in more than three years.

Call money is down to 3½ per cent and the very best commercial paper can now be sold at less than 6 per cent. Liberty bonds, Treasury certificates and other interest bearing obligations which have a broad market and fluctuate in inverse relation to interest rates are gradually advancing. This is always the first stage of what is called by some "inflation" and by others prosperity. No matter what it may be called it is due to the increase in our gold supply and to the apparent reversal of the deflationary policy by which until recently the Federal Reserve Board and Banks were inspired. As to whether their change of heart is due to the criticism to which they have been subjected by ex-Comptroller Williams, Senator Owen and others, or to a quickened sympathy with farmers and business men, we need not now inquire. Mr. Williams' appearance before the joint committee of the House and Senate has been postponed until Aug. 2, but the Congressional Record of July 25 contains some rather sensational correspondence between Representative Bland of Georgia and Vice Governor Platt of the Federal Reserve Board, from which it would appear that the Federal Reserve policy is rapidly becoming a political issue of the first magnitude.

Meantime it may be taken for granted that there will be plenty of money to move the crops without any financial discomfort or drain upon the investment funds of the country. The volume of new security issues has accordingly increased sharply during the week, an offering of $300,000,000 of Treasury notes, part of which bear the lowest interest rate offered this year, being heavily oversubscribed.

But easier money is helping the commodity as well as the investment markets and those who have hesitated to buy before they sold are now becoming more confident of their ability to distribute merchandise and are therefore willing to replenish their exhausted stocks. As I pointed out last week, in many lines they are finding that they have delayed too long and that earlier underproduction has created something of a shortage.

This is particularly apparent in the textile trade. The latest market letter of the National Wholesale Dry Goods Association comments upon the acute scarcity of at least four lines, one of which is ginghams. This report should be read in connection with others showing unusually heavy retail sales of cotton piece goods, a notable increase in the distribution of dress patterns, especially of the simpler kind, and a remarkable growth in the sale of sewing machines by a Chicago mail order house. The revival of home dressmaking, the astonishing maintenance of chain store sales at a high level and the increase in savings deposits in Greater New York by $110,000,000 during the first six months of 1921 are each in their way evidence of the hard work and economy to which we must look for increased production at lower costs and complete resumption of business on a basis mutually profitable to capital and labor.

Agitation for lower railway rates shows no sign of decreasing, and their reduction may be the next great specific influence to bear on business improvement. Industrial leaders are taking care that the public is not left in the dark as to the important relation freight rates have to prices. For instance, in announcing a recent price cut a prominent steel man showed that the making of a ton of finished steel requires the transport of more than five tons of raw materials, and the increase in the charge for this transportation represents more than a third of the total increase over the prewar cost. Rumors are already in circulation that the roads will soon ask another reduction in wages, to be followed immediately by a reduction in freight rates, and where there is so much smoke there is likely to be fire.

The condition of the roads is steadily improving. The crop movement is beginning to bring the surplus cars into use, June earning reports showed radical reductions in expenditures and their financial position will be greatly strengthened when President Harding's plan of funding their debts to the government while at the same time paying the government's debts to them is acted upon. Therefore it seems improbable at present that it will be necessary to act on the appeal of 400 Michigan fruit growers that Henry Ford should be put in charge of all the railroads.

Public appreciation of the improved prospects of the railways is shown in the firmness of their shares on the Stock Exchange, but it may still be pointed out that their total securities are selling at little more than $12,000,000,000, while their original cost of construction was around $20,000,000,000 and their reproduction cost at present values would of course be considerably more.

More idle employees are being recalled and put to work on delayed improvements and repairs. The revival of railroad buying, which is not now far distant, will give impetus to many industries, especially the laggards, lumber and steel. I was surprised the other day in talking to a prominent rubber dealer to find that even he was looking forward to railway buying to strengthen the rubber market. He explained that in the aggregate the tonnage of rubber products used by the roads was considerable and that he looked for a definite improvement in business as soon as they began purchasing.

Rubber men are in fact becoming affirmatively optimistic. The steady increase in tire manufacturing and consumption has been beyond their hopes, the demand is increasing, and the crude rubber market is strong. Automobile business is fairly well maintained, though this industry is still suffering somewhat from indigestion and would be better off if it had fewer makes and lower production costs. Steel mill operations seem to be picking up at last, and Judge Gary is distinctly hopeful. The leather export trade has turned the corner to better times and hides are strong and active. Petroleum production during June showed a decrease for the first time since January, a good sign that the reckless exploitation of our resources is being curtailed and the market becoming more stabilized. Even coal men look for better business as the season wears on and the time when buying can be no longer postponed comes nearer. The American Woolen Co.'s opening of spring fabrics, at prices mainly unchanged from last year, was entirely successful, demand in a few lines reaching record proportions.

In the grain markets rash enthusiasts are talking of $2, wheat and higher prices before the end of this crop are widely expected. Sugar is again higher for both raw and refined, the latter having sold at six cents per lb. and the Cuban crisis is in consequence becoming daily less acute as the large stocks held there find buyers despite the predictions of the pessimists.

Cotton futures are somewhat lower on speculative short selling inspired by an alleged improvement in the crop outlook, but the War Finance Corporation is broadening its aid to exporters and in cotton as in sugar it may be that the weight of the statistical surplus has been exaggerated. Certainly there is no prospect that the growing crop of cotton will be in excess of the world's reviving consumption and those who hold the residuum of the present supply will probably continue to hold it for some time.

The tariff bill having been passed on to the Senate seems likely to be sidetracked at least for the present, as President Harding is urging that prior consideration should be given to the much more important matter of tax revision.

The week's statistics indicate that the volume of trade is well maintained. The National Association of Manufacturers predicts that July exports will show an increase over June in several of the more important classes of goods and more foreign buyers are arriving in the United States. Bank clearings for the week as reported by Bradstreets are 22.8 per cent under last year, which indicates a trade fully up to last year when the decline in prices is considered.

The Credit Clearing House shows more buying, less indebtedness and better collections in July than in June and the improved status of affairs generally is thus summarized by the American Exchange National Bank of New York in a circular which says: "More progress toward the realization of plans for the compositon of the affairs of the world on a basis of sanity and common sense was made in July than in any month since the armistice was signed. The progress was really stupendous in its significance."

The market for foreign exchange is slightly lower, reflecting so it is claimed, Germany's gradual accumulation of "dollar drafts" against the next big reparation payment to be made Nov. 1. This is, however, conjectural, for as previously stated the speculation in exchange is enormous and no one can gage the significance of the daily fluctuations. It has been reported and denied that the Treasury Department is trying to control or suppress this speculation.

Japan's promise to attend the disarmament conference assures that this momentous gathering will be held and upon the action there taken the future of the world's civilization is momentously dependent. Meantime the sore spots in Europe appear to be rapidly healing. In Turkey, Greece and Silesia there is still some suppuration, but elsewhere the wounds of the war are gradually becoming scars that will, it is to be hoped, serve to remind men of the horrors of war without reviving its enmities.

From Germany the reports are conflicting. Some say that in the travail of war German industry has been born again and will shortly overwhelm the world with cheaply manufactured goods, but as most of the raw material out of which these goods would be made must be imported it is to be doubted the world's fear of German competition is entirely warranted.

British trade is improving and the London Stock Exchange is almost bouyant as a result of the reduction in the Bank rate and the hope of still cheaper money that it has inspired. The same statement is measurably true of France as the Bank rate there has also been reduced to 5½ per cent.

On this side the Atlantic Mexico is still an unsolved problem upon which the news of the week does not shed much light. The statesman who can find a way to reopen Mexico to American capital and enterprise without affronting the hypersensitive egotism of the Mexican people will do a great service to both countries and may initiate the next great boom in American business. The reestablishment of orderly government in Cuba after the Spanish American War was the occasion of a great business revival in the United States and the settlement of the Mexican question might work a similar change in our psychological condition. Such a change would seem to be the one thing necessary to the better feeling that is the inspiration as well as the product of better business in this country.

The War Department no longer holds any motor equipment which can be construed as surplus. As a result the wild scramble on the part of other government departments to secure transfers of this equipment is over. At present the War Department has insufficient motor cars for its own use, it is declared. More than 50,000 motor vehicles were transferred to other government departments. Over 30,000 were transferred to the Bureau of Public Roads for distribution among the states.

Obituary

Just as we go to press, we learn of the death of E. A. Suverkrop formerly a member of the editorial staff of the *American Machinist* and very well known in the machinery industry, both here and abroad. A full obituary notice will appear in our next issue.

Business Conditions in England

BY OUR LONDON CORRESPONDENT

Great Britain, or perhaps to maintain the self esteem of the other portions one should say England, appears to be muddling through her labor troubles. As far as can be gathered these are being settled on no particular plan, except that reductions of wages are being effected. Still they are being settled, if only temporarily, for further drops in wages may be anticipated as time goes on. The coal dispute was ended without any regard to price to be obtained for the product. Yet this is one of the most important considerations for the iron and steel and, in fact, most construction industries. By some ironmasters 20s. a ton has been quoted as the limit of price for coal for bare renewals of working; others have asserted that pre-war prices must prevail if foreign competition is to be met. With the aid of a government subsidy of £10,000,000 the miners are guaranteed certain wages for a period and the coal owners, as they are called by courtesy (for it was long ago discovered that "the earth is the landlord's and the fulness thereof"), are to take as profits 17 per cent of the wages paid with the same proportion of any surplus profits, the remaining 83 per cent going to the miners. Whether there will be any surplus profits remains to be seen, for it is reasonably certain and has been prophesied that wages will be adjusted to avoid them. This is of no great importance, the outstanding fact being that the profit-sharing system has been devised without any regard for the consumer. It is to the interest both of the miner and mine owner that prices shall be forced up to the very limit that can be paid. The demand for a wages pool has been abandoned, and wages will be regulated from district to district. In three months the contest has cost the miners in loss of wages some 50 million pounds and the loss to the nation has been estimated at five times that figure. Nevertheless it is all to the good that workers of this class are busy once more. The cotton and woolen industries have composed their differences, cuts have been accepted by certain electrical and gas workers, and it really looks as though, for the time being, peace will be maintained in the engineering industry. As the result of two months or more of negotiations, certain terms were put before the members of the trade unions concerned —and were very definitely rejected. Nevertheless it is probable, is indeed generally taken for granted, that newer proposals will be accepted implying a reduction of 3s. a week almost at once and a similar reduction in a month's time, leaving the question of the removal of the Ministry of Munitions, or Churchill, 12½ per cent bonus to be decided according to the position of the industry in September. This is rather like merely postponing trouble, and it is probable that in any case workpeople will have to bow to the inevitable. For it is very unlikely that the present wage reduction will be sufficient to stimulate trade, and with the possibility of the further 12½ per cent coming off it looks as though buyers, when they can, will hold off to make sure of the further reduced prices. Consequently the present unsatisfactory state of employment will continue, the funds of the trade unions being further depleted, and the trade unions themselves will be in a worse condition for a fight, should this seem necessary.

By the terms of the agreement with the miners, national and district boards are to be constituted with representatives in equal numbers of coal owners and workpeople. Wages are to be periodically adjusted according to district, based on returns for the previous period, and surplus profits are to be ascertained after account has been taken of the cost of standard wages, plus the cost of production other than wages and standard profits equal to 17 per cent of the standard wages. Special allowances are to be made for districts which do not provide a subsistence wage for lower grade workers, and in all cases the units are the districts according to a schedule. Standard wages will be the district basis rates as at the end of March last, plus the district percentage payable in July, 1914, or equivalent, plus for piece workers the percentage additions made as the result of reduction of hours from 8 to 7; but in no district will the wages be lower than standard wages plus 20 per cent. The government subvention, not to exceed £10,000,000, will be used to prevent falls in wages in July, as compared with March last, greater than 2s. a shift to persons above 16 years of age, or 1s. a shift for younger persons, the reduction during August being 2s. 6d. and 1s. 3d., and during September 3s. and 1s. 6d., provided the subvention is sufficient for the purpose. The agreement runs up to the end of September, 1922, and thereafter until terminated by three months' notice.

Cost of Strike to Government

An estimate has been given in Parliament of the charges on the exchequer as a direct result of the coal troubles. In addition to the coal industry subsidy of £10,000,000 there was the sum of £7,000,000 for the defence force, army reserves, etc., £1,225,000 for the navy, £330,000 for the air force and £300,000 for civil emergency organizations. As to indemnification on railway profits, this will probably cost more than £10,000,000, and there may be further charges due to coal purchase operations. Meanwhile, according to the latest return persons on the unemployment registers of the Board of Trade numbered 2,177,899, with 832,000 persons claiming in connection with short-time working, plus of course the coal miners on strike, and others.

Meanwhile, in view of the financial position the government is to offer a new cash loan in the form of a series of 5½ per cent bonds, maturing in 1929, the issue price being 97. Obligations are maturing one way or another to the extent of £300,000,000, and against this the budget provisions present £100,000,000. But it is of course recognized that the budget estimates will in all probability not be realized. Apart from the slackening of trade and losses due to the coal troubles, the revenue returns are making a rather bad showing. This is perhaps due to a decline in the yield of excess profits duties and in the sale of surplus stores.

Machine Tool Situation

The failure to obtain bids of any amount has led to the indefinite postponement of government auctions of stocks, including much in the way of machine tools. On the other hand, the closing-down of various engineering firms, almost entirely of small magnitude, has meant the public dispersal of a number of plants. In short, despite the generally hopeful feeling no great improvement is shown in engineering as a whole or in the machine tool section in particular. As to the latter, on the continent of Europe, Belgium has been a relatively bright area of late. Trading on the London iron and steel exchange has been reported quiet for, despite labor settlements and prospect of settlements, hesitancy is shown. In the Manchester iron market the general position has been regarded as more uncertain than ever, nothing being known as to the price at which furnace coke will be supplied, and it was freely stated that if fuel prices are not lower than those current when the coal dispute was started there is little prospect of immediate activity. At Middlesbrough the pig iron trade has been quiet and "makers are not inclined to re-start the furnaces on a large scale until fuel is more abundant and raw material generally is cheaper." The finished iron and steel trades are also quiet, but in some works a start will be made almost immediately. As to the coal position, quantities will probably be available in the course of a few days, though obviously full output cannot be reached for some little time; export of coal was expected to commence about a week or ten days after the resumption of work.

Further consideration has naturally been given to economies in the use of coal and attention has been drawn to the fuel research station erected at East Greenwich on the outskirts of London. Sir George Beilby, director of the work, has been considering the—at present uncommercial—production of a solid smokeless fuel intended for domestic use and obtained by the carbonization of selected coals at 550 deg. C., or thereabouts. He mentioned the matter in connection with the 27th James Forrest lecture delivered before the Institution of Civil Engineers. The coke thus produced has no smoke-producing hydrocarbons, but still contains from 10 to 12 per cent of volatile combustible matter which burns with a smokeless flame. The coke is enveloped in these flames and the surface becomes incandescent. In the meantime, economy is being looked for by greater care in sorting at the mine; by improvement in boiler-firing methods; by sorting out combustible constituents by preliminary carbonization and classifying fuels according to heat values, availability and convenience. At East Greenwich the capacity is about 30 tons of coal a day, but about 10 tons a day is being used, and the products are being taken by the neighboring gas company.

Shrinking Profits

The effect of trade conditions on the chief industry of Sheffield may be gathered from the recently issued balance sheet of Edgar Allen & Co., Ltd., steel makers. It relates to the year ending with March last and records a net profit of £42,110 as compared with £83,959 the year previous—a drop of one half. Similarly, the increased cost of production as a whole is illustrated by figures given at the annual meeting of shareholders of Robert Stephenson & Co., Ltd., the Darlington locomotive builders, when it was said that for a given standard locomotive, which in 1914 cost £3,800, the present cost is £11,100. Another case relating to standard locomotives showed that a pre-war cost of £5,000 compared with a present cost of £14,000.

The motor tax, based mainly on horsepower, still meets the opposition of organized automobile owners, though there is no prospect of change this year. In the first five months the tax has provided nearly 8½ million pounds, licenses having apparently been issued for about 853,900 motor vehicles, including motorcycles, while taxed horse vehicles numbered about 261,000.

◆

Hearing on Senator Ladd's Metric Bill

An early hearing on his bill providing for the compulsory adoption of the metric system, after a period of ten years, has been asked by Senator Ladd of North Dakota. Senator LaFollette, chairman of the Committee on Manufactures, states that he is disposed to grant the hearing but that he is dubious of securing the consent of any three members of his committee to act as a sub-committee to conduct the hearings. Senator LaFollette states that there is so much legislation at this time which appeals to him as being of greater importance that he cannot undertake the conduct of the hearing personally. He expresses the opinion that it will be difficult to find three members of the committee willing to take the time for metric system hearings during the consideration of the tariff and other matters of first importance.

Senator Ladd's plan is to conduct a short hearing at the earliest possible time in order that the outstanding arguments may be presented by each side, thus giving the public an opportunity to study the relative merits of these contentions. After the convening of the regular session in December, it is his desire to re-open the hearings and go into the question more fully.

◆

Tech Club in Denmark

According to trade commissioner T. O. Klath, at Copenhagen, Denmark, there has been formed in Copenhagen an association called "The Anglo-Danish Technical Society," with the object of promoting co-operation between Denmark and Great Britain along industrial and commercial lines. Capt. H. Ewald, the newly appointed representative of the Federation of British Industries in Denmark, and vice-president of the Danish Cable Manufacturing Co., has been elected president of the association, and Sir Martin Abrahamson, a well known engineer and commercial man, has been made vice-president. Ewald made the following statement to the Copenhagen press with regard to the plans and purpose of the organization:

The society which has just been formed is to be considered in the nature of a technical club. New members will be admitted only if approved by the original members. We expect to establish intimate relations with English industrial and other associations, so that the knowledge and experience gained in Great Britain concerning various commercial and technical conditions will be made available to our Danish members to be made use of to their advantage. The society will have monthly meetings when addresses will be made on technical subjects, and it is also planned to issue and distribute various publications.

Concessions in Russia

By V. Leitis
Riga, Latvia
Formerly Representative in the U. S. of the United Credit Union of Siberia.

It seems that the Bolsheviki are abandoning their absurb radical ideas and are endeavoring to bring about a return to the despised capitalistic order. The following important changes were recently made: Factory committees were abolished and the management was placed in the hands of the more capable colleges and even in the hands of individual persons; time wages were partly abolished by the return to the piece wages and the length of the labor day changed from 10 to 12 hours; the intellectual class, engineers, chemists, etc., was placed in privileged positions; the requisitioning of food products from farmers was abolished and a special tax, to be paid instead, was introduced; free trade was allowed to enable the farmers to sell their surplus; the return to a more stable monetary system, through the aid of printed money guaranteed with salt, is being tried; and the number of employees in all government institutions has been reduced and results from these remaining have been demanded.

Of course, all these changes are more or less in the embryo because the great mass is demoralized and does not wish to follows its leaders, but if the leaders are recognizing that their old doctrines are wrong then that is a sign of recovery. We do not have much confidence in the good intentions of the Bolshevist leaders but famine and poverty will do their part and persuade them to return to saneness.

The official press we find at times to be quite reasonable, and from its opinion of the much advertised concessions in Russia, it would seem that these concessions are worth considering. Soviet Russia is pressed to make use of her natural resources by offering them to the foreign capitalists and the concessions are her only and last hope. She has no other means of attracting foreign capitalists and must offer a bargain, and a very profitable one.

The world revolution seems to have become less important to the Bolsheviki and they are now openly recognizing that they are unable to exist without friendly relations with the rest of the world, which they realize will be impossible until Russia shall have sound economic conditions, stable Russian money, adequate and capable institutions for trade, transport and industry, and until lawful order shall exist.

The Bolshevist press is trying to show that the improvement is beginning. And it is, but without foreign help Russia cannot recover. The official reports prove that Russian industry has now only 10 per cent of its former capacity, and only 30 per cent of the former agricultural products.

Soviet-Russia has no goods to export, and no gold to pay for foreign goods; she knows that a foreign loan is out of the question and that, inasmuch as the right to private prosperity does not exist, there is no possibility of selling Russian land or houses to foreigners. Should they recognize the right to private property they would overthrow their socialistic doctrines—their communism.

In view of these circumstances concessions to foreigners have been made, and the Bolshevist conscience cleared by the statement that, as they must now deal with foreign capitalists, granting them the concessions, such procedure must be regarded as a temporary means to strengthen the revolution.

It was not difficult to understand that those receiving the concessions will take much and give little, and there was great dissatisfaction in the whole of Russia. But as the concessions are the last hope, the last hold of Russia, the masses grew calm and the Vanderlip syndicate got the first concession.

We do not know the particulars of the Vanderlip agreement but we know that the Bolsheviki will grant the best possible arrangement and facilities because they are pressed to do so in order to obtain foreign help. There is no other form of foreign help possible. Russia, without this help, is unable to use her natural wealth, repair her railroads, feed and clothe her population and renew her industry.

Of course, the concessions will bring big profits to the foreign capitalists. There is no doubt about that. The question is only about the safety. If the foreign governments will back their capitalists, we do not see any risk. The Bolsheviki of today are not so dangerous. They will be pressed to be honest with concessionaires and their property. The concessionaires are needed too much to be treated otherwise.

The labor conditions are different now. The laborer is accustomed to working longer and with greater energy than formerly. He will be glad to have plenty of food, adequate clothing and no commissaires on his back.

If the concessionaires will deal with the local Russian market, they will obtain raw materials which will give better profit than money. We do not think Russia will remain long without stable money. Sooner or later there will be lawful order with stable money and private property. All signs prove it.

What can Russia offer to foreign concessionaires? The Bolshevist press mentions the following:

(1) The forests about the Irtish, Ob and Taz rivers, seventy million desiatins. There are rather good harbors and it would be possible to make railroad connections with Petrograd, Murmansk and Archangel. The food supplies could easily be obtained from West Siberia by river.

(2) Nineteen million desiatins of forest along the North Dvina, Suhovka and Pechora rivers.

(3) The coal districts in Altai and Tomsk. The latest investigations proved there should be about 250 million tons of high-grade coal.

(4) Iron ore about Telsbesk (near Kuzneck) with 1,500,000,000 poods of high-grade ore (at a maximum depth of twenty-five fathoms).

(5) Coal district in Ekibastuesk, which is connected by railroad with Irtish, 35,000,000,000 poods of coal.

(6) Zinc ore on the Irtish (Ridder), about 150 million poods of ore, containing 15 per cent zinc, 1 per cent copper and in addition 7 zolotniks of gold and 59 zolotniks of silver in every 100 poods of ore.

(7) Iron ore in Irbin, Abakansk, on the Yenisei river connected by railroad with the rich coal districts of Kaliagin, Iztilsk and Chernogorsk.

(8) Three million desiatins of rich black agricultural land in the Samara, Ural, Don, Cuban, Stavropol, and other districts.

(9) Naphtha in Baku, Grozny, Maikop, etc.

(10) Coal in the Don district.

The data and figures are from the Bolshevist official press organs and cannot be guaranteed. But the writer spent eleven years in Siberia as a business man and knows that there is more wealth than the Bolsheviki offer. The Ural and Caucasus can offer enormous profits but it will require enterprising and bold men to secure them, inasmuch as this territory has been devastated and is without laws. However, it would seem that the result would justify the risk.

One must not always believe every rumor. We know that damaging rumors are spread regarding Soviet Russia in order to keep other competitors away but in the meantime large profits are being earned by dealing with the Bolsheviki. Every day trains are crossing Latvia to Russia with foreign goods. Someone, who is not afraid, is working.

We here in Latvia have plenty of small troubles with the Bolsheviki, but we are not afraid of them. Our railroads are profiteering by the transit which increases every day. Thousands of our wartime refugees are returning from Soviet-Russia, bringing us the most reliable information. We know the Russian people and the country, and know that the foreign capitalists will earn big profits there.

Thermal Stresses in Steel Car Wheels

The investigation of stresses in cast-iron and rolled steel railroad wheels has now been in progress for some time at the Bureau of Standards. With the aid of the results obtained from tensile tests on material taken from the wheels and thermal expansion data obtained on similar materials, computations have been made of the stresses set up by heating the tread of various steel wheels. It was found that the stresses on the outside of the wheel were in compression near the tread and in tension near the hub, the maximum value being in each case greater than the proportional limit of the material. This distribution is similar to that previously found in the single plate cast-iron wheel. In order to analyze further the stress distribution in the wheels, some of them are being prepared in such a way that stress measurements can be taken on the back and also in a circumferential as well as a radial direction.

Washington Notes

By Paul Wooton
Washington Correspondent

One of the very highest duties imposed in the entire Fordney tariff bill is that on tungsten ore and concentrates, which are made dutiable at 45 cents per pound on the metallic tungsten content. This is admitted by Representative Tilson of Connecticut, the chairman of the sub-committee which drafted the metals schedule. The action of the committee in placing such high rates of duty on all the ferro-alloys and then refusing to give an opportunity for these schedules to be amended before the passage of the bill by the House has caused much criticism. It is fully expected that the Senate will reduce these duties, partcularly the one on tungsten. It is contended that tungsten of the grade produced in the United States can be used only in a limited way, making it absolutely necessary for steel makers to import their supplies regardless of the rate of duty that may be enacted. In addition, many mining engineers are of the opinion that the very limited domestic deposits of tungsten should be safeguarded to meet a possible future emergency when it would be impossible to import this essential alloy.

Under the Payne-Aldrich Act, tungsten-bearing ores of all kinds were dutiable at 10 per cent ad valorem. The equivalent of the specific rates in the Fordney bill may not figure, at the present price of tungsten, as much as 300 per cent, but it is admitted that the rate would approach that equivalent.

The increase in the duty on ferro-manganese also was admitted to be very high. It was pointed out, however, that the United States Steel Corporation, the principal manufacturer of ferro-manganese, as well as other manufacturers, opposed this duty. Mr. Tilson stated that the duty is merely a compensatory duty on the manganese content and was put in the bill at the insistence of the mining interests.

The Fordney tariff bill passed the House on July 21 with comparatively few changes in the bill as reported out by the Committee on Ways and Means. The Ways and Means Committee was overruled, however, on the important petroleum, asphalt and dye duties. After an extended debate characterized by great bitterness, crude petroleum, fuel oil and asphalt were placed on the free list. The Longworth proposal that the United States Tariff Commission administer the importation of dyes under an embargo proposal was lost.

Probabilities point to greater changes by the Senate in this tariff bill than has been the case before. Chairman Fordney has the reputation of being that type of protectionist who believes the sky only should limit the upward revision of the rates. The bill reflects Mr. Fordney's ideas. There is much difference of opinion among Republicans as to the wisdom of enacting schedules as high as are those proposed. In many instances, the ad valorem rates are less than are those provided in the Payne-Aldrich Act in 1909. It is claimed, however, that the substitution of American valuation for foreign valuation will have the effect of increasing very materially these ad valorem rates. If the Senate agrees to the new plan of American valuations, it is anticipated that there will be a material reduction in the ad valorem rates. The Senate also is expected to reduce materially many of the specific rates.

"Management Engineering" Launched

The first issue of *Management Engineering*, a monthly, published by the Ronald Press Co., New York City, appeared last month. It contains sixty-four 9 x 12-in. editorial pages. The object of the magazine, according to an editorial statement, is to serve those who are responsible for the operation of industry.

The Editor is L. P. Alford, vice-president of the American Society of Mechanical Engineers, formerly editor of *Industrial Management* and before that editor for the *American Machinist*.

E. W. Tree, who was until recently on the staff of *Mechanical Engineering*, is associate editor of the new magazine.

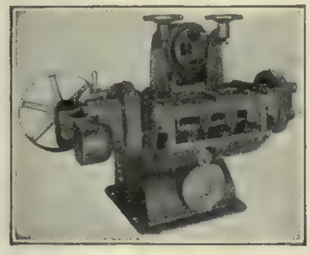
A feature is the employment, in connection with the articles, of the indexing system used by the Engineering Societies' Library of New York for cataloging its books. This system provides that the article be classified and indexed and that a reference card or cards be made and filed.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Milling Machine, Straddle, Model C-70

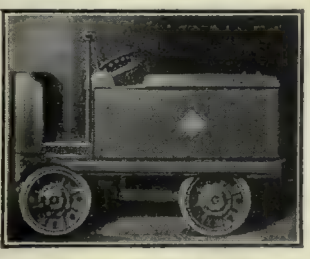
Newton Machine Tool Works, Inc., Philadelphia, Pa.
"American Machinist," April 28, 1921



This is a specialized type of machine for facing, with caps removed, the bearings for crankshafts of automotive engines, and at the same time milling the oil slinger grooves. The spindle carrying the cutters does not change position, but the feed motion is ob-obtained by vertical movement of the table, the loading and unloading being done at the top of the stroke when the table is in line with the conveyor system. The table is raised and lowered by a cam providing slow feed and a quick return. The cutter mandrel is driven from both ends and supported between cutters by bearings, so that it cannot spring or buckle. Spacing collars to give a variation of 0.002 in. are provided to hold the proper dimensions between the cutters. The machine illustrated has eight cutters, to suit the casting being machined.

Tractor, Industrial, Electric, Type-TM

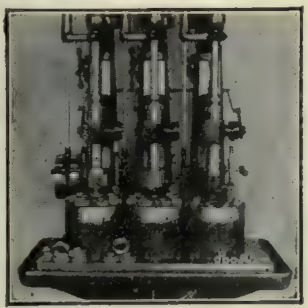
Elwell-Parker Electric Co., Cleveland, Ohio
"American Machinist," April 28, 1921



The tractor is designed especially to meet the requirements of iron and steel plants, the motive power being supplied by storage batteries. The drive from the motor is through a worm reduction to a full-floating axle, the power being delivered to 20 x 5-in. drive wheels having 7-in. double-row radial and thrust bearings. The rear of the tractor frame is supported over the drive axle on springs which work in lubricated boxes. The forward, or third point of suspension is on a ball held in a bracket. The frame consists of four heavy channels to which the front and rear bumpers are hot-riveted, the channels being tied together by cross braces and plates. The tractor is steered by a hinged adjustable lever located in front of the operator. It has three speeds in each direction. The normal draw-bar pull is 500 lb.

Nut-Facing Fixture, Automatic

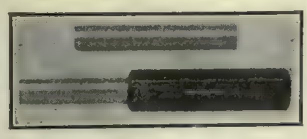
Edlund Machinery Co. Inc., Cortland, N. Y.
"American Machinist," April 28, 1921



The illustration shows an automatic nut-facing fixture fitted to a three-spindle No. 2B drilling machine. The machine is intended for facing the top surface and bevel on cast-brass hexagon valve-packing nuts ranging from 1 to 2¼ in. across the flats. The work has been previously faced on the bottom, tapped and bored. Each fixture consists of a revolving work table, operated and driven by worm gearing. The tool is moved by the arm to quickly approach the cut, is fed to the desired depth, and revolved several times without feed to give a smooth finish to the work. Each work table has seven spaces into which are fitted the work-holding plugs. Chips are removed by a blast. The operator has simply to load and unload the fixtures. All three fixtures can be used for one size of work, or a different size can be handled on each.

Gage, Plug

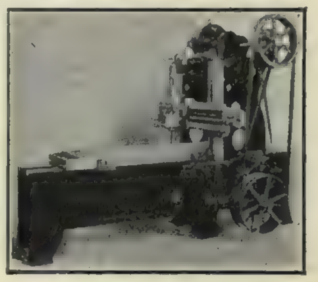
Van Keuren Co., 361 Cambridge St., Allston, Boston, Mass.
"American Machinist," April 21, 1921



The simplicity of the construction is shown by the illustration. A plain, lapped cylinder constitutes the usable part of the gage. It is inserted for about one-third of its length in a hexagon handle, being cemented in position by means of shellac. The plug is reversible. When one end of it is worn, the handle may be heated in a flame to a temperature about that of boiling water, so that the plug can be removed and its position reversed. The plug is made by a special process of manufacture, which is said to result in a cylindrical surface of fine finish and great accuracy, in regard to both roundness, straightness, and size. Standard sizes of the gage, up to ½ in. in diameter, are made in the type shown. A different type of handle is used for larger sizes.

Planer, Changes in, Wilson

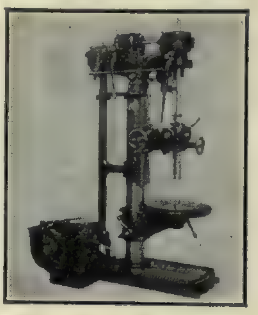
Morley Machinery Corporation, 215 North Water St., Rochester, N. Y.
"American Machinist," April 28, 1921



The illustration shows the type of motor drive now fitted to the planers, the motor being mounted on top of the uprights and the usual double-belt arrangement being used. The pad for mounting the motor has been added to all sizes of the machine, even though the drive be from a countershaft, so that the motor drive can be easily fitted when desired. The ends of the bed have been squared and the cross-sections strengthened, while additional support has been placed under the uprights. The width of the bearing surface on the cross-rail has been increased, and all the racks are made of steel instead of cast iron.

Drilling Machine, Upright, Heavy-Duty, 21-In.

Fosdick Machine Tool Co., Cincinnati, Ohio
"American Machinist," April 28, 1921



The machine is heavily made, in order to produce accurate work. It is ordinarily driven by a constant-speed belt to tight and loose pulleys on the speed box. A range of spindle speeds from 49 to 550 r.p.m. is thus obtained, being suitable for driving all sizes of drills above $\frac{1}{16}$ in. in diameter and boring tools up to 5 in. in diameter. There are five geared feeds, ranging from 0.004 to 0.028 in. per revolution of the spindle. The machine is equipped with a tapping attachment controlled by a lever on the spindle head. It may be driven by a constant-speed motor geared or belted to the speed box or by a 3-to-1 variable speed motor. The machine can also be furnished as a gang drilling machine, having from two to six spindles and various types of tables, bases and drives.

Comparator, Dial

B. C. Ames Co., Waltham, Mass.
"American Machinist," April 28, 1921

The device is intended for use in the shop on production, as well as in the inspection department. All parts are protected from dust and all bearing surfaces are hardened and ground. The gage is adapted to use on most work ordinarily checked by micrometers, but the gaging pressure is controlled by a spring. The dial is 1⅞ in. in diameter. A movement of 0.0005 in. at the measuring point appears as $\frac{1}{64}$ in. on the dial. The point has a travel of ¼ in. so that although the gage be set to a 0.500 in. standard, it will measure from 0.500 to 0.750 in. The gage is useful on shafts or bushings having more than one diameter of nearly the same size. A stop is furnished for positioning round work. The device is furnished with two anvils, one ½ x 2 in. and the other 2 x 2 in. and scored. It stands 10½ in. high, weighs 10 lb. and is finished in black japan.

Switch, Regulator, Pressure-Operated

Cutler-Hammer Manufacturing Co., Milwaukee, Wis.
"American Machinist," April 28, 1921

The device is more simple and compact than the other diaphragm-type regulators made by the same concern. Its overall dimensions are 6 x 6½ x 8 in. It is used with motor-driven pumps or compressors controlled by a mainline magnet switch or some other suitable automatic starting device. It has two poles, which construction enables it to be used for connecting small a.c. and d.c. motors directly to the line. The air, water, or other fluid under pressure is conducted into a chamber in the base of the regulator, and the pressure acts against a rubber diaphragm and compresses a spring, the normal compression of which can be changed by means of an adjusting nut to allow of operating the switch at various pressures. The difference between the opening and closing pressure is about 20 lb. The device is made for 60 lb. maximum pressure.

Clip, paste on 3 x 5-in. cards and file as desired

Personals

Walter G. Bunzl, formerly chief engineer of the Richmond Radiator Co., New York City, is now associated with the Pittsburgh Electric Furnace Co., of Pittsburgh, Pa. He is attached to the New York office.

William P. Barstow, for twenty years secretary and general manager of the Smith & Winchester Manufacturing Co., South Windham, Conn., has retired from active duty. He is succeeded by Walter Abbe.

Arthur D. Fiske has been appointed traffic manager of the American Steel and Wire Co., with headquarters in Worcester, Mass.

Charles F. Hildreth has resigned as general manager of the Morgan Grinder Co., of Worcester, Mass. This company was recently acquired by the Greenfield Tap and Die Corporation.

E. D. Lines, formerly general manager of the Dahlstrom Metallic Door Co., Jamestown, N. Y., and for eight years with the Art Metal Company, Jamestown, N. Y., has been made general manager of the Central Metal Products Co., Canton, Ohio.

W. H. Heywood, who has been vice-president and treasurer of the Youngstown Boiler and Tank Co., Youngstown, Ohio, for the past two years, has resigned.

Donald P. Hess has become general manager of the Columbus (Ohio) plant of the Timken Roller Bearing Co., succeeding C. N. Replogle, who resigned. Mr. Hess has been connected with the Timken Roller Bearing Co. at its main plant in Canton for nearly three years.

Holden A. Evans, president of the Baltimore Dry Docks and Shipbuilding Co., Baltimore, Md., has resigned from that position and has been succeeded by Clement C. Smith, of Milwaukee. Mr. Smith is also chairman of the board of directors. Mr. Evans will continue to serve on the board.

W. S. Finlay, Jr., has been elected chairman of the Metropolitan Section of the A. S. M. E. The executive committee comprises G. I. Rhodes, R. B. Wolf and A. E. Allen.

Alexander McInnes, formerly sales manager of the Hammond Steel Co., of Syracuse, N. Y., is now occupying a similar position with the Rochester (N. Y.) Forge Co., specializing in a full line of tool steel and forgings. The Iroquois Steel Co., of Buffalo, N. Y., will act as selling agents for Buffalo, Detroit and Cleveland territory.

George H. Kennedy, formerly a machinist at the plant of the William Todd Co., Youngstown, Ohio, sailed Aug. 3 from San Francisco for Honolulu. He has accepted a position there as instructor of machine shop practice in the Kamehameha school, an institution for boys and girls. A new building for use in the work of his department is to be erected and Kennedy is to supervise its construction.

Obituary

Charles C. Butterworth of Philadelphia, Pa., died on July 21 of heart disease. He was 74 years old. Mr. Butterworth was a manufacturer of machinery, being a member of the firm of H. W. Butterworth & Son, Philadelphia.

Major Louis A. Fischer, chief of the Division of Weights and Measures of the Bureau of Standards, died at his home in Washington on July 25, aged 57 years. Major Fischer has been in charge of that division of the bureau's work since its foundation in 1910. Prior to that time he served for many years in the old Weights and Measures office of the Coast and Geodetic Survey. Major Fischer obtained his rank during the war, when he was commissioned to carry forward important work for the Ordnance Department. He was in immediate charge of the section of gage design.

Thomas H. Rabe, age 92, founder of the Canton Malleable Iron Co., Canton, Ohio, died on July 22, following a brief illness. He was born in Washington, Ohio, December 18, 1829. He spent 60 years in Pittsburgh, where he became an intimate friend of Andrew Carnegie. He came to Canton in 1892 and established the Canton Malleable Iron Co., and since that time has resided there.

Business Items

The Riverside Foundry Co. has been incorporated at Silver Lake, Wis. The owners are Charles B. Boher and R. C. Dixon.

Sommers & Co., Milwaukee, Wis., will build a new foundry and machine shop at 31st and Burleigh Sts.

The Co-operation Axe and Tool Co., of Chicago, Ill., has established a plant at Green Bay, Wis., where electroplating and steel refining machinery will be installed.

The Great Western Lathe and Tool Co., has been organized at Cincinnati, Ohio, with a capital stock of $25,000. Henry Albert and J. R. Roginger are named as directors.

The Giant Drill Extracting Machine Co., has been organized at Jersey City, N. J., to deal in machinery.

The Cleveland office of the Illinois Machinery Co., of Chicago, Ill., has been moved to the Kirby Building. Ralph T. Stone is manager at this branch.

The Sullivan Machinery Co., of Chicago, Ill., has opened a supply depot and service station at Terre Haute, Ind. This station will handle orders from the coal mining industries. M. C. Mitchell is in charge.

The Detroit Alloy Steel Co., 1436 Lafayette Blvd., Detroit Mich., announces that it has perfected a process of reclaiming scraps of Stellite so as to make it again available for further use.

Peter A. Frasse & Co., Inc., of New York City, has been appointed sole agent in the metropolitan districts for the Sibley drilling machines, a product of the Sibley Machine Co., South Bend, Ind.

H. D. Warner Co., of Hartford, Conn., has moved to larger quarters at 26 High St. This new building will afford more room for the display of used machine tools, etc.

The Owen Thomas Engine Co., has been incorporated at Cleveland, Ohio, with a capital stock of $25,000. S. W. Phyppars and Murray Smith are the directors.

According to a recent announcement by president B. H. Sinks, the Steelcraft Corporation of America, Cleveland, Ohio, has purchased a substantial stock interest in Howell, Field & Goddard, Inc., of Long Island City.

In order to facilitate the repair of its motor equipment and machinery the Great Northern Paper Co., of Bangor, Maine, is constructing a machine shop at Greenville Junction.

The National Machine Tool and Equipment Co., has been organized at New Haven, Conn., by A. Bletchman, F. M. Schang, Jr., and L. T. Green.

The Link-Belt Co., Philadelphia, Pa., has acquired all of the capital stock of the H. W. Caldwell & Son Co., and Frank C. Caldwell has been elected a director of the Link-Belt Co. There will be no change in the product of the Caldwell plant.

The Stark Sheet Metal Works, Canton, Ohio, has been incorporated by H. B. Manges, E. L. Harrington, A. J. Bartunek, F. M. Wheeldin and J. A. Friend.

The H. W. Steel Shank & Specialty Co., Preston, Ontario, Canada, has been organized and incorporated to manufacture iron and steel products.

The Machinery Company of America, Big Rapids, Mich., announces a reduction in the prices of most of its machinery products.

The Kach Manufacturing Co., has been incorporated at Portland, Ore., to manufacture manifolds, goniometric levels, tools and other machinery products.

The Ray-Shield Manufacturing Co. has been organized at Wilmington, Del., to make automobile bodies and parts. T. F. Hogan, H. E. Algard and I. W. Hogan are directors.

The Kennedy Valve Manufacturing Co., Elmira, N. Y., has purchased the plant of the Ellis Smith Manufacturing Co., in that city. The shops will be used for the production of malleable castings.

Menary & Wetherill, Wetaskiwin, Alberta, Canada, has purchased the Wetaskiwin Welding Works and opened a machine shop there. The company is desirous of receiving catalogs on lathes and other machinery.

The George F. Croak Foundry Co., of Boston, Mass., has been organized and incorporated with a capital stock of $25,000 to engage in general foundry business. George F. Croak, of Athol, Mass., is president and treasurer; Gerald M. Croak and Winthrop I. Nottage are associated with him.

The H. P. Townsend Manufacturing Co., 10 Hoadley Place, Hartford, Conn., manufacturer of machinery for small screws and hardware, recently completed an addition to the plant which will provide additional floor space of about five thousand square feet. The addition is a one-story brick and mill building.

The American Steel and Wire Co., Worcester, Mass., has discontinued its New England sales district office, and the work, with the exception of Worcester and Boston sales, will be handled through New York.

Goddard & Goddard Co., manufacturer of milling cutters, of Detroit, Mich., has opened Eastern sales offices and exhibition rooms at the Manufacturers' Exhibit, 45 West 18th St., New York. James W. Sederquist is in charge of this district.

The machine and annealing shops of the J. D. Crosby Co., Pawtucket, R. I., fabricator of steel, were recently destroyed by fire with a loss of $60,000. They will be rebuilt.

The Logan Husker Co., Bellefontaine, Ohio, has been organized and recently purchased the Mahlon Hostettler plant, formerly the Ironwood Manufacturing Company, at Bellefontaine. The new company will manufacture huskers and feed cutters. Clinton Bowen is president of the company. J. S. Kauffman is vice-president, R. E. Black, secretary, and George Bowen, treasurer.

Completion of the new plant of the Lima Sheet Metal Products Co. is expected by September 1, according to Charles Ackerman, president. The plant costing approximately $110,000 will be 60 x 234 ft. with three wings, each 40 x 60 ft.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A commercial agent in the United States who is about to leave for the Far East desires to secure the representation of firms for the sale of tools, automobiles, trucks, machinery, engines and hardware. Reference No. 35134.

A commission merchant from Japan who is in the United States desires to purchase an ice plant, ammonia compressor, ice-plant motor, vacuum cleaners, cement scales, milling machines, railway supplies and equipment, and second-hand automobiles. Reference No. 35189.

A mercantile firm in Mexico desires to purchase a steam-power caterpillar tractor. Quotations f.o.b. factory, catalogs, and descriptive literature should be forwarded. Cash to be paid. Reference No. 35190.

Forthcoming Meetings

The third annual convention and exhibition of the American Society for Steel Treating will be held in the Manufacturers Building, State Fair Grounds, Indianapolis, Ind., during the week of September 19 to 24 inclusive.

The annual congress of the National Safety Council will be held at Boston, Mass., during the week of September 26. C. W. Price, 168 North Michigan Ave., Chicago, Ill., is general manager.

A joint meeting of the American Society of Mechanical Engineers, the Society of Automotive Engineers and the Army Ordnance Association will be held at Aberdeen, Md., Friday, October 7.

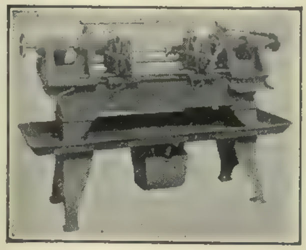
The National Machine Tool Builders' Association will hold its Fall Meeting at the Hotel Astor, New York City, October 18, 19 and 20.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Centering Machine, Double-Head

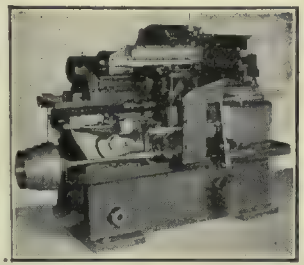
Hendey Machine Co., Torrington, Conn.
"American Machinist," May 5, 1921



The machine is intended chiefly for centering simultaneously both ends of the bars. Instead of the usual belts driving to the spindles from an overhead drum, a single belt drives a countershaft running on ball bearings and supported on brackets on the rear of the bed. From the countershaft the power is transmitted to the spindles by means of silent chains. The spindles are fitted with spring collets to hold the centering tools. The work-holding jaws are operated in unison through the medium of bevel gears on a splined shaft. A ½-hp. motor is said to be sufficient to operate the machine.

Grinding Machine, Piston-Ring, Automatic

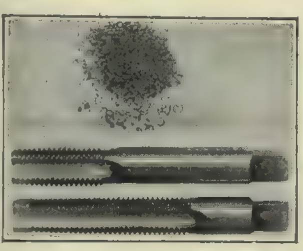
Badger Tool Co., Beloit, Wis.
"American Machinist," May 5, 1921



The machine consists of the company's No. 220 grinding machine fitted with special attachments for handling the rings. The function of the machine is to rough-grind the parallel sides of the individually cast rings, bringing them down to approximate size preparatory to the finish grinding operation on a high-precision grinding machine. It is stated that the machine can grind an average of 8,000 rings per 10-hr. day, and that one man can operate two machines. The ring castings are made to pass across the entire grinding faces of the opposed cupped wheels, which are 18-in. in diameter and have 5 in. center holes. The machine is adjustable to take rings varying in diameter from 2¾ to 4½ in., and in thickness from ⅛ to ¼ in. The complete equipment weighs 4,500 lb., and 10 to 15 hp. are required.

Taps, Ground, "Easy-Cut"

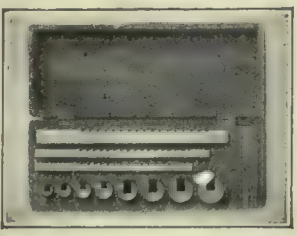
John Bath & Co., Inc., 8 Grafton St., Worcester, Mass.
"American Machinist," May 5, 1921



The roughing tap is provided with a pilot to square it and keep it concentric with the hole. The first few teeth are similar to the U. S. form but are gradually blended into the Acme form. Alternates sides of the teeth are relieved so that only one side of each tooth does any cutting. The tap being tapered, the cutting is distributed over the full length. The finishing tap, besides having the teeth relieved alternately on the sides, is ground after being hardened to correct any distortion of the lead and helix angle due to the hardening process. The taps are available in U. S. Standard and National coarse and S. A. E., or National fine thread sizes; also in Lowenhertz or International Metric sizes and in special diameters and pitches.

Broaching Set, Keyway, "Handy"

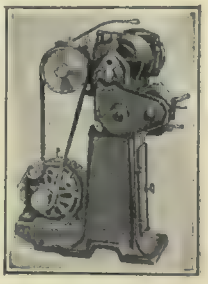
J. N. Lapointe Co., New London, Conn.
"American Machinist," May 5, 1921



The set is intended for jobbers and manufacturers who have a comparatively small number of parts in which keyways are to be cut. It consists of three broaches to cut ⅛, 3/16 and ¼ in. keyways, respectively, and eight bushings for holes ranging in size from ⅝ up to 1½ in. in diameter. Liners are furnished for each broach, so that two passes of the broach may be used to cut a keyway. With the set twelve combinations may be obtained, and keyways cut in holes up to 2 in. long. The broaches are of standard high-carbon steel, and they, as well as the bushings, are ground all over after hardening. The set is packed in a wooden box.

Lathe, Geared-Head, Motor-Driven, 14-Inch, "Economy"

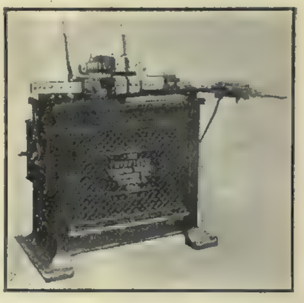
Rockford Lathe and Drill Co., Rockford, Ill.
"American Machinist," May 5, 1921



The illustration shows only the headstock end of the machine, the lathe itself being similar, except for the drive and the head, to that described on page 771, Vol. 51, of the "American Machinist." The headstock is driven by a single pulley and provides twelve spindle speeds in geometrical progression with the use of but thirteen gears. The quick-change gear box provides thirty-two changes of threads and feeds, obtained through sliding steel gears and hardened steel clutches. The motor may be of 1½ or 2 hp. with a constant speed of not more than 1,200 r.p.m. It is mounted on a detachable plate fastened to a base cast integral with the cabinet leg, and driving through a belt kept at the proper tension by means of an adjustable idler pulley.

Welding Machine, Butt, Drill, Type B6

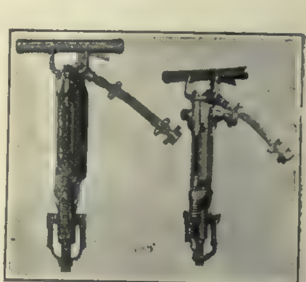
Winfield Electric Welding Machine Co., Warren, Ohio.
"American Machinist," May 5, 1921



The machine is self-contained, and is intended for flash welding high-speed steel drills, handling stock from ¼ to ¾ in. in diameter. A 15-kw. transformer and a 6-step self-contained regulator are provided. The lower dies are copper and the upper dies tool steel. Water circulates through all copper terminals. The work is clamped by hand in dies located at the front of the machine and a single toggle hand lever is used for upsetting the weld. The machine is said to be so constructed that the small particles formed by the flash are prevented from getting into the movable parts and bearings. The floor space is 42 x 40 in., the height of the dies 36½ in., the height over-all 56 in., and the weight approximately 1,000 pounds.

Paving Breaker, Pneumatic

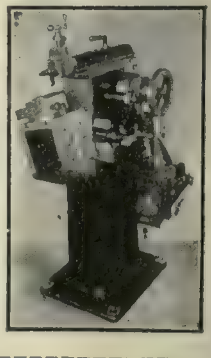
Ingersoll-Rand Co., 11 Broadway, New York, N. Y.
"American Machinist," May 5, 1921



The device is made in two types, BC-25 and CC-25, both shown in the illustration, the former type being intended for operation with higher air pressure than the latter. The device in intended primarily for the breaking up of asphalt and concrete pavement, but is adaptable to a wide range of work. Most of the parts are drop forgings. The handle is of T-shape and the throttle valve is controlled by means of a trigger. The joints are bolted instead of screwed, the working parts being easily accessible. The spring connections provide for the absorption of undue shock. The steel or cutting point is secured to the device by means of holders. The BC-25 breaker employs a "butterfly" valve, the action being very rapid; and the CC-25 machine uses a differential piston.

Shaper, Changes in

Rhodes Manufacturing Co., Hartford, Conn.
"American Machinist," May 5, 1921



A swivelling knee has recently been added to the shaper. Also, the shaper has been made an independent unit by mounting a ½-hp. motor, with a starting box so located as to be within easy reach of the operating position. A countershaft is interposed between the motor and the machine, being driven by a Whitney chain from the motor and, in turn, driving the shaper through a 1¾-in. leather belt running on three-step cones. The knee is finished accurately square in all directions at one setting. The specifications for the machine are the same as heretofore, except that a slightly larger floor space is required for the motor-driven machine. The stroke is 7½ in.; the traverse movement of the saddle, 9 in.; the vertical movement of the table, 7 in.; and the weight 650 lb.

Clip, paste on 3 x 5-in. cards and file as desired

THE WEEKLY PRICE GUIDE

This Week's Market

Steel shapes, sheets, etc., are 15c. cheaper in the New York market than last week, with even lower prices rumored. Sheets are down ¼c. per lb. in Cleveland.

Only changes in the metal market is a ⅜c. drop in zinc, and a further decline of ¼c. in antimony.

White and red lead have been decreased ⅜c. per lb., which is the first price adjustment since January. The present price of red lead is the same as obtained in February, 1919; that is, 13c. per lb., in 100-lb. kegs.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.80
Northern Basic	25.50
Southern Ohio No. 2	25.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	32.26
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75	27.26
Virginia No. 2	*27.00
Basic	†25.00
Grey Forge	24.40
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern, sil 2.25@2.75	28.67
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	24.96
Basic	23.46
Bessemer	24.96

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$2.88	$2.89	$3.03
Soft steel bars	2.78	2.79	2.93
Soft steel bar shapes	2.78	3.48	2.93
Soft steel bands	3.43	....	
Tank plates	2.88	2.89	3.03

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh (refined)	$2.50
Warehouse, New York, delivered	2.78
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	3.53	3.25	3.68
No. 12	3.15	3.58	3.30	4.18
No. 14	3.20	3.63	3.35	3.78
No. 16	3.30	3.73	3.45	3.88
Black				
Nos. 17 and 21	3.75	4.05	3.80	4.70
Nos. 22 and 24	3.85	4.10	3.85	4.75
No. 25 and 26	3.90	4.15	3.90	4.80
No. 28	4.00	4.25	4.00	4.90
Galvanized				
No. 10 and 11	4.00	4.25	4.00	5.70
No. 12 to 14	4.10	4.35	4.10	5.80
Nos. 17 and 21	4.40	4.65	4.40	6.10
Nos. 22 and 24	4.55	4.80	4.55	5.75
No. 26	4.70	4.95	4.70	5.80
No. 28	5.00	5.25	5.00	5.90

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb.	$4.43	$4.63	$4.00
Flats, squares and hexagons, per 100 lb.	4.93	4.63	4.50

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	55%
Cleveland	55%
Chicago	50%

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 3/32, 8½c. per lb.; ⅛, 7.15; 5/32 to ¼, 6.75. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	5.00	6.50	8.25
Spring steel (light)	8.00	6.50	10.50
Coppered Bessemer rods(base)	8.00	8.00	6.20
Hoop steel	3.88	3.44	3.83
Cold rolled strip steel	7.50	8.25	7.90
Floor plates	4.85	3.09	5.78
Spceial best cast steel	....	15.00	....

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of July 7, 1921:

	Steel			Iron	
Inches	Black	Galv.	Inches	Black	Galv.
BUTT WELD					
1 to 3	64½	52	¾ to 1½	39½	24½
LAP WELD					
2	56½	44	2	34½	20½
2½ to 6	60½	48	2½ to 4	37½	24½
7 to 12	57½	44	4½ to 6	37½	24½
13 and 14	45	37	7 to 12	35½	22½
15	42½	32			
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	62½	51	1 to 1½	39½	25½
2 to 3	63½	52			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	54½	43	2	35½	22½
2½ to 4	58½	47	2½ to 4	38½	26½
4½ to 6	57½	46	4½ to 6	37½	25½
7 to 8	53½	40	7 to 8	30½	18½
9 to 12	48½	35	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	13@13½
Tin in 5-ton lots	26.75
Lead	4.75
Zinc	5.00
ST. LOUIS	
Lead	4.35
Zinc	4.60

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	20.50	21.50	23.50
Copper wire (carload lots)	15.50	16.50	19.50
Brass sheets	15.75	18.00	10.75
Brass pipe	16.50	22.00	23.50
Solder (half and half) (case lots)	20.00	23.50	16.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	13.75
Cleveland	16.00
Chicago	18.00

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel

Ingots and shot	41
Electrolytic	44

Monel Metal

Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots........ 10.00

	Warehouse In Casks	Warehouse Broken Lots
New York	11.50	12.00
Cleveland	11.15	11.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	5.25
Chicago	6.00
Cleveland	6.75

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	9.50	9.50	$10.00
Copper, heavy, and wire	9.00	9.00	8.25
Copper, light, and bottoms	7.50	7.00	7.00
Lead, heavy	3.25	3.50	3.00
Lead, tea	2.00	2.50	2.00
Brass, heavy	5.00	5.00	7.25
Brass, light	4.50	4.00	4.25
No. 1 yellow brass turnings	5.00	4.00	4.50
Zinc	3.00	2.50	2.75

ALUMINUM—The following prices f. o. b. shipping point in cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	25.00	25.00@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	19.50
Chicago	23.00
Cleveland	22.00

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	38.50	35.00
Commercial	30.00	13.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

This market is very soft, and our quotations for the present are useful only as a guide.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	2.00	$2.25	3.00
Hot pressed hexagon	2.00	2.25	3.00
Cold punched hexagon	1.50	2.25	3.00
Cold punched square	1.50	2.25	3.00

Semi-finished nuts, 7/16 and smaller, sell at the following discounts from list price:

	Current
New York	75%
Chicago	50%
Cleveland	80%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in.	50%	60–10%	50–5%
1¼ and 1½ in. by 3 in. up to 12 in.	40%	50–5%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York...... $3.00 Cleveland...... $4.50 Chicago....... $4.00

For cast-iron washers, ¾ and larger, the base price per 100 lb. is as follows:
New York...... $4.25 Cleveland...... $3.75 Chicago....... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	50%	60%	55%
Larger and longer up to 1 in. by 30 in.	45%	50–10%	50–5%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40–10%	10%
Chicago	net	net
New York	50–10%	25–10%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel 7/16 and smaller	50–10%	60–10%	45%
Tinned	50–10%	60–10%	30%

Structural, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.40 Cleveland...$3.90 Chicago....$4.88 Pittsburgh..$2.65

Boiler, same sizes:
New York...$4.50 Cleveland...$4.00 Chicago....$4.98 Pittsburgh..$2.75

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	19.00	24.00	25.50
Brass	16.50	22.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in., inclusive in rounds, and ¼-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$6.85 per 100 lb.; New York prices is $7.50.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	7.50@10.00	12.00	14.25
Colored mixed	5.50@ 9.00	9.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.00
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$2.75@$3.00
Prompt foundry	4.00@ 4.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current New York	Current Cleveland	Current Chicago
Raw in barrels (5 bbl. lots)	$0.80	$0.83	$0.87
5-gal. cans	.83*	.98	1.12

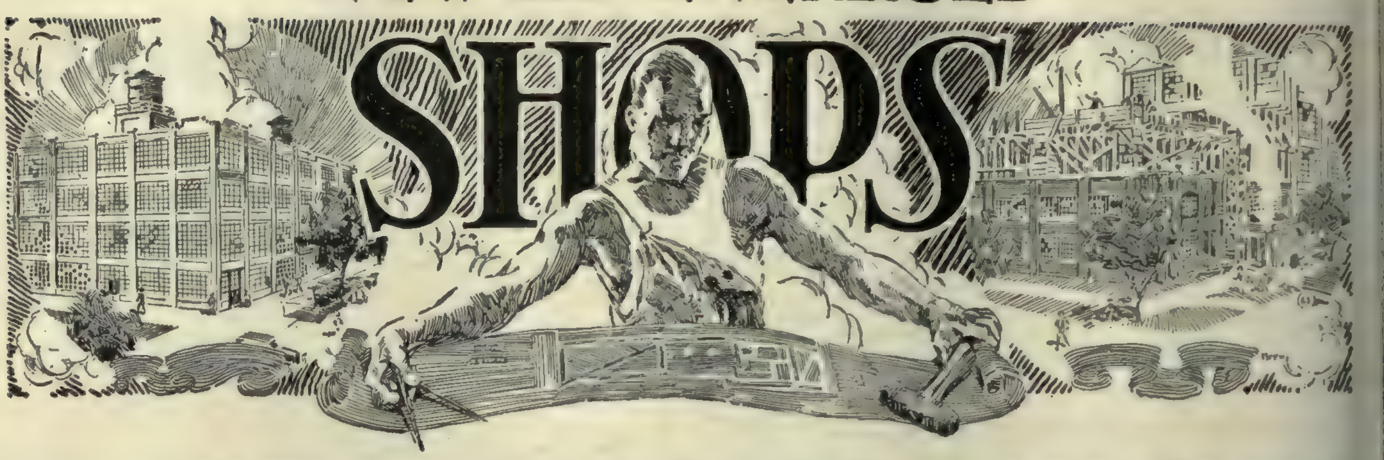
*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	12.25	13.75	12.25
25 and 50-lb. kegs	12.50	14.00	12.50
12½-lb. keg	12.75	14.25	12.75
5-lb. cans	15.25	16.75	15.25
1-lb. cans	17.25	18.75	17.25

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount. Business is good in white lead.

NEW *and* ENLARGED



Machine Tools and Machinery Wanted

Machine-tool wants published without charge

N. Y., Buffalo—Auto Repair Shop, 253 Krettner St., G. F. Wessel, Purch. Agt.—equipment for repair shop.

N. Y., Buffalo—F. N. Burt Co., 540 Seneca St.—one 12 in. and one 14 in. lathe, Universal tool grinder, sensitive drill with 1 in. spindle.

N. Y., New York—B. Mago, 265 West 87th St.—drill press, back geared, power fed, automatic stop.

N. Y., New York—Turner Constr. Co., 37 Hewes St., (builders) A. Brady, Purch. Agt.—metal band saw machine, belt driven, etc.

N. Y., Port Jefferson—E. C. Barker, Jones St., one 11 in. 5 ft lathe with quick change gear, etc.

Pa., Chambersburg—Chambersburg Eng. Co., Lincoln St.—multiple drill head.

Pa., Philadelphia—M. Smith, 845 Brooklyn St., (auto machinist)—one 10 in. screw cutting lathe.

Ala., Birmingham—C. T. Lehman, 2300 Ave. A., C. C. Penny, Purch. Agt.—grinders, hack-saws, also engine lathe, 17 to 20 in. swing, 27 to 30 ft. bed, with paper attachment, 2 face plates, must take 22 ft. between centers, etc.

Va., Richmond—G. M. Greggory & Bro., 611 West Main St., one 36 in. sheet iron metal roller.

Va., Richmond—Ross & Carle Co., 1606 West Main St. (machinists), drill press.

Va., Richmond—C. R. Rowsey & Co., 703 West Main St.—one medium size lathe (new or used) and one drill press for auto repair work.

Ill., Chicago—E. M. Heller Co., 144 West Kinzie St.—two 10 x 72, three 10 x 50 and ten 10 x 36 Norton cylindrical grinders, four No. 12 Barber-Coleman gear hobbing machines, 2 ⅝ in. five spindle Detroit horizontal drilling machines (used).

Ill., Rockford—The Bd. Educ., c/o E. E. Lewis, Supt.—manual training equipment for proposed high school.

Ill., Tuscola — The Bd. Educ., c/o G. Fuller—manual training equipment for proposed high school.

Mich., Bay City — Garber Machine Co. Inc.—machine shop equipment.

Mich., Detroit—The Fulton Iron Wks., 3508 St. Aubin Ave., P. B. Selter, Prop.—one multiple blow riveting machine, capable of riveting ⅝ in. cold rivets (used).

Mich., Iron Mountain—E. G. Kingsford—auto repair machinery for garage.

O., Columbus—J. W. Brazier, 37½ South Scioto St.—metal working machinery for new factory on west end of Buttles Ave.

Wis., Milwaukee—L. C. Pauly, Jr., 2530 North Ave.—drill press and lathe suitable for garage work.

Wis., Racine—C. Stuh- 1207 10th St.—14 in. lathe.

Wis., Rice Lake—Burnett Perfect Heating System—sheet metal working machinery, drill press, etc.

Mo., Clarence—A. Burnett, c/o Clarence Auto Co.—drill press, lathe and emery wheel for auto repair shop.

Okla., Miami — F. Stalton—lathe and drill press for garage.

Okla., Oklahoma City—N. S. Sherman Machine & Iron Wks., Inc., 18-36 East Main St., W. S. Sherman, pres.—machine for grinding and one for grooving flour mill rolls (new or used).

Que., Montreal—D. Donkner, 14 St. Lawrence St.—small lathe suitable for garage repair shop and assorted tools for new garage at 319 St. Dominique St.

N. Y., New York—J. S. Kohlmeier, 711 3rd Ave.—power driven hack saw, etc.

Fla., Chipley—Chipley Leather Mfg. Co., F. Tuttle, Genl. Mgr.—machinery for tannery and for the manufacture of leather novelties.

Ga., Waycross—Waycross Packing Co., W. H. Baxley, Pres. and Genl. Mgr.—one 40 x 72 closed retorts, 10 ft. Vance baker steam boxes, conveyors, pulleys, shafting, etc.

Tenn., Knoxville—J. G. Ducan Co., Jackson and Central Sts., J. Ducan, Purch. Agt.—one 20 to 24 in. circular saw, used in good condition, one 24 in. planer, matcher and molder, and other woodworking machinery.

W. Va., Morgantown—Riverside Lumber Co., 616 Monongahela Bldg., D. O. Mallorie, Genl. Mgr.—complete woodworking machinery.

O., Cleveland—Glauber Brass Co., 4917 Superior Ave.—machinery and equipment for new brass goods manufacturing plant.

Wis., Green Bay—The Investment Corp., c/o L. M. Hansen Co., 113 West Walnut St.—refrigerating machinery for cold storage plant.

Wis., Kodan (R. D. Algoma), H. Maedke—special machinery for cheese making.

Wis., Milwaukee—Back Printing Co., 403 Grand Ave.—Paper cutting machine 23 or 25 in.

Wis., Milwaukee—Sullivan Delivery Co., 90 Mason St., A. Lutz, Purch. Agt.—complete electric welding outfit for repair dept.

Wis., Wausau—Marathon Rubber Products Co., B. Rees, Mgr.—additional special rubber working machinery.

Kan., Galena — C. W. Squires — rock crushing machinery.

Kan., Pittsburg—The Pittsburg Marble Wks., Bway., H. and P. White, Mgrs.—electric marble scraper.

Tex. Dallas—Texas Boiler Wks. Co., 3215 Hickory St.—fuel welding machine.

Ont., Chatham — The Rennie Seed Co., Richmond St.—complete machinery and equipment for seed elevator.

Ont., London—The London District Milk Producers, J. C. Nichol, R. R. 2, Wilton Grove, Pres.—equipment for making cheese and ice cream; also for pasteurization and cold storage plant.

Ont., St. Marys—St. Marys Milling Co., H. L. Rice, mgr.—milling equipment.

Ont., Trout Mills — G. Hughes — shingle saws, lathe saws, etc., for shingle mill.

Que., St. Tite des Capes—E. Gauthier—complete equipment for modern bakery.

Metal Working Shops

NEW ENGLAND STATES

Conn., Bridgeport — Estate of S. H. Wheeler, 1188 Main St., plans to build a 1 or 2 story, 80 x 100 ft. garage and repair shop on Middle and Gold Sts. C. F. Baron, 79 Sage St., Archt.

Me., Greenville — The Great Northern Paper Co., Millinocket, has awarded the contract for the construction of a 1 story, 102 x 218 ft. repair shop, here. Estimated cost, $100,000. Noted July 28.

Me., Portland—S. J. Shatz, Bracket St., has awarded the contract for the construction of a 2 story, 50 x 126 ft. garage. Estimated cost, $60,000.

Mass., Hyde Park (Boston P. O.)—Tileston & Hollingsworth, 49 Federal St., Boston, manufacturers of paper, have awarded the contract for an addition on River St., to include a finishing room and machine room. Estimated cost, $40,000.

MIDDLE ATLANTIC STATES

Pa., Warren—The Allegheny Fdry. Co. has been reorganized under the name of Conewango Car Co. and has awarded the contract for the construction of several buildings to replace those which were destroyed by fire, including a 40 x 40 ft. machine shop, a 50 x 140 ft. car building and a 22 x 40 ft. sand building.

MIDDLE WEST STATES

Ind., Laporte — The Advance Rumely Thresher Co., Capitol Ave and Georgia St., plans to build a 1 story factory for the manufacture of farm implements. Estimated cost, $50,000. J. C. Lewellyn, 38 South Dearborn St., Chicago, Archt.

Ind., Michigan City—The Triangle Steel Co., c/o T. C. Casse, 163 Washington St., Chicago, Ill., plans to build a 1 story, 250 x 500 ft. steel factory. Estimated cost, $75,000. Private plans.

Mich., Crystal Falls—The Bd. of Supervisors of Iron County will receive bids until Aug. 13 for the construction of a 60 x 180 ft. machine shop and garage.

Wis., Milwaukee—Filer & Stowell Co., 219 Becher St., manufacturer of saw mill machinery and automobiles, has awarded the contract for remodeling its 1 story foundry. Estimated cost, $25,000.

WEST OF THE MISSISSIPPI

Mo., Clarence—A. Burnett, c/o Clarence Auto Co., plans to build a 1 story auto repair shop. Estimated cost, $45,000. Architect not selected.

Okla., Miami—F. Stalton plans to build a 2 story garage on Main St. Estimated cost, $50,000.

CANADA

Ont., Chatham — The Lorne Tractors Ltd., is having plans prepared and receives bids about Aug. 15 for the construction of a factory. Estimated cost, $150,000. W. A. Greene, c/o owner, Engr.

20 9-24.

American Machinist

Volume 55 NEW YORK, AUGUST 11, 1921 Number 6

Elevated, Midway, and Subway Gating

Using Three-Part Flasks on Two-Part Work to Increase Production—Arrangement of Gates and Runners—Abandoning the Horn Gate

By WILLIAM H. PARRY

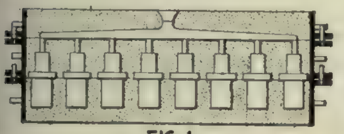


FIG. 1

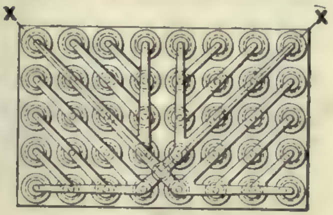


FIG. 2

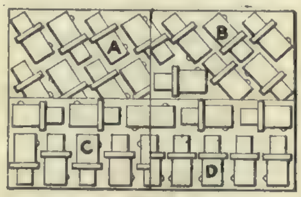


FIG. 3

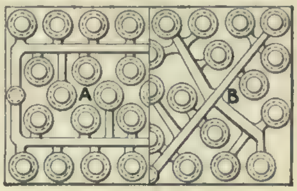


FIG. 4

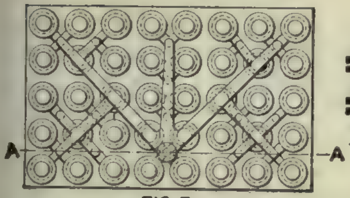


FIG. 5

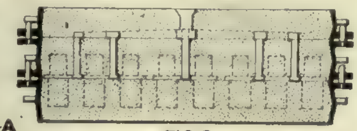


FIG. 6

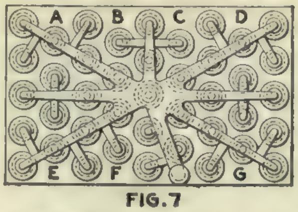


FIG. 7

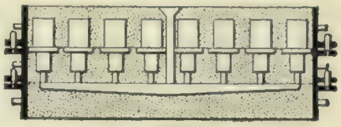


FIG. 8

FIG. 1. STAGGERED SECTION OF THREE-PART MOLD SHOWN IN FIG. 2. FIG. 2. PLAN OF MOLD SHOWN IN FIG. 1. FIG. 3. QUARTERED LAYOUT SHOWING DIFFERENT ARRANGEMENTS OF SAME PATTERN. FIG. 4. HALVED LAYOUT SHOWING RUNNERS AND GATES USUALLY USED. FIG. 5. LAYOUT OF MIDWAY GATING WITH ELEVATED RUNNER. FIG. 6. SECTION OF MOLD SHOWN IN FIG. 5. FIG. 7. BAD LAYOUT OF RUNNERS. FIG. 8. HOW SUBWAY POURING CAN BE MADE EFFICIENT WITHOUT USE OF HORN GATE

ADVOCATING the use of three-part flasks in the making of castings usually molded in a two-part flask would appear, on first thought, an absurd proposition.

There are conditions, however, constantly cropping up in the foundry industry that are puzzling the most expert mechanics, and among them is the rapid production of sound castings, particularly on pressure work.

In these days of the almost universal use of production pattern-plates, either mounted on molding machines or not, it is not an unusual happening to find that such plates do not always produce as many good castings as the number of patterns on them would indicate, in fact in many instances not one good casting has been found among the great number cast.

It is not claimed here that improper gating is the cause of these conditions in all cases, but there is no question but what it enters into a very large percentage of lost casting totals.

In designing production pattern plates it is not always good policy to crowd as many patterns into the confines of the flask spaces as possible, with the idea in mind of greater production, as very ofter the reverse is the result.

Again, the number of plate patterns is restricted to the spaces not occupied by the one, two, three, or four runners plus the necessary connecting gates that, as any experienced mechanic will testify, take up very valuable space which could be utilized for more patterns.

In Fig. 1 is shown a staggered section of a three-part mold assembled, showing the sprue and runner in the cope, the pop gates and the upper part of the castings in the cheek, and the lower part of the castings in the drag. Fig. 2 is a layout to show the position and number of patterns on the plate or plates and also to show the runners and gates. Fig. 1 is a sectional view of Fig. 2 on the lines *XX*.

It will be noted that this is an apparently simple two-part job, and it was so rigged at first, with gates attached to the flange and two runners running lengthwise. The castings were to stand 1,000 lb. pressure after being finished all over, and hundreds of thousands of them were needed badly. As every casting was porous, it was evident that some other method of gating must be tried to make production possible.

Pattern plates by the dozen were made, each embodying some new wrinkle thought out by the executive force—and they all failed. A mechanic not connected with the foundry force suggested the "three-high idea" as he called it, and was looked upon as being violently insane when he tried to explain how a two-part job could be better made in "three boxes" of sand. Nevertheless his scheme was tried and succeeded beyond his wildest hopes. Three plates were made, the one for the cope rigged with the runners and one half the sprue height, as shown in Figs. 1 and 2. The cheek plate accounted for the upper parts of the castings with pop gates attached to each and every one of the forty patterns, projecting upwards just high enough to come flush or a trifle under the flask height, and engaging with the runners at points shown in Fig. 2. The drag plate was mounted with the larger of the two hubs. The sprue was so placed that the inrushing metal did not pour directly into a casting cavity, while the runners were designed to give the most direct passage to the metal. As tight flasks were used, it was possible to pour forty castings to each mold, and get them all sound. This was seventeen in excess of the number of patterns spaced on the two-part flask plates as originally designed, and from which not a single casting was free from porosity.

One very decided advantage in using the elevated runner method, is that no attention need be paid to the runner or gate positions in placing the patterns, other than to keep in mind that they must not be placed so that a staggered runner is necessary to engage with the pop gates, though a little variation from a straight line is not necessarily objectionable. Again this method lends itself to direct pouring into the cavities and in a measure provides a feeder to counteract gravity shrinkage in castings with heavy and deep sections on each side of a light flange. On the original two-part flask plates the gates engaged with the flange so that the metal flowed down, then up in the cope with the result that the upper hubs did not always fill and when they did, sponginess was to be found at the juncture of hub and flange. As to how far this method can be carried on other classes of work it is hard to state at this writing, but there is no reason to doubt that it will succeed on a wide variety of castings that cannot be cast on end because of conditions in the design.

In Fig. 3 at *A*, *B*, *C* and *D* are shown four quarter layouts of a similar piece on split pattern plates, half on each side, as the little boss near the end of the biggest hub prevents molding so that the pouring can be done on end, and illustrates how many patterns can be placed on plates without any attention being paid to gates and runners, as they would be provided for in the cope of a three high mold. If the mold was filled as at *A*, *C* or *D*, twenty-eight castings are possible, while if as at *B* twenty-six can be surely counted on, which is at least eight in excess of what could be expected from the two-part flask method. This well repays the extra labor of ramming up a shallow cope to form the elevated runner. Pop gates are not shown on these layouts, though they can be placed on either hubs or flanges, their positions being determined at times by the ease with which they can be separated from the casting, or all evidence of their presence destroyed in machining.

At Fig. 4 are two half layouts, *A* and *B*, showing the antiquated runners and gates usually employed to coax the metal into a two-part flask mold in an attempt to get sound castings.

Layout *A* provides for a maximum of thirty-four castings, with a first class chance of losing one-third of them, while layout *B* can be crowded a little more to account for thirty, with a fair chance for a 25 per cent loss, the estimated loss percentages being in favor of layout *B* because of the shorter run of the metal and the doubt ever present that some of the cavities as per the layout *A* being filled with anything more substantial than air. Fig. 5 is a layout of midway gating still using the elevated runner to feed the gates located in the cheek, and which are fed in turn from only sixteen uprights that project clear through the cheek, as shown in the section in Fig. 6. No great advantage is apparent in using this method except that it may fit in on work that must be poured into the midsection of the casting.

Fig. 6 is a section of Fig. 5 at *AA* and illustrating the possibility of feeding forty castings with but sixteen upright feeders. A rather dubious advantage, but may adapt itself to some classes of work. Fig. 7 will serve to illustrate just how bad a runner layout can be, in spite of all the virtues claimed for the elevated gating method.

It will be noted that forty-one casting are provided for in this layout by resorting to the checker-playing or staggered idea of crowding all patterns possible on a plate regardless of future consequences, yet with all the crowding there are seven waste spaces *A*, *B*, *C*, *D*, *E*, *F*, and *G* in evidence that would better be utilized, as is the case in Fig. 2 where forty castings is the sum total.

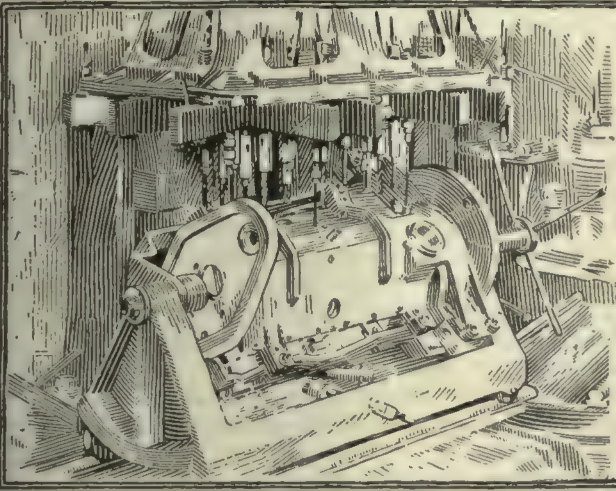
It will be noted also that at the junction of all the runners at the center there is a mass of metal that serves no good purpose and is apt to create serious trouble when cooling. Fig. 8 shows how bottom or subway pouring is made effective without horn gates, in fact it is no more expensive than ordinary every-day molding, yet is very effective on pressure work.

Note how the sprue passes through the cope and cheek feeding the runners, gates and forty castings just as easy as the old-fashioned horn gate used to feed one casting.

As a matter of fact, it is easier by this subway pouring method to make forty, yes, or a hundred castings as against one with the horn gate. This would appear to be a rather wild statement, but on analysis it develops that the handling of a loose horn gate to place it in correct position, and keep it there, means molding skill of a high order and lots of time while doing it. Next in order is the delicate job of drawing it out of the sand cleanly which also takes time and while all this is going on the man with the molding machine and a dozen flasks has rammed them up and is ready for a pour off.

Many of the readers of this article may scoff at the temerity in giving publicity to a scheme that involves the ramming up of an extra flask, be it ever so shallow, to pour castings that are usually made or spoiled in two-part flasks, and I am not unmindful of the fact that the adoption of this system means increased flask equipment with its attendant cost, but true economy begins in the foundry when first class equipment only is used if the maximum in the production of sound castings is desired. It will be noted that no mention is made as to the use of risers as part of any of the three proposed methods, as that is left to individual tastes, though a closer study of the subway pouring system as shown at Fig. 8 would seem to indicate that risers from each and every casting would insure better work. Another objection that may make prospective users of the methods shown hesitate in adopting any of them, is the extra labor entailed in separating the castings from the gates and runners, but a little study discloses a very simple way, by first cutting through the runners and laying the castings on their sides to cut through the gates. This method of course, applies to non-ferrous castings, as when gray iron is the metal used, the castings can be knocked off in most cases.

It is not claimed that any or all of these gating methods will prove to be the panacea for all gating ills, but they will solve many gating problems that have puzzled the best of experts. In conclusion, it is but fair to state that snap molds cannot be expected to give the results that tight flask molds will, as the binding qualities of stiff metal flasks permit the placing of more patterns on a plate with a greater factor of pressure-resisting safety, than could possibly result from snap molds even when jackets or bands are used to stiffen them.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Albert A. Dowd Engineering Co., New York City

Milling Fixtures Continued—Design and Operation of Indexing Fixtures — Semi-Automatic and Automatic Indexing Devices—Uses of Twin Fixtures—Fixtures for Continuous Milling

MANUFACTURING conditions frequently make it necessary to design indexing or continuous milling fixtures in order to obtain maximum production. There are many factors which influence the design of such fixtures, consequently the tool designer must be continually on the watch for parts which can be handled to advantage in this manner. In analyzing the operations on a given piece of work to determine the kinds of fixtures to be used, the following points should be considered: (1) Production required; does it justify the use of multiple holding fixtures for continuous milling? (2) Shape and general outline of work. If work is of such shape that pieces cannot be set up close enough together to permit continuous cutter action, it will not pay to make up fixtures for continuous milling. A piece of work which is to be milled at both ends and which cannot be conveniently re-set, may sometimes be placed in an indexing fixture in such a way that one end may be milled and the fixture indexed to allow the other end to be machined without disturbing the setting of the work. Several examples of fixtures of this kind are given in this article. An indexing fixture may often be required when pieces are to be cut into two or more parts; for example, a ring casting which is to be cut up so that it will make three parts. (3) Surfaces to be machined. This item determines to a large extent the type of machine selected for the work, and the arrangement of the surfaces also influences the design of the fixture. (4) Cost of the fixture. This matter is an important one and should be determined by the production required, rapidity of operation and convenience of handling.

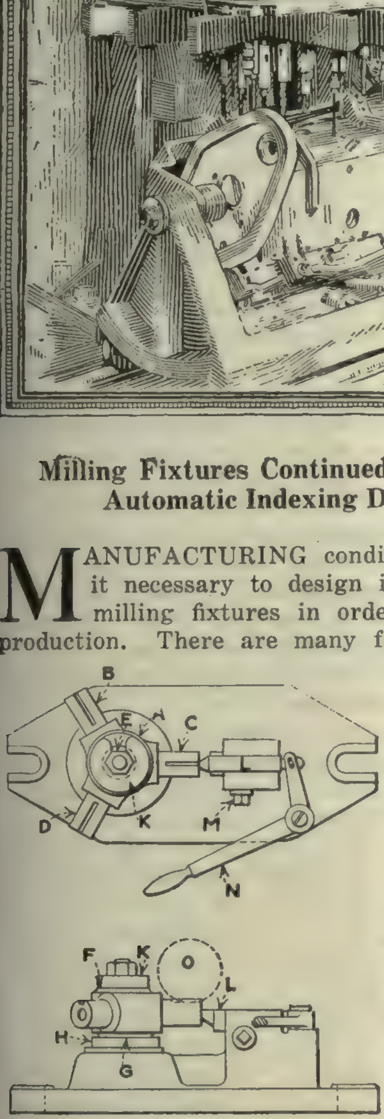


FIG. 144. SIMPLE INDEXING MILLING FIXTURE

There are so many points to be considered in connection with the design of indexing and continuous-machining fixtures that it is difficult to specify them in general notes, but they will be mentioned specifically in connection with the various designs of fixtures illustrated and described in this article.

Simple Index Milling Fixtures

In taking up index milling fixtures, the simpler forms are given first, gradually working up to those more complicated. Fig. 144 shows a "spider" *A* having three arms *B*, *C* and *D* which are to be grooved as indicated. The hole *E* and the faces *F* and *G* have been machined and the three arms have been centered and turned.

The work is located on the hardened stud *E*. The sliding point *L* is brought up so that it enters the centered end of the arm *C*, then the binder *M* and the nut on the C-washer *K* are tightened. The sliding point *L* is operated by the lever *N*. Attention is

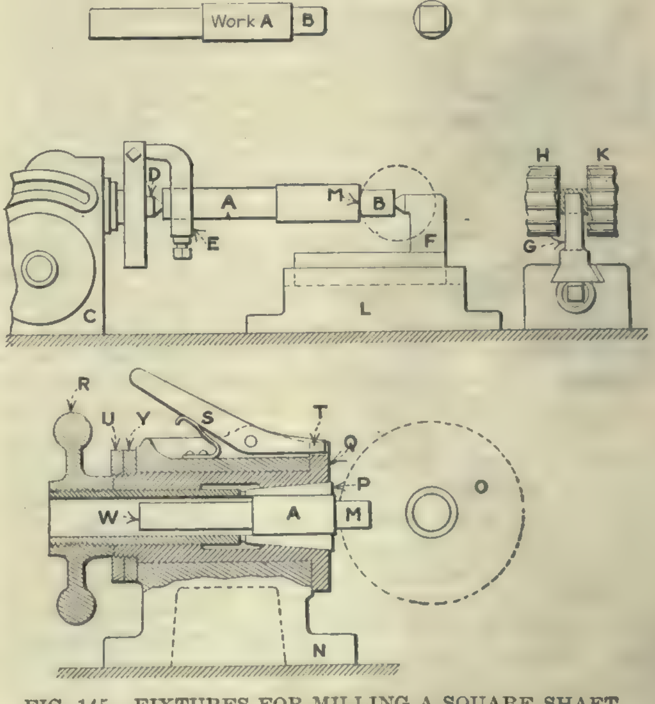


FIG. 145. FIXTURES FOR MILLING A SQUARE SHAFT

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called to the way in which the sliding point is cut away on its upper surface to give clearance for the center *O*.

It is necessary that the C-washer and the binder *M* be loosened when indexing from one position to the other, but as this can be done rapidly and as the groove dimensions do not have to be particularly accurate, the results obtained are satisfactory.

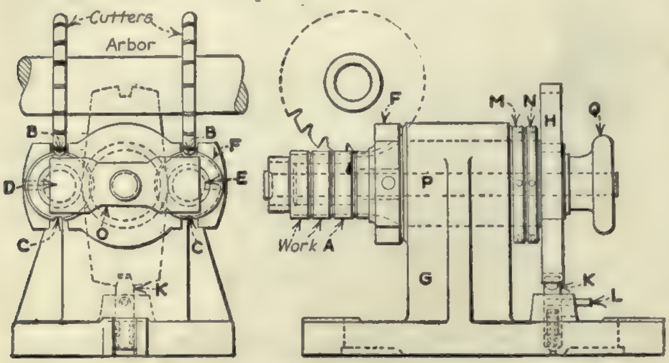


FIG. 146. TWIN INDEXING MILLING FIXTURE

Fixtures for Milling a Square Shaft

There are many cases in general manufacturing where a shaft is to be squared up at one end like the example *A* in Fig. 145. The portion *B* must be milled on four sides so that it will be perfectly square. This can be done in several ways, two of which are shown in the illustration. The index head *C* is used to obtain the correct relation of the sides of the shaft to each other while milling; the work being held on the center *D* and driven by means of the dog *E*. The other end of the work *B*, which is to be squared, is held on a special sliding center *F* which is made narrow as indicated at *G* in order that the cutters *H* and *K* may pass it without interference. The sliding point and the block *L* must be made to suit the local conditions. After two sides have been milled, the cutters are withdrawn while the work is indexed 90 deg. by means of the head *C*, after which the second cut is taken to complete the piece. If it is necessary that the shoulder at *M* be perfectly square the table must be fed in the direction indicated by the arrows.

Another example of an indexing milling fixture for the same piece of work is shown at *N*. This is a self-contained fixture which can be used with straddle mills as indicated at *O*, or with a single end milling cutter, or with two cutters arranged like those at *H* and *K*. The work is located in a spring collet *P* which is drawn back into the index sleeve *Q* by means of the handwheel *R*. The indexing is accomplished by means of the lever *S* which engages suitable slots in the edge of the index plate as shown at *T*. Attention is called to the method of adjusting the indexing member by means of threaded collars at *U* and *V*. This fixture will hold the work firmly. A permanent stop should be provided against the end of the shaft *W*, so that end location will not be affected by slight variations in the diameter of the work which might allow the collet *P* to be drawn into the chuck more or less thus causing variations in the position of the shoulders *M*.

This piece of work can also be handled in a fixture so designed that the work is held vertically to allow the cutters to pass completely by the portion to be squared up.

It is often possible to set up two or more pieces in an index milling fixture, thus increasing the production without extending the setting-up time any appreciable amount. In Fig. 146, the work *A* consists of collars which are to be grooved in two places as shown at *B* and *C*. Four pieces at a time are set up on each of the studs *D* and *E*, these studs being located in an indexing member *F*. This member has a bearing in the fixture base *G* and it is provided with a suitable index plate *H* as shown. A very simple method of indexing is used in this fixture, the pin *K* engaging an angular slot in the edge of the plate. The index plunger is disengaged by pressure on the pin *L*. Adjustment for wear is provided by means of the two nuts *M* and *N*. The work is clamped by means of the strap *O* through the action of the rod *P* operated by the hand knob *Q*.

The cutting action on these pieces is toward the solid portion of the fixture and as the cut is not very deep vibration of cutters and fixture is eliminated.

Index Fixture for Castellating Nuts

Ordinarily the manufacturer who uses a great number of castellated nuts buys these from some firm specializing in their manufacture. Occasionally, however, some special size is required which cannot be obtained from the manufacturer in the required time, so that it becomes necessary to design a special fixture for the purpose of castellating.

Fig. 147 shows a fixture of this kind in which the nuts *A*, *B*, *C* and *D* are held on one side of the fixture while the nuts *D*, *E*, *F* and *G* are loaded into the opposite side. The method of locating the work is clearly shown at *H*. The nut rests in a shallow V-block *K* and is clamped in position by means of the equalizing clamps *L* and *M*, which are operated by the same thumb-knob *N*. No indexing is provided for the three cuts on the nut as it is only necessary to loosen the knob *N* in order to release them so that they can be turned around by hand. The action of this device is not as rapid as some, yet it is capable of giving very good results and is sufficiently accurate for commercial work. A suitable indexing device must be provided for the different positions of the fixture. The method selected can be any one of several which have previously been described. A binder handle should be provided to hold the fixture firmly after indexing.

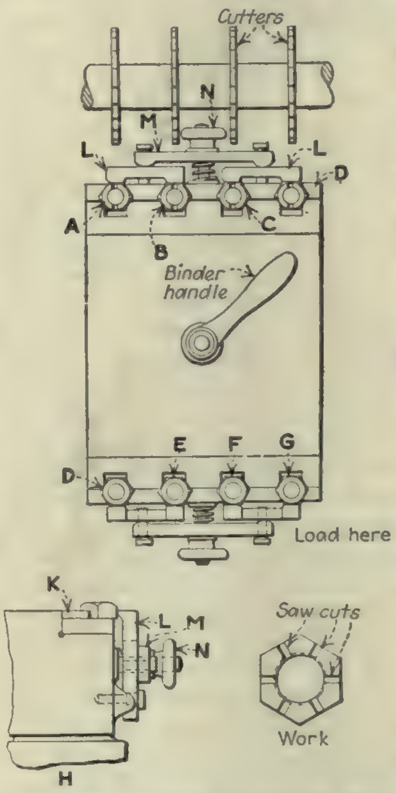


FIG. 147. INDEX FIXTURE FOR CASTELLATING NUTS

One of the principle uses of indexing fixtures is for cutting and splitting into segments various pieces which have been machined in circular form in order to cheapen the cost of manufacture. An example of this kind is shown at *A* in Fig. 148. The work is a bronze ring about 12 in. in diameter which is turned up, bored, and faced before cutting into the three parts indicated at the points *B*, *C* and *D*. Five pieces are held at the same time on the arbor *D*, which is relieved so that the work only fits it for a short distance at the points where the cutting action is to take place. The lower ring locates on three hardened blocks *E* and all of the rings are clamped down by means of the three clamps *F*, *G* and *H*.

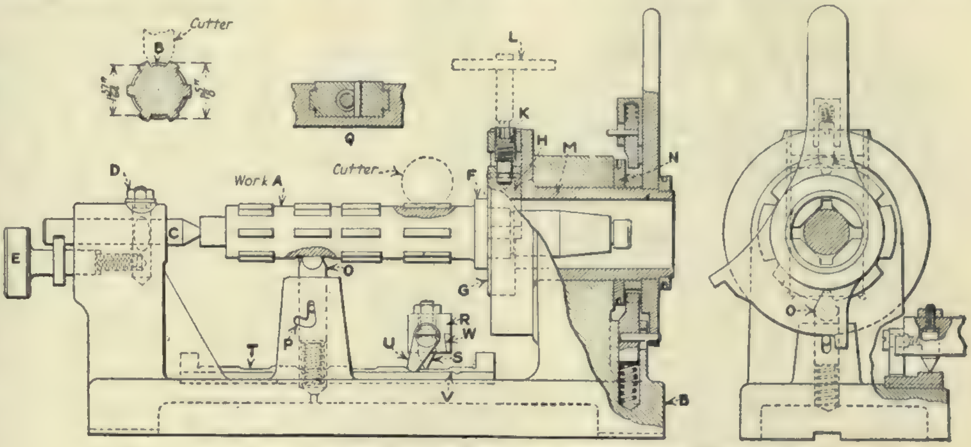


FIG. 149. SEMI-AUTOMATIC INDEXING FIXTURE

The clamps are slotted to allow the cutter to pass through them and they are located in a slotted plate so that they can be moved back when locating and removing the work. The indexing member *K* is provided with bushings at *L* to take care of the three indexing positions required. A simple type of index pin such as that shown at *M* is all that is required for correct indexing. The fixture is made quite heavy in order to absorb the vibration of the cut. This design taken as a whole will be found useful for many other operations of a similar nature, and it will be found that better results will be obtained by making it of rather heavy construction.

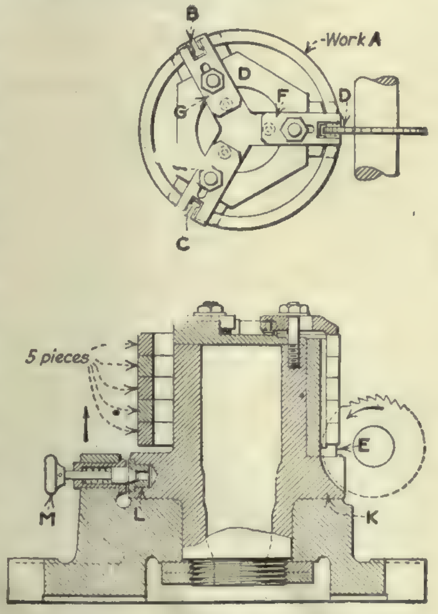


FIG. 148. INDEX FIXTURE FOR CUTTING BRONZE RINGS

A fixture which is quite out of the ordinary is shown in Fig. 149. The work *A* is a splined transmission shaft which is so designed that the portion *B* indicated in the sectional view must be undercut between the various splines. This cut is not a heavy one, as the relief required is only a few thousandths, yet it is of great importance that it should be made rapidly and economically. The machine selected for this work is a Whitney hand milling machine having a weight feed to the head of the machine. The fixture base *B* is provided with an adjustable center *C* at one end with a binder at *D*. Adjustment is by means of the special screw *E*, clamping the shoulder *F* against the face of the V-block *G* in the indexing head. An adjustable V-block is provided at *H*, the adjustment being made by means of the screw *K* and a special socket wrench indicated by the dotted lines *L*. The sectional view *Q* shows the construction of this jaw. Both V-blocks are located in the index spindle *M* which is provided with an indexing mechanism similar to one which has been previously described. Suitable adjustments are provided to take up wear as indicated at *N*. The work is located for the first cut by means of a plunger *O* which makes a contact between the splines on the shaft. This locator is not used except when the work is first placed in the fixture. While the various operations are taking place the pin is pulled down and locked by means of the bayonet lock *P*.

The sliding head of the machine is provided with a block *R* which has a follower point *S* so arranged that it will run along on the former plate *T* until the end of the work has been reached, when the swinging cam *U* strikes the recess *V*. This happens at the end of the cut and the moment the table feed is reversed the swinging point *U* strikes against the shoulder *W* and remains there during the reversal of the table thus causing the cutter to lift slightly away from the work so as to avoid interference.

A fixture of this kind is rapid in operation and will produce excellent results. The principles employed here can be used to advantage on other fixtures for similar work.

Semi-Automatic Indexing Device

It is possible to design a fixture for a hand milling machine so that it will index automatically as the table travels backward and forward. One device of this kind is shown in Fig. 150. This mechanism consists of a fixture base *A*, shown in partial section, in which an indexing shaft *B* is mounted vertically. The upper part of this shaft passes through the fixture so that the work to be milled can be attached to it. It can easily be arranged so that it will operate a table of suitable diameter and the latter can be provided with clamps or locaters for the work.

It may be mentioned here that this mechanism is suitable only for work having a number of short radial cuts spaced from 10 to 20 deg. apart as the indexing movement obtainable is too small for indexing 45 or 90 deg.

The index wheel *C* is mounted on the vertical index shaft *B*, the notches being cut in accordance with the requirements of the work that is to be machined.

On some convenient portion of the machine such as the head, a bracket *D* is fastened, and through it passes the control rod *E* which is provided with adjustable locknuts at *F* and *G*. As the nuts *G* strike the bracket when the table is moving in the direction indicated by the arrow, the arm *H* is held in a fixed position so that rod *K* pulls out the lock pin *M*, to which it is connected by the arm *L*. As the table continues to travel, the pawl *N* engages a tooth of the index wheel and indexes the mechanism to a point determined by the adjustment of the arm *H* on the shaft. After the arm strikes the shoulder at *X* the operator reverses the table feed and the spring *O* returns the operating members to their normal position as shown.

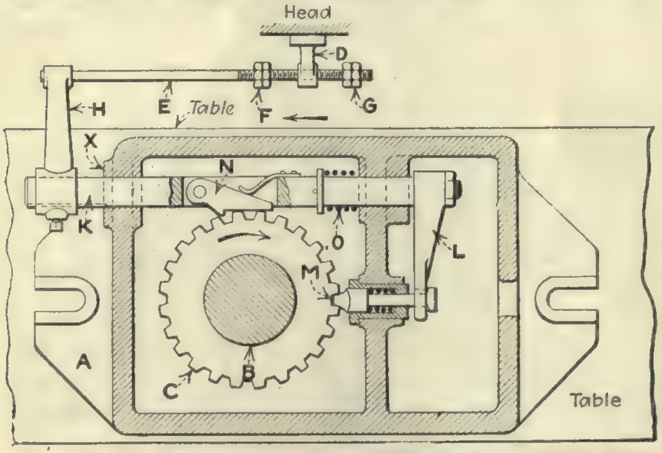


FIG. 150. SEMI-AUTOMATIC INDEXING DEVICE FOR HAND MILLING MACHINE

The amount of movement which can be obtained on the index wheel *C* is somewhat limited, consequently care must be taken when designing a mechanism of this sort to be sure that the action of the pawl *N* is such that it will work properly. A very good point about this device is that all the working parts are concealed in the base of the fixture so that there is no chance for chips or dirt to clog it up and interfere with its working.

AUTOMATIC INDEXING DEVICE FOR HAND MILLING MACHINES

A diagram of another mechanism having similar indexing features is shown in Fig. 151. These parts are indicated only in order to make clear the working of the mechanism, but the entire application is not specified. Let us assume that the index stud *A* is suitably mounted in a fixture and that the upper part of this stud is connected to the table on which the work is mounted. An index wheel is provided at *B* for a number of notches to correspond with the work which is to be done. The index pawl lever *H* is so mounted that it is controlled by the sliding member *F* which has a bearing at *G*. The movement is controlled by the cam *D* which is fastened to a stationary portion of the machine. As the table travels in the direction indicated by the arrow, the roller rides up on the cam until it reaches the point *P*, the height of which determines the amount of indexing obtained.

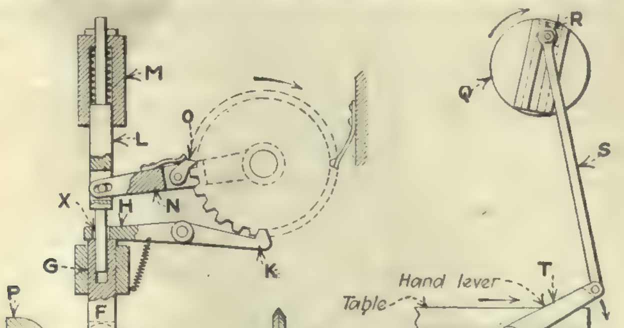


FIG. 151. AUTOMATIC INDEXING DEVICE FOR HAND MILLING MACHINE

It is evident that the lever *H* is first moved by the end of the push rod *F* until the portion *K* releases the index wheel. A continuation of the movement of the part *F* acts against the rod *L* and thus moves the lever *N* and turns the index wheel through the pawl *O*. The rod *L* is mounted so that it is a slide fit at *M* and also in the push rod *F*. Care must be taken to allow plenty of clearance in the hole *X* in order to permit the necessary movement. As the machine table returns, the springs force the push rod back against the cam until it rides once more in the position shown.

This mechanism can be operated automatically if desired by using a special countershaft above the machine and mounting on the end of this shaft a faceplate *Q* in which there is a slot as shown. The end of the rod *S* can be adjusted on the block *R* to give the proper amount of "throw" to the hand lever *T*. The speed at which the countershaft is run must be very slow. A number of devices of this kind are in use and have been found to work out very satisfactorily for work which does not require very accurate indexing.

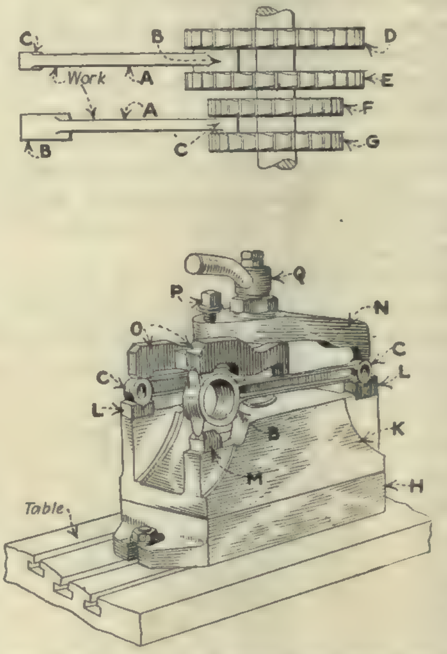


FIG. 152. DOUBLE INDEXING FIXTURE FOR CONNECTING ROD

When any kind of a double-end lever or a rod like a connecting rod is to be milled at both ends it is very often difficult to hold it properly, if a re-setting is necessary after one end has been milled. In the standard type of connecting rod for automobile motors, the subsequent operations are greatly helped if all the milling can be done without disturbing or re-setting the work. An excellent example of this kind is shown in Fig. 152. In the diagram work *A* is shown in position in order to illustrate the principles involved in the milling. The work is set so that the large end *B* and the small end *C* of the two connecting rods are at the same end of the fixture. The cutters *D* and *E* are spaced so that they will face both sides of the boss *B*, and the cutters *F* and *G* both sides of the boss *C*. The work is located on an indexing member *K* mounted on the base *H* and rests in V-blocks at *L* and *M*, as shown. The work is clamped by an equalizing device operated by the binder lever *Q*. The clamp *N* locks the ends of the rods *C* and *B*, while the other ends of the rods are held by the clamp *O*. The screw *P* is adjusted so that an equalizing action is obtained.

The table is fed into the cutters so as to mill opposite ends of the two rods, after which the fixture *K* is indexed and the other end of the work milled. This fixture is an excellent design and is rigid, easily cleaned, and rapid in operation.

Double Indexing Fixture for a Forked Lever

A very difficult milling job is shown at *A* in Fig. 153. This is a double-end forked lever of irregular shape which would be difficult to hold and machine if an attempt were to be made to mill each end separately. The work is located in knife-edged V-blocks at *B* and *C* and it is also supported by a single V-block at the end *D*, while at the opposite side it rests on a corrugated surface *E*. A spring plunger *F* located at each side of the fixture forces the work into the locaters *B* and *C* while a special equalizing clamp *G* clamps the work down into the V-blocks and corrugated surfaces at the ends of the piece. The shape of the levers at the portions where they locate in the knife-edge V-blocks is shown in the sectional view at *H* and *K*.

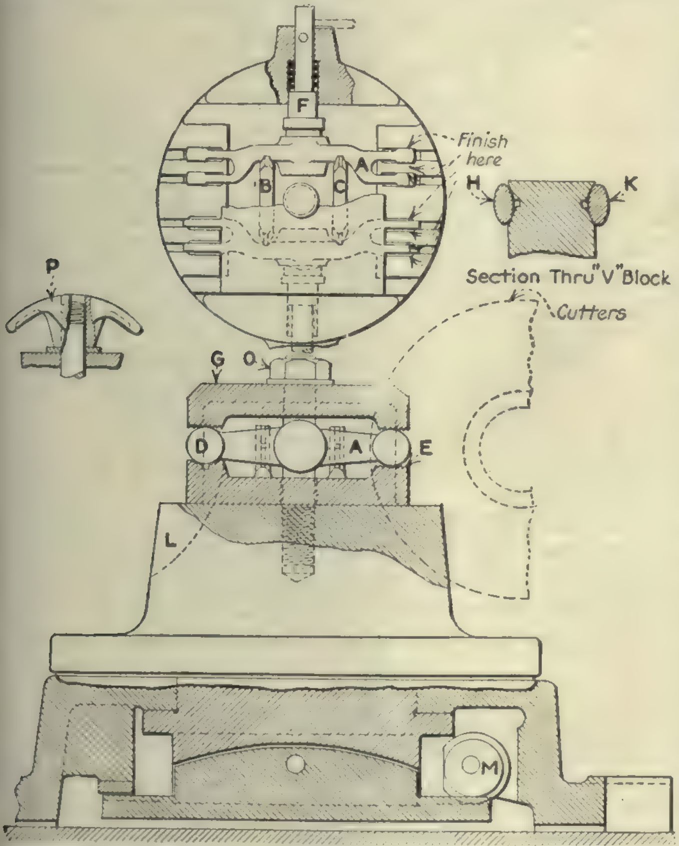


FIG. 153. DOUBLE INDEXING FIXTURE FOR A FORKED LEVER

The entire locating device is mounted on the indexing table *L* and a mechanism for indexing and clamping is concealed in the base *M*. This indexing mechanism has been previously described and therefore requires no further mention. The clamp *G* can be operated either by the nut shown at *O* or by a hand knob *P*. In either case it is necessary to remove this completely when placing or removing work. Devices of this kind may be found useful for small levers which required milling operations similar to the one shown above in Fig. 153.

We have previously spoken of the necessity for continuous cutting action when making multiple fixtures. Unless this matter is carefully considered a continuous milling fixture may be made which will not be as economical as a much simpler and less expensive type of fixture.

Fig. 154 illustrates an economical method of setting up the work *A*, the pieces being set up alternately as indicated at *B* and *C* so that only one fixture is used for milling both sides of the work. By so doing the cutting action is very nearly continuous and the expense of an extra fixture is saved. Two revolutions of the table complete all the pieces on both sides. This idea may be used often and the advantages are evident.

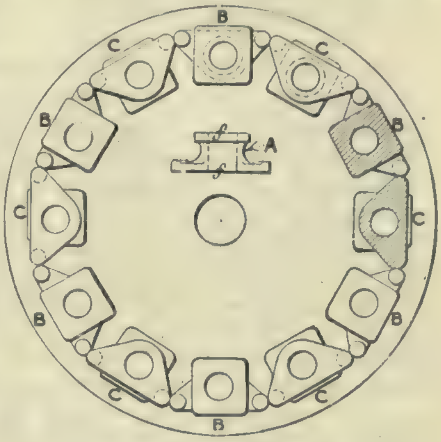


FIG. 154. ECONOMY IN LOCATING WORK FOR CONTINUOUS MILLING

It does not always pay to set up large work for circular continuous milling on account of the time wasted in "cutting air" if the pieces are not close to each other. An example of an excellent arrangement for continuous milling of cylinder heads is illustrated in Fig. 165. The work *A* is located on buttons and jacks as shown at *B* in the sectional view and is clamped against the hardened corrugated blocks *C* and *D* by means of the clamps *E*. The thrust of the cut is taken by the hardened pin at *F*.

The fixtures are made up in unit form as indicated at *G*, *H*, *K*, *L* and *M*, and are bolted to the circular table of the milling machine. This example of continuous milling is a very good one as it shows clearly that there is very little space between the pieces so that the cutting action is very nearly continuous. It

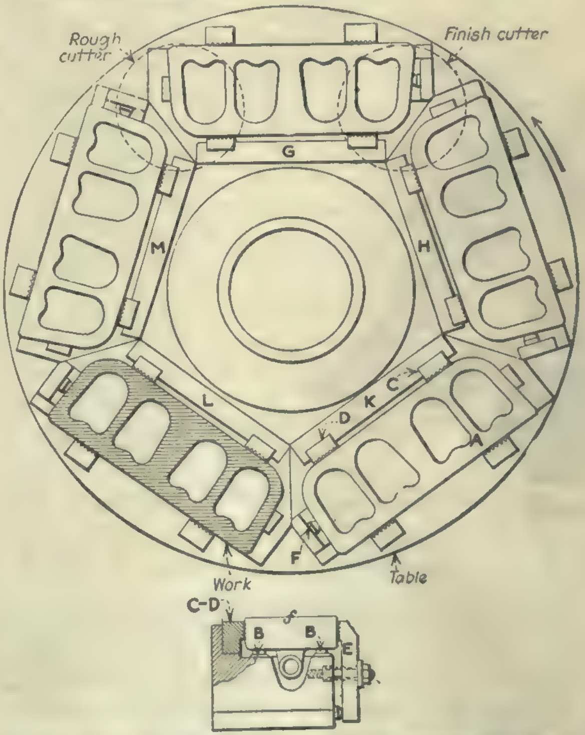


FIG. 155. CONTINUOUS MILLING FIXTURE FOR CYLINDER HEADS

can also be seen that the cuts are long enough to give the operator plenty of time to remove one cylinder head and replace another. In fact, it would probably be possible for one operator to handle two machines without great difficulty.

SERRATING FIXTURE FOR CHUCK JAWS

Another application of continuous milling is shown in Fig. 156, in which the cutter acts on the inside of the work. The operation requires a formed cutter as indicated at *A*. The chuck jaws *B* are set up around the fixture, being located on pins at *D* and *E*. The method of clamping should be such that the clamps will not interfere with the cutter.

The requirements for this work are that the inside of the jaw at *A* must be cut to a specified radius and serrated at the same time. This fixture gives very good results and although the cutting action is not entirely continuous, the pieces are set as closely together as their shape will permit so that in all probability no better arrangement can be made. The work can be set up easily and is produced within the required limits of accuracy.

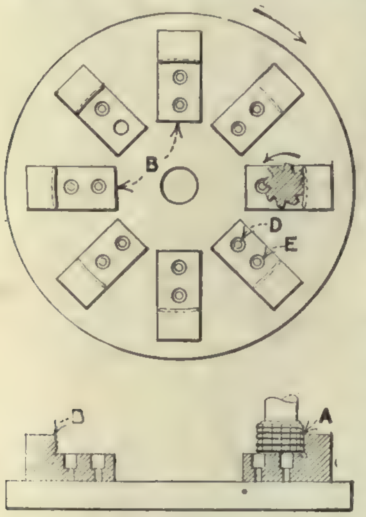


FIG. 156. SERRATING FIXTURE FOR CHUCK JAWS

Certain kinds of work permit its being set so closely together that economical production can be obtained by the use of continuous milling fixtures of circular form. An example of this kind is shown in the work *A* in Fig. 157. This piece is to be straddle milled and slotted at the points *B* and *C* as shown in the diagram. The nature of the work is such that the pieces can be set very closely together and clamped two at a time by means of a binder similar to that shown at *D*. This binder is so arranged that by tightening the nut at *E* the shanks *F* and *G* are clamped simultaneously and in a positive manner. The body of the fixture *H* is a simple ring of cast iron and is bolted to the circular table of the milling machine so that it forms a unit with it. It may be argued that the cutter action produces a large radius in the bottom of the slot which is to be milled, but even if this were the case it would not detract from the utility of the fixture. In reality the work *A* is a forging and the points *B* and *C* are relieved so that it is not necessary to cut the entire depth of the slot. This is clearly shown in the illustration.

CONTINUOUS MILLING FIXTURE FOR PUMP BODY

Fig. 158 shows a very good arrangement of eight pieces for continuous circular milling of the part *A*. This piece is a small pump body which must be machined on the surface *B* in correct relation to the cylinders *C* and *D*. The work is set up in two knife-edge V-blocks as shown at *E* and the third point of support is obtained by means of a hardened stud *F* which makes the setting up of the work approach the ideal condition. The work is clamped by means of the equalizing clamps *G* and *H*, the clamps *G* resting on a support *K* at the outside of the fixture. Provision is made for removing the clamps by the slot *L*, which allows them to be pulled back in order to insert the work. The clamps *H* are also slotted and they rest in a ring *M* at the center of the fixture.

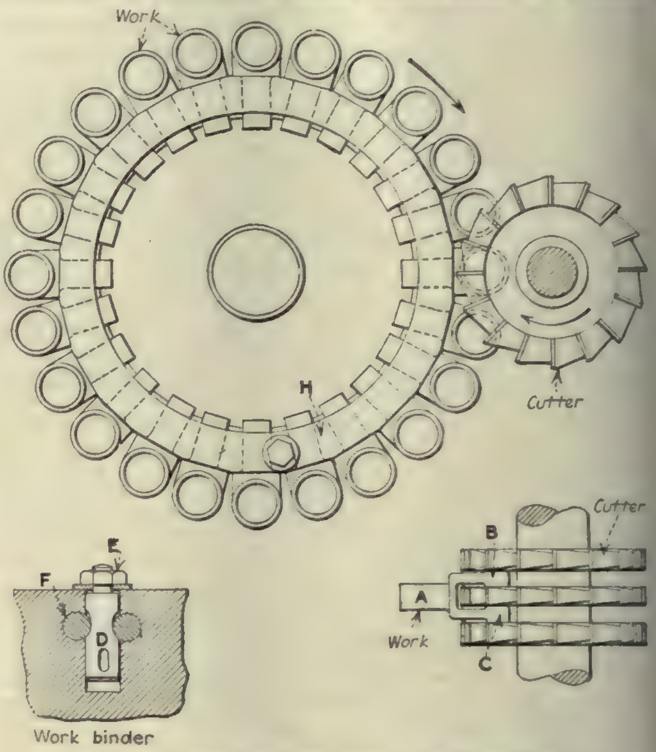


FIG. 157. CONTINUOUS SLOT AND STRADDLE MILLING FIXTURE

A glance at this design shows that it is symmetrical in its proportions, and while there is some time lost while the cutter is passing from one piece of work to the other, this amount is not great enough to restrict the utility of the fixture. Obviously, work having a

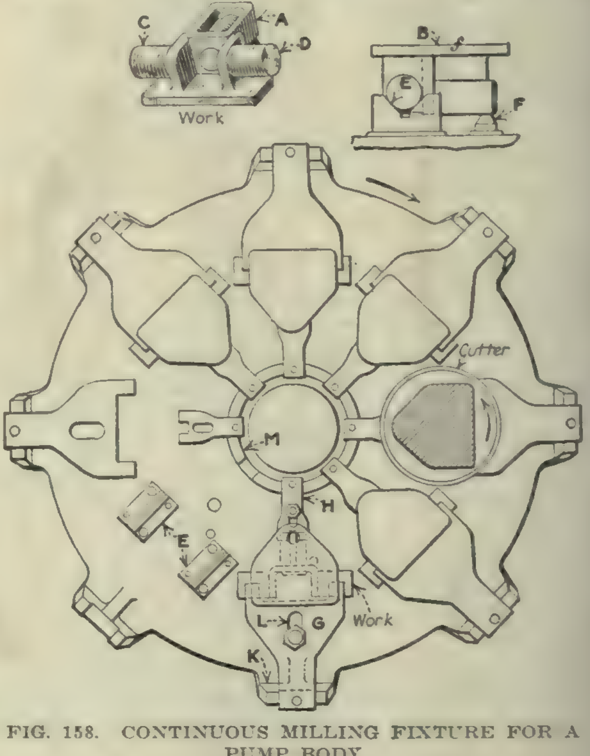


FIG. 158. CONTINUOUS MILLING FIXTURE FOR A PUMP BODY

shape like a "piece of pie," or in other words a wedge-shaped piece, usually lends itself readily to the design of a continuous circular milling fixture. Irregular pieces can occasionally be machined to advantage on fixtures of this kind, but often there is a great deal of time lost while the cutter is passing from one piece to another.

Fig. 159 shows a high-production continuous circular milling fixture which was used on a part of the Browning machine-gun tripod. This part is shown clearly in the detail drawing *A* and the portion to be machined is indicated at *B*. The work had been finished on the surface *C* in a previous operation, and the holes reamed so that the pins *D* could be used for locating. The work is clamped by means of the swinging leaf *E*, operated by the cam lever *F*. When removing the work from the fixture the lever stands in a vertical position and allows the clamp *E* to drop back against the surface *G*, thus giving plenty of clearance so that the work can be removed without difficulty.

Unit construction was used in designing this fixture and the blocks *H* are all made up so that they can be located one at a time on the circular plate *K*. In order to make the illustration perfectly clear one block has been left out at *L*.

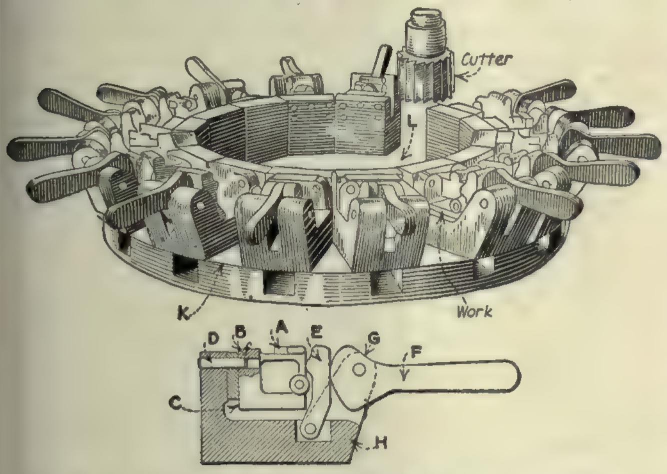


FIG. 159. CONTINUOUS CIRCULAR MILLING FIXTURE FOR A BRONZE CASTING

In considering the design of this fixture the unit construction should be studied carefully, as its advantages are quite apparent. As a matter of fact, by using this arrangement two units were made up and used more than a month before the entire fixture was completed. Another point in favor of unit construction is the reduced cost of manufacture, as it is evident that small units can be made up and applied to the fixture much more easily than if they were actually a part of the fixture. Attention is called to the clamping lever and its rapid action. Not only is it powerful but it locates the work firmly and positively against the seat.

When work is to be milled on two opposite sides as in the example *A* shown in Fig. 160, maximum production can be obtained by setting the work up in series. In the case shown the machine used is a duplex milling machine having large inserted tooth cutters at *B* and *C* and the fixture is designed so that it will hold a number of pieces. Fixtures of this kind are usually made up in units in order that the base plates *H* may not be too difficult to handle when machining. The pieces are located on dowels at *D* and *E* and clamped down by means of heavy clamps at *F* and *G*. These clamps are made U-shape so that they can be removed quickly. The number of pieces which can be machined on a fixture of this sort depends entirely upon the length of the table and it is advisable to use the full length whenever possible in order that the machine may be run continuously for a considerable period of time. The operator is thus able to work two machines if they are conveniently placed so that he can pass from one to the other without loss of time.

After the work has passed by the cutters *B* and *C*, shown in the upper view, the operator can take off those castings which have been machined so that when the entire group of castings has been finished the table can be run back and a new casting placed in position, allowing the machine to be started again without long delay. Then while it is in operation, other castings can be removed and replaced with new ones. There are on the market a number of machines built especially for the continuous milling of heavy castings. One of these carries its fixtures similar to the arrangement shown in Fig. 160, while another machine has a circular action, the table revolving in a vertical plane. Although these machines are extremely useful for certain classes of production, the writers do not deem it necessary or essential to describe fixtures which should be used on them. The data which have been given here will enable an engineer to design suitable fixtures for machines of the character mentioned in case he is called upon to do so.

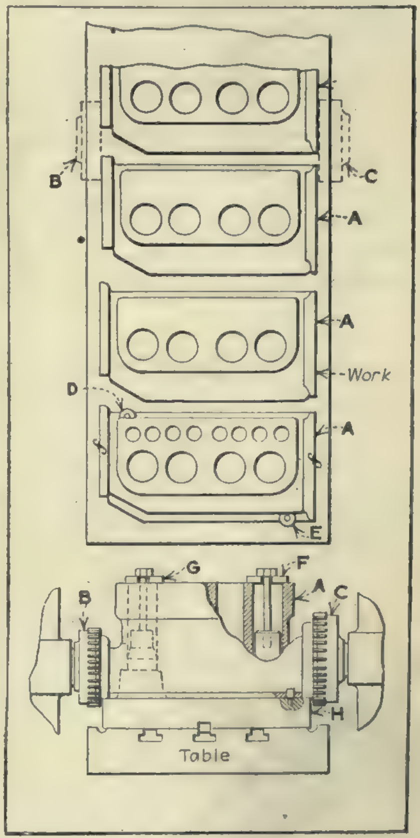
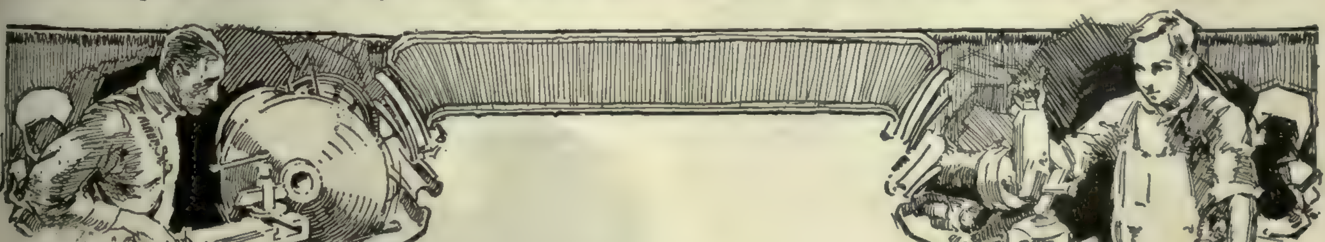


FIG. 160. CONTINUOUS MILLING FIXTURE FOR DUPLEX MILLING



Tools for Boring and Turning Locomotive Tires—I

Data on Sizes, Angles of Clearance and Rake of Tools Together with Speeds and Feeds Used by Seventeen Leading American Railroads

By FRED H. COLVIN
Editor, *American Machinist*

IN ORDER to ascertain the prevailing practice in tire boring and turning, questionnaires were sent to the leading railroads, the result of these inquiries forming the basis of this article. In the accompanying table is condensed information as to the tools used in tire boring as practiced by some of the leading railroads of the United States. The tabulated form followed does not permit of many details or variations from standard practice, and for this reason several notes have been appended to give such additional data as may be of interest and value. Illustrations are also given showing details of tire boring tools from different shops.

These notes are designated by numbers which correspond to the numbers in the table, making it unnecessary to refer to each railroad by name.

No. 1. Boring tools are the same as standard lathe tools, being interchangeable. The form of cutting edge and the angles are shown in Fig. 1. *A* and *B* show the large tool while *C* shows the cutter used in a toolholder. The tools *A* and *B* are made double ended at times, one end right-hand and the other left-hand. It should be noted that the clearance angle is given as 105 deg. but is equivalent to 15 deg. as usually measured. On the inserted tool *C*, the clearance is 30 deg. The top and side rake is 12 deg.—considerably more than usual in both cases, but giving a shearing cut in all directions. These tools are all high-speed steel.

No. 2. The boring tools are ground on a Sellers tool grinder using "Former B." The roughing tool has a ¾-in. straight face as at *A*, Fig. 2, while the finishing tool has a straight face of 1½ in. Both have a cutting edge radius of ¼ in.

No. 3. Fuller details of the tire boring tools used are shown in Fig. 3. The rough-boring tool *A* is interesting in several ways. The round nose, the curved top of the cutting lip and side rake, make a very free cutting tool. The finishing tool *B* has a flat nose

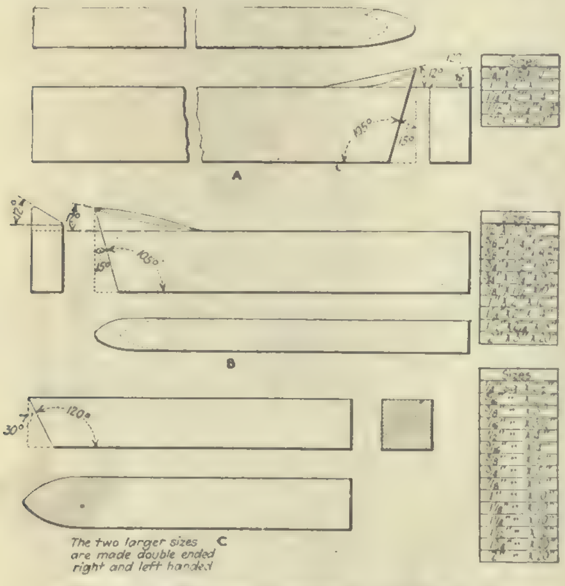

A
12°
105°
15°
12°
105°
15°
B
Sizes
120°
30°
The two larger sizes are made double ended right and left handed
C

FIG. 1. ATCHISON, TOPEKA & SANTA FE

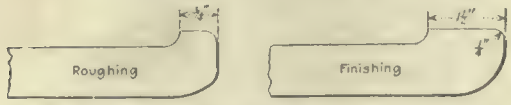


FIG. 2. CHICAGO AND ALTON

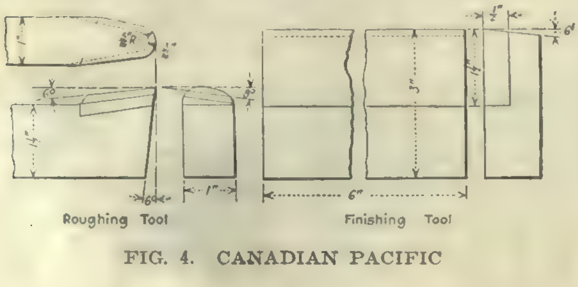


FIG. 4. CANADIAN PACIFIC

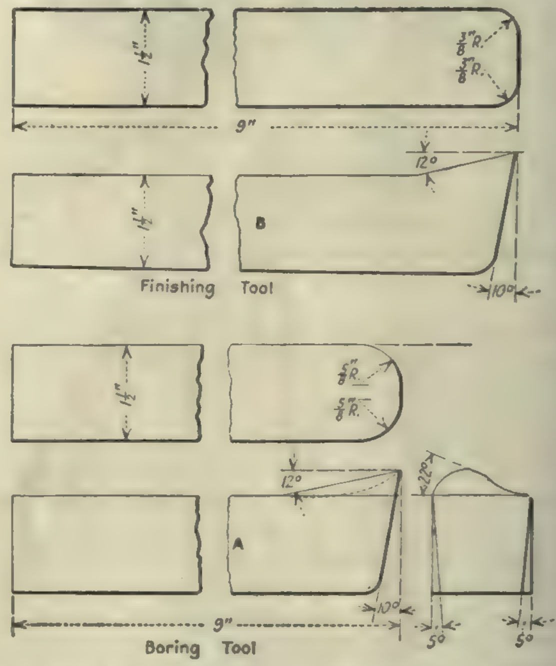


FIG. 3. CHICAGO AND NORTHWESTERN

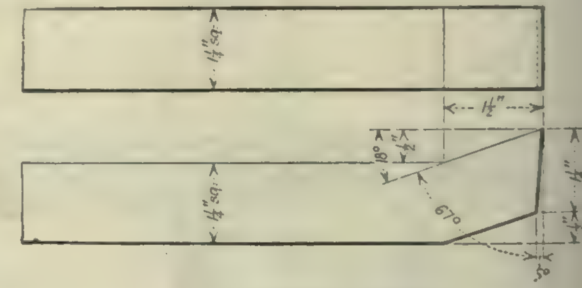


FIG. 5. GRAND TRUNK

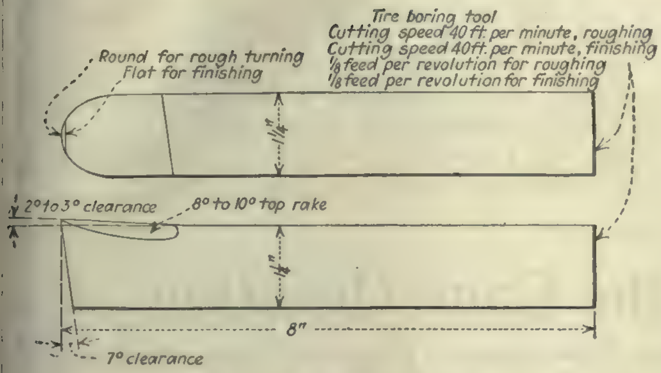

Tire boring tool
Cutting speed 40 ft. per minute, roughing
Cutting speed 40 ft. per minute, finishing
1/8 feed per revolution for roughing
1/8 feed per revolution for finishing
Round for rough turning
Flat for finishing
1¼"
2° to 3° clearance
8° to 10° top rake
1¼"
8"
7° clearance

FIG. 6. HOCKING VALLEY

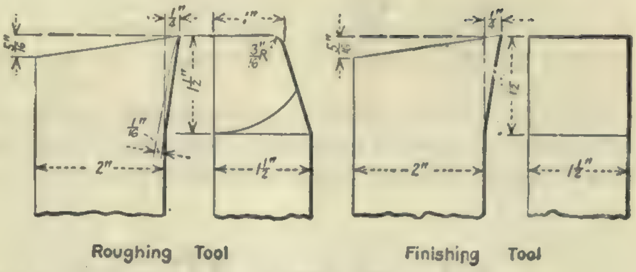


FIG. 7. LEHIGH VALLEY

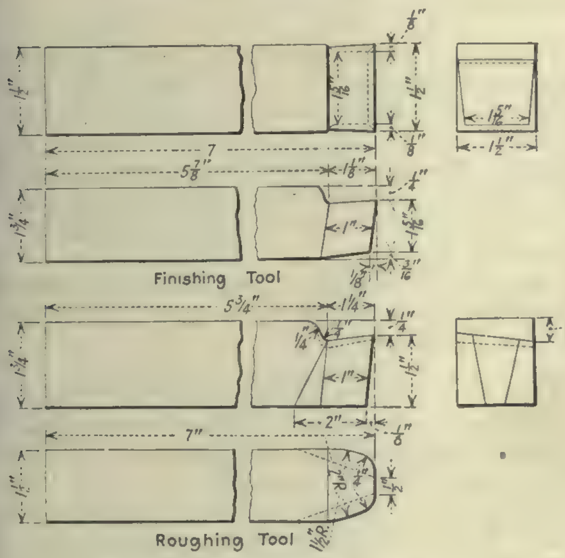


FIG. 8. NEW YORK CENTRAL

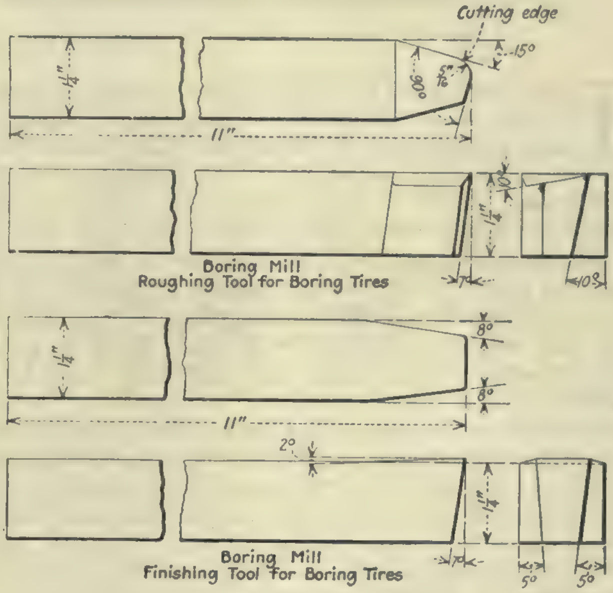

Cutting edge
15°
90°
11"
Boring Mill
Roughing Tool for Boring Tires
10°
8°
8°
11"
2°
Boring Mill
Finishing Tool for Boring Tires
5°
5°

FIG. 9. PENNSYLVANIA

with liberally rounded corners and top rake of 12 deg.

No. 4. These tools have high-speed tips welded to the body and in the case of the finishing tool, the cutting edge is 6 in. wide. Details are shown in Fig. 4. They have a side rake of 8 deg.

No. 5. Tools ground to shape on Sellers tool grinder.

No. 6. The blue chip steel used is heated white hot, dipped in oil and then cooled in an airblast. The roughing cut is from ¼ to ½ in. deep, the finishing cut from ⅛ to 3/16 in. deep.

No. 8. The triple-mushet steel used is heated slowly to 1,500 deg. F., then rapidly to 2,200 deg. F. and cooled in airblast. A round-nosed tool is used for roughing. The flat-nosed tool shown in Fig. 5 is used for finishing the bore of the tire.

No. 9. As can be seen from Fig. 6, the boring tool has a side rake on top of the cutting edge. A double-headed boring mill is used, both roughing and finishing cuts being taken at the same time. The same type of tool is used for both cuts but the nose of the finishing tool is flattened a little, as shown.

No. 10. Details of the roughing and finishing tools for boring tires are shown in Fig. 7, the rake and clearance being given in inches instead of degrees as in the table.

No. 11. The roughing tool has a round nose, while the finishing tool has a straight cutting face. The finishing tool is 1 x 2 in. After the roughing cut is started, the finishing tool is set to size and follows the roughing cut through the tire, using the same feed.

No. 12. The Midvale steel used is preheated to 1,800 deg. F., then reheated to 2,300 deg. F., quenched in oil and drawn to 1,100 deg. F. The roughing tool has a round nose and the finishing tool is square. The tools are ground on a Sellers tool grinder.

TABLE I. CONDENSED TIRE BORING TOOL DATA FROM SEVENTEEN RAILROADS

Name of Railroad and Shop	Size of Tool Body, Inches	Top Rake of Tool, Degrees	Clearance at Point, Degrees	Cutting Speed Feet per Min. Roughing	Cutting Speed Feet per Min. Finishing	Feed per Revolution Roughing	Feed per Revolution Finishing
1. Atchison, Topeka & Santa Fe, Topeka, Kans.	See sizes on drawing	12	15	18	18	¼	¼
2. Chicago & Alton, Bloomington, Ill.	1¼x1¼	8	6	25	25	¼	½
3. Chicago & Northwestern, Chicago, Ill.	1½x1½	12	10	15	15	⅛	½
4. Canadian Pacific, Montreal, Can.	1 x1½	6	6	14	12	⅛	¼
5. Chicago, Rock Island & Pacific, Silvis, Ill.	1¼x1¼	6	7	16	16	5/16	½
6. Denver & Rio Grande, Burnham, Colo.	1¾x1¼	8	6	16	20½	3/32	3/32
7. Grand Trunk, Battle Creek, Mich.	1¼x1¼	8	5	26	26	5/16	5/16
8. Grand Trunk, Montreal, Can.	1¼x1¼	18	5	23	23	5/32	5/16
9. Hocking Valley, Columbus, Ohio	1¼x1¼	8–10	7	40	40	⅛	⅛
10. Lehigh Valley, Bethlehem.	1½x2	7	8	12–20	12–20	¼	¼
11. Norfolk & Western, Roanoke, Va.	1x1	4	6	18	18	⅛	⅛
12. New York, New Maven & Hartford, Readville, Mass.	1x2	5	7	55	50	⅛	⅜
13. New York Central, Depew, N. Y.	1½x1¾	4	4½	24	24	¼	¼
14. New York, Ontario & Western, Middletown, N. Y.	1x1	15	6	28	28	1/16	1/16
15. Pennsylvania, Olean, N.Y.	1¼x1¼	2	7	19¼	19¼	5/16	5/16
16. Philadelphia & Reading, Reading, Penn.	1½x3	6	4	30	30	1/16	1/16
17. Wabash, Decatur, Ill.	1¼x1¼	2	7	30	30	⅜	⅜

No. 13. Details of the tire-boring tools are shown in Fig. 8, the roughing tool being rounded on the nose and also having both top and side rake. The finishing tool is square.

No. 14. A diamond-point tool is used for rough boring and a broader surface for finishing. Both the roughing and finishing cuts are taken at the same time on a double-head boring mill. Tools are ground on a Gisholt tool grinder.

No. 15. Round-nose tool for roughing—flat-nose for finishing. Both are shown in Fig. 9. Both are used at once on double-headed boring mill.

No. 16. There is a side rake on the roughing tool and a slight top rake on the finishing tool.

Starting Right on the Gage Question

Standard Nomenclature of Gages and Gaging Operations—Types of Gages Defined—Temperature for Comparison of Gages—Notes on the Uses of Gages

SPECIAL CORRESPONDENCE

THE Committee on Plain Gages for Engineering Work of the A. S. M. E. is trying to make a sound beginning by having all terms used thoroughly understood at the start. It believes, that the terms and definitions used should, as nearly as possible, conform to those in common use. The coining of new terms should be avoided as far as possible, and where a choice of terms is available weight should be given the term being the most significant or subject to the least misconstruction. With these ideas in mind, the following fundamentals and definitions have been adopted:

Direction of Tolerance on Gages.—The extreme sizes for all plain limit gages shall never exceed the extreme limits of the part being produced. All variations in the gages, whatever their cause or purpose, shall bring the gages within these extreme limits. Thus a gage which represents a minimum limit may be larger, but never smaller than the minimum size specified for the part being produced; while the gage which represents a maximum limit may be smaller, but never larger, than the maximum size specified for the part being produced.

Temperature at Which Gages Shall Be Standard.—This committee recommends the use of 68 deg. F.

The final result sought by gaging is interchangeable manufacture in some degree. This means that the parts of a mechanism can be assembled without *fitting* one part to another and when assembled the mechanism will function properly.

Applied to manufactured material, the result sought is sufficient uniformity in size and contour to adapt the material to the requirements of the industries without further fitting. The fundamental principle involved in interchangeable manufacture requires that "A system of standardization and classification of fits must establish a clearly defined line at which interference between mating parts begins." Hence: (a) The standard or basic size, as physically represented by a correct standard master gage, represents the line at which this interference begins on mating parts. (b) It is the minimum size of the external members of all mating parts of standardized practice, regardless of the kind of fit. (c) It is the maximum size of internal members of all mating parts where interference begins or that fit metal to metal; the conditions of (b) and (c) are represented by a mating pair of correctly fitting standard gages. (d) The limits of the component as physically represented by the limit master gages must never be exceeded as a result, either of error or wear of the gages. (e) "Go gages" or the equivalent verification of all the factors involved in the fit are necessary to prevent interference of mating parts. In the case of force fits, "go gages" are necessary to determine the maximum amount of interference between mating parts. (f) "No-go gages" or the equivalent verification of the determining factor are necessary to prevent the maximum looseness of mating parts exceeding the limits specified.

In the case of force fits, "no-go gages" are necessary to determine the minimum amount of interference between mating parts.

DEFINITIONS WITH ILLUSTRATIONS

(1) *Gaging*—A process of *measuring* manufactured material to assure the specified uniformity of size and contour required by the industries.

(2) *Gage*—A device for verifying one or more of the specified *limits* of manufactured material; (a) *Ring Gage*—One with inside measuring surfaces circular in form. The measuring surfaces may be cylindrical or conical. The exterior shape or form of the gage is immaterial. (b) *Plug Gage*—One with outside measuring surfaces arranged to verify the specified uniformity of holes. A plug gage may be straight or tapered and of any cross-sectional shape. (c) *Receiving Gage*—One with inside measuring surfaces arranged to verify the specified uniformity of size and contour of any piece of manufactured material. (d) *Indicating Gage*—One that exhibits visually the variations in the uniformity of dimensions or contour, the amount of the variation being measured by a graduated scale or by marks, such as dial, lever, flush pin, plunger gages, etc. (e) *Snap Gage*—A fixed caliper with inside measuring surfaces for measuring diameters, lengths, thicknesses, etc. (f) *Caliper Gage*—One which for internal members is similar to a snap gage, and for external members is similar to a plug gage.

(3) *Standard*—A fixed physical value defined by the Government, such as the yard and meter.

(4) *Standard Sizes*—Are a series of subdivisions of the yard and meter having correct values. (Note: The industries by common consent have chosen several different series important for interchangeable manufacture and when they have the correct value they are commonly called standard sizes. Such as: $\frac{1}{8}$-in., $\frac{3}{16}$-in., $\frac{1}{4}$-in., $\frac{5}{16}$-in., etc.)

(5) *Nominal Size*—A name given to the subdivision of the unit of length having no specified limits of accuracy, but indicating close approximation to standard size.

(6) *Basic Size*—The exact theoretical value from which all variations are made.

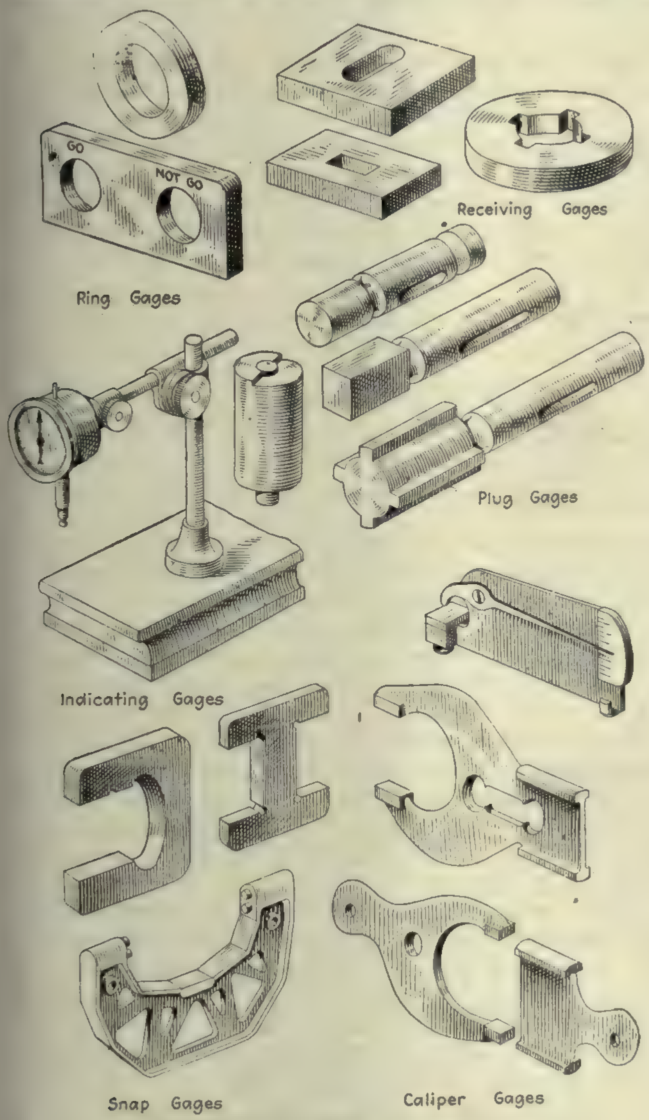
(7) *Allowance*—A difference in dimensions, the limits of which are prescribed. It is to provide for different kinds or classes of fits. It represents maximum tightness or minimum looseness.

(8) *Tolerance*—A definite difference in the dimensions prescribed in order to permit variations in manufacture. It is equal to the difference between the maximum and minimum sizes.

(9) *Neutral Zone*—A space between the mating parts which is not to be encroached upon.

(10) *Limits*—The extreme dimensions which are prescribed to provide for variations in fit and workmanship.

(11) *Master Gage*—One whose gaging dimensions represent as exactly as possible any physical dimension of the component. It is the gage with which all other gages and all dimensions of manufactured material are finally checked or compared, either direct check or comparison: (a) *Reference Gage*—a commonly used name for master gage. (b) *Check*—another commonly used name for master gage. (c) *Standard Master Gage*—any master gage whose gaging dimensions have the standard or basic value of an established nominal size. The legal authenticity of a standard master gage should be established by having its deviations ascertained by the Bureau of Standards at Washington. (d) *Limit Master Gages*—Gages which represent as nearly as possible the exact limiting physical dimensions of the manufactured material as established by the specified tolerances.



DIFFERENT TYPES OF GAGES

(12) *Inspection Gages*—Gages for the use of the manufacturer or purchaser in accepting the product. They must not pass any product which the master gages will reject.

(13) *Working Gages*—Gages used by the manufacturer to check the work as it is produced. They should not pass any product which the inspection gages will reject.

How the Shop Manager Can Use an Appraisal—Discussion

By L. L. Thwing

I think that Mr. Farrell, on page 929, Vol. 54, is a trifle unfair when he cites as a typical appraisal one in which all materials were not arranged by buildings and by floors. This at least is a nearly universal practice with companies that have had any experience in such matters. It may be admitted that an undue amount of space is used in the enumeration of pipe and fittings, and the fundamental reason why this is done I do not know. I do know however that as soon as you send out various and sundry men to "estimate" piping, that this process becomes more and more sketchy, until the only practical recourse is to have it all taken. One other reason for these long lists is that they actually do impress the treasurer or other office men as being an evidence of extreme care. They ought not to, but they do.

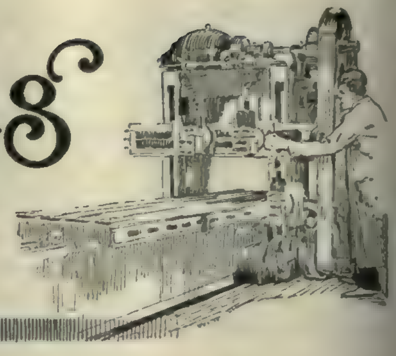
I have never yet seen a superintendent or shop manager who took an active interest in appraisals. They are usually annoyed by being asked so many questions while an appraisal is in progress. The demand for appraisals usually originates in the treasurer's office and is usually made for insurance or taxation purposes. For such purposes departmentalization is not needed and is not asked for, consequently it is not furnished. A separation of piping into separate list for manufacturing, power, heating, etc., is also made when requested, but to make an appraisal which will be adaptable to all possible uses, would indeed be an unjustifiable expense. A general purpose appraisal should have four columns of values: (1) Original cost remaining; (2) original cost depreciated, or present value; (3) replacement cost, new; (4) replacement cost, depreciated. Nearly any figures involving investment, values, or insurable values can be taken from these columns.

One other thing that I object to is the arbitrary assigning of rates of depreciation, and particularly such assumptions of accuracy as 6⅔ per cent. Depreciation is a fact and not a theory to be worked out by empirical rules.

I do think that if you can get the appraisal out of the safe in the treasurer's office into the shop manager's office and particularly into the cost department, that a much better use will be made of it, and the next time an appraisal is to be made suggestions will be forthcoming as to what additional information or classification can be used to advantage. Neither appraisal companies or industrial engineers are perfect. The first give you what you ask for, and the second what they think you ought to have.

Metal Cutting Tools.

By
A.L. DeLeeuw



XIV. The Use of Liquids When Cutting Metal—For Purposes of Lubrication—For Carrying Off Heat and Washing Out Chips

LIQUIDS used when cutting metal are often called lubricants. This name may or may not be correct, because liquids are used for three distinct purposes: For lubrication; for cooling; for washing out chips. We will first treat of liquids used as lubricants.

It is a well-known fact that the use of liquid when cutting metal has a very marked effect on the finish produced. Besides, it will affect the amount of power required under certain conditions and it may affect the size of the finished piece. At a first glance it would seem strange that the use of a liquid can have any effect whatsoever on the finish produced because the liquid cannot affect the surface until after the surface has been produced by the tool. Efforts have been made to explain the action of a lubricant by considering the fact that the splitting off of a chip probably occurs a little distance ahead of the tool point and that therefore the lubricant might penetrate between the chip and the work some distance ahead of the tool. But this cannot affect the way in which the chip is being separated from the body of the metal. It will therefore be necessary to look somewhat closer into the manner in which the tool effects the formation of the chip in order to explain some of the well-known effects of a lubricant on the cutting action of a tool.

In Chapter I reference was made to the probable way in which the chip is being separated from the work. All observations made so far point in that direction and though the statements made there should not be considered as statements of fact, but rather as the writer's way of visualising what happens when a tool acts on a piece of work, yet these considerations lead to so much clearer an understanding of the cutting action of tools that it may be well to go somewhat further in the same direction; constantly remembering, however, that we are dealing with a hypothesis which may have to be modified when careful observations on this subject have been made.

In Fig. 221 a tool is about to split off a chip. The tool is shown as having a contained angle of 90 deg., a condition which does not prevail in practice. We will further consider the effect of the tool on the chip only, neglecting everything except the fact that there is resistance against splitting off; in other words, we will not consider compression or friction between the chip and the work or friction between chip and tool or various other items. The thickness of the metal to be removed—in other words the depth of cut—AB will be called t; the width of work b; the unit resistance against shear S the pressure required for this splitting off P; and the angle along which the chip will split off β.

If no other forces were at work the force P would be counteracted by the resistance in the direction of the arrow, which would be $Sbt \operatorname{cosec} \beta$. This force would be equal, but opposite in direction, to a component of force P, which would be $P \cos \beta$; so that we have:

$$P \cos \beta = Sbt \operatorname{cosec} \beta$$

$$P = \frac{Sbt \operatorname{cosec} \beta}{\cos \beta} = \frac{Sbt}{\cos \beta \sin \beta}$$

P will be a minimum when $\frac{Sbt}{\sin \beta \cos \beta}$ is a minimum or when

$$\sin \beta \cos \beta = \text{maximum}$$
$$\text{and this is so when } \beta = 45^\circ$$

We see then that all chips would split off at an angle of 45 deg. if no other conditions had to be considered than those mentioned above.

However, if we introduce some other element we will find that this result is modified. In the first place, the fact that the tool bears on the chip in the direction of the arrow (Fig. 221), causes the chip to bear against the work with a pressure equal to $P \sin \beta$. This pressure has the same effect as if the resistance against splitting off were increased; in other words, as if the molecular attraction between the particles of metal were greater. The total resistance against splitting off becomes, therefore:

$Sbt \operatorname{cosec} \beta + P \sin \beta$, which is the resistance to be overcome by the pressure P, so that we have:

$$Sbt \operatorname{cosec} \beta + P \sin \beta = P \cos \beta$$
$$Sbt \operatorname{cosec} \beta = P (\cos \beta - \sin \beta)$$

$$P = \frac{Sbt \operatorname{cosec} \beta}{\cos \beta - \sin \beta}$$

In order that P shall be a minimum

$$\frac{Sbt \operatorname{cosec} \beta}{\cos \beta - \sin \beta} \text{ must be a minimum}$$

Dropping the constant Sbt,

$$\frac{\operatorname{cosec} \beta}{\cos \beta - \sin \beta} = \text{min.}$$

$$\frac{\cos \beta - \sin \beta}{\operatorname{cosec} \beta} = \text{max.}$$

$$(\cos \beta - \sin \beta) \sin \beta = \text{max.}$$

Differentiating we find:

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$$\cos\beta\, d\sin\beta + \sin\beta\, d\cos\beta - 2\sin\beta\, d\sin\beta = 0$$

$$\cos^2\beta - \sin^2\beta - 2\sin\beta\cos\beta = 0$$

As $\cos^2\beta - \sin^2\beta = \cos 2\beta$ and

as $2\sin\beta\cos\beta = \sin 2\beta$ we have

$$\cos 2\beta - \sin 2\beta = 0$$

$$\cos 2\beta = \sin 2\beta$$

$$2\beta = 45^\circ$$

$$\beta = 22^\circ\ 30'$$

This shows that in reality chips do not split off at an angle of 45 deg. and also how greatly the introduction of another factor affects the final result.

When the tool penetrates into the work and causes a chip to split off, it moves the chip against the remaining parts of the metal and also against the tool. We have seen how the resistance of shear affects the angle of splitting, also how the pressure of the chip against the work affects that angle, and we will now investigate what effects the friction of the chip against the tool has on the final result.

In Fig. 222 a planer tool is shown removing a chip. The chip is shown as bearing against the tool some distance from the point where it is being separated from the work. Under the conditions represented in the sketch the sections of the chip offer so much resistance against sliding one over the other that the tool is not able to reach the solid part of the metal, as the pressure between tool and chip is great enough to cause a new section to split off. The distance between the point where the splitting off takes place and the tool point is a variable quantity and depends on a great many elements. It was for the purpose of showing how the final result is largely affected by a variation in one of the elements that the two hypothetical cases were taken at the beginning of this chapter.

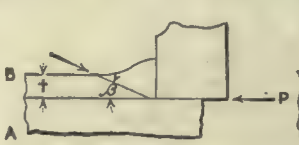


FIG 221

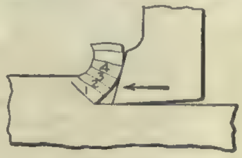


FIG. 222

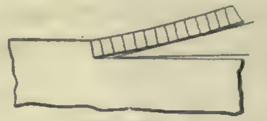


FIG. 223

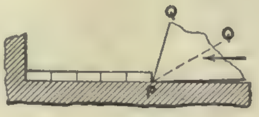


FIG. 224

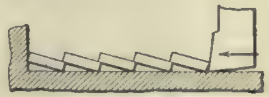


FIG. 225

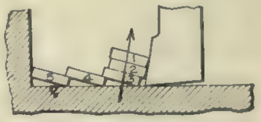


FIG. 226

FIG. 221. THEORETICAL TOOL ABOUT TO BREAK OFF CHIP. FIG. 222. ACTUAL PLANER TOOL TAKING CHIP. FIG. 223. THEORETICAL TOOL WITH EXTREME RAKE. FIG. 224. WEDGE ACTING ON ABUTTING BRICKS. FIG. 225. BRICKS ARRANGED LIKE CHIP SECTIONS. FIG. 226. POSITION OF BRICKS AFTER TOOL ADVANCES

When the tool has no rake the chip tends to split up at an angle of 22½ deg. with the work. Consequently the length of the line along which a section of the chip splits off is several times the thickness of the metal to be removed. As a result the pressure between tool and chip is very great. If, on the other hand, we should have a tool with a very large amount of rake, such as represented in Fig. 223, the plane of cleavage will be almost at right-angles to the work and the length of the line along which the chip splits off is but very little more than the thickness of the metal to be removed. Under the condition shown in Fig. 223 which, of course, does not occur in practice, it is not even necessary for the chip to be completely split off. It merely needs to be displaced slightly in relation to the next section of metal in order to allow the tool to penetrate further. We have here very much the same condition as when an impression is made in a piece of sheet metal by a punch and dies, but without completely punching through. Consequently a chip sliding over the tool has almost the same strength as the original metal. The pressure required for splitting off is very much less than under the conditions shown in Fig. 222. After a section has moved far enough to permit the tool to penetrate somewhat farther, the entire chip can bend. It is not necessary that this chip should be further deformed. Here, then, we have the two extreme conditions: in one case the line of cleavage is long, the pressure required for splitting off one section is great, and the sections slide one over the other a long distance in order to permit the tool to penetrate further. In the second case, the line of cleavage is short, the pressure required for splitting off one section is small, and the sections do not need to slide one over the other after the first initial shear has taken place and has permitted the tool point to penetrate farther.

There is another element which modifies these conditions still farther and makes the difference between the two extremes still more pronounced and that is that the resistance caused by the friction against the work is almost, though not quite, at right-angles to the face of the tool. It may be expected that the coefficient of friction between a rough chip and the surface of the tool must be very great. Under the conditions shown in the sketch the pressure between tool and chip is practically the same as the pressure required for the shearing off of a chip and this pressure is almost at right-angles to the tool. To understand better what will happen under such conditions, let us suppose that a number of bricks are laid on the ground and abutting against a wall, Fig. 224. We take some implement *A* and push it in the direction of the arrow with sufficient force to overcome any resistance there may be. If the front of the implement is the line *PQ*, almost at right-angles to the direction of motion, it will not be possible for the implement to get under the brick and lift it up, as the brick will refuse to slide over the face of the implement. As a result, the bricks will have to be crushed in order to allow the implement to move forward. If, on the other hand, the face of the implement were in the direction of the line *PQ*, we would need only sufficient force to lift the weights of the bricks and overcome the resistance of friction between the bricks and the implement. This friction depends on the surface of both bricks and implement and on the weight of the bricks.

Referring again to Fig. 222, the individual sections of the chips are the bricks. Their weight is the resistance they offer against shear. The chief difference is that while in Fig. 224 the bricks are laid against each other so that each one forms the abutment for the previous brick, the sections of a chip are arranged somewhat like shown in Fig. 225, except that whereas in

Fig. 225 the bricks would be free to slide over each other (except for the friction between them), in the case of a chip the resistance between the various sections is very great and is, in fact, the resistance against shear. As the implement advances in Fig. 225, we get the condition shown in Fig. 226, which shows that the bricks must have moved in the direction of the arrow sliding past the implement. The pressure against the implement is then composed of two elements: the pressure required to push brick 3 over 4, and to slide bricks 1, 2 and 3 along the implement. This shows that the total pressure is much more than that required for the separation of the chip only.

In taking a heavy cut the pressure against the tool is so great that the front of the tool is rapidly worn away. It is not possible to say what the coefficient of friction between the chip and tool may be, but it is not likely that it would be less than 0.40 or 0.50; so that we may expect that the work done in overcoming this friction is somewhere in the neighborhood of half the amount required for splitting off of the sections. Besides, when the front of the tool is nearly at right-angles to the direction of its movement, it may not be possible at all to make the chips slide. In that case the chip must be crushed so as to get out of the way of the tool. All of this means that a large amount of power is consumed for no useful purpose and that the tool will wear out very rapidly. Anything that can be done to decrease the friction between chip and tool must then materially reduce the amount of power required and will prolong the life of the tool. And this is one of the objects of applying a lubricant.

There are actually three ways in which we can reduce this friction. In the first place we can give the tool a very sharp angle, thus reducing the presure required for splitting off a chip; by doing this we increase the length of the path of the chip over the tool. If we have reduced the pressure to half its original amount, but we make it slide over the tool double the distance, we have not saved any power required for overcoming the friction, but we have reduced the wear on the tool. Furthermore, we now have a tool with such a delicate cross-section that it is apt to break, while at the same time the cross-section is no longer sufficient to carry off the heat, so that the tool is liable to failure on account of softening of the steel. The second method would be to give the tool a polished surface, thus reducing the coefficient of friction. This simple method of reducing the friction is very seldom employed, strange to say. The writer's experience has been that this is a most efficient way of prolonging the life of the tool and reducing the power required in a great many instances. The third way is to apply a lubricant, which has the same effect as the polishing of the front of the tool, but which has the advantage of being independent of the length of time that the tool has been in action. It stands to reason that, if the front of the tool is polished, it must gradually lose its polish, so that by and by the tool, will be in the same condition again as if it had never been polished; whereas if we apply a lubricant its beneficial effects will be the same during all of the time we use the tool. Of course, doing both is best of all.

If the tool were placed in relation to the work as it is shown in Fig. 227, the lubricant, coming in in the direction of the arrow, could do but little if any good, because that portion of the chip which strikes the tool under the heaviest pressure completely shuts off any possibility of the lubricant reaching a section of the metal which is not yet bearing against the tool. This condition, however, does not exist in practice. Fig. 222 shows more nearly what actually occurs. The front of the tool does not bear against the section which is being split off, but against some section which has already been split off, and there is an opening left of approximately triangular shape between the front of the tool, the finished part of the work and the chip. This opening is shown in exaggerated form in Fig. 222. If the lubricant can enter this opening it will lubricate the front of the tool before the chip bears up against it. In Fig. 222 section 4 is suposed to bear up against the tool; section 3 is in close proximity to the tool but not yet against it; section 2 has just been split off, and section 1 is beginning to split off. When the tool advances in the direction of the arrow, section 3 will become the one which bears up against the tool. It will not bear directly against the metal but against a film of oil. The adhesion between the different sections is great enough to transmit the pressure from the tool to section 1.

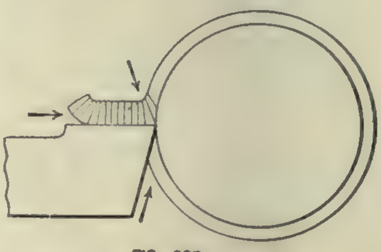


FIG. 227

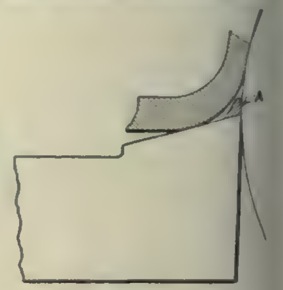


FIG. 228

FIG. 227. A CONDITION UNDER WHICH LUBRICATION WOULD BE USELESS. FIG. 228. ACCRETION OF METAL PARTICLES ON TOOL POINT

The question now is what conditions must be fulfilled to enable the lubricant to penetrate into the triangular space between tool and work. The size of the triangular opening is very small. The thickness of the individual section is also very small, so that a great number of these sections are split off per minute, and this number becomes greater with increased cutting speed. The tool must advance a certain distance before the next section will begin to split off. In other words, some of the lubricant is squeezed out of the triangular opening before a new section is split off. Putting it still another way, the size of the triangular opening contracts and expands once for every new section split off. During the time that this triangular opening expands the lubricant must flow in, in order to be of some use for the purpose of reducing friction. The direction in which this lubricant enters the triangular opening is at right-angles to the direction of the cut, or we might say at right-angles to the plane of the illustration.

If we take a lathe cut, one side of the chip still adheres to the work so that the lubricant can flow in to a depth equal to the amount of the feed per revolution. This may be anything from 0.01 to ¼ in. or even more, and as the cross-section of the triangular space is, of course, exceedingly small, the lubricant must penetrate at a very high rate of speed in order to cover every part of the tool. The fact that we may have a large stream of lubricant pouring over the tool does not help any. We must depend on the adhesion between the lubricant and the material to be cut for its penetration. We may say, then, in a general way that we should use a lubricant which will spread very quickly over the metal. Such lubricants would be thin oils, and if we did not have to consider any other facts we could say that thin oils must be used for lubrication. However, a thin oil would not help as a lubricant under the extremely heavy pressure that exists between the chip and the tool, so that if we want to have a real lubricant we should use a very heavy oil. There are, then, two opposing requirements. The speed with which the oil must penetrate requires a light oil, and the pressure which it must resist requires a heavy oil.

We will now see to what extent we can harmonize these two opposing conditions.

Everybody who has ever taken a heavy cut on a lathe must have noticed how sometimes chips will stick to the surface of the tool. A little closer observation will show that this sticking of the chip to the tool is not always the same thing. Sometimes one finds quite a considerable chip adhering to the tool surface, but only lightly, so that the touch of a finger will remove it. Sometimes one will find one or two sections of the chip stuck to the tool and it takes considerable pressure—the blow of a wrench or the push of a screwdriver—to remove it. At still other times one will find that a little hill has been built up close to the cutting edge and, looking at it with a magnifiying glass, this hill may appear as a densely compact little mass of very fine particles of metal and sometimes as if these fine particles had been welded together and onto the tool. This last condition is the most dangerous.

When such a little heap of fine particles has formed and has been welded to the tool point, one may expect failure of the tool within a very short time—but not always. Fig. 228 shows a tool with such a little heap of metal welded on and also shows a chip in state of formation. The mass of metal built up at the tool point is marked *A*. So long as this little mass of metal is within the triangular space between work, chip and tool there is a possiblity that the tool may go on functioning. But when this litle heap of metal extends further, so that the chip must ride over it, then the friction created at that point will be so severe that the particles of metal are welded together and that porition of the tool over which the chip must slide becomes hot and soft enough to break down under pressure of the chip.

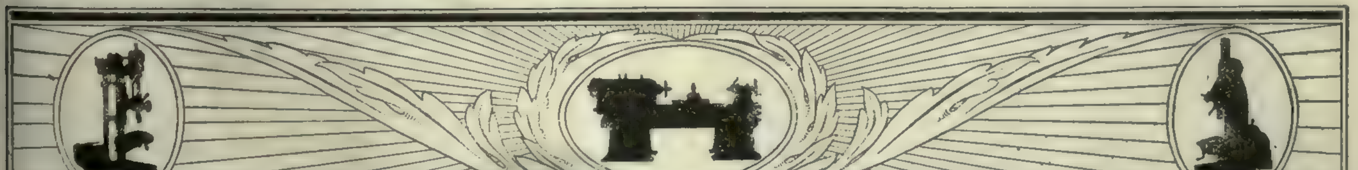
This manner of failure is quite common when taking heavy cuts, and especially when no lubricant is used. If a lubricant is used and this condition prevails, it is evidence that the lubricant did not reach the tool point in the proper manner. We have observed that this little heap of metal does no great harm as long as it is not welded together by the friction of the tool, and on the other hand we might have noticed that there is very little danger of a solid hill building up so long as the tool can be kept cold. The thing to do, then, is to make sure that the lubricant gets into the triangular space and that it is of such a nature that it will carry off the heat, thus preventing the particles of metal from welding together.

Mineral oils do not take up heat as readily as some animal or vegetable oils, such as lard oil, fish oil, or olive oil. On the other hand, these vegetable or animal oils do not have the lubricating qualities of the heavier mineral oils. Lard oil, for instance, will carry off heat much better than a heavy mineral oil, and it has about the same lubricating qualities as a light mineral oil. There is no liquid which would take up heat as readily and to as great an amount as water, but its lubricating qualities are very poor. Some heavy mineral oil would be an excellent lubricant under great pressure, but it would be almost useless for the purpose of cooling work and tools. Lard oil, or some other oil with the same qualities, would not be as good a coolant as water, but would have much better lubricating qualities; nor would it be as good a lubricant as heavy mineral oil, but it would be a much better coolant. So that, altogether, lard oil is a very good compromise between the two extreme conditions we have to meet. When we use lard oil for light cuts, we will have pretty nearly ideal conditions because, though its lubricating qualities are not very high, they are as high as may be necessary for the cut we are taking.

LIGHT AND HEAVY LUBRICANTS

The nature of the lubricant to be used is often based on the nature of the machine. It is rather natural to think that a machine which requires 10 hp. should need a heavier lubricant for the cut than some other machine which requires only 5 hp. This, however, is not correct. We should not look at the amount of power the machine requires, but at the size and particularly at the width of the chip. For instance, if we should take a cut ¼ in. deep and with 1/16 in. feed, we will obtain a thick and strong chip which will bear heavily on the tool, and such a cut will require a heavy lubricant. The amount of metal we have removed has a cross-section of 1/64 of a square inch. If we should take a forming cut on a large screw machine, a cut say 7 in. long and with about 0.002 in. feed, we would remove the same amount of metal per revolution; the chip would have the same area of cross-section, but would be of an entirely different shape. At no point would there be a heavy pressure between chip and tool, and for that reason a heavy lubricant is not required. Furthermore, a heavy lubricant under those conditions would be detrimental for, as this lubricant must flow into the exceedingly long, triangular groove left between chip, work and tool, it must have great fluidity in order to reach all the points of the tool, so that a heavy lubricant would not serve at all. This will illustrate how necessary it is to study the peculiarities of the cut before determining what lubricant will give the best results.

(Continued in next week's issue)



The Human Machine in Industry

Care of the Human Machine as Necessary as Care of Machines of Metal—Length of the Working Day—Periods of Rest—Fuel

BY WALTER J. MATHERLY

THE science of machinery reigns supreme in industrial organization. In the selection and testing of all mechanical devices, exact scientific standards are followed. Nothing is left to chance. Every precaution is taken to get the very best. Whatever machines are chosen are chosen with regard to their fitness for particular purposes. The strictest attention is given to the raw materials out of which they are made; to the speed at which they are to be run; to the avoidance of unnecessary friction; to keeping them well oiled and cleaned, and to the efficiency with which they are to perform their functions. The whole purpose of technological science is to construct mechanisms which will produce a maximum output at a minimum of expense, in money, mechanical injury, and deterioration.

Machines of iron and steel, however, are not the only machines which are essential to industry. They are not the only mechanisms which are subject to scientific analysis, and which are worthy of the closest scrutiny with regard to the speed at which they should be run, the care which they should receive, and the output which they should produce. To them must be added human machines. By human machines is meant the industrial workers themselves. As physical entities such workers are complexes of body and mind. They are human organisms, and may be regarded with reference to standards of industrial efficiency as human mechanisms. Such a conception in no wise involves any disparagement of the workers, nor is it opposed in any manner to the principles of physiology.

SCIENCE AS RELATED TO THE HUMAN MACHINE

Naturally, the science of human machines is not as highly developed as the science of non-living machinery. Not as much attention has been paid to it. The reason for this is that emphasis in the past has been placed on mechanical factors and processes. The technological aspects of industrial organization have been given ascendancy. The aim has been the standardization of metal machines rather than human machines. The goal has been the efficiency of inorganic matter rather than the efficiency of living matter.

There has been a change of front along this line, however. Since human beings play such a large part in industry, the chief point of emphasis today is the human factor. It is beginning to be recognized that the human as well as the non-human machine must be standardized. The big problems for solution are not so much problems of technics as problems of personnel. The greatest industrial need is not for the science of mechanics, but rather for the science of humanics. The great objective is or ought to be the organization of industry on a physiological and human basis rather than on a mechanical and non-human basis.

The human machine which is beginning to receive such scientific notice is superior to all other machines in industry. The human body is the mechanism par excellence. There is no engine like the engine which pumps the blood through the human system. There are no pipe lines for the transportation of liquids that are comparable to the arteries and veins. There are no grab buckets and steam shovels that are as deft and accurate as human fingers. There are no machines in manufacturing establishments that can automatically lubricate themselves or that can replace themselves without depreciation funds as can the human machine. Indeed, the human body transcends all other machines in the specialization of functions and the co-ordination of parts, and stands out as the mechanism of all mechanisms.

MENTAL AND PHYSICAL ENERGY

The mental and physical energy which human machines generate is indispensable to the economic structure. To fight in the business arena, or to work in the plants of production, physical and mental prowess is necessary. The best workers, whether executives or employees, are men of strong physique. Strength has characterized almost every master workman. To meet the demands of present-day industrial activity, men must be veritable steam engines. They must have strong bodies and be able to endure all industrial wear and tear. In a word, strong human machines are absolutely essential to the organization of all industrial enterprises.

While human machines must have strength, their strength is somewhat different from that of non-living machinery. Unlike machines of metal, industrial workers can not do the same amount of work each hour of the day or even each day of the week. The longer the hours they toil the less will they produce. The curve of output, as investigation has frequently shown, decreases with the increase of fatigue. Production is greatest in the early hours of the morning when the workers are freshest, while it is smallest in the late hours of the afternoon or in the hours worked overtime, when the worker's supply of energy is exhausted and fatigue has stored the body with poison.

The same is true more or less for the weekly curve of output. While production is relatively low on Monday, it rises to the highest point by mid-week and then tends to drop to the lowest level at the end of the week. Low production on Monday is known as the "Monday effect." The cause for it has been ascribed to dissipation at week-ends. A better explanation seems to be "the lack of neuro-muscular co-ordination" due to Sunday rest. Whatever the reason for the relatively low output at the very beginning of the week, production follows about the same course as daily output for the rest of the week, declining generally, though not always, at the end of the week with the increase in fatigue.

FATIGUE OF NIGHT WORK

The effect of night work on output is still more noticeable. Night workers, as was brought out by experiments in munition plants during the war, are never as productive as day workers. While the level of production rises in the early hours of the night, it drops down to almost nothing during the last two hours before day, the laborers often going to sleep on the job. So far as the quantity of products turned out is concerned, night workers might as well be sent home for rest and sleep during the last two hours as to be kept at their posts of duty without the capacity to perform their tasks with even half-way efficiency.

Still another evidence of the effect of fatigue on the workers is its relation to industrial accidents. With the increase of fatigue there is an increase in accidents. This signifies that the longer human machines operate the less accurate they become in the performance of their functions. Unlike machinery constructed from dead matter, they can not do their work with precision indefinitely. It must be clearly recognized that there is a point in the utilization of human materials beyond which it is industrial folly to attempt to go.

All of this indicates "that fatigue is an enemy to high production." Since such are its effects, provision must be made for its removal as far as possible or at least for reducing it to a minimum. This suggests at once the length of the working day. How long should the working day be? What is the number of hours most conducive to highest daily efficiency? While there may be some exceptions, the evidence which is gradually accumulating seems to point to eight hours as the best condition for the highest productivity. In the light of industrial output, the scientific standard for running human machines may be found after all in the old adage of eight hours for work, eight hours for sleep and eight hours for play.

In further reducing industrial fatigue, rest periods during the day ought to be provided. Opportunities for moments of relaxation ought to be given. Wherever possible, suitable seats ought to be installed instead of having the laborers stand all day. Under no circumstances ought the human machine be worked overtime or be driven at a high rate of speed in absolute disregard of its capacity for productive effort.

MEN SHOULD REST ONE DAY IN SEVEN

In most cases weekly labor ought to be confined to six days. One rest day in seven is just as necessary in industry as it is in religion. While daily fatigue may be lessened in a number of ways during working hours and more or less completely removed at night by sleep, weekly fatigue requires something more than this. It requires, in order for the workers to recuperate completely, a strict observance of Sunday rest. Anything less than this would be a short-sighted policy in the scientific management of industry.

Moreover, all night work probably ought to be prohibited. Men are diurnal, not nocturnal, animals. Night work on their part is abnormal. For centuries they have toiled in the day and restored their expended energies at night. To work at night is to go against the habit of generations. The only way by which as much can be produced at night as in day is to bring about a reorganization of the entire human mechanism. Instead of trying to go so far as to reconstruct human nature outright, it is probably better to confine man's industrial activities to daylight and eliminate night work altogether from the realm of production.

In addition to reducing fatigue to a minimum, there are other measures which must be taken into consideration in order to increase the efficiency of human machines. Foremost among such measures is the providing of proper fuel. Proper fuel to industrial workers means proper food. Those who toil at the lathe or forge can not perform their tasks successfully unless they are adequately and wholesomely fed. Attention must be directed to their diet. They must have access to a balanced ration. If they do not get it outside of the plant then employers must see that they get it within the plant by operating cafés and canteens at actual cost for their particular benefit. Without an adequate supply of proper fuel, human engines can not produce the energy which is needed in the operation of industrial enterprises.

Human machines must not only have the right kind of fuel but they must also be kept clean. No industrial mechanism can do its work acceptably unless it is kept free from dirt both within and without. The human machine is no exception. It is just as important to remove grease, rust and grime from it as it is to remove them from other machinery. To this end all manufacturing plants ought to provide adequate bathing and toilet facilities, maintain the strictest standards of sanitation, and improve the factory environment in every way possible. Indeed, not to take these precautions and provide clean surroundings for the laborers is to neglect the productive capacity of the whole industrial structure.

WASTE MOTION SHOULD BE ELIMINATED

Furthermore, human machines must not be allowed to operate with waste motion. This imperative involves the problem of wasted energy. Motion studies have demonstrated that workmen make many idle and useless movements. Much activity of hands and legs is absolutely without profit. As illustrative of this, it has been shown by actual experimentation that the motions in laying a brick may be reduced from eighteen to one and three-fourths. Scientific experiments have proved also that just as great savings as this can be effected in other occupations. In the midst of such facts, it is an industrial crime of great magnitude to allow employees to waste their energy by excessive activities. If a maximum of human power is to be provided for the processes of production, all waste motions must be eliminated from the tasks of industrial workers.

Nor is this all. In order to keep human machines in good running order the science of industrial medicine must be encouraged. Plant physicians and nurses must be employed. Hospitals and first-aid stations must be added to factory equipment. Contagious diseases must be detected and kept from spreading among the working forces. Dental services must be made available. Physical examinations must be required not only of new employees but also of old employees in order to discover defections, and properly treat and remove them. In short, industrial medicine must do everything within its power to keep the whole labor force in perfect working order and efficiency.

Finally, in strengthening the productive power of human machines, the problem of labor turnover must be considered. The turnover of factory employees means a change in personnel. It indicates an annual replacement of so many human machines. It signifies an annual installment of so many new mechanisms. This, like the installment of all other new machinery, is costly. It is impossible to change the entire personnel of an industrial plant without a great loss of time and a big expense in hiring the new workers, initiating them into their tasks, and training them for high-grade service. To provide the greatest industrial efficiency in factory, mill and shop, the turnover of human machines must be reduced to the very lowest limits.

Manufacturing with Special Machines vs. Standard Equipment

III. Planing, Milling, Boring and Drilling Operations—Types of Machines and Fixtures Used—Special Planer with Uprights Set at an Angle

By Col. G. F. JENKS* and M. H. CHRISTOPHERSON†

OPERATION 12, consists of boring a semi-circular cut in the recess of the sleigh between the reservoirs and is illustrated in Fig. 15. Two Otis type-5 boring mills were used for this purpose by installing a crosshead directly behind the cutter head, thus forming a bearing and support for the boring bar by permitting the crosshead to move endwise with the bar on a sustantial slide bolted to the bed of the machine.

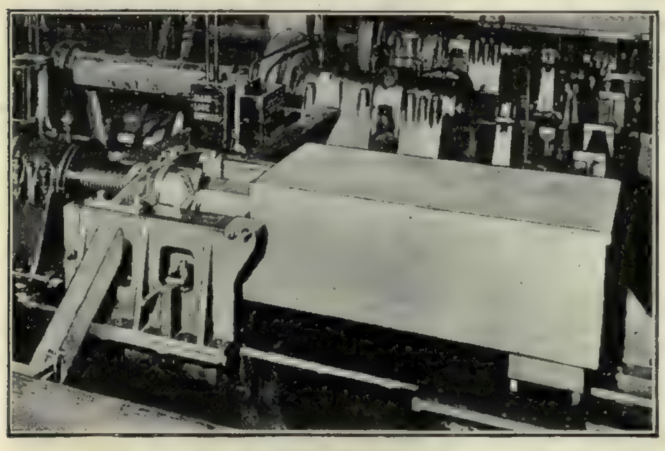


FIG. 15. BORING A HALF HOLE

Revolutions of boring bar, 12 per minute. Peripheral speed of 11⅜-in. diameter cutters, 36 ft. per minute. Feed of cutter head, 5½ in. per hour. Average time setting sleighs and removing 990 cu.in. of metal in this operation was 6 hr. The time for this operation at the Arsenal was 7.51 hours.

The sleigh as originally designed had the recess cut out in rectangular outline instead of semi-circular as finally made, which made it necessary to mill the recess between the reservoirs on a vertical spindle milling machine requiring on an average, 45 hr. One sleigh while being milled in this manner was spoiled by the operator who, through inattention to his work, permitted the cutter to feed into one of the reservoir walls.

Operation 14

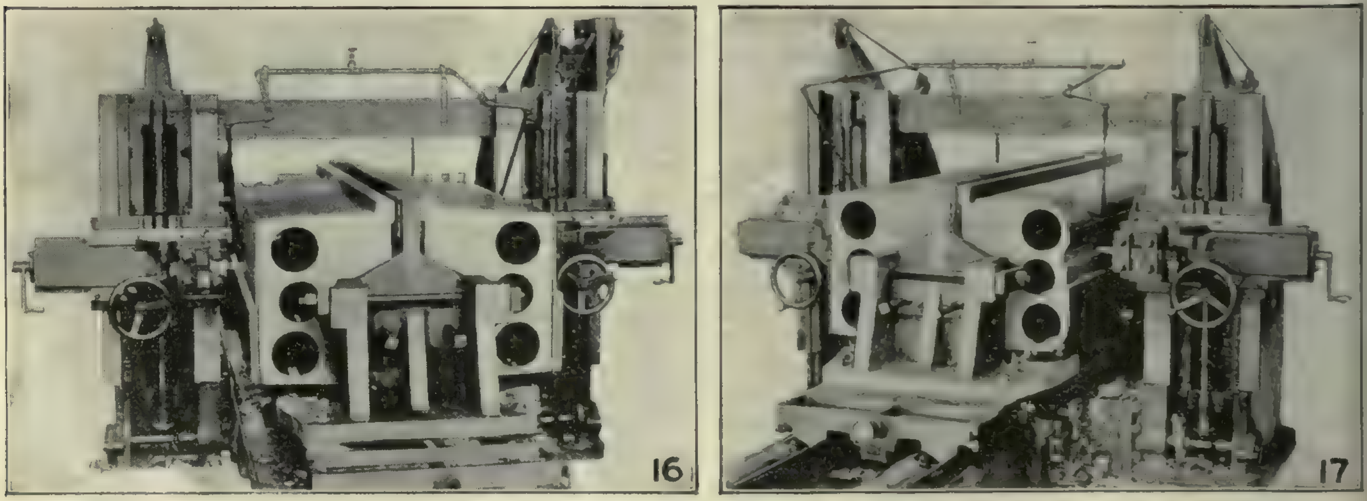
Counterboring the end of both reservoirs 2⅜ in. deep to form a seat for the reservoir caps and preparatory to machining the threads for the securing nuts.

One Otis type-5 boring mill was used, the end of the boring bar being fitted with a boring head having two inserted carbon-steel step cutters turned and ground to the proper radius, so that the two diameters in the counterbore were finished in one cut. The end of the cutter head carried a loose bronze pilot ring to support and center the bar in the reservoir bore.

Revolutions of boring bar, 12 per minute. Peripheral cutting speed of 8$\frac{9}{16}$-in. diameter cutter, 27 ft. per minute. Feed was by hand, by means of an extended feed-worm shaft on which two handwheels were installed. Average time setting sleighs and counterboring both reservoirs, 2½ hr. This operation was combined with one other at the Arsenal so that the times cannot be compared. Lard-concentrate oil was used on cutters.

Operation 15

Removing surplus material from bottom of sleigh preparatory to forming is shown in Figs. 16 and 17.



FIGS. 16 AND 17. PLANING TWO FORGINGS ON A SPECIAL PLANER

Four Otis type-2 side head planers 49 in. between heads were used on this operation, planing two sleighs on substantial holding fixtures at one setting. The amount of material removed varied considerably with the forgings.

Cutting speed 30 ft. per minute. Return speed, 38 ft.

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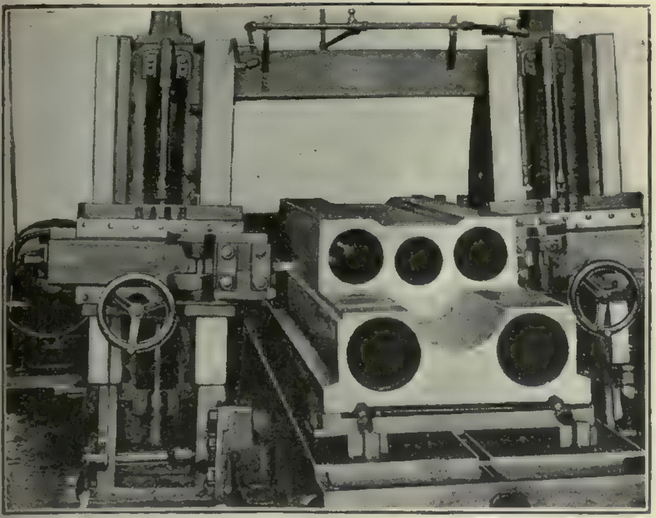


FIG. 18. SPECIAL PLANER WITH UPRIGHTS SET AT AN ANGLE

per minute. Average time of this operation including setting was 20 hr. Cutting compound was used on the tools. No record of Arsenal time on this operation.

The planers were also used for planing the slot underneath the gun clearance preparatory to finishing on type-11 milling machines. This work was finally done by milling on type-6, horizontal-spindle slab milling machine in operation 24.

The planer tables had worm and rack drive and each planer was operated by an individual constant-speed alternating-current motor through a countershaft from which the power was transmitted to the planer by means of reversing belts. An adjustable ratchet power feed connected both heads; the handwheel operation for the heads was connected to the feed through a worm and gear nut by which the heads could readily be moved by hand while the automatic feed was engaged.

Later experience with the so-called rotary planer heads, as used on Operation 1, indicated that the removal of surplus metal such as encountered in this operation, could be accomplished by that method in much less time and with a saving in power.

OPERATION 16

Finish planing both sides of sleigh to an angle of 87 deg. 30 min. from the horizontal is shown in Fig. 18.

Six Otis type-2 planers with housings set at the correct angle were used in this operation. Planer cutting speed, 30 ft. per minute. Return speed, 38 ft. per minute. Average time of operation including setting time, 9 hr. Cutting compound was used on the tools. Time at the Arsenal on this operation was 9.61 hours.

Before the installation of type-4 milling machines it was necessary to use planers to assist in removing the excess material on both sides of the sleigh in addition to taking the finishing cut.

Setting the planer housings at the required angle made it possible to locate the sleigh on the setting fixtures and plane both sides at one setting, thereby avoiding the necessity for setting the sleigh on an angle fixture, in which case only one side could be planed at a time. The housings were set to angle by inserting bevel wedges between the bed and housings. These wedges could be removed if necessary and the housings set vertically by installing a longer cross girt. The planers otherwise are the same as used on operation 15 except the distance between toolholders is 39 in. instead of 49 inches.

OPERATIONS 17, 18 AND 19

Finish slab milling outside of three cylinder walls. Four Otis types-6 slab milling machines were used. Figs. 19 and 20 show two of these operations. Spindle revolutions, 9 per minute. Peripheral speed of cutters: Operation 17, 29 ft. per minute. Operation 18, 33 ft. per minute. Operation 19, 33 ft. per minute. Table feed 30 in. per hour. Average time setting and removing the sleigh and in milling the three operations, 9½ hr. Cutting compound used on cutters. The time on this operation at the Arsenal was 15.58 hours.

In the original planning of the machining operations on the sleigh, this method of removing the surplus material was decided upon in preference to planing, as it was believed it would result in saving in time because the fixed peripheral speed of the cutters, coupled with continuous cutting with a predetermined feed, would not be subject to the whim of the individual operator. The experience with slab milling in the several operations on type-6 machine was that their extremely heavy spindles and arbors and their worm gear drives eliminated to a marked degree the vibration and chatter inherent to spur gear driven machines, so that much time was saved by giving the milling machine its fullest opportunity. Many sleighs were rough planed on the cylinder walls and cutters used for the finish cut only, as abundant planer capacity was available. However, a number of sleighs were milled with full depth cuts in these three operations, combining the roughing and finishing in one cut, with satisfactory results in workmanship and in cutter upkeep.

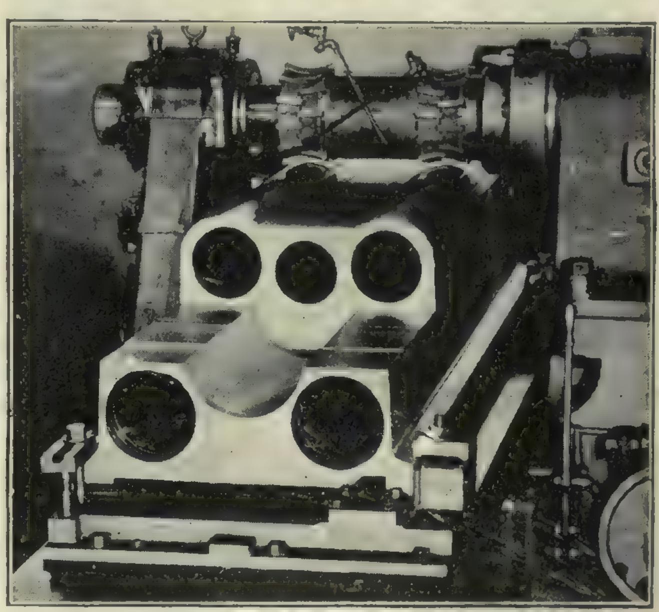


FIG. 19. RADIUS MILLING

The reason for the "set up" of milling cutters in three operations was due to the original recuperator design which left a square pipe-boss at the end of the sleigh between one of the recoil cylinders and the recuperator cylinder. In operations 17 and 18, the cylinder walls were milled throughout their entire length. In milling the third section, in operation 19, the cutter was stopped upon reaching the line of the pipe boss. This lug was milled off on all the completed sleighs after the design was changed. Had the lug been

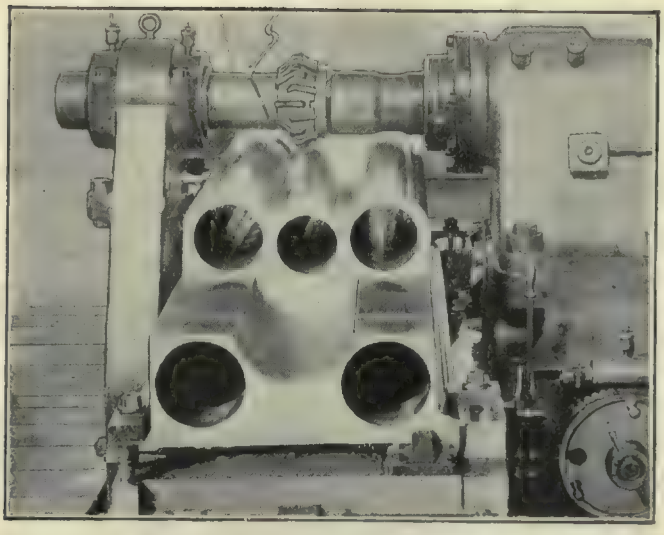


FIG. 20. ANOTHER MILLING OPERATION

omitted from the design in the beginning the three cutters would have been combined on one machine when used for finishing cut only, but if the work had been continued to the full contract completion, later experience would doubtless have led to roughing the walls in an earlier milling operation, instead of rough forming them on planers and finish them in a final operation.

THE CUTTER GRINDER

The electric cutter grinder shown in Fig. 21 is partially balanced by a counterweight and is readily moved on the surface plate by hand. The cutter blade to be ground is made to bear on the vertical height gate *A*, then clamped on the arbor by the handwheel *B*. The adjustable hardened contact piece *C*, at the base of the grinder, is pressed against the hardened form plate *D* that is dowelled and bolted to the surface plate on a center line with the cutter. The shape of the grinding wheel is maintained by resurfacing with a diamond the holder of which is pressed against the contact piece *C*.

OPERATION 20

Planing both slide liner seats simultaneously, and in this operation it was customary to have one man work on each side of the planer. Three Otis type-2 planers, 39 in. between toolholders, were used.

Cutting speed 30 ft. per minute. Average time setting and removing the sleighs and machining, 11½ hr. Arsenal time on this operation was 20.61 hours.

A mixture of ten parts paraffin and one part lard oil concentrate was applied with a brush to the cutting tools.

Removal of the metal to form the seat for the bronze slide liners was a trifle difficult due to the interference of the outer lip and the need for the close machining tolerances on account of interchangeability of liners. Forming tools were used to insure accuracy and on a portion of the operation special toolholders with clappers set in vertical position were inserted in the toolheads to prevent interference with the tools on return stroke.

OPERATION 21

Fig. 22 shows the rough boring from solid of the semi-circular gun clearance throughout the full length of the sleigh, using boring head *A*, Fig. 23, on the taper end of the boring bar, preparatory to finish boring the taper gun seat in operation 23. The cutting tools in this head are set eccentric, the first cutter being set to $6\frac{29}{32}$ in. radius and the last cutter $8\frac{19}{32}$ in. radius, the eight intermediate cutters each being set to do their proportionate work.

Circular cutter *B* Fig. 23, was bolted on the first boring bar flange back of the eccentric head, the tools in this head being set to bore $9\frac{11}{16}$ in. radius. The cut made by the circular cutter head stops at the forward gun seat.

OPERATION 22

Finish boring the gun clearance. For this operation it was more expedient to move the sleighs to other boring mills where circular cutter *B*, Fig. 23 with cutters set to bore $10\frac{7}{16}$ in. radius was bolted on the first boring bar flange. A cutter head with cutters set to $10\frac{11}{16}$ in. radius was bolted to the third flange and cutter head *A*, Fig. 24, with cutters set to $11\frac{19}{32}$ in. radius, was bolted to the fourth boring bar flange. The cut made by the first cutter head stops at the forward gun seat. A liberal supply of cutting compound was used. Eight Otis type-7 boring mills were used for both operations. Boring bar revolutions 5½ per minute. Peripheral cutting speed of eccentric boring head, 25 ft. per minute. Peripheral cutting speed of largest diameter cutter head, 34 ft. per minute. Table feed 7 in. per hour. Average time setting and removing sleighs and machining, both operations, 26 hours. Arsenal time on operations 21 and 22 was 18.68 hours.

OPERATION 23

Finish boring the gun-seat taper in the forward end of the sleigh. Taper boring head *B*, Fig. 24, was used, the table remaining stationary and the toolholders in the taper head were fed into the cut by means of the star on the feed screw. Circular cutter head *A*, Fig. 24, fitted with four 45 deg. angle cutting tools, was bolted to the rear boring-bar flange and was used for facing the chamfer in the gun-clearance bore at the forward line of the breech pocket.

Two Otis type-7 boring mills were used. Boring bar revolutions, 5½ per minute. Peripheral cutting

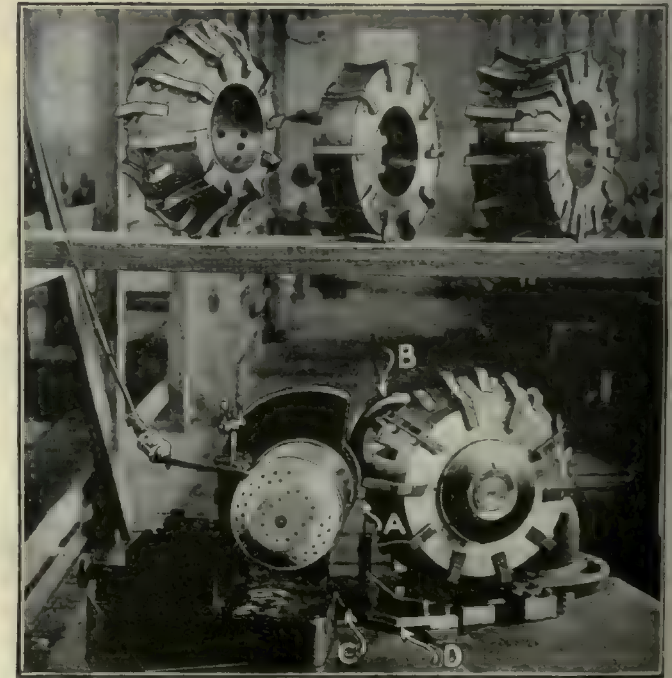
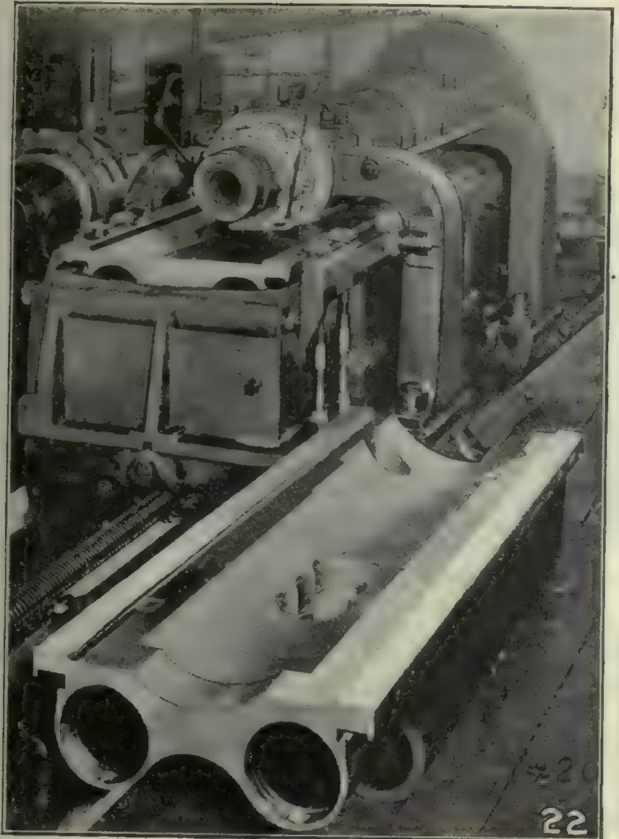
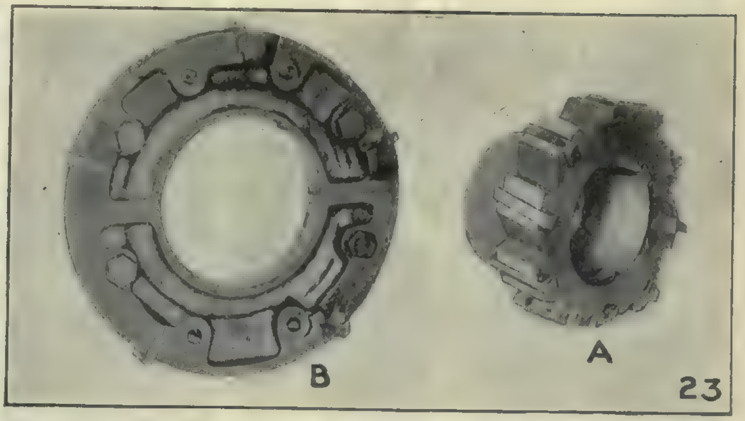


FIG. 21. GRINDING AN ANGULAR CUTTER





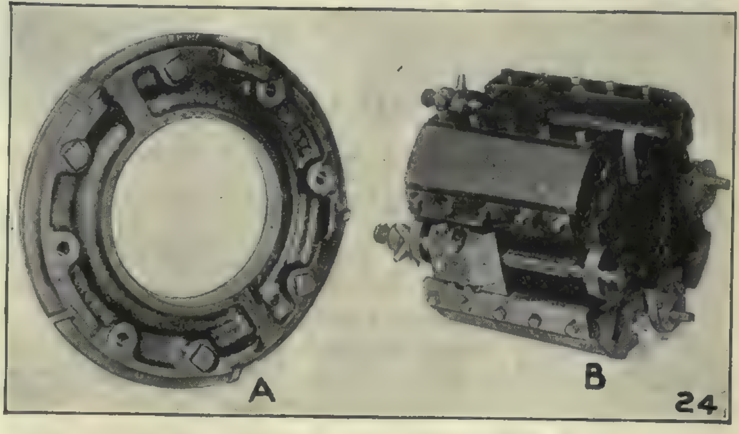


FIG. 22. BORING THE GUN CLEARANCE. FIGS. 23 AND 24. CUTTERS AND BORING HEADS

speed of the circular cutter head was 34 ft. per minute. Average time setting and removing sleighs and in machining, 2½ hours. Arsenal time on this operation was 6.33 hours.

OPERATION 24

Milling away portions of the metal for a length of 43½ in. at the reservoir end of sleigh to partially compensate for the overhanging weight of the Howitzer. One Otis type-6 milling machine was used. Revolutions of spindle, 8½ per minute. Peripheral cutting speed of 14½-in. diameter cutters, 31½ ft. per minute. Table feed, 22 in. per hour. Average time setting and removing sleighs and machining, 2½ hours. Arsenal time on this operation was 9.91 hours.

This operation was originally done on vertical spindle milling machines where the average time was 12 hr. A slight modification in the design of the slots to be milled made it possible to do the work on horizontal spindle milling machines with slabbing cutters and resulted in considerable saving of time. In this operation as in all others on type-6 milling machines, it was customary after grinding the cutters, to raise the hardened setting plates on the holding fixtures to compensate for the reduction in cutter diameter.

OPERATION 25

Milling 7⅞-in. wide slot from the breech end to the taper gun lock at the front end of the sleigh is shown in Fig. 25.

One Otis type-6 slab milling machine was used in this operation. Spindle revolutions 6 per minute. Peripheral cutting speed of 20½-in. diameter cutters, 32 ft. per minute. Average time setting and removing the sleigh and in milling the slot which had previously been planed was 2¾ hr. To this time is to be added 3½ hr. for planing the 5-in. slot, making 6¼ hr. total average time to rough and finish mill the 7⅞-in. slot. A liberal supply of cutting compound was used. This operation as performed at the Arsenal was included with four other operations so that the times can not be compared.

The milling cutter used in this operation did exceedingly good work, and this method of machining the slot was more satisfactory and less expensive than by rough planing and through finish milling on vertical milling machines, as the work had previously been done. The cutters in this milling head, as in all other cases where large surfaces were being machined, had grooves ground into their cutting faces to break the chips and prevent chatter. The grooves were ground spirally with the cutter head, leaving perfectly smooth finished surfaces on the work.

OPERATION 26

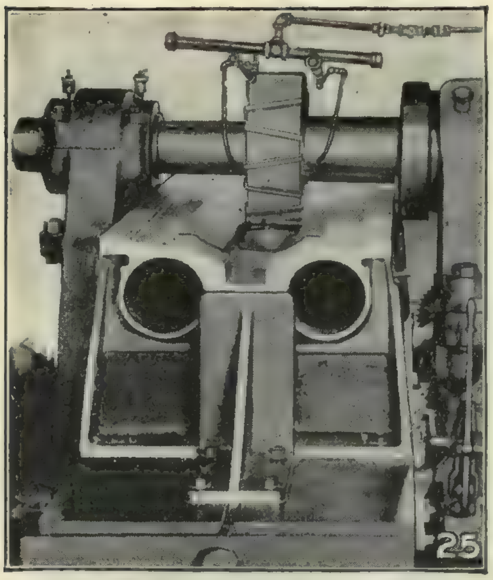
Drilling three 7⅜-in. holes, forming a pocket in the middle of the sleigh underneath the gun to reduce the weight of the recuperator is shown in Fig. 26. Three Otis type-5 horizontal boring mills were used.

Boring bar revolutions 17 per minute. Peripheral speed of 7⅜-in. diameter drill, 33 ft. per minute. Boring bar feed, 6 in. per hour. Average time setting and removing sleigh and boring the three holes after 7⅞-in. slot had been milled, 4½ hours. The time for this operation at the Arsenal was 14.83 hours.

OPERATION 27

Fig. 27 shows milling the outside walls of recoil cylinders over that portion which was left unfinished in operations 17 to 19. Two Ingersoll vertical spindle milling machines were used. Revolution of cutter spindles, 25 per minute. Table feed, 45 in. per hour.

Machining a number of the sleighs required 18½



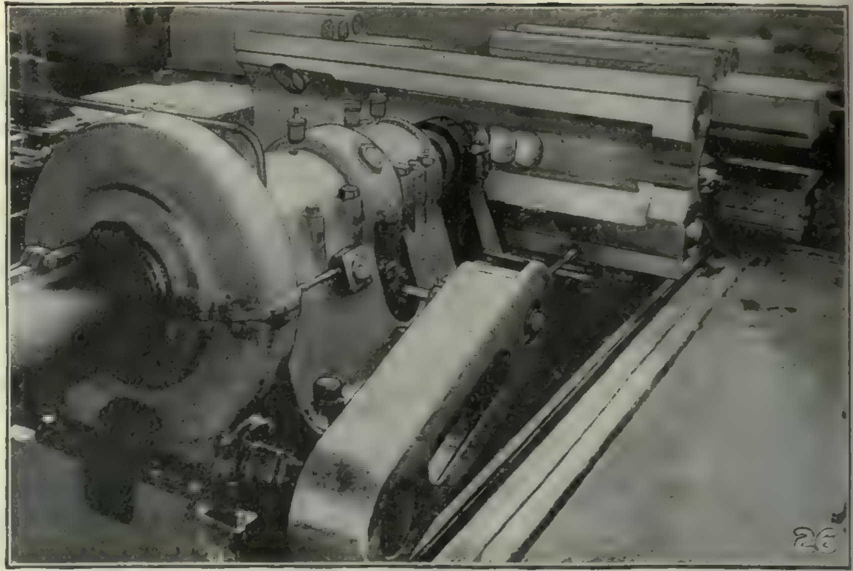


FIG. 25. MILLING A WIDE SLOT. FIG. 26. DRILLING TO REDUCE WEIGHT

hr. for this operation. This time was finally reduced on an average, for setting and finish milling in one cut, to 7½ hr. by previously rough planing the corners in conjunction with operation 16, which required three hours additional time, making the total time 10½ hours. The time on this operation at the Arsenal was 8.68 hours.

The sleigh was set in holding fixtures with hardened steel locating plates, the fixtures being doweled and bolted to the milling machine table. The depth of the milling cut was fixed by the hardened circular disk, forming a tool setting gage; this gage was also doweled and bolted to the milling machine table in correct relation to the holding fixtures thus insuring uniform thickness of cylinder walls, as the sleigh was set in similar holding fixtures on the boring mills where the cylinders were finish bored and reamed.

OPERATION 28

This operation consists of milling the outside cylinder walls of both reservoirs and is similar to operation 27. Three Ingersoll vertical spindle milling machines were used.

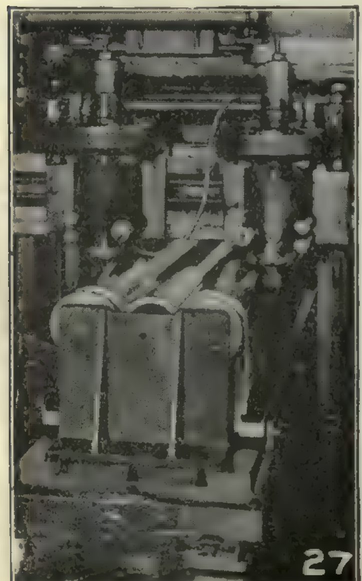
Revolution of cutter spindles, 25 per minute. Table feed, 36 in. per hour. Machining of a number of the sleighs required 35 hr. but in the later developments, increasing the cutter speed and feed resulted in finally reducing the time for setting and milling, making the average time 17 hours. The time on this operation at the Arsenal was 10.52 hours.

Holding fixtures and cutter setting gages were used on the machine tables for this operation, same as in Operation 27.

OPERATION 29

Fig. 28 shows completing the milling of that portion of reservoir walls left unfinished by the Ingersoll milling machines in Operation 28 due to large diameter of the milling cutters. One 45-deg. angle portable milling-machine was used for this operation. Average time on milling both reservoirs, 6 hours.

It was originally intended to chip away the surplus metal with air chisels. This did not prove satisfactory and the portable milling machine was designed for the purpose. The machine was held in position by an expansion sleeve extending into the reservoir bore



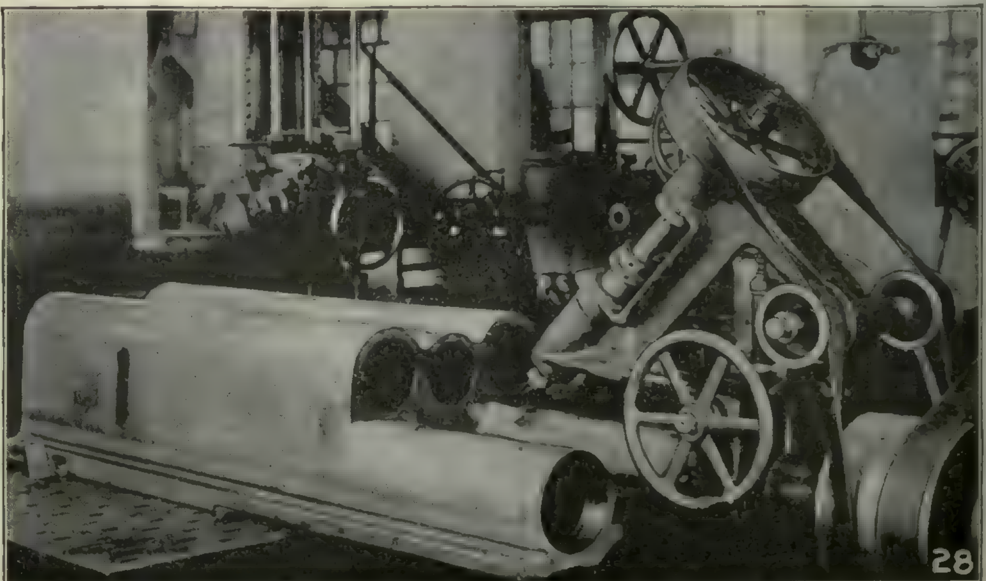


FIG. 27. MILLING OUTSIDE OF RECOIL CYLINDERS. FIG. 28. AN ANGULAR MILLING DEVICE

clamped by means of the handwheel at the pulley end of the shaft which actuated wedges in the sleeve. The entire frame was then rotated by means of the handwheel at the end of the wormshaft. The worm meshed into a worm gear keyed to the sleeve and the operator in revolving the handwheel moved the frame in a semicircular arc. The work in this operation was done at the Arsenal by chipping and filing and the time was 38.28 hours.

OPERATION 30

Rough milling the locking wedge pocket in the breech end, the forward gunlock and the center pocket. Fifteen Otis type-11 milling machines and three Otis type-12 milling machines were used.

Spindle revolutions for type-11 machines, 45 per minute. Peripheral speed of 4¾-in. diameter cutter, 56 ft. per minute. Average time of this operation on the first 120 sleighs was 129 hr. This was reduced to an average time of 60½ hr. on the next lot of 164 sleighs by training operators in the correct use of the various cutters and in limiting the portion of the work performed by each man. The operation was divided into three sections:

(A) The first setting consisted of rough-milling the entire breech end to the depth of the first shelf. The sleigh was then moved to another machine for another partial operation.

(B) The second setting consisted of rough-milling the breech end and bridge to within ⅛ in. of finished dimensions; a partial operation.

(C) The third setting consisted of rough-milling the forward gunlock and finish milling the center pocket.

A liberal supply of cutting compound was used on the cutters. Average time for the complete operation on ten carbon forging sleighs was 47½ hr. and this time would doubtless have been further reduced if the work had continued. The time on this operation at the Arsenal was 102.02 hours.

The milling cutters used in this operation were designed by Mr. Kirchenbauer after various attempts had been made to economically remove the large mass of metal with regular cutters.

The cutter shown in Fig. 29 was made spirally, like a hob with round nose cutting edges, making a strong hog nose tool with small chip space and it proved to be an excellent tool for removing the metal rapidly.

Foreign Buyers and the U. S. Dollar

Discussing the subject of foreign exchange and its influence on American business, Malcolm Stewart, manager of the Cincinnati Chamber of Commerce Foreign Trade Department, says, in the *Cincinnatian*, the official publication of the Cincinnati chamber:

"The matter of foreign exchange presents many difficulties in the way of commerce between nations at the present time. A very unfavorable impression has been created towards the United States in certain foreign countries, because the currencies of these countries have depreciated to such a point that it appears impossible to make any purchases. However, this is not the truth. When hard times come a large number of business men get a grouch, become discontented and look around for something to blame it on. The importer in those countries which have depreciated currencies, seems now to have the desire to blame it on the high price of dollars, when as a matter of fact, dollars are not high priced. The only trouble is that the paper money in the country of the foreign exporter is cheap.

"A great many American manufacturers have aggravated the situation above mentioned by making all quotations in United States dollars. The foreign buyer is peeved very greatly over the fact that his own money is not worth much and it takes so much of it to buy the dollars that he feels like cussing, and the most convenient thing to cuss at the moment is the dollar exchange. By a very simple process he could be switched off and made to cuss his own paper money.

"For example, gold is gold the world over. Any manufacturer of America who receives a request for quotations can immediately ascertain information from his bank what the equivalent of the American valuation would be in the gold coin of the country from which he receives the inquiry, and he could at once quote the foreign buyer in the gold money of his own country. Then, if it is necessary for the foreign buyer to put up paper money to buy the gold coin, he would immediately begin to rave about the cheapness of his own paper money in comparison with the metal and think nothing further of the difference between his paper and the good American dollars.

THE VALUE OF PAPER

"When we come to a full knowledge of the fact that paper is not a value and that it is only good in so far as it represents real value, we will readily understand why certain foreign currencies are so greatly depreciated. There is a limit to the amount of money that a printing press can turn out and still is accepted at its face value. Therefore, if prices are fixed the world over in gold, the American manufacturer need have no fear whatever of competitors from countries which have depreciated currencies if he will make his quotations as above outlined in the money of the country in which he wishes to sell. He will do more business, because a foreign buyer will more readily see that the American prices are right; and taking the quality of the goods into consideration he will be able to buy in the United States as cheaply, or in some cases, more cheaply than in European countries."

Are Hollows Worn in Hammer Handles by the Fingers of the User?

BY E. A. SISSON

Replying to L. L. Thwing's article under the above title which appeared in the *American Machinist*, Vol. 54, page 980, I wish to state that I have a Millers Falls hacksaw frame on which the bead on the wooden handle next to the ferrule has been worn five sixteenths of an inch by the thumb while using. This particular frame has been in use twenty-five years and aside from the wear mentioned is in perfect condition.

In the plant of C. B. Cottrel & Sons, Westerly, R. I., there was employed over thirty years ago a man, Jack Booth by name, whose duty it was to chip and file racks used in presses which the company manufactured. Booth had done this work for years and the imprint of his fingers was worn into the handle of the hammer he used to a degree that was astonishing.

Undoubtedly there are a few old-timers who remember Booth and his hammer, and as far as my knowledge goes Bill Andrews or Fann West will remember the writer and vouch for his statement

Ethics of the Machine Shop

By John S. Watts

There have been frequent references of late, to the increased efficiency of all classes of labor, especially since the demand for labor fell off, and from all sides we hear it asserted that since jobs are hard to find, the output of the individual worker has increased considerably over what it was when men were scarce and work plentiful. I have not heard of the statement being denied by any of the representatives of labor, and I am sure that its truth will not be disputed, as the facts are too widely known and too easily checked, to be denied.

This conduct, especially on the part of the skilled trades, has led me to study the morality of such actions, and in my opinion the question is deserving of deep consideration from all interested in the advancement of the mechanical arts.

The immorality of this conduct lies in the giving of as little work as possible for as large a payment as can be secured, and still hold the job. The majority of those guilty of this conduct do not, I believe, give much, if any thought to the rights and wrongs of the question, and those few who do defend it upon the ground that they do, even when slacking in good times, return full value for the pay they get, and that in bad times they work harder because compelled to do so by the competition of their fellow workers.

Examining this defence that the smallest day's output is equal in value to the wages received, we find that we have no real criterion on which to base the value of any man's work, except by comparison with what others receive, and the value of the others' work, in terms of money, is equally hard to evaluate. The only trade that seems to offer a possibility of fixing the unit value of an hour's labor in actual wealth in goods is the agricultural, where it can be determined with some degree of exactitude how many hours of labor plus a fixed degree of skill will produce an average quantity of wheat or other food.

However, this defence that the lowest rate of production given is fair value is not admissable, for the reason that when a man accepts a given hourly rate for his labor, there is an implied, if not an actual, contract, that he will give in return the best value of which he is capable.

That a rate less than it should be may have to be accepted under the compulsion of poverty is not justification for giving less work in return. Let the man who thinks so imagine a parallel case, such as the storekeeper, who because of a falling off in the demand for his goods is compelled through need of money to sell his goods at less than they cost him. If our friend ordered five yards of cloth from this merchant at the reduced price, he would consider it robbery if the merchant palmed off only four yards on him, or substituted a cheaper quality, and would be highly indignant if his own argument that value equal to the money tendered was used by the merchant.

The very machinery which the slacker has worked on in hard times is often sold by his employer at less than its actual cost, because of the absolute necessity of the employer finding money to pay his employees with. A manufacturer, who in such cases attempted to supply a machine in any way inferior to those sold at the higher prices, would not stay in business for any length of time.

In both of the above parallel cases it is demonstrable that the money received is less than the value of the services rendered, that is, the storekeeper or manufacturer, selling at a loss, receives no salary whatever for the time spent in handling the goods, or for the use of his capital and plant. In the case of the employee, he would be hard put to it to prove that the lowest pay he received was not equal to the value of his labor. Not that I would assert that it is, but simply that it is impossible to absolutely prove that it is not.

Although if the skilled mechanic, or even a laborer, will compare the hours he works and the conditions under which he labors, with the hours and difficulties of a skilled farmer, and the relative remuneration of each, I think he will be at least doubtful as to whether he is giving full value in return. Then again, the farmer has to wait a year to know what his remuneration will be, because while he does actually produce a measurable value of material, what he will get for his surplus after feeding himself and family is an unknown quantity, depending to a considerable extent upon the wages paid to the town workers who manufacture the clothing, fuel, machinery, etc., which he must purchase. On the other hand, the town people, being paid usually weekly, or monthly, can estimate closely the value of their wages in necessities, as the prices do not vary so much in that short space of time as they will in a year.

It is only natural, that in making out a case for an increase the wage earner should choose for comparison that other occupation which appears to be better paid than his own. This procedure, however, leads in an unending demand from first one and then another trade for adjustment, and will never produce a final decision. Therefore it should be discarded, and in its place, the remuneration received by the workers in some basic trade, such as agriculture, should be used as the fixed unit, to be used in calculating the fair wage for all classes of labor.

To loaf on the job because of a feeling that one's trade, or class, is not receiving its fair share in the distribution of wealth, is simply to defeat one's own object, as the less wealth produced, the less there will be to be distributed, and in the end the weaker will be still less able to enforce their demands. If the machine-tool manufacturers decided they were not receiving sufficient pay for their work, would they sit back and take it easy, and let the output look after itself? I think not.

Evidently, then, this slackening of effort, accompanied by demands for higher remuneration, is characteristic only of the wage earners in factories, and as it would be absurd to suppose that they are any less moral than other classes of the people, we must look deeper for the motive for this action. The difference, I think, lies in the fact that a manufacturer is too far sighted to attempt to do anything so crude and useless, as to cut down the quality of his product to match a temporarily lower price. The most successful method he has is to increase the value of his product beyond that of his competitors, and by so gaining extra trade, be enabled to recoup himself for his extra ability and work. This method takes time, patience and perseverance, but is in the end the most universally successful, and is the only one that will bring the factory employees that higher living which everyone is willing and anxious they should have, but which in the final analysis, must be earned by themselves.

The idea they must digest is, that in the case of all successful movements success was earned by strenuous efforts over a long period of time, before it could be enjoyed, as in this world one must look far ahead and not expect immediate reward for every little thing we do, over and above what is actually expected of us.

The fear that any additional effort on the part of the employee simply adds so much more profit to the employer, is one that must be eradicated by intelligent leadership of labor. Granted that at first the additional output so gained will revert largely to the employers benefit, it must be remembered that we cannot gain ourselves without profit to others, as we are all interdependent upon each other's efforts. The long view must be taken, that a factory filled with efficient workers will never need for profitable work. That the only sure criterion of the value of our work is the profits made by the company employing us. That the dividends paid by almost all companies are public, and well known, and it is not difficult to decide the point when capital is getting over its share of the profits. That a continuously successful company will be only too glad to share its prosperity with its employees, and cases are numerous where this prosperity has been shared with the employees.

If your complaint is that some other employee is getting more than he ought to, why not train yourself for his job. You will get it if you go about the matter with energy, and when you do, you will, I think, decide he was earning every cent he got; and if the man who gets your old job, does not do any better at it than you did yourself, there will be some comments from you about it. Such is human nature.

A Nut Castellating Fixture

Special Correspondence

The nut castellating fixture used in the Peerless plant and shown in Fig. 1 is mounted on a No. 12 Brown & Sharpe plain milling machine. Fig. 2 shows the details, this fixture being arranged to handle from ½- to ⅞-in. hexagon nuts.

The nuts are placed in the charging tubes at *A*, Fig. 2, which are filled before the machine is started. The pulley *B* drives the shaft *C* which in turn, drives the gears *D* and *E*, which can be changed to alter the feed if necessary. The gear *E* drives the shaft *G* on which are mounted the cams *F* and *F*. These cams work against the rollers *I* and *I*, mounted on the nut plunger *H*. This plunger pushes the nut out of the tubes *A* and into the tracks *J*, beyond the back plunger *L*.

This is completed at one revolution of the cam. The spring *K* then pushes the plunger *H* back to the starting point ready to take other nuts and the cams again push the nuts into the tracks. This is continued until the first nut reaches the slitting saws at *Q*. Here the nuts are all in line in tracks *J* and as the cams revolve they force one nut into each track. This action in turn forces the nuts under the cutters *Q*, mounted at *U*.

After the first slot is milled in the nuts are again fed into the charging tube *A* being turned in the proper direction to have the second slot cut. The third slot is cut in the same way.

The table *O* is for convenience of the operator on which he can place a pan of nuts. It will be noted that the fixture is set on an incline to assist in draining the water away from the mechanism and prevent its working up into the various parts. The tracks *M*, *N*

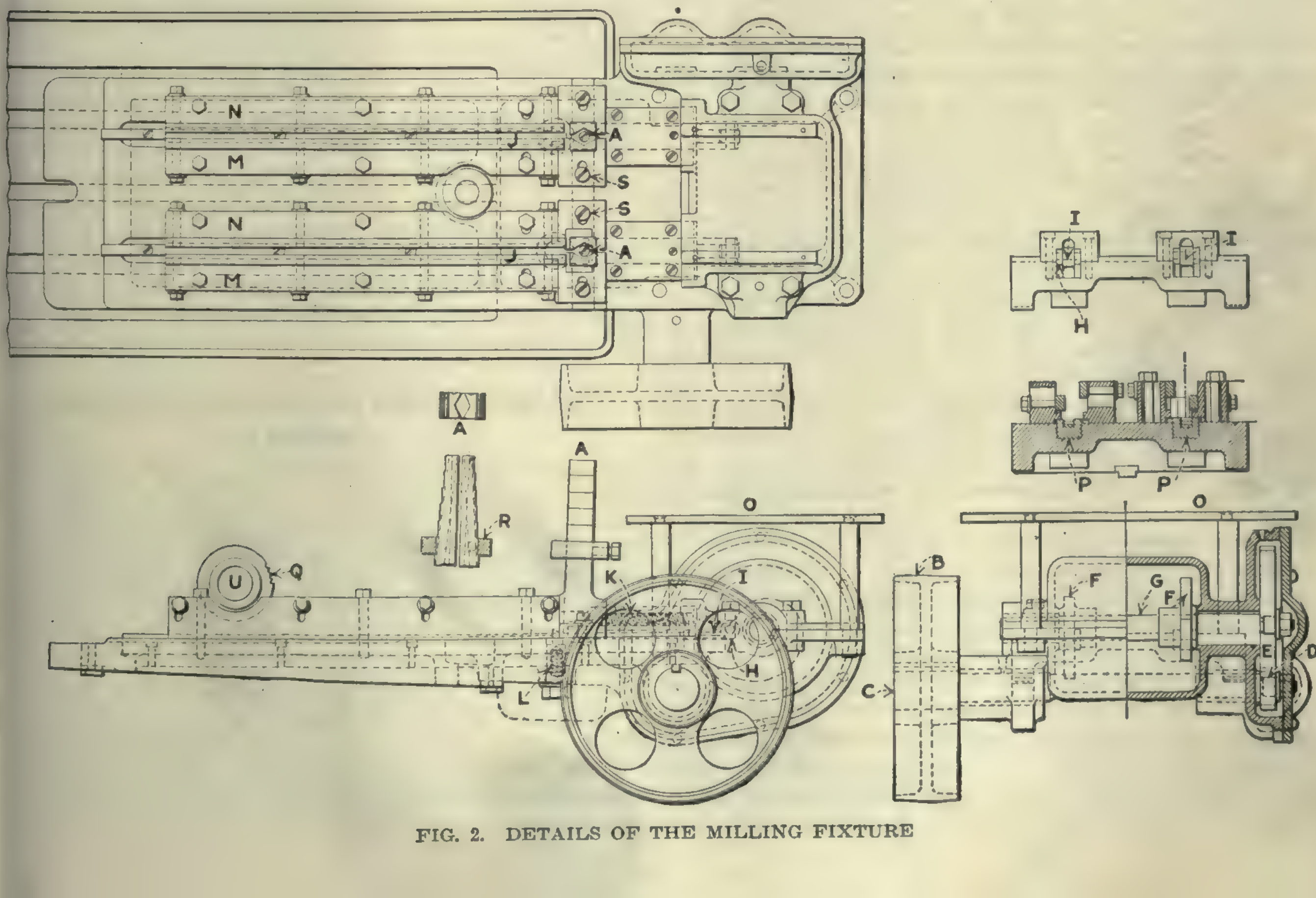


FIG. 2. DETAILS OF THE MILLING FIXTURE

and *P* are hardened and ground. In changing to the different size hex nuts, the collars *R* are loosened by means of setscrews and set to the different spaces shown in the charging tubes *A*. The tracks are also adjustable to accommodate the different sizes of nuts. As shown, the machine is set for ½-in. hex nuts.

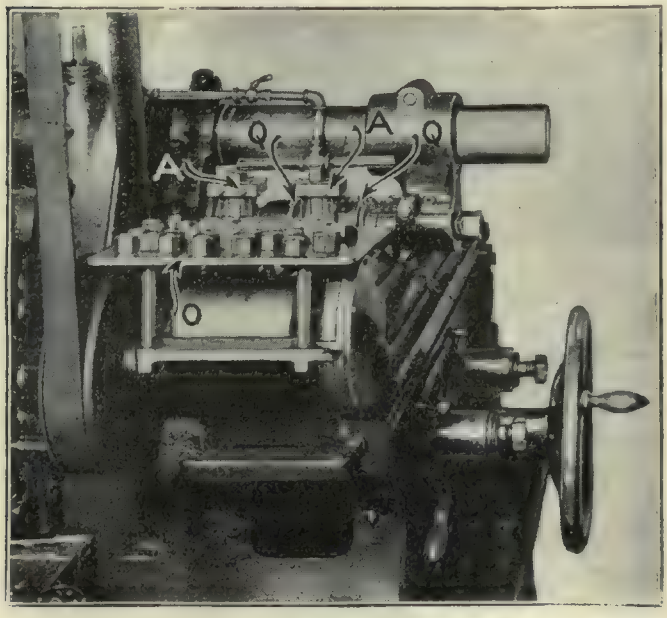


FIG. 1. MILLING MACHINE EQUIPPED FOR CASTELLATING NUTS

Maintaining Harmony in the Shop

By Robert Mawson

The article by R. A. Schultz on page 1125, vol. 54, of the *American Machinist* is of timely interest and states very clearly the condition existing in many machine shops today. In most shops and drafting rooms when a new man enters he is scarcely ever shown the "ropes" and the result is that much time is wasted both for the man and the concern in preliminaries.

The correct method is to consider that the new man is one of the family—one of the bunch if you want—and make his advent as congenial as possible. It is usually hard enough to break into a new shop without the men working alongside of you adding to your troubles.

With this in mind the new man should be shown what is the particular practice followed there as regards, say, finish on machined parts, as almost all plants have their particular desires and demands.

A case in point may illustrate this: a man went to work in a certain shop and was given a part to machine in the milling machine, and told to make a good job. He did so, using the practice followed in the shop where he had previously worked, machining the part to within a thousandth of an inch of actual size.

When the job was done the foreman said, "You were too long on that job, Bill, we don't make watches here. A good job means within a sixty-fourth of an inch and none of that Swedish gage surface either."

Now the fault was both with the foreman and the men working with Bill. Either or both should have told him what was their practice as regards a good job. Such information given would have made the man feel at home and prevented lost time on the machining operation.

Similar methods should be followed in the designing department. It is a good system to have a book of standard practice to be given to the new men so that they may see what to follow. Some plants insist on certain sizes of fillets for walls of castings of a given thickness; studs and bolts of certain sizes to agree with determined conditions, and these are not always governed or controlled by stresses in machine but are standard practice of this concern and the only way the new man can know about them is either by being shown or wasting time to find them out. It would be better for both parties if he were shown when he started on the job.

The same applies to the tool designer. Let him see how you prefer to do things at your shop and then if he can offer any suggestions the firm will profit accordingly, but if you forget to get him started right and he makes designs contrary to your practice, don't think he is a damphool for the shoe is on the other foot.

One feature not mentioned by Mr. Schultz might be brought out here, namely, the questions asked in advertisements for men sometimes seen in technical magazines or on the application blanks as to what religion or secret order you belong to.

Now for a fair question: Does it make me a better machinist or designer if I go to a certain church or do not attend any? And again: Suppose that I walk around with regalia from secret orders until I look like a comedian. Does that help me to be a better designer? Certainly not. "Meeny, meeny mini-mo" obtained from any order does not help me in figuring out stresses in machine parts.

I recall what a friend told me about going to work in a machine shop. The first week he was asked by the foreman what church he attended and when he said he had no particular preference, he was advised to go to the "Blank" church as the president of the company attended there and by so doing he would stand in better for promotion.

He replied that he came there to work as a machinist and that Sundays were not included in the arrangement and he rather thought he would attend any church he desired.

In conclusion therefore give the new man all the help you can. He needs it. Don't be too nosey as to how he spends his time out of the shop so long as he is on the job and in good condition for the week's work and the man will be happy and contented and harmony will not only be obtained, but what is of more importance will be maintained as well.

A Convenient Tool for Oxy-Acetylene Cutters

A convenient tool has been devised for use in determining the proper tips and pressures to be used in cutting metal of different thicknesses with the oxy-acetylene blowpipe. The tool is in the form of a scale graduated in inches and quarters, and having the size of the blowpipe tip and the pressure of gas to be used with the greatest economy indicated at the left of the graduation.

Some makes of blowpipes differ as to both the economical size of tip and pressure to be used in cutting metals of specified thickness. The tip and pressure indications suiting the apparatus made by two large manufacturers have been marked on opposite sides of the scale.

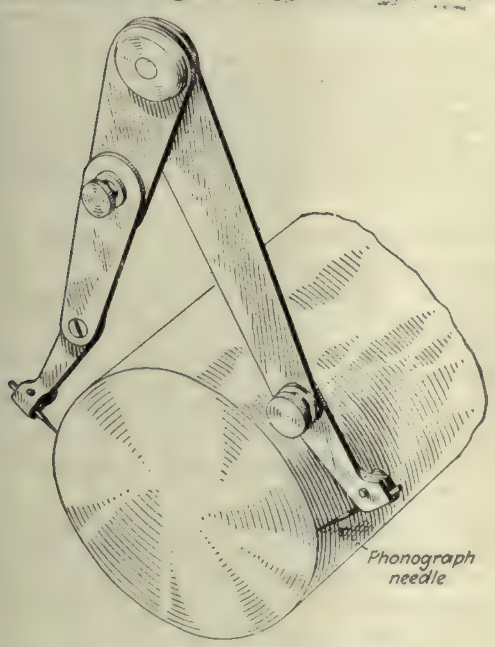
Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Divider for Round Work and for Large Radii

By W. C. Betz

To space or divide a round piece of work for drilling he divider shown in the illustration will be of value, s no small tool now on the market covers this need. 'o set the tool the legs are approximately adjusted to he chord of the arc to be spaced and the scriber points wiveled to a radial position; the tool may then be set xactly to the chord by measurement or by trial around he circumference of the work.



DIVIDER FOR ROUND WORK

The tool will also be of service as a divider of large cope by the introduction of an extension, which may e of any length to suit conditions. The tool may also e used as an inside or outside caliper by reversing the eedles as contact points.

Plaster Casting for the Machine Shop or Factory

By Homer S. Trecartin

A young mechanic, new to our shop, showed us a ioney saver the other day. We needed a pattern in hurry for making a casting of a part of a special iachine. The superintendent had made a sketch of the art and was telephoning to find a pattern shop which ould make the pattern the same day. This new boy eard the superintendent, and asked to see the sketch. Ie studied it a moment, then said, "I'll make you a attern for that in two hours."

The sketch was turned over to him with much kepticism, but he made good his promise, and I got im to tell me the details of his method.

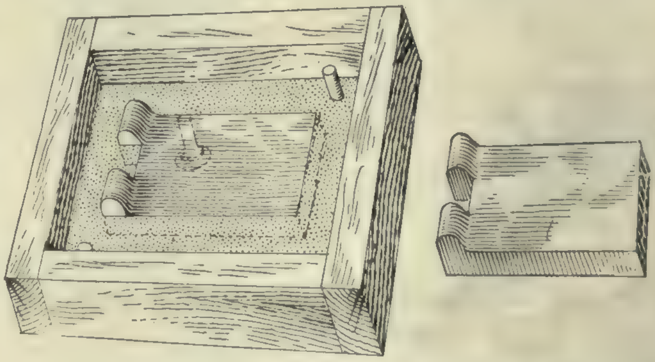
The boy made the pattern of plaster. He had worked sixteen months in a plaster-casting establishment and knew the tricks of the trade. He bought a double handful of modelers' clay for ten cents and two pounds of plaster of paris for twenty cents.

Working on a smooth flat board on the bench, he made a model with the clay the size and shape of the part to be cast. This took him twenty minutes. He took a small wooden box and placed the model in the bottom. Then he prepared the plaster. He put about a pint of cold water in a tin basin, and sprinkled evenly into it as much plaster as would absorb the water, so that the plaster came to the surface of the water but not above it. This was then stirred slowly with a spoon for fifteen or twenty seconds, until it became like thick cream.

This liquid plaster was poured into the box around the clay until it rose evenly to the middle of the model or "parting line." What remained in the bowl was thrown away and the bowl rinsed out.

Before the plaster had "set" two short ¼-in. dowels were stuck perpendicularly into opposite corners and left projecting, and two little clay cylinders were stood on the model to form a "gate," for pouring, and an "air vent."

He then mixed up a little soap in some warm water and, as soon as the plaster was hard (about ten minutes after pouring) he painted the surface of it all over with the soap solution. After this dried, he brushed it over lightly with thin oil. Then another pan of plaster was mixed and stirred and poured in like the first until its surface was about ¼ in. above the highest part of the model.



THE CLAY MODEL IN THE LOWER HALF OF THE MOLD

After waiting about twenty minutes, the sides of the box were carefully pried apart and removed. The edge of a chisel was gently worked into the "parting" line of the mold and the upper half was lifted off. The clay model was dug out, with care not to injure the still soft plaster, and the mold was cleaned out with water and a soft brush.

Then the inside of the two halves of the mold were painted thoroughly with the soap solution, and lightly oiled when the soap had dried. The two parts were then fitted together; being located by the dowels.

Now a third batch of plaster was mixed, a little thinner than the first, and was at once poured into the "gate" hole in the mold.

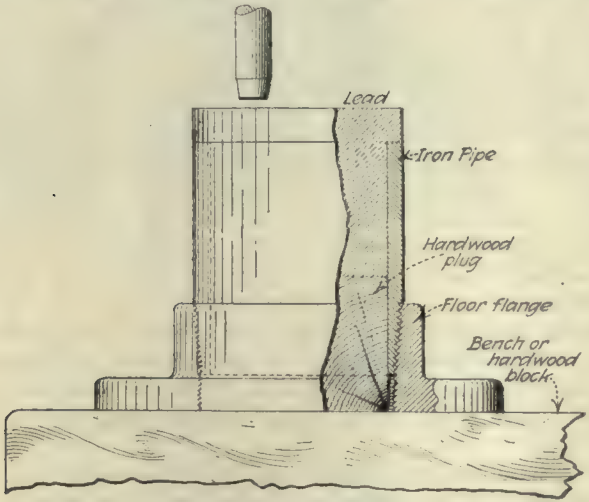
The cast was allowed to set for thirty minutes before the mold was removed. Only a slight tapping on the mold was needed to loosen it from the cast.

This method is simpler in practice than it sounds in the telling. Its use can be made especially economical in experimental work, where a clay model of a part may be made more readily than a drawing.

Bench Punching Stand

By H. H. Parker

The sketch shows a useful contrivance which may be screwed to the workbench or to a hardwood block and used for punching and similar work. A length of 2- to 3-in. iron pipe, threaded at one end, is sawed off and the cut end trued up, then screwed tightly into a floor flange. A strip of sheet iron is bent around the top of the pipe and wired on so that it will extend about ⅜ in. above the open end. Then the pipe is filled with molten lead or old babbitt metal even with the top of the sheet-iron mold, which is removed when the lead has cooled. In order to conserve lead, the lower part of the pipe may be filled with a hardwood plug.



A PUNCHING BLOCK OR SOFT ANVIL

If this punching face becomes marred from usage it is an easy matter to drive or melt out the lead and pour over again.

A Device for Fluting Wobbler Ends of Rolls

By Martin H. Ball

The accompanying drawings show a device designed for fluting the wobbler ends of rolling mill rolls on a 48-in. McCabe engine lathe. The rolls were made from forgings of an especially strong grade of steel. The device is also suggested for use on castings where trouble is experienced in getting the wobbler ends true enough by the casting method.

The boring bar is screwed onto the end of the lathe spindle and the roll is clamped on the cross-slide of the lathe carriage, as shown in Fig. 1. The locating block *A* is made to the proper height to bring the center of the roll to the height of the spindle center and is fastened to the cross-slide with two bolts *C* and *C'*.

The clamping block *B* is held in place by the two bolts *D* and *D'* which pass through locating block *A* and into the cross-slide *E*.

Both these blocks are made of hard wood. The block *A* is made of two pieces nailed together, the grain in the lower piece running at a right angle to that in the top piece. The bottom piece is wide enough to be attached to the cross-slide *E* with the two short bolts *C* and *C'*.

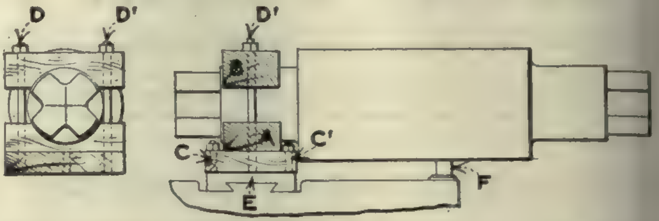


FIG. 1. HOW THE ROLL WAS MOUNTED IN THE LATHE

A parallel piece *F* is packed to the proper height and bolted to the extreme end of the carriage to support the overhanging part of the roll, and affords a smooth top surface over which the roll easily slides when operating the crossfeed screw to set the roll for the depth of cut to be taken.

The regular longitudinal feed of the lathe is used for feeding the roll along to its cut. It is advisable to take the cut on the back side of the roll as this brings the thrust of the cut downward.

In cases where the fluted part is very long in proportion to the length of the roll, a holding down strap may be required on the roll over the parallel *F*. The vertical and horizontal lines shown on the end of the roll are placed there for convenience in setting the roll to the four positions required.

Attention is called in Fig. 2 to the interlocking feature of the cutters which positively determines their position radially. They are held firmly against their backing and prevented from moving endwise by the four setscrews shown.

The cutters have no adjustment for wear as on this class of work there is a rather large tolerance for the radius, thus giving the cutters a long life. The 1½-in. crosshole through the bar is for convenience in turning the bar on and off the spindle.

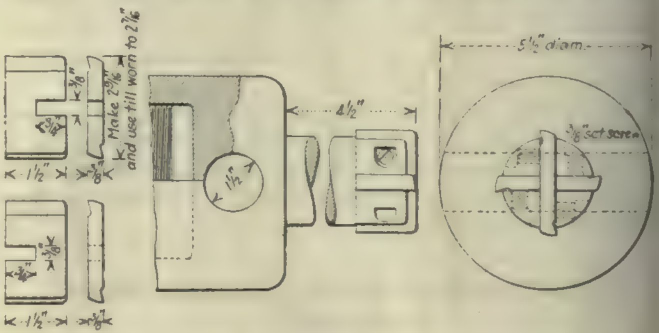


FIG. 2. THE CUTTER BAR AND CUTTERS

Changing Sizes of Cone Pulleys

By Franz Szabo

It is oftentimes desirable to change the speed ratios or to add new steps to existing cone pulleys in order to obtain additional speed ratios. To obtain the desired result "Kent" gives Dr. R. Burmester's graphical method. Following the directions as given, one ncounters some difficulties when changes in present one pulleys are desired. The directions for using Dr. Burmester's method as explained in this article will liminate these difficulties.

Let us assume for example a pair of pulleys, 6 in. in diameter for the driver, and 12 in. in diameter for the driven, and we wish to add one step to each pulley to get a speed reduction of 1½ to 1. The center distance between the pulleys to be 30 in. It is desired to find the diameters of the new pulleys using the same belt.

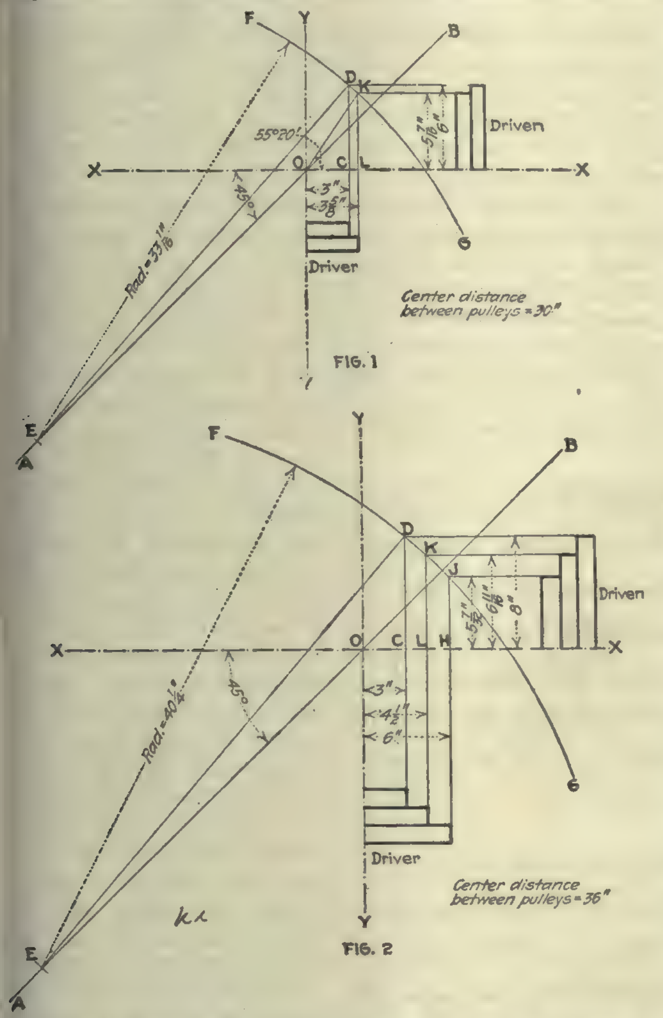


FIG. 1

FIG. 2

DIAGRAM FOR CHANGING SIZES OF CONE PULLEYS

Solution: Draw axes *XX* and *YY* intersecting at *O*, Fig. 1. Through *O* draw line *AB* at angle of 45 deg. to axis *XX*. On *XX* lay off distance *OC* equal to the radius of the 6-in. pulley, or 3 in., to some scale, the larger the better, and erect the perpendicular *CD* equal to the radius of the 12-in. pulley, or 6 in., to the same scale. Then with *D* as center, intersect *AB* at *E*, making distance *DE* to the same scale equal to 1.118 × center distance between pulleys, or 1.118 × 30 = 33.54, say 33 9/16 in. With *E* as center draw arc *FDG*. Angle *KOC* is then laid off, its tangent being equivalent to the desired ratio of the new pair of pulleys, or 1.5 in this case, the angle being 56 deg. 20 min., approximately. From *K* drop a perpendicular to *L* and the new pulley radii are represented by *OL* and *LK*, which are 3⅝ and 5 7/16 in., making the diameters 7¼ and 10⅞ in. respectively.

Another example: It is desired to reduce the feed of a certain machine having a pair of three-step cone pulleys by adding 4 in. to that step of the driven cone pulley giving the lowest feed. The diameters of the driver being 6, 9, and 12 in., and the diameter of the largest step of the driven being 12 in. before changing. What are the new diameters of the driven cone pulley so that the same belt will fit all three steps?

Solution: Draw axes *XX* and *YY*, and diagonal *AB* as previously explained. Then, as shown in Fig. 2, lay off *OC*, *OL*, and *OH*, representing to the largest scale possible the radii of the driver, 6 ÷ 2, 9 ÷ 2, and 12 ÷ 2, respectively. Then draw line *CD* perpendicular to *XX*, and equivalent to the radius of the largest new driven pulley to the same scale, or (12 + 4) ÷ 2 = 8 in. With 1.118 × center distance between pulleys, or 1.118 × 36 = 40.248, say 40¼ in. to the same scale as radius and *D* as center intersect *AB* at *E*, and with *E* as center draw arc *FDG*. Erecting perpendiculars on *XX* at *L* and *H*, the distances *LK* and *HJ* represent to the same scale the radii of the other two steps of the driven cone pulley, 6 11/16 and 5 7/32 in. in this case. The diameters are then 16, 13⅜, and 10 7/16 in., respectively.

The constant 1.118 is the ratio of the radius of the arc to the center distance between the cone pulleys in Dr. Burmester's graphical method. From the above it is seen that Dr. Burmester's method is more easily applied.

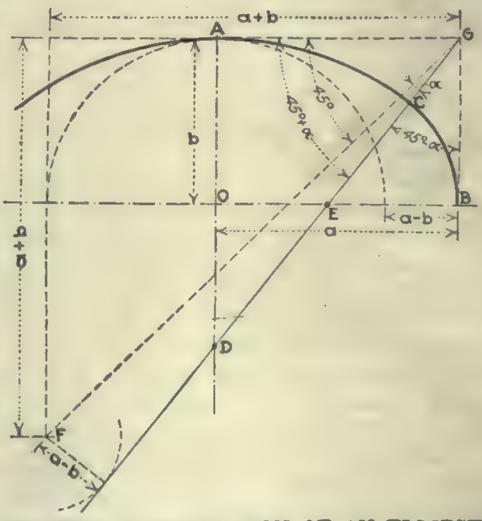
Calculating the Radii of an Ellipse

BY EDWARD HELLER

Most engineering handbooks give a method for the construction of an ellipse by two radii which gives a very close approximation of the figure, as shown by the accompanying sketch in which a is the semi-major axis and b the semi-minor axis. Lay off $a + b$ horizontally and vertically as shown. From F describe an arc with radius a-b. Draw GD tangent to this arc and the intersections D and E are centers for radii DA and EB respectively and the point of junction G is on the ellipse. Now, this method becomes inconvenient when the ellipse is very large, or on the other hand, when it is very small and is to be laid out on the job itself, it is not very accurate. To overcome this difficulty I worked out the radii mathematically and I can tell at once what the lengths of the radii DA and EB will be.

First of all it is necessary to obtain the angle α. This is equal to

$$\sin^{-1} \frac{a - b}{\sqrt{2}\,(a + b)}\,; \text{ then } AD = a \tan (45^\circ + \alpha) \text{ and }$$
$$EB = b \tan (45^\circ - \alpha).$$



GRAPHIC CONSTRUCTION OF AN ELLIPSE

IN THIS ISSUE

IN ALL our efforts to secure economy we must not overlook the foundry, for it is there that economy begins. The first article is by William H. Barry on the subject, "Elevated, Midway and Subway Gating." He advocates the use of three-part flasks on two-part work to increase production, which may appear at first to be a rather uncertain scheme, but one with which you will have more sympathy after you have finished reading the article.

There is an unusual treat this week in Tool Engineering, as it comprises seven pages, beginning with 211. It continues the subject of milling fixture design, taking up in particular the design and operation of indexing fixtures, semi-automatic and automatic indexing devices, the use of twin fixtures, and fixtures for continuous milling. The seventeen line cuts illustrate many types of fixtures that embody the principles discussed by the authors. You will be glad to know that many other readers are just as much interested in this series as you are and that some who failed to start in with the first installment have been making efforts to secure back numbers so that they may join the procession. While it is too late in most cases to secure the back numbers it is not too late to take up the series, which will run on, one installment per issue, for many months to come.

Colvin has taken enough time from his automotive articles to write several on railroad work. "Tools for Boring and Turning Locomotive Tires," page 218, furnishes data on sizes, angles of clearance, and rake of the tools together with the speeds and feeds used by seventeen of the leading American railroads. In an effort to secure some definite knowledge of present practice in tire boring and turning Mr. Colvin sent questionnaires to the leading railroads. The article referred to has been written with the results from these inquiries as a basis.

A special correspondent has supplied, page 220, an article called "Starting Right on the Gage Question." It has to do with the fundamentals and definitions adopted by the committee on plain gages for engineering work, of the A. S. M. E. Standard nomenclature for gages and gage fixtures is given, as are definitions of various types of gages and notes on their use. All of us no doubt recognize the desirability of standardizing nomenclature, but we have up to date accomplished little in that direction. It is to be hoped that all gage users will follow the work of the A. S. M. E. committee and will give their assistance toward determining standards whenever possible.

Mr. DeLeeuw takes up in Metal Cutting Tools the use of liquids when cutting metal, showing when liquid should be used for lubrication, for cooling and for washing out chips. The use of liquid has been common for some years, yet we are forced to believe that many users do not have a complete understanding as to why a liquid should be used and what kind of liquid should be used under given conditions. After you have studied this chapter you will have added something important to your production knowledge. Page 222.

Coming Features

Our next issue will be devoted chiefly to series articles, among them Tool Engineering, Machining the Wrigley Automobile Transmission Gear, The Organization and Management of the Small Shop, Modern Production Methods and Incentive or Production Basis of Wage Payment.

We are glad to announce at this time that on about the twenty-fifth of August, or the first of September, probably the former, we shall introduce a new series. It will deal with economics, a subject that is now demanding more attention from business than any other. There will be about ten installments, all short and to the point, and sufficiently elementary to be generally understood.

When everything is going well and we are able to do a good day's work we are prone to think little of the human body. W. J. Matherly, page 226, reminds us once again that proper care of the human machine is as necessary as is care for machines of metal. His dissertation is not long, but it serves to bring out some of the things that we know, yet will insist upon forgetting.

The comparison of doing work on special machines and on standard equipment is continued this week in the third of the articles by Col. Jenks and Mr. Christopherson. Planing, milling, boring and turning operations are taken up.

We regret that we have recently lost one of our old stand-by contributors, E. A. Suverkrop, better known to some as E. A. Dixie, and familiarly known at the *American Machinist* office and among some of the plants as "Suver." Mr. Suverkrop died recently after a short illness. We still have one or two of his articles to be published. There is a brief story of his life in our news section.

Some of our articles are necessarily short, which is not an indication that they are lacking in quality. We call attention to "Foreign Buyers and the U. S. Dollar" page 233 and "Ethics and the Machine Shop" page 234. The first discusses depreciated currency and paper money. It contains some advice that exporters will do well to appropriate. The other is a discussion by John S. Watts on the efficiency of labor.

EDITORIALS

The Passing of Rule-of-Thumb Methods

MANKIND, especially the variety that flourishes in these United States, is prone to be satisfied with methods that are almost good enough provided they produce results that will pass inspection. The enlightened Westerner smiles condescendingly at the Oriental who is content to do things as his grandfather did, but in some respects he is but little better than the man he pities.

Take for example the art of turning metal. What real advances have been made in the actual method of separating the chip from the work in the last generation? We shall not carry this line of thought further as to do so would be to steal some of Mr. DeLeeuw's thunder. The illustration is but one of many that might be cited.

The machine shop owner or manager who employed a trained scientist to solve his more intricate problems twenty or even ten years ago would have been considered well on the way to his second childhood. It just wasn't done.

But today the visitor in a thoroughly modern plant where fine machinery is manufactured cannot but be struck with the contributions of science to the excellence of the product. Not that the scientist does not make mistakes—he does, for he is only human, but he brings to his task a mind especially trained for the work in hand and a knowledge that combines the experience of many men.

This attitude of management toward expert scientific advice and ability is one of the most encouraging factors in the outlook for American machinery manufacture. It means that every possible means is being employed to reduce manufacturing costs and that we may hope to compete with European products without lowering the living standards of our workmen.

The respect for scientific education has been increasingly evident at recent meetings of some of the big engineering societies, notably the Automotive Engineers. A few years ago it was sufficient to build an automobile that would run without an undue amount of trouble and expense, whether the builder knew much about what actually went on inside the cylinder or not. Gasoline was cheap and the buying public did not know enough to be very critical of engineering inefficiencies. It may have been the threatened shortage of fuel and consequent price rise that did it, but anyhow there has recently been keen interest in what happens to the fuel charge drawn into the combustion chamber, with a view to improving the mechanism so as to eliminate some of the seventy-five per cent or more of waste that now goes on. We may not get tangible results at once but there is a rumor of a forty-mile-per-gallon car developed as a result of this research work, which is approaching a marketable stage.

Not every manufacturer can afford scientific advice, the real thing comes high, but he can at least take advantage of the information that is available to all and turn it to his own advantage, rather than to look askance at something his father never heard of.

The Right Price

SOME of the automobile builders are showing indications of buying new machine equipment while others are releasing orders which have been held up for delivery. But the question of price is being very carefully considered.

One large buyer is requesting that the machine builders furnish a statement of the price of the machine in 1914, in 1918 and in 1921. This is for comparison as to increase and the reduction from peak prices. The automobile builder then compares the prices of the machines with those of his own product. If the reduction has been in proportion to his own, no further questions are asked. If not, he passes to other machines which have come nearer to his own percentage of reduction.

This is much fairer than the usual demand for reductions regardless of the advances made. It gives the machine builder who advanced his prices only in accord with increased costs a good chance for getting the orders he deserves. Those who demand a heavy horizontal reduction are unfair to the machine builders who did not take advantage of the necessities of the situation.

The unfortunate fact is that many prices were too low in 1914 to allow a proper standard of shop equipment, of shop conveniences and of wages. We should never go back to that condition because it was subnormal or below standard. But we must all adjust ourselves to a lower rate of profits than was made possible by the demands of war. The attempt to maintain the war standard cannot fail to delay the return of normal business.

Have Machine Tool Builders Given the Public What It Wants?

WHILE the report of the American Engineering Council committee on the elimination of waste in industry is not by any means the engineering work that we had expected, the general conclusions reached are of value.

Worthy of comment is an opinion that the main cause of waste or inefficiency in the machine-tool business is "the failure of machine tool builders to give the public what it wants."

The machine-tool builders who, for many years gave in, against their better judgment, to customers' whims and caprices instead of standardizing and sticking to it will find it hard to agree with the statement. They will remember the number of "specials" that their shop cards carried and how costly these same specials became before they were finally tucked away in a freight car.

There is another way to look at it: what the public wants is machine tools that will give production—and it is getting them. Users of machine tools have sometimes shown the way to important improvements, but as a rule the builders themselves have taken the big steps in development.

Shop Equipment News

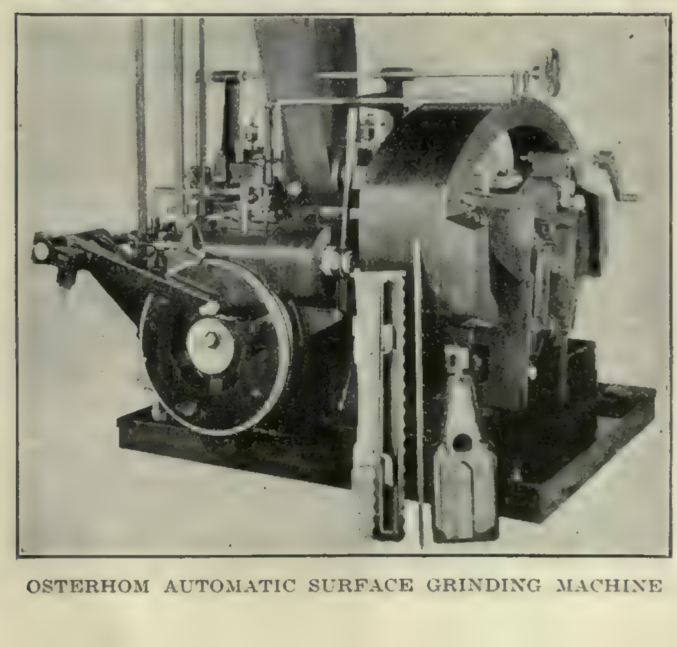
Osterhom Automatic Surface Grinding Machine

The illustration shows an automatic surface grinding machine recently built by William Osterhom, consulting engineer, 2301 N. Knox Avenue, Chicago, Ill. The machine is intended for the rapid and economical surfacing of parts up to 12 x 40 in. made in large quantities. One of the pieces of work in front of the machine is a radiator top for a motor truck, and the other a small drill press base about 20 x 10 in. in size. The chucking time is said to be 13 sec., and the actual grinding time 45 sec., about $\frac{3}{32}$ in. of metal being removed.

The machine is fully automatic, with the exception of locating the work and locking it in the fixture, which is mounted on a table pivoted about a swinging arm and moved across the surface of the abrasive wheel by means of a cam. Upon the completion of the cycle of the cam, the fixture is tilted back 45 deg. away from the wheel, allowing the operator to remove the work. The illustration shows the fixture in the grinding position, with the wheel dresser in place. Provision is made for varying the length of the stroke of the swinging arm from 2 to 24 in., and a change-gear box allows for varying the time of the cycle from 10 sec. to 2 min., to suit the work.

The water is automatically turned on and off with the opening and closing of the tilting table. A rotary pump supplies the coolant through the center of the spindle; and if delicate steel parts, such as edged tools, are to be faced, water is also supplied through the fixture.

The feed of the wheel is automatically controlled by a cam shown on the side of the machine, feeding the wheel gently forward onto the work during the grinding operation. The action of starting the grinding after placing the work in position is accomplished by pulling the handle on the top of the machine, which throws the belt on the tight pulley behind an arresting lever. The sheer drop on the cam releases the arrest lever, and also raises the work to the grinding position. A series of steps on the cam communicates the rotary action to a shaft to drive the wheel housing forward a preconceived distance against the work. A quick return of the lever to its original starting point traps the shifter arrest lever, unlocks the tilting work table and stops the action of the machine. An emergency stop is also provided.



OSTERHOM AUTOMATIC SURFACE GRINDING MACHINE

Wear of the wheel, as well as the proper placing of the wheel housing in relation to the work surface, is taken care of by means of a graduated handwheel. Another lever adjacent to the change-gear box allows the operator to stop the rotation of the cam, but gives free swinging of the work arm, as while dressing the wheel. The feed lever is cushioned so that in heavy grinding of irregular castings, the wheel has an opportunity to adjust itself, the cushioning spring taking the shocks and allowing the wheel to cut itself free. The entire working mechanism is supplied with positive oiling devices. The spindle is 42 in. long and 4 in. in diameter, with forced lubrication.

The machine can be equipped with automatic magazine feed. In this case, two magazines are used, one for receiving and one for delivery. The magazines control the operation of the machine as long as they are properly attended to. If the receiving magazine gets clogged up, the machine will stop, as it will, also, if the raw material magazine is emptied up to a certain point. This method of grinding is adaptable to such work as the facing of thin, hardened pieces of steel up to 6 x 6 in., thrust washers, and anything that can be stacked and magazined properly. The plain grinding machine is recommended by the maker on such grinding as manifolds and housings where a 2-minute operating cycle is used, one operator handling four machines.

A cylinder wheel, 20 in. in diameter, 8 in. thick and having a 10-in. hole, is used. The weight of the machine is 7,800 lb. Twenty hp. is required when operating at the maximum. The floor space is 72 x 84 inches.

Baily Electric Sheet-Heating Furnace

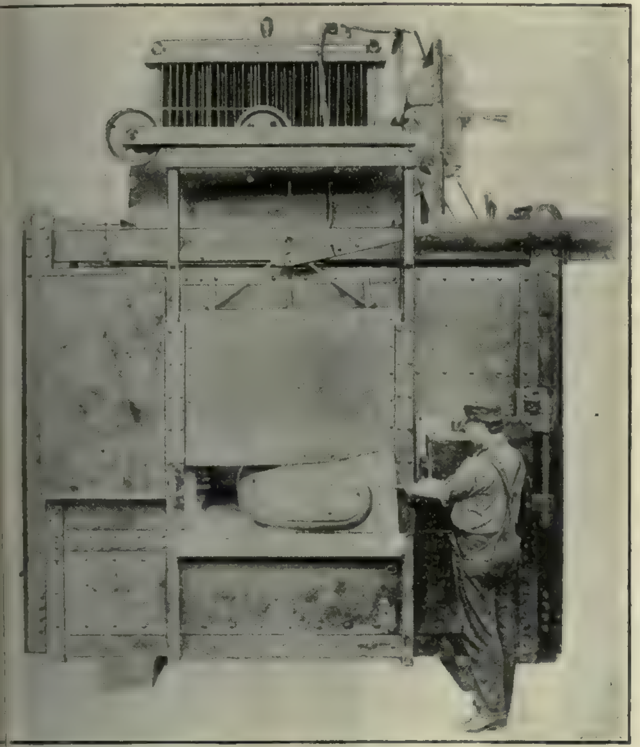
The illustration shows a resistance-type electric furnace intended for use in the heating of sheet-metal when forming parts of automobile bodies and fenders. It is made by the Electric Furnace Co., Alliance, Ohio, the one illustrated being installed in the plant of the Mullins Body Corporation, Salem, Ohio.

Since a large part of the pressing or drawing to shape is performed cold and only one or two hot runs are required for perhaps six or seven cold operations on the press, the furnace is portable, being handled by a crane and taken from place to place as the work requires, so that it need not be idle while one batch of material is receiving its cold runs. Four eye-bar connections are provided at the top, one at each corner, for hooking on the crane chains. The transformer and control equipment are located on the top of the furnace.

The furnace is rated at 100 kw. in electrical capacity, and has a hearth 3 ft. 4 in. wide by 6 ft. 5 in. long, with a door opening 3 ft. 4 in. wide by 2 ft. 2 in. high. It has a capacity for heating 750 lb. of material to

800 deg. F. per hour. In plants where a crane is not ailable for moving the furnace, the equipment can mounted on a car which may be moved on a track rallel to the battery of presses.

One of the features of the equipment is claimed to be the uniformity of temperature obtained on the sheets, largely because the doors need not be opened frequently as in fuel-fired equipment. Scaling is said to be reduced to an almost negligible item, making very much smoother sheets than is possible in fuel-fired practice, and saving labor in finishing them.



BAILY ELECTRIC SHEET-HEATING FURNACE

Alfred Herbert Power-Operated Hardness-Testing Machine

The hardness-testing machine shown in the illustration has recently been placed on the market by Alfred Herbert, Ltd., Coventry, England, and 50 Church Street, New York, N. Y. The machine operates on the Brinell principle, using a 10-mm. ball and employing the standard pressures of 500 or 3,000 kg., as required by the material being tested. The chief features of the machine are power operation and automatic application of the pressure.

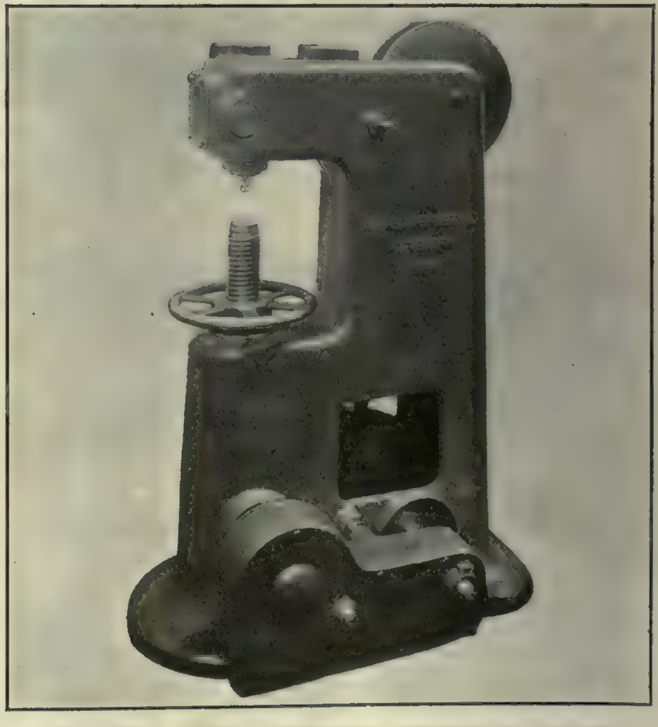
It is claimed that the time required to apply the load, the duration of the load, and the time taken to remove the load are uniform for all tests and do not depend on the operator or on his physical effort. The operation of the machine by power enables the attendant to make tests continuously without fatigue and without chance of error it is stated. The machine can thus be considered as belonging to the class of workshop production machine intended for high output, as well as to the class of laboratory appliances.

Apart from the main frame, which carries all the mechanism, the machine may be said to consist of two elements, a weighing element and a straining element. The ball through which the pressure is applied to the specimen is carried by the lower end of a vertically moving plunger, the weight of which is neutralized by a light spring. This plunger moves upwards a small amount when the specimen to be tested is raised into contact with the ball, the pressure between the specimen and the ball being weighed by a pair of compound levers and a weight, which latter becomes poised when the full pressure is reached. The fulcrum of the first lever consists of a pair of ball-bearings, and the point of application of the pressure is a hard steel roller between two hard steel seatings. The other lever takes the shape of a pair of pulleys or sheaves with a pinion keyed between them and engaging with the teeth on the first lever.

A wire cord passes around the two sheaves and also around a third sheave attached to a weight located inside the column. An opening is provided in the column for removing and changing the weights. The first-mentioned lever is provided with a sliding weight for calibrating the machine for each load in the first instance. An indicator situated at the front of the machine shows when the weight is poised, and the full load on the specimen.

The object to be tested is placed upon a flat anvil or pressure plate resting on a spherical seat on the top of a vertical screw, which can be elevated by a handwheel to bring the work into contact with the ball. The screw itself occupies an axial position in a vertically moving cylindrical ram, the small upward movement of which forces the work against the ball and applies the pressure, which is regulated and resisted by the poised weight of the weighing element.

The lower end of the ram carries a roller resting on a cam, which makes a single rotation for each test. The cam is formed so as to apply the load gradually, to maintain it for the predetermined period and then to remove it. It is rotated by a wormwheel and worm driven by spiral gears from a single driving pulley.

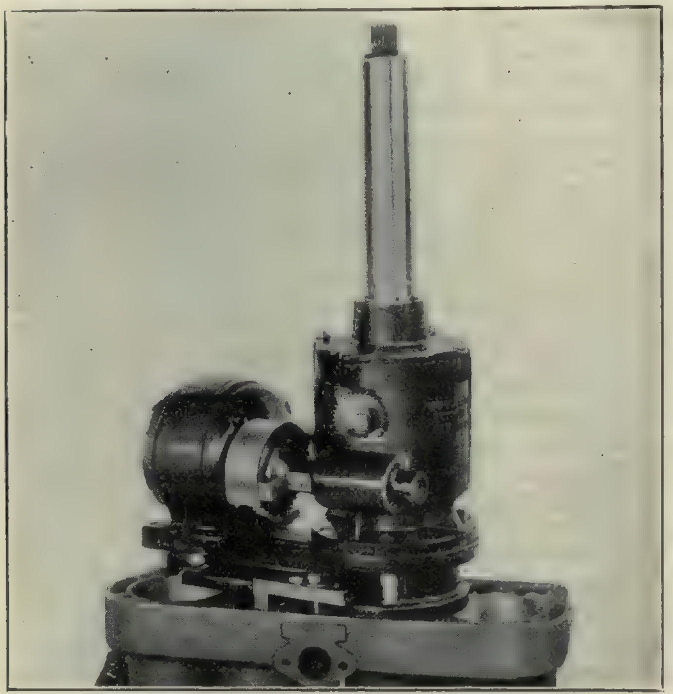


HERBERT POWER-OPERATED TESTING MACHINE

Specifications: Diameter of ball, 10 mm. Pressures provided, 500 and 3,000 kg. Maximum height between ball and pressure plate, 10½ in. Distance from center of ball to frame, 9¾ in. Diameter of pulley, 9 in. Width of belt, 1¾ in. Speed of pulley, 500 r.p.m. Floor space, 2 ft. 6 in. x 3 ft. 6 in. Weight: net, 1,680 lb.; gross, 2,200 lb.

Van Dresser Electric-Driven Cylinder-Reboring Tool

On page 924, Vol. 54, of the *American Machinist* appears a description of the Van Dresser cylinder-reboring tool made by the International Purchasing and Engineering Co., Inc., 506 McKerchey Bldg., Detroit, Mich. The device was intended for drive by hand or by means of a drill press; but it has now been fitted with the individual motor drive shown in the illustration.



VAN DRESSER ELECTRIC-DRIVEN REBORING TOOL

The motor is mounted as a part of the tool, no flexible shaft being employed. A friction clutch is incorporated between the motor and the tool, so that slippage is possible in the event that the cutter head becomes wedged, thus protecting the motor. The final drive is through a hardened worm and bronze worm wheel running in oil. Without making any disconnections, it is stated, the tool can be operated by hand or by the spindle of a drill press. The tool has a range of from $2\frac{3}{4}$ to $5\frac{1}{16}$ in.

Some of the features of the tool which the maker emphasizes are the solid hardened and ground feed bar that has no threads, the heavy bearings $10\frac{1}{4}$ in. long, the tapered arrangement for fitting the boring head in the feed bar, the six high-speed-steel blades, the quick-return feature that allows the boring head to be brought instantly to the starting point, and the elimination of split guide rings.

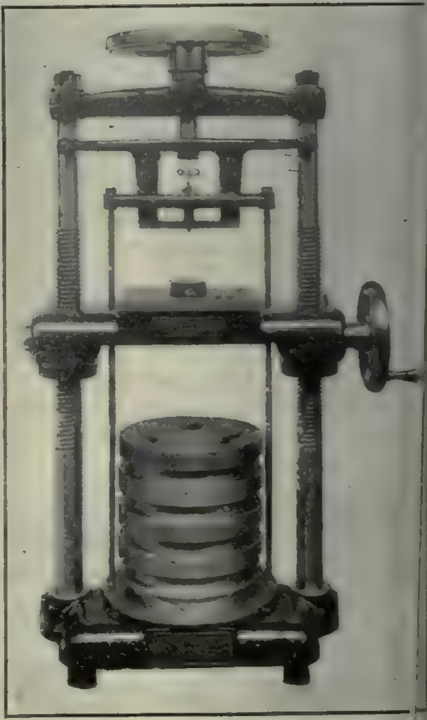
Alfred Herbert Small-Ball Hardness-Testing Machine

The hardness-testing machine shown in the illustration has recently been placed on the market by Alfred Herbert, Ltd., Coventry, England, and 50 Church St., New York, N. Y. The machine is a development of the Brinell method of determining hardness, the difference being not in principle but in the use of very small balls with correspondingly small loads. It is intended for determining accurately the hardness of thin specimens, such as the walls of small-arm cartridge cases, and of finished articles which cannot be subjected to the pressure of ordinary hardness-testing machines, eithe because of their small size or because of the injur caused by making a comparatively large impression.

The maker claims that the hardness of material 0.0 in. or even less in thickness may be determine accurately. Thin-walled tubes and other hollow form may be tested without internal support, and article such as cutlery blades which would be disfigured by large impression may be tested by an impression s small as to be imperceptible to the unaided eye. Th machine is of use for testing case-hardened work, th hard skin of which is too thin to be tested by th ordinary method, and the hardness of a cutting tool ma be determined close to the cutting edge.

The load is applied by dead weight. The balls us are 1 and 2 mm. in diameter with loads up to 50 k although balls of 5-mm. diameter are supplied for te ing extremely soft material. The hardness numbers a calculated in the same way as in the ordinary Brin test, the load being divided by the area of the impre sion.

The machine consists of a baseplate which suppo two threaded columns. The table for holding the spe mens to be tested is carried by these columns, and is adjustable up and down by a handwheel, so as to set the table at the required height. The baseplate is furnished with leveling screws. At the top of the column is mounted the crosshead, in the center of which is a fine-pitch non-rotating screw, which can be raised and lowered by a handwheel provided with ball thrust bearing. The lower end of the screw carries a suspension stirrup, prevented from rotating arms bearing against the columns, and from this s- pension stirrup is hung a loading stirrup, to the u er portion of which is attached the ball-holder, while ne lower portion carries the weights.



HERBERT SMALL-BALL TESTIN MACHINE

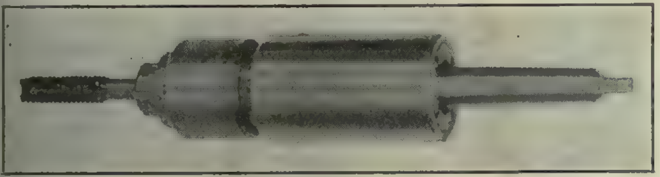
The ball is attached to the ball-holder by an ir a- rubber solution, so as to render the changing of ball an easy matter. The table can be set at the requ ed height, and the work then placed in position unde he ball, a supporting block or fixture being used if des ed. The upper handwheel is then turned until the ball sts upon the specimen, the loading stirrup being free nd disconnected from the suspension stirrup, so that he whole weight is upon the specimen. The upper hd-wheel is then turned back to take the weight of the work, which can be removed and the diameter of the impression measured. Each machine is supplied with three ball-holders, a set of graduated weights totalling 50 kg., and a hardened steel disk or anvil for supporting small articles.

Specifications: Work table: width, $7\frac{1}{2}$ in.; depth, 6 in. Height from work table to ball using maximum weight of 50 kg., 8 in. Overall dimensions: width, $21\frac{1}{2}$ in.; depth, $12\frac{1}{2}$ in.; height, 36 in. Weight: net, 210 lb.; shipping, 280 lb. Shipping box, 19 cu.ft.

Apex Safety Friction-Slip Tap Holder

The Apex Machine Co., Dayton, Ohio, has recently placed on the market the friction-slip tap holder shown in the accompanying illustration. The principal feature of the device consists of the arrangement which permits of slippage within the holder itself, in case the tap becomes wedged or strikes the bottom of the hole. It is thus particularly adaptable to use in tapping blind holes, both in single-spindle and multiple-spindle drilling and tapping machines. Because of the small outside diameter of the device, use on multiple-spindle machines is quite easy. The tap holder will operate in any position, whether horizontal, vertical or inverted.

The holder is made in two sizes. Type A has a body $1\frac{1}{4}$ in. in diameter and 3 in. long, and will tap all sizes of holes up to and including $\frac{1}{2}$ in. Type B has a body $1\frac{3}{4}$ in. in diameter and 4 in. long, and will tap holes from $\frac{1}{4}$ to $\frac{3}{4}$ in. in diameter. The type A holder has a No. 1 Morse taper shank for holding it in the machine spindle, and the type B has a No. 2.



APEX SAFETY TAP HOLDER

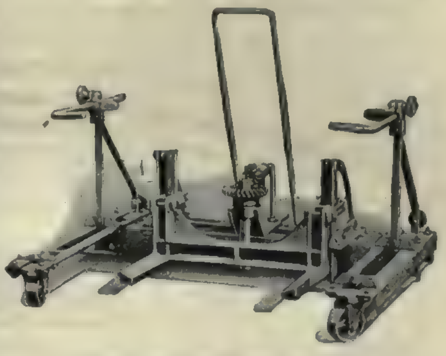
The holders may be fitted with screw jaw chucks or with quick-change collets for the holding of standard hand taps. In the collet the tap is driven by the square and held in position by means of two dogs mounted in a slot at the end of the collet, with the ends protruding into the flutes of the tap. The collet may be inserted or removed by raising the sleeve.

A very large amount of friction surface is said to be provided in the holder, by the use of a number of alternate steel and fiber washers, so that it is easy to maintain the adjustment of the holder and so that long life is obtained. The amount of friction may be quickly adjusted when changing from one size of tap to another. The holder embodies a $\frac{3}{16}$-in. vertical float movement, to allow for a slight variation in the lead of the tap. There is also a lateral float of $\frac{1}{32}$ inch.

Manley Truck-Wheel Dolly

In the accompanying illustration is shown a device recently brought out by the Manley Manufacturing Co., York, Pa., for handling automobile truck wheels in a repair plant. This dolly is intended both for conveying the truck wheels and for raising or lowering them. It is mounted on ball-bearing casters, and provided with a handle by which it can be manipulated about the shop.

The truck wheel is carried on two projecting forks, seen at the front of the illustration, the forks being far enough apart to enable them to be put under a wheel standing on the floor. The forks have a vertical movement of 5 in., being operated by a crank, so that the height of the wheel can be easily varied. The elevating screw runs on a ball thrust bearing. The device is particularly adapted to removing wheels from the spindle of the axle, or replacing them. Owing to the fact that the dolly is very low, it does not strike the fenders of the truck. The top of the wheel is not obstructed, so that a chain attached to a crane may be easily used for lifting the wheel into a tire press. An unobstructed view may be obtained inside the hub. Two arms are provided for holding the truck wheel from falling, these guards being needed chiefly when pneumatic-tired wheels are being handled. The position of the guards are adjustable.

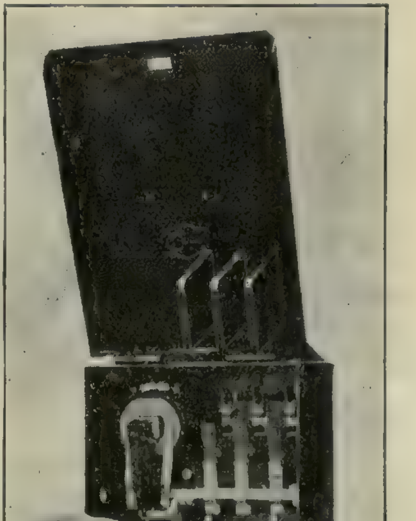


MANLEY TRUCK-WHEEL DOLLY

The dolly is made principally of structural steel. It is 24 in. in height, 44 in. in width, and has a depth of 37 in. The weight is 210 lb. It is claimed that the device can hold wheels up to 48 in. in diameter and having a 16-in. face width, being capable of supporting a load of one ton. The dolly is said to permit of the handling with ease and safety of the largest truck wheels by one man.

Cutler-Hammer Automatic Starter for Squirrel-Cage Motors

The accompanying illustration shows the No. 9604 automatic starter developed by the Cutler-Hammer Manufacturing Co. for small squirrel-cage motors of $7\frac{1}{2}$ hp. or less. The starter is said to allow a large starting current for several seconds, but at the same time to give positive protection against burning-out and to prevent harmful overloading of the motor. The two mercury overload relays mounted below the contact fingers are intended to eliminate fuse troubles, while allowing overloads as high as 25 per cent for a limited period. The overload relay consists of a glass tube carrying a mercury column, which forms a part of the pilot circuit of the magnetic switch coil. A portion of this column is surrounded by a heating coil, or thermal element, in



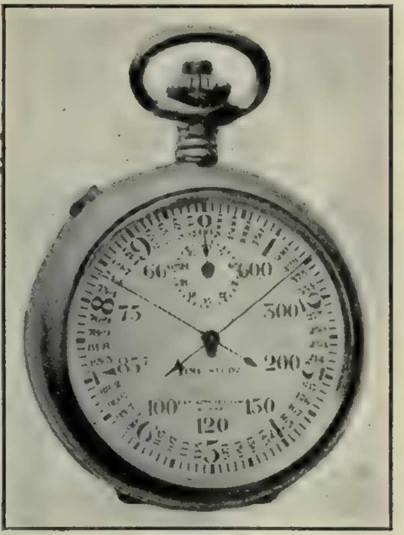
C-H AUTOMATIC STARTER FOR SQUIRREL-CAGE MOTORS series with the motor circuit and heated in the same proportion as the motor windings. Excessive current passing for too long a period heats the coil, causing the mercury to boil and the vapor to pass up into the chamber at the top of the tube. This action breaks the liquid mercury column and opens the circuit to the magnet coil. As this coil is de-energized, the contact fingers drop away and disconnect the motor from the line. After such an interruption, the mercury cools down and becomes liquid again, dropping back into the tube so that the pilot circuit to the magnet coil is soon complete. The motor will not start, however, until the control button is depressed after the relays have reset.

As the functioning of these overload relays depends upon the temperature at which mercury will boil, it is evident that the current required to operate the relay increases with the decrease in the temperature of the surrounding air. If the motor and the starter are installed in a cool location, the relay permits a greater starting current or a higher overload than if the temperature of the surrounding air were higher. The push-button station which is supplied can be installed in any position that is most convenient for the operator. It is stated that considerable time is saved by using the automatic starter in place of a manually operated starter, the amount depending, of course, upon the frequency with which the motor is started and stopped.

Time Study Watch

The time study watch illustrated herewith has recently been placed on the market by the Stein & Ellbogen Co., 31 North State St., Chicago, Ill.

The double hands permit the taking of two closely related operations at the same time or a comparative observation of two workmen or machines. In case of an interruption, the total time and the waste time entailed can be shown in figures of production as well as in decimals of a minute, thus simplifying computation. On the dial there are placed at intervals of 0.02 min. figures showing the rate of hourly production. Thus, if an operation started at zero and lasted 0.84 min. the dial would show that the operation was being performed at the rate of 71.4 pieces or operations an hour.



TIME STUDY WATCH

Both hands are started by pushing down the crown. By pushing the button at the left of the crown, the under hand is stopped while the upper one is allowed to travel.

In the case of an observation of two different operations, the under hand would be stopped at the completion of one of the operations. In the case of timing two workmen on the same kind of work, stopping one hand would show the time taken by one workman to complete his task. In the first case stopping the upper hand would show the time consumed by the operation taking the longer time, and in the case of timing two workmen it would show the time taken by the slower.

Is Superficial Training Satisfactory?—Discussion

By A. W. Forbes

W. K. Campbell has an article on page 1,067, Vol. 54, of *American Machinist*, entitled "Is Superficial Training Satisfactory?" I think most of us will agree that it is not, but how are we to get any other kind?

Assume that a boy wants to start work at the age of 15 or 16. This year his choice of work is quite limited, but a year ago, and a year hence, he had or will have a choice as broad as could be desired. He could learn to run a machine on one operation and get man's pay in a very short time. He could go to one of the shops where the old-style apprentice training was in effect. He could go to a trade school. The first choice will always produce the largest immediate returns in the pay envelope, and who is to prevent the boy from choosing it? Our child labor laws also encourage this course, by making so many prohibitions, that some are bound to conflict with any employer that tries to give all-round training. Give the boy just one thing to do and the chances are that it will not conflict with any law.

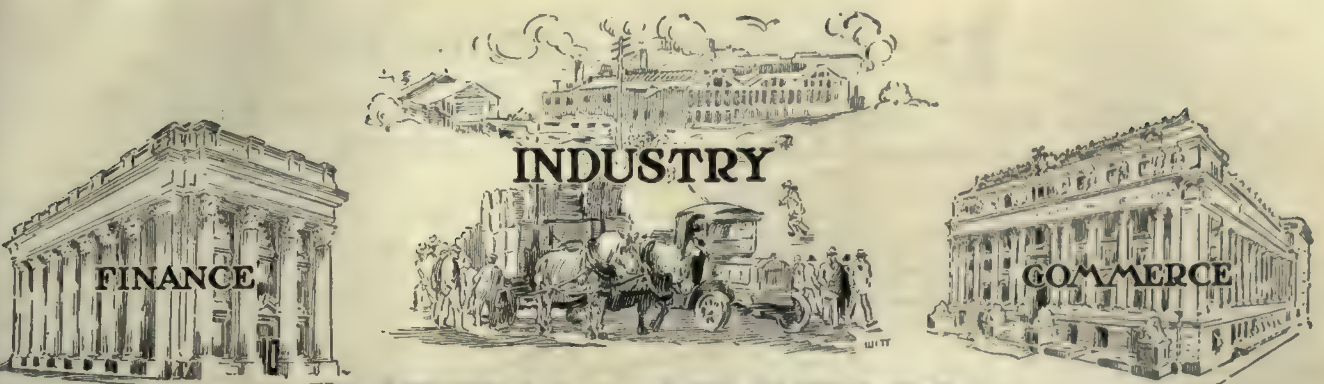
But then I am not sure that it is a bad thing to become a specialist on one machine. All the machines in a machine shop are much alike so that a real specialist on one can do good work on any with practice for a day or two. The trouble is that most of them are not specialists, except in the sense that this term may be used as a limit of knowledge rather than as a statement of it. Give a specialist a piece of stellite after he has been using high-speed steel, or vice versa, and few of them will know enough about their work to make good with the other materials. In examining applicants for a job, I often ask what material they would use for the cutting tools, and the so-called specialist usually says that he uses what is given him by the management. Certainly he has no right to the name of specialist.

ADVANTAGE OF VARIETY IN WORK

Variety in work has an advantage, but I find that in my shop the boys get too much variety for their own good. The work is such that I can seldom give them more than 100 pieces of a kind, and the exceptions where the quantity is larger are not the jobs that require much time or thought. The boys get acquainted with all the machines so that after a few years they can do most any kind of job within our range of work, but they do not stay at one thing long enough to get the fundamental theories of the action of a tool, or long enough to see that the tool might cut 25 per cent faster if placed in the toolpost at a slightly different angle.

The trade schools in general carry this fault one step further, and give such a great variety of work that it seems as though the boys lost most of the value of the practice.

I should like to see some shop make a real effort to produce specialists who really know the job. But this is probably impossible. Before they had advanced very far they would either think they knew it all and stop learning, or they would be taken into the engineering department.



NEWS SECTION

O. K. Davis to Represent U. S. at Postal Congress

The appointment of O. K. Davis, chairman of the advisory committee on foreign mails, as chief representative of the United States Government at the Pan American Postal Congress, to be held in Buenos Aires, Argentina, marks a new step forward in the development of closer relations between the Government at Washington and the business men of the country.

Mr. Davis is chairman of the advisory committee on foreign mails, an organization of American business men interested in the use of development of postal service to all parts of the world. During the last few years, this advisory committee has been working in close co-operation with the Post Office Department and has been able to initiate and secure many extensions and improvements in our foreign mails. Mr. Davis is also secretary of the National Foreign Trade Council, an association that stands for "greater prosperity through foreign trade."

"The selection of Dr. Davis is a matter of great significance to our foreign trade," said Postmaster General Hayes in announcing the appointment. "Mr. Davis goes as the representative of the great industrial organizations of the country to establish foreign money order policies, postage rules, and other matters vitally affecting our trade with Pan America."

The Congress, which meets in Buenos Aires in August, will consider matters affecting letter mail and printed matter. Among the suggestions given the delegation by the business men of the United States, through the medium of the advisory committee on foreign mails, are the following, which are considered by many to be the most important.

Extension of domestic rates on letters and printed matter to all Pan-American Countries.

Removal of taxes on printed matter entering a country by mail.

Elimination of consular invoices on parcel post shipments, especially on those of less than $100 value.

Standardization of customs declarations and customs procedure in simplified form throughout all Latin America.

Extension of registered mail service to all Pan-American countries, and increase in indemnity obtainable to at least $50.

Removal of prohibitions on the import of articles by parcel post, and agreement to admit any article not barred by the mails of the country of origin.

Increase in weight limits of parcel post to 50 lb. and in measurement to 7 ft. combined length and girth.

Extension of direct money order service to all Latin America, and eventual establishment of parcel post C. O. D. service.

Two Firms' Equipment Being Sold

W. H. Savage, Fitchburg, Mass., is selling off all the machinery and equipment of the Standard Plunger Elevator Co. and the Powell Machine Co., of Worcester, Mass., at private liquidation.

This equipment includes some six hundred machine tools, drawings, patterns, tools, jigs and fixtures, and parts in process of Powell planer, which is to be sold as a going business.

Walter H. Rastall to Head New Division of Department of Commerce

Problems connected with the marketing of American heavy machinery throughout the world are to receive the special attention of the new heavy machinery industrial division of the Department of Commerce. The Secretary of Commerce announced July 28 that Walter H. Rastall, of Dayton, Ohio, has been selected to take charge of the division.

The situation in regard to establishing markets abroad for machinery is unusually attractive at this time, state officials of the department, owing to the strong nationalistic spirit which the experiences of the war has created in many countries. This spirit is manifesting itself particularly in Latin America and the Far East, where the business men have learned the dangers of complete dependence on outside sources for essential industrial supplies. As a result, departmental officials believe that the potential market for American heavy machinery is most promising, and the hope is expressed that the work of this new division may be instrumental in the sale of much American equipment of this character in industrializing the less developed countries of the world.

WALTER H. RASTALL

Mr. Rastall is a graduate of Cornell University and a mechanical engineer. He has had much practical experience in marketing machinery both in this country and abroad. A short time ago he returned to the United States from an investigation of markets for American machinery in the Far East. In his new position he will keep in close touch with the centers of machinery production in this country and by personal contact endeavor to afford that industry and trade maximum service from an informational and marketing standpoint.

Mr. Rastall was born in Burlingame, Kan., forty-one years ago. His primary education, however, was obtained in the public schools of Chicago. He also attended the Manual Training School maintained by that city. He then entered Hebron Academy at Hebron, Maine, and later took the three-year civil engineering course, with electrical electives, at the University of Maine. He then took two years of mechanical engineering with electrical electives at Cornell University, where he earned the degree of mechanical engineer.

In his private practice, Mr. Rastall has served as a marine draftsman at the Bath Iron Works, Bath, Me., and at the Eastern Shipbuilding Co., at New London, Conn. Later he was chief draftsman of the Latrobe Steel & Coupler Co., at Melrose Park, Ill.

From 1904 to 1911, inclusive, Mr. Rastall was stationed at Kobe, Japan, as resident engineer for the American Trading Co. In that position he was responbile for the engineering and commercial features of the business involving the sale of American industrial machinery to Japanese buyers. Under his direction the volume of business done was increased from an insignificant amount to $500,000 annually. The company which he served acted as agents for some twenty of the leading American machinery manufacturers, including such equipment as mining machinery, pumping machinery, power plant equipment, gas engines, ice plants, waterworks, paper mills, cement-making machinery, railroad and ship yard supplies, and steam engines and boilers. Mr. Rastall installed the first mechanical filter plants used by municipalities in China. He also installed filter plants in Japan and Korea. One of the important pieces of work undertaken by Mr. Rastall during his stay in Japan was the delivery of 2,000 tons of sugar-making machinery at a point in Formosa. He directed the erection of a plant having a capacity of 500 tons of sugar cane daily.

From 1912 to 1917 Mr. Rastall engaged in engineering work in the United States. From 1913 to 1917 he was sales engineer for the Worthington Pump and Machinery Corporation. With the outbreak of the war he joined the staff of the Bureau of Aircraft Production and was given charge of the Dayton, Ohio, district. In 1918 he was borrowed from the Bureau of Aircraft Production by the Department of Commerce to investigate industrial machinery markets in the Far East. This survey, which was completed within recent weeks, involved visits by Mr. Rastall to practically every port in Asia from Karachi and Bombay to Yokohama, including Ceylon, the Dutch East Indies and the Philippines.

Tempering of Hardened Steels at Bureau of Standards

A very thorough investigation is under way in the metallurgical division of the Bureau of Standards dealing with the micro-changes which occur during the tempering of hardened steels. Some idea of the work involved in this investigation may be gained when it is remembered that it is necessary to take hardness measurements and make microscopic examination of all the specimens of each type of steel for each tempering treatment. Over 800 specimens are involved in the investigation and the time necessary for the mere polishing for examination is very considerable.

The results of the investigation are published from time to time for the benefit of American industries.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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That the **Soviet** government has agreed to release the Americans it held in prison in order to obtain relief for the famine stricken people of Russia is by far the most important news of the week. Politically it means that Communism has confessed failure and in its economic aspect it is no less auspicious, for through the door that has been opened from within the forces of western civilization will no doubt be able to make their way and ultimately effect the commercial and industrial regeneration of the hundred and seventy millions who compose the Russian population. In a recently published and very interesting book upon "The Economics of Communism" written by Leo Pasvolsky, editor of the *Russian Review*, the collapse of the Lenin regime is predicted upon the ground that "Communism is impossible without the application of compulsion in the economic life of the country; but economic production is impossible with the application of such compulsion."

It is of the highest significance that under the compulsion of events, the truth of this syllogism is being made evident to the Russian people for it argues the early re-establishment of a sane and orderly government that will foster and stimulate their economic development.

Second in importance to the news from Russia is the announcement that the Sinn Fein army in Ireland is being demobilized. This is construed as meaning that a solution of the Irish problem has been found and that another irritating sore in the world's body politic is healing. The stage is thus being cleared and set for the disarmament Congress to be held in November and if at that gathering a concordat that will insure peace shall be secured, a world wide revival of enterprise and activity will no doubt follow.

To rouse our business men from their unwarrented lethargy it would seem to be necessary that the facts which connote improvement should be marshalled with dramatic effect, for as we turn our eyes from overseas to a survey of the forty-eight states which comprise the Union, the view is far from discouraging though many refuse to be comforted and persist in a melancholic interpretation of the record as they call attention to the decline in copper and the poor demand for iron, steel and coal, which are almost the only unfavorable features in an otherwise normal outlook. But while it is true that July production of pig iron was only 864,555 tons, the lowest since 1903, it is also true that at each decline in the price of steel there is more buying and the *Iron Age* reports that the volume of orders is increasing although the railroads, who are the largest buyers of steel, are still waiting to get the $500,000,000 for which President Harding has encouraged them to hope before entering the market. Of copper it is said that the present offtake is twice the current output, although prices are lower because the large producers are wise in stimulating consumption by selling cheaply.

The prospect is that we shall go into the winter facing a shortage of both steel and copper, as a result of which belated buyers may have to pay dearly. The same statement applies to coal, for the predicament into which consumers are drifting through indifference or pessimism is alarming thoughtful students of the facts. At the present rate the indicated soft coal production for the year will be the smallest since 1911 and far below the consumption, even though there be no revival in the industrial demand.

But the admitted depression in these three mineral products is more than offset by cheerfulness that pervades most other markets. Bradstreets index number reflects an advance of 3.07 per cent in wholesale commodity prices during July, on top of a rise of 1.05 per cent in June.

The improvement is greatest in textiles, which have continued to harden during the week, reflecting the advance in the cotton market where a broad speculation is developing following the government's alarmingly low condition report and the sensational statement made with regard to the ravages of the boll weevil. Much higher prices are quite possible as it is doubtful whether the public or the trade yet appreciate what a crop that some think may not be over 8,000,000 bales would mean. It would be the smallest since 1895, since when the world's spindles and normal consumption have almost doubled.

RISE IN STAPLES

Sugar, coffee, tea, hides and canned goods continue firm with an upward tendency, and even Irish and sweet potatoes are described as excited and higher. In the grain markets a curiously confident belief in higher prices seems to be gaining ground, though it has not yet found expression in higher prices for wheat.

In all these commodities the reversal of speculative sentiment probably reflects a subconscious appreciation of the gold inflation to which I have so often alluded. This influence is more directly apparent in the London price of silver, which has advanced to 38⅝d. per ounce from a low of 30⅝d. touched last March. Probably because it fluctuates more directly than commodities in inverse relation to the value of gold and is still the currency preferred by more than one half the world's population, many shrewd observers regard it as the most reliable indicator of commercial and financial conditions of which we have knowledge. At all events the record shows that an advance in silver generally coincides with an improvement in the world's trade and as gold piles up in the United States it seems unreasonable to expect a decline in the white metal.

At the risk of seeming academic I stress these somewhat recondite aspects of the situation, because gold imports for the first seven months of 1921 exceed $400,000,000 and the weekly statement of the Federal Reserve Banks shows a further gain of $21,000,000 in the total gold held. It is my firm conviction that this continued influx of the yellow metal must ultimately work a marked advance in the values that are measured in gold. Whether Europe is sending us her gold because she has to or with the deliberate purpose of so cheapening credit that she will be able to borrow freely here does not make much difference. The result will be the same and it is upon this assumption that my expectation of an early revival of speculation is based.

That it will be the policy of the Federal Reserve Board and bankers generally to restrain the speculative outbreak that impends may be taken for granted, but the opposition to this policy is growing and public opinion may compel its abandonment now that President Harding is boasting of the reduction in the rediscount rate as one of the things that his administration has done for business, and Ex-Comptroller Williams' testimony before the Agricultural Committee of Congress is attracting nation wide attention. The sensational character of Mr. Williams' statements and the effort that Governor Harding of the Federal Reserve Board made to answer them with his fists is in fact almost the only really exciting item in the domestic news of the week.

It is the abnormal that inspires the scare heads to which we became accustomed during the war and normalcy is now general rather than exceptional in American business. Making allowance for the decline in prices the volume of business is rather above last year, if bank clearings and department store sales for June are reliable indicators. The former are 15.6 per cent under 1920 and the latter as reported by the Federal Reserve Bank shows a decline of only 11 per cent, the percentage in both cases comparing with an average depreciation of 40 per cent in market values.

Money is in abundant supply at from 5¾ to 6 per cent for the best commercial paper and the demand for high class bonds continues. The $300,000,000 treasury certificates offered at 5¼ to 5½ were three times oversubscribed and Liberty Bonds have been slowly rising.

The daily fluctuations in the prices of these Government securities are so small that the advance registered may not be generally appreciated. The prices of last Thursday compare as follows with the low record of 1920:

			Present Price	Low 1920
1st	3½s	1947	88.24	89.10
2nd	4¼s	1927–42	87.74	81.10
3rd	4¼s	1928	92.04	85.60
4th	4¼s	1933–38	87.80	82.00
5th	4¾s	1922–23	98.80	94.70

As money declines Liberty Bonds are almost certain to advance and there is every indication of lower interest rates. The stock market has been dull but steady. Price changes are not important or significant. The railroad stocks continue steady with a tendency toward higher prices which reflects the improvement in net earnings and the gradual betterment in the financial condition of the transportation industry.

The demand for lower freight and passenger rates is, however, becoming more insistent day by day and if the railway managers are wise they will heed it. Great dissatisfaction is expressed at the action of the Interstate Commerce Commission in refusing to allow Henry Ford to reduce rates on his railway more than 5 per cent each thirty days. It is recalled that an advance of about 30 per cent over night was permitted and shippers feel that it is a poor rule that won't work both ways.

Secretary Mellon is apparently trying to compel governmental economy by asking Congress to spend less or raise more revenue by advancing letter postage to three cents, putting a two-cent stamp tax on checks and a Federal license tax of $10 on automobiles. The probability is that appropriations will be reduced, for the Congressman that votes to increase taxes will probably lose his job in 1922.

Mr. Fordney's tariff bill seems to have been chloroformed in the Senate. Whether it will survive the capital operation to which it is there to be subjected is doubtful. There will not be much grief over its demise, for in its unpopularity it is unique.

The prevailing opinion is probably expressed by a friend who said that if Congress would readjust taxes, reduce railway rates and go home, business would boom. This is too much to hope for, but we may at least be thankful for a temporary respite from new legislation.

	End of Last Week	End of Previous Week	Last Week
Bank Clearings (Bradstreets) in thousands	$6,548,228	$5,620,478	$7,767,160
Business failures	319	390	128
Security prices, N. Y. Stock Exchange			
20 Industrials	69.50	68.18	84.06
20 Railroads	73.97	73.58	74.03
40 Bonds	78.27	77.76	74.18
Commodity prices			
Wheat, No. 1 spring	$1.62	$1.59	$2.97
Corn, No. 2 yellow	.76½	.78¾	1.71
Beef, good dressed steers	16.25	16.00	24.00
Pork, mess, bbl	24.50	24.00	33.00
Sugar, refined	.06	.06	.21
Coffee, Rio No. 7	.07 3/16	.06¾	.10¼
Cotton, middling	.1345	.1200	.3950
Print cloths	.04¼	.04⅜	.13
Wool, domestic average	.4021	.3974	....
Silk, No. 1, Sinshiu	5.70	5.80	5.4[illegible]
Rubber, crude, plan	.15	.13¾	.29¼
Hides, pack, No. 1	.14	.14	.29
Iron, No. 2, Phila	21.35	21.35	52.00
Steel billets	30.00	30.00	55.00

American Engineering Council's Report on Waste in the Metal Trades Industry

Some of the findings of the various investigators reporting to the committee on the elimination of waste in industry of the A. E. C. are now being disseminated. Among them is the report on waste in the metal trades industry, a summary of which follows:

Idle men and machinery are causing an annual loss of nearly a billion dollars a year in the metal trades industry. This estimate covers the value of labor only and does not include the value of materials that would be utilized if the productivity of labor were increased. The value of increased possible production in the United States even in normal times would, it is estimated, be over half a billion dollars.

The views of some of the managing executives in thirty-two of the plants visited, as to the main cause of waste or inefficiency were as follow:

"In eight plants the answer referred particularly to present business conditions and was to the effect that 'the most important cause is the uneven volume of business or the fluctuation in the demand for the product; lack of enough business to keep going at normal capacity.'

"In four plants the cause given concerned the railroad situation and the functioning of the Railroad Adjustment Board.

"In three plants the cause given was 'lack of standardization of design of products.'

"In two plants the cause given was 'labor turnover and strikes,' one executive saying that these had been caused by wartime conditions.

"In four plants the cause given was 'lack of planning'—the exact words used being 'lack of proper planning and routing;' one 'lack of correct planning and material control;' one 'unscientific planning and management,' and one 'lack of efficient planning and management methods.'

"In six plants the cause given was 'lack of co-operation between management and labor.'

"Other causes given in various plants were as follows:

'Lack of intensive study of methods;' 'cost control system needed;' 'daily cost reports needed;' 'lack of scientific management applied to all phases of the business;' 'inefficiency of labor and excessive overhead.'

"In other plants special causes in the machine tool business were given as follows:

"The failure of machine tool builders to supply what the public wants.

"Most of the metal trades shops are very small and require personal handling by the manager of such important problems as are handled by our system of production control.

"Insufficient capital to develop sales and to improve facilities.

"Purchasing in small quantities, by the small plants, which places them at a disadvantage as to favorable prices and as to transportation and handling expense."

The major cause of waste or non-production in the metal trades industry at the present time is the unemployment of available labor and equipment, due to general business conditions which affect all other industries.

The estimated waste in fifteen representative plants selected by the committee averages 28 per cent for them all and ranges from 8 per cent waste for the best plant to 56 per cent for the worst. The size of the plant, whether large, medium or small does not necessarily affect its efficiency, as some large plants as well as some small ones have a large waste factor.

The metal-making branch of the industry is not included in this survey—that is the branch which produces what are usually known as raw materials, plates, shapes, wire, piping, etc.

A comprehensive study and survey was made of fifteen representative plants, of various sizes and types, distributed through the states which lead in the industry. In addition to these detailed surveys or assays, a number of other plants were studied, and general information obtained through the co-operation of various metal trades associations.

The major causes of waste or non-production, applicable to normal times as well as to the present abnormal times, is attributed to instability of labor employment and inefficient management. Most of the plants surveyed gave very little thought to the instability of labor employment.

The proper relationship between management and labor, such as exists in the most productive plants investigated, is more than ever a controlling factor. The plants with the highest labor turnover (which reflects discontent) are in general the most wasteful of human effort; hence secure the smallest production per man hour. It is found further that generally the best relationship exists and the best understanding and least friction prevail in plants where the most thorough and scientific study of organization methods and standards have been made by the management in co-operation with the workers.

The careful planning of work; the providing and the moving of materials by means of effective and recognized methods of material control; comparison of output of departments and of individuals with fair standards of performance, fairly and scientifically determined; these are the practices of those concerns which have been most free from labor unrest, and where greatest mutual confidence and co-operation exist between employer and employed.

The provision by the management of proper facilities and conveniences for developing the latent productivity of the workers and the provision of fair incentives for those who make good, play a large part in eliminating waste in the best establishments.

It is shown by experience of the plants visited, as well as by general experience, that considerable improvement can be brought about by means of modern employment methods, which provide among other features for a close study of why men quit.

The average labor turnover for the year 1920, for the plants covered by these studies (wherever records were kept, which was the case in less than half of the plants), was 160 per cent, the percentage given in most cases being the ratio between the number of separations and the average number on the payroll. The highest turnover was 366 per cent.

There is a practical minimum to the labor turnover in a shop or factory, which cannot be excelled in special cases. There are separations that are unavoidable, due to deaths, marriages, etc., for which 60 per cent may be allowed which still leaves an avoidable or preventable turnover of say 100 per cent annually, in the metal trades industry. This of course can be done only by a most thorough understanding and co-operation of all concerned: management, labor and the public.

In this industry, then, with its 2,000,000 employees, with the average plant virtually renewing its entire working force, or filling each position, one-and-a-half times a year, we have 2,000,000 unnecessary separations, the equivalent of 2,000,000 workers annually separated and re-hired somewhere, and at what cost? Expert estimates of the cost of labor turnover vary from $50 to $250 per employee hired, trained and separated. An average figure of only $50 each applied to 2,000,000 employees means an average waste of $100,000,000 due to avoidable labor turnover, in this one industry.

Instability of labor employment resulting from strikes and lockouts has not been as serious in the metal trades industry as in some other industries, with the exception of the shipbuilding branch of this industry.

An open interchange of ideas and business results by managements both in this particular industry and in other industries, should lead to a higher level of methods, service and general business ethics. If carried on through definite channels such interchange might easily result in a combined study of the possibilities of the future and the avoidance, in the years to come, of such conditions as we are now facing. It is evident that management of labor must be elevated to a higher plane. Because labor is the major factor in most if not all industries, it should be led by recognized intelligence rather than by radical agitators on the one hand or by stupid reactionaries on the other.

Remarkable and very favorable results have been secured in labor relations and in improvement of efficiency simply by establishing frank and open conferences and free interchange of opinions, usually in genuine open shops (shops in which no prejudice or discrimination is allowed to exist either for or against men who do or do not belong to labor organizations) and some times by collective bargaining and dealing with a shop committee of which is delegated all responsibility for keeping the men to agreements fairly made between management and employees.

The great variety of designs called for by those who buy street cars, locomotives, trucks and other transportation equipment, is well known to be capable of beneficial limitation if all manufacturers and users could, through some agency, get together and by scientific study of the problems, not only from a utility or service standpoint, but from a manufacturing standpoint as well, reduce as much as possible the enormous number of varieties, styles, and types now required to be built. Many of these varieties are largely a matter of personal opinion or judgment of the buyers who have not had the opportunity to study the subject in all its phases. A great deal can be done toward standardizing the designs of these products and thus promoting the best interests of all concerned.

It will take time to bring the entire industry up to the higher level. During that time some establishments will probably be eliminated by the competition of the more advanced; but in this direction lies the only hope of eliminating industrial wastes.

Favorable Reports from the Southeast

That business, industrial and economic conditions are more nearly normal in the southeast than they have been for the past three years, is the statement made in the monthly business review of the Federal Reserve Bank of Atlanta, issued the latter part of July and covering general conditions in the sixth federal reserve district.

In part the report states:

"At this time it might be well to refer to conditions a year ago, when production, trade and business generally had reached their peak during May and June, 1920. Those who gave much thought to existing conditions realized that there must be a turning point and considerable uneasiness and anxiety were being felt. Commencing with July, 1920, production and trade began to show decreases, followed by recession of prices, values and wages. The demand for money continued, however, and contrary to former years, bank loans throughout the district increased during and after the crop-moving season in the latter months of the year, while deposits were declining. Six months after other readjustment phases were in evidence the high point of expansion of credit was reached and contraction of credit set in. The loans and investments of forty-three banks in selected cities of the district on July 6 of this year were $454,698,000, as compared with $441,924,000 on June 8, 1921, and $551,060,000 on July 9, 1920. Banks in the same reporting cities show demand deposits were $214,853,000 and $271,367,000 on July 6, 1921, and July 6, 1920, respectively. Time deposits were $145,239,000 and $151,106,000 on the same dates."

The report indicates an unprecedented revival of building activity over the whole district with Atlanta leading the other cities, and New Orleans, Jacksonville, Tampa, Birmingham and Savannah next in order.

Men of the iron, steel and kindred industries in the Birmingham district are confident that the turning point is close at hand and that from now on there will be a gradual resumption of operations at the plants in that section, with a pronounced change for the better after October 1.

The resumption of operations at No. 3 furnace of the Woodward Iron Co., at Woodward, Ala., early in August, caused a distinct thrill of optimism in iron and steel circles, for this company is now the only merchant interest in the state making iron, with two furnaces in operation. In announcing the resumption of activity, Frank H. Crockard, president of the company, stated that the stocks of iron in yards are exhausted and new orders are being received. The blowing in of the second furnace means a speeding up also at the ore and coal mines and the byproduct works, and this will call for the employment of hundreds of men who have been idle for several weeks.

The Birmingham Steel Corp., manufacturers of structural steel for buildings and bridges, is cleaning up and overhauling its plant preparatory to an early resumption of operations. This action follows the dismissal recently of bankruptcy proceedings brought against the corporation.

Wire drawing mills in the Birmingham district report a larger volume of new business the latter part of July than they had experienced in some months, and in this quarter there is also considerable optimism as regards the outlook for the future.

The bar mill of the Gulf States Steel Co., at Fairfield, Ala., is now operating five days per week, this being about double the scope of the operations at the plant for the past several weeks. An influx of new orders caused the increase in activity at the mill.

The hoop and tie mill of the Conners-Weyman Steel Co., at Woodlawn, Ala., resumed operations on steel hoops the latter part of July after a long period of idleness.

Most of the pipe shops and plants in the district are operating, some of them at full capacity.

Work of the International Chamber of Commerce

Here is the way Merle Thorpe, editor of the *Nation's Business*, published by the United States Chamber of Commerce, sizes up the results achieved by the first congress of the International Chamber of Commerce, held recently at London:

Struggling through racial barriers, which at times seemed well-nigh impassible, business leaders from Sweden and Holland, Japan and Italy, Poland and Czecho-Slovakia, France and England, Belgium and Denmark, Australia and America, appreciating the gravity of the world situation, worked through hours and days to bring about, as a delegate expressed it on the floor, "a common document, a common law, a common practice, which will be accepted by all the nations, and which will make it easier for commercial men to carry on international business."

Upon scrutiny, the obstacles in the way of a restoration of the world's commerce fell into two classes: those political, and those purely of the business world.

Tackling the first, the business men reached these conclusions (the ideas are theirs, the words are mine):

"The most important factor in the resumption of normal trade is the restoration of confidence. Confidence that governments will endure and peoples will work and pay will beget adequate credit and financial resources."

Then human nature asserted itself in an "I told you so"—

"A year ago at Brussels and at Paris we emphasized the urgent need of financial reform of governmental expenditures if grave disaster were to be avoided."

"Little has been done and many of the evils anticipated are upon us."

"It ought to be apparent now that confidence and prosperity cannot be restored until all governments, yours and mine, without delay, remove burdens so largely responsible for widespread unemployment and paralysis of industry."

If governments sincerely wish the advice of business men on this business subject, it is:

1. Drive the knife deep into governmental expenses.
2. Stop printing paper money.
3. Study carefully the effect which the Inter-Allied debts and the payment and use of the German reparation will have on exchanges. We will help.
4. Disarm, according to the treaties, and thereby reduce budgetary expenses.
5. Support export credit organizations, but let private enterprise create and run them.
6. To governments with depreciated rate of exchange—don't contract new external debt.
7. Grant the greatest possible liberty to all commercial and financial transactions.
8. Remove the system of double taxation—a heavy burden on international trade.
9. The Ter Maulen plan of export credits we have examined carefully. It is all right. Support it.
10. Don't harass a foreign bank, just now of all times.
11. Consider: A tax on export of raw materials inevitably increases cost of product.
12. Don't make it so hard for commercial travelers, with burdensome, complicated, and difficult formalities as to their samples, and the slow and irritating procedure of identification.
13. Simplify passports, abolish exit visés, fix moderate fees for entrances and transit visés.
14. Government control or operation of business renders trade conditions uncertain and artificial. Desist.

These were the suggestions to governments, not flipped off as I have written them, but after days—and nights—of consideration.

Nor in the searching analysis did the delegates spare themselves. Here are some of the tasks business may do without the help of government in clearing away obstructions:

1. Arrange for a combined rail and ship bill of lading.
2. For a uniform ocean bill of lading.
3. Interpret f.o.b. and other trade terms to importers, exporters, bankers, forwarding agents, ship owners and underwriters of each and every country.
4. Reduce waste in the production and use of raw materials.
5. Learn definitely the status of construction in each country.
6. Get accurate statistics on materials essential to the world's economic life, and make them promptly available.
7. Set up machinery to settle trade disputes by arbitration, thus eliminating the law's delay and the fear of the law's delay.
8. Confer with science and religion in an effort to adopt an unchangeable calendar.
9. Standardize in factories; eliminate multifarious parts.
10. Establish on great international traffic routes through freight trains.
11. Work together for improvement of international telegraph, cable, telephone, and wireless communications.
12. Create free zones for re-exportation of goods.
13. Restore and extend pre-war international postal services; pay losses promptly; extend to all countries the system of declared values.

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Chamber of Commerce Tax Recommendations

A general turnover tax on all business transactions was recommended by the Chamber of Commerce of the United States July 27 to the Ways and Means Committee of the House of Representatives, which began hearings on revenue legislation.

The committee was informed in a communication that the chamber advocates this form of sales tax as a part of a general tax program, which it is advancing as the result of a final referendum vote just completed among the commercial and industrial organizations within its membership. This referendum is the second taken on taxation within six months. The program which the chamber suggests to Congress is as follows:

Repeal of excess-profits taxes.

Repeal of war excise taxes, both those on transportation and communication, and those levied in relation to particular businesses.

A tax on all turnovers to bring in such revenues lost through these appeals as the Government's necessities require.

Decentralization of administration of income taxation.

Ascertainment by the Government of any tax based on income before payment.

A court or courts of tax appeals to be entirely separate and independent of the Treasury Department.

Net losses and inventory in any taxable year to cause redetermination of taxation on income of the previous year.

An exchange of property of a like or similar nature to be considered merely as a replacement.

Gains realized from the sale of capital assets to be subject to lower rates than income received from business or other activities.

Income from any new issues of securities, which lawfully may be made subject to federal tax, to be taxable.

Exemption of American citizens resident abroad from the American tax upon income derived abroad and not remitted to the United States.

More than 500 business organizations voted in the referendum just completed. A preliminary canvass shows that the most general demand, after a vertually unanimous demand in the previous referendum for repeal of the excess profits tax, is for repeal of the taxes on freight and express charges, passenger fares and pullman charges, and messages—i.e., for an end to the war excise taxes on transportation and communication. For repeal of these excise taxes there were 1,443 votes to 290 votes against.

The various organizations are entitled to from one to ten votes, based on their membership strength.

The next largest vote is for repeal of war excise taxes levied in connection with particular businesses—i.e., ranging from automobiles and their accessories, through theater tickets, beverages, candy, jewelry, insurance, wearing apparel, musical instruments, etc., to chewing gum.

The excess profits tax and the excise taxes, the removal of which the chamber urges, have been estimated to produce more than a billion dollars in revenue. So far as the Government's necessities require a replacement of the revenue lost through these repeals, the voting which has just closed means that the chamber would have Congress use a tax on all turnovers.

In voting for such a tax the chamber's members had an opportunity to vote for an increase in the income tax on corporations. The result of the balloting shows that they decisively preferred the general turnover tax.

The referendum which has just closed was in effect supplemental to the referendum taken in the winter on taxation. The earlier referendum was important in fixing the chamber's position upon many questions but it did not produce a definite result with respect to sales taxes. A conclusion to discussion among the chamber's membership on sales taxes has now been reached, with an unmistakable declaration for a sales tax and with designation of the general turnover tax as the type that is widely favored.

On the issue between an increase in the income tax for corporations and a sales tax, to take the place of the excess-profits tax, the voting was clear-cut in its indication of the point of view that prevails among the member organizations. One thousand one hundred seventy votes were cast for the sales tax to 108 for an increase in corporate income tax. Technically, all of these votes cannot be counted in the official canvass, but their effect is not lost since they were correctly cast upon the questions which followed and which determined the chamber's position.

On the form a sales tax should take, 1,142 votes were cast in favor of a tax on turnovers to 395 for a tax on retail sales. On the question as to which of two forms of turnover tax should be used there were 824 votes for a tax on all turnovers to 366 for a tax on turnovers only of goods, wares, and merchandise.

"In two respects the chamber's present program differs from the position it originally took," says a statement issued by the chamber. "In the referendum of last winter there were 1,217 votes cast in favor of excise taxes upon some articles of wide use but not of the first necessity, and 504 against. There were later some suggestions that a number of organizations had erred in marking their ballots, with a result that they were recorded in favor when they were in fact opposed to such taxes. However that may be, the present declaration for a sales tax of the turnover form leaves no doubt that the chamber favors a sales tax, and not excise taxes.

"The second instance involves the income tax upon gains from capital assets. Last winter the members of the chamber voted that these gains should be allocated over the period in which they were earned and taxed at the rates of the several years in the period. At the chamber's annual meeting, held in April, the delegates representing the organization members took the attitude that this would not afford sufficient relief and that if, in the maintenance of necessary revenues, such gains are to be treated as income, they should be properly defined and then subjected to more reasonable rates, these rates to be lower than on income derived from business or other current activities."

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Metric Bills in Congress

On December 29, 1920, Mr. Britten, Congressman from a Chicago district, introduced a bill (H.R.-15420) entitled "A bill to fix the metric system of weights and measures as the single standard of weights and measures." This bill died with the expiration of the 65th Congress.

On April 11, 1921, Mr. Britten introduced another bill (H.R.-10) entitled, "A bill to fix the metric system of weights and measures as the single standard of weights and measures for certain uses"—the last three words being additional to the title of the December bill. The bill was referred to the Committee on Coinage, Weights and Measures, the chairman of which, we are informed, has announced that he sees no reasons "for further delay in holding comprehensive hearings on legislation looking to the adoption of the metric system as the single standard of weights and measures."

The Publicity Service of the Institute recently issued an analysis of this bill in news letter No. 53. This has been mailed to all members and others. Additional copies and a copy of the bill itself may be had upon request.

It is probable that actual hearings on the Britten bill will be considerably delayed, although Mr. Britten, on numerous occasions, has loudly proclaimed his intention to force the issue as fast as possible.

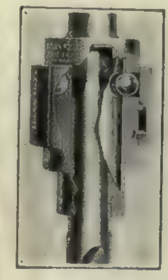
As a matter of fact the bill is a straddle. It exempts the manufacturer in part, but clamps down the metric lid tight on domestic trade and commerce. Evidently the metric party has begun to feel the weight of the condemnation of manufacturers and is now trying to lure them into an acceptance of a partial compulsory adoption by the trick of a dual system. Such a scheme could only lead to hopeless confusion and the establishment by law of a confused hybrid system with all its evil consequences. The lure will not succeed.—*From July Bulletin of the American Institution of Weights and Measures.*

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Chuck, Drill, Quick-Change

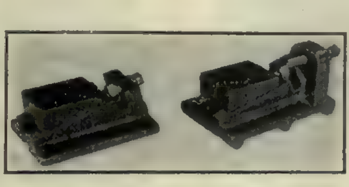
Titan Tool Company, 26th and Holland Sts., Erie, Pa.
"American Machinist," May 5, 1921



The chuck is of the collet type, collets being provided to fit either straight-shank or taper-shank drills, the latter being illustrated. The speed of operation of the chuck is emphasized, it being necessary to use only one hand to insert or remove the collet carrying the drill. On taper-shank drills the tang projects through the upper end of the collet, so that the drill may be removed by merely striking the end of the tang. A special type of collet is provided for use with broken-tang taper drills, so as to give a positive drive. A positive drive is provided for straight-shank drills. The chucks are made of high-carbon steel. Because of the fact that the ring is spring actuated, it is possible to operate the chuck in any position.

Wedges, Leveling

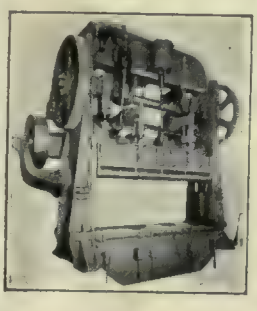
Cincinnati Engineering Tool Co., 4659 Spring Grove Ave., Cincinnati, Ohio.



The wedges were originally developed for use in leveling planers, but it is said that, due to the accuracy of the adjustment and the convenience, they can be used successfully on all types of machines where a high degree of accuracy is to be maintained. The fine pitch screw allows accurate adjustment. The blocks are furnished in two types, the plain leveling wedge and the abutment block, the latter having an additional screw to press against the foot of the machine and to serve for moving it. The blocks ordinarily set in concrete. For merely leveling, the plain wedge is used. The abutment block serves in addition for positioning and holding the planer or other machine.

Press, Double-Crank

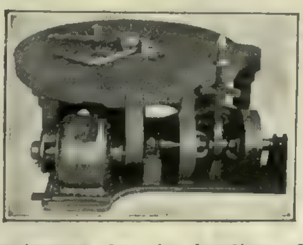
Toledo Machine and Tool Co., Toledo, Ohio.
"American Machinist," May 12, 1921



The press is said to be adapted to a wide range of work, and especially suited to the needs of builders of automobiles who do not have a sufficiently large output to warrant a power press for the performing of but one or two similar operations. A cam-actuated stripping and holding device and a spring-pressure drawing attachment are provided. The former is used in connection with perforating dies, and the latter with some of the forming dies. The press is self-contained. It is fitted with a friction clutch, which permits of the instantaneous stopping or starting of the press at any point of the stroke. Centralized forced-feed lubrication is provided. Two air cylinders are mounted on the crown of the press to counterbalance the slide. The drive is through twin gears on the main shaft, from a motor belted direct to the flywheel.

Bending Machine, Bar, No. 8

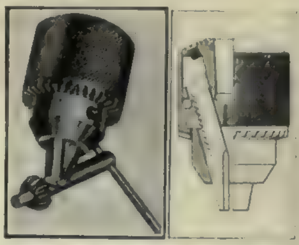
Wallace Supplies Manufacturing Co., 412-20 Orleans St., Chicago, Ill.
"American Machinist," May 12, 1921



The machine is intended chiefly for the bending of reinforcement bars in large quantities, but also adapted to bending angle iron, channels, pipe, tubing and special sections. It can be furnished either with an independent motor or arranged with friction clutch pulleys for belt drive. Square twisted reinforcement bars 1½ in. in diameter can be bent on the machine, or two 1¼ in. bars at one time. By using extra high forming pins and rollers, small bars in quantities from 8 to 10 can be formed simultaneously. Special equipment for the bending of flats, rounds, squares, channels, angles, tees and other sections can be furnished. A motor of 7½ hp. is required to operate the machine. The approximate weight is 3,500 lb., and the floor space required is about 6 x 6 ft.

Chuck, Drill, "Super"

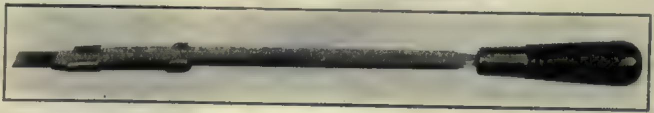
Jacobs Manufacturing Co., Hartford, Conn.
"American Machinist," May 5, 1921



In principle the chuck is the same as the former design of Jacobs chuck, but it has been redesigned to reduce the weight relative to the capacity and at the same time to increase the strength of the parts and give a stronger grip. The accompanying illustration shows the appearance of the chuck, as well as the interior construction. A ball thrust bearing has been added to reduce the friction of the sleeve in tightening the chuck on a drill, and the lead of the thread on the nut and jaws has been increased. The chuck is made in seven sizes, giving a capacity up to 1 in. The smallest size, which holds drills from 0 to ¼ in., weighs 7 oz., and the largest size, with a range of from ⅜ to 1 in., weighs 6 lb. 8 ounces.

Scraper, Hand

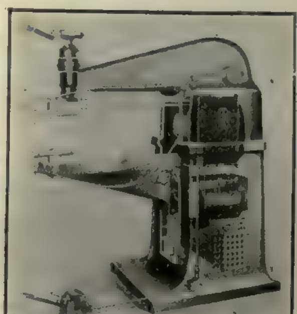
Anderson Bros. Manufacturing Co., Rockford, Ill.
"American Machinist," May 5, 1921



The tool is an outgrowth from the development of pneumatic scrapers, since it was found necessary to obtain a special alloy capable of withstanding severe scraping service. This steel is used for the blade of the hand scraper; and it is said that it takes a greater hardness, holds a keener edge, does not scratch, and that one blade lasts as long as four ordinary hand-forged scrapers. The body is of tough steel. The clip is notched on the inside to receive and hold the blade in place, and a lug prevents the blade from slipping back. This lug causes the clip to automatically tighten when pressure is applied.

Welding Machine, Spot, Vertical

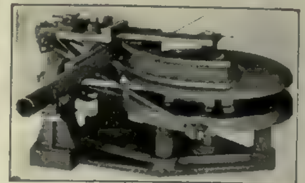
American Electric Fusion Corporation, 1906 N. Halsted St., Chicago, Ill.
"American Machinist," April 28, 1921



The machine is built in four sizes and designated as Type VW, the nominal throat depths of the different sizes being 12, 24, 36 and 48 in., but in each case the actual throat depth exceeds the nominal by about 8 inches. The column is of box-form and incloses all high-voltage parts of the electrical mechanism, including the switches. The lower horn support is a box-form casting that slides on ways bolted to the front of the column. The upper head is so constructed that it may be completely turned around. The welding points are copper die-castings. The total height of the machine is 76 in.; the floor space, 28 x 52 in. for a 12-in. throat; and the net weight is 1,950 lb.

Bending Machine, Pipe, No. 14

Wallace Supplies Manufacturing Co., 412-20 Orleans St., Chicago, Ill.
"American Machinist," May 12, 1921



The machine is intended for bending standard iron pipe or tubing up to 4-in. pipe size, or 4½ in. outside diameter. The roller bracket is adjustable to take forms up to 48 in. in diameter, and is operated by an eccentric lever to force the tube or pipe into a groove or form. The machine is operated by a lever, engaging friction-clutch pulleys for forward and reverse drive. Adjustable stops are provided to suit any degree of bend required. Bends can be made cold without the use of an inside follower or floating mandrel. Four-inch pipe can be bent to a radius as small as 24 in. Six standard forms are furnished with the machine, but special equipment can be provided.

Clip, paste on 3 x 5-in. cards and file as desired!

Washington Notes

By Paul Wooton
Washington Correspondent

Activities at all United States Navy Yards are practically at a standstill. All new construction has been ordered stopped. The limited forces being retained at some of the larger Navy Yards will be concentrated on work of an entirely essential character. The order already has been issued closing the naval station at New Orleans, which was an establishment calling for an expenditure of $1,000,000 a year. Other large naval activities will be suspended at the earliest opportunity.

This action on the part of the Secretary of the Navy has put a stop to the operation of a large number of plants engaged in many types of mechanical work. When the armistice was signed, these plants were employing 100,000 mechanics and related shop workers. On August 1, there still were being carried on the rolls some 45,000 of these employes, but the greater part of them were on enforced furloughs. An idea of how deep the knife has gone can be had from the fact that only 1,900 men were actively engaged in the New York Navy Yard on August 1. Even with the present reduced forces, further cuts are said to be in contemplation.

The intimation is abroad—and it comes from a source no less than the Secretary of the Navy—that we may mark time in naval activities at least until the outcome of the disarmament conference is known and possibly until the influence on naval construction of aviation, chemical warfare and the submarine may have become demonstrated more clearly. It is very evidently the idea of those who influence the nation's naval policy that the chance of war will be small during the next decade and that this offers a particularly opportune time to reduce naval expenditures.

Maj. McFarland Honored

By order of the President, a distinguished service medal has been awarded to Maj. Earl McFarland, of the Ordnance Department. During the war, he attained the rank of colonel. The citation comes for his service in designing, developing and directing the production of machine guns, automatic rifles and their accessories. The citation states that he also rendered exceptionally meritorious and distinguished service in organizing the industries of the country to meet the unprecedented demands for automatic arms created after the entrance of the United States into the war. Later, Col. McFarland was made special assistant to the Chief of Ordnance in charge of all matters pertaining to small arms, automatic arms and equipment.

Maj. McFarland is now stationed at Springfield, Mass. He is a native of Kansas and received his appointment to the United States Military Academy from that state.

Metric System Bill

Senator Ladd, who on July 18 introduced a bill in the Senate providing for the compulsory use of the metric system after a period of ten years, is making every effort to have a sub-committee appointed in order to arrange for an early hearing on the bill. It is possible that three members of the committee on standards, weights and measures can be induced to take the time necessary for these hearings, in which case the hearings may begin not later than August 15.

◆

Representative Garner, of the House Ways and Means Committee, declared repeal of the excess profits tax, reduction of surtax to 35 or 40 per cent and an increase in the income tax on corporations are all the Ways and Means Committee will offer in tax revision.

Senate Finance Committee reported favorably the Administration bill giving Treasury blanket authority to conduct negotiations for funding of Allied debts.

A bill was introduced in the House by Representative Appleby, of New Jersey, providing a tax of 40 cents per horsepower on automobiles.

◆

Patent Legislation Blocked

Patent legislation continues to be held up in Congress, says a statement issued by the American Engineering Council of the Federated American Engineering Societies.

"Meanwhile," the statement adds, "applications at the Patent Office during the past six months broke all records. The congestion there is becoming more and more serious. Failure to provide additional help and salaries continues to operate against efficiency under the increased load."

Death of E. A. Suverkrop

E. A. Suverkrop, whose writings have been known to the readers of the *American Machinist* for many years, both under his own name and the pen name E. A. Dixie, died July 29, aged 57 years. Among his first writings for the *American Machinist* were those concerning the doings of "Hanlon" which attracted much attention on account of their combined humor and suggestions as to handling various mechanical difficulties.

E. A. SUVERKROP

His writings led to his becoming a member of the editorial staff on April 11, 1904, this connection continuing until July 1919, when he resigned to develop his method of manufacturing accurate gage blocks.

Born in Washington, D. C., May 6, 1864, but educated abroad for the most part, "Suver" as all his friends called him learned his trade in English and Scotch shops, largely on marine engine work. This, coupled with his love of adventure led him to the sea and as a marine engineer he visited practically all parts of the globe. His travels, together with his observing nature and an excellent memory, gave him a fund of general information which was remarkable in its variety. Whenever an unusual inquiry came into the office, the first step was always to ask "Suver" and in most cases it was unnecessary to go elsewhere for the desired information.

His work on the *American Machinist* needs no comment as it speaks for itself and while it covered a wide field of activity he was always keenly interested in extremely accurate work. His enthusiasm over the first Johansson block which came to this country helped in no small measure to popularize "Jo" blocks in the American machine shop. Always wanting to know how difficult tasks were accomplished he set about finding a method of making similar blocks in a commercial manner and patented machinery for doing this work long before he left the *American Machinist*, The development work had just been accomplished and he had begun to market his products in a small way when attacked by his last illness.

No one who knew "Suver" can forget his genial manner, his frankness, his dislike of pretence, his unselfishness, both in giving information or other assistance freely or his fund of interesting anecdotes. He had many friends in various parts of the world who will miss him in many ways. He was a member of the American Society of Mechanical Engineers and Copestone Lodge F. & A. M. He leaves a widow and three sons.

◆

George W. Ketcham, former New Jersey State Senator, banker and manufacturer, died July 22 at his home in Newark, N. J. Mr. Ketcham was a director in the Central Stamping Co., of Newark, and was also its secretary and treasurer. He was also a director of the American Insurance Co.

Frank F. Stanley, for the past 39 years head of the Stanley Co., builders of machinery, and also president of the Stanley Marine Engineering Co., both of Swampscott, Mass., died at his home in that town July 18, aged 71 years. He was the last of the three trustees named in the will of Gordon McKay, millionaire shoe machinery builder.

Glauber Mfg. Co. to Have New Home

Purchase of the entire plant and grounds at Cleveland, Ohio, recently vacated by the National Malleable Castings Co., as the new home for the Glauber Brass Manufacturing Company, was announced Tuesday by Morris H. Glauber, owner and operator of the latter corporation.

Twenty-six factory buildings are included in the National group and the ground area covers eight acres.

The buildings in the group are all modern and of steel, brick and concrete. They range from one to four stories in height and will require little alteration to suit the requirements of the Glauber company. Work on the necessary changes has already begun.

According to Mr. Glauber, plans are being worked out for incorporating on a larger scale, and provision made for taking over other large brass concerns.

◆

Investigating the Corrosion of Soft Metals

The results of the investigation by the Bureau of Standards of soft metals have been assembled and work on a publication will soon be started. The investigation was conducted for the purpose of determining to what extent inter-crystalline embrittlement occurs in the soft metals—zinc, aluminum and tin, as a result of prolonged corrosion. The behavior of lead has previously been studied. An additional study of the last-named metal to show the accelerated influence of applied stress in causing embrittlement by corrosion was also made.

New Publications

Statistical Abstract of the United States, 1920. Issued by the Bureau of Foreign and Domestic Commerce, Department of Commerce, and printed by and sold through the Government Printing Office, Washington, D. C.

A volume of condensed statistics, mostly in tabular form, covering practically every phase of our national life. It is a very complete work and contains valuable information to every business or professional man.

The Advertising Handbook. By S. Roland Hall, former advertising manager of the Alpha Portland Cement Co., and Victor Talking Machine Co., and former principal of the International Schools of Advertising and Salesmanship; contains 743, 5 x 7-in. pages and is published by McGraw-Hill Book Co., 370 Seventh Ave., New York City.

This is a book that should be of great value to everyone having to do with advertising in any of its phases. Especially valuable to the business man interested in some degree in advertising who wants detailed, definite information, and to the younger man studying the art of advertising.

It is the best text book on advertising that we have seen. It is one of the most constructive and useful books on advertising that has yet been compiled. It contains a certain amount of the right kind of theory of advertising and is also intensely practical. It is profusely illustrated with advertisements that have been actually used. The typography is excellent and the arrangement makes it easy to find any subject in which the reader is interested.

History of the Shipbuilding Labor Adjustment Board, 1917 to 1919. By Willard E. Hotchkiss and Henry R. Seager, of the Board: Bulletin No. 283 of the U. S. Bureau of Labor Statistics, published at the Government Printing Office, Washington, D. C.

A comprehensive history of the work of the Shipbuilding Labor Adjustment Board covering the period of its existence as a war emergency organization. Its several chapters tell of the operations of the board in settling labor difficulties and rendering awards in the various shipyards under Government control. In the appendix are given tables showing the wage rates established by the board.

The authors are capable administrators Mr. Saeger being professor of politica economy at Columbia University, and Mr Hotchkiss director of the National Industrial Federation of Clothing Manufacturers

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Furnace, Heat-Treating

Bellis Heat Treating Co., Blake and Valley Sts., New Haven, Conn.

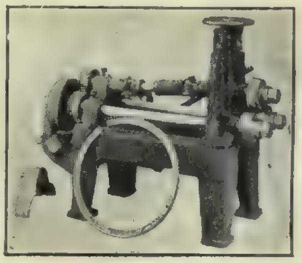
"American Machinist," May 12, 1921

The company is prepared to install furnaces and supply crucibles and salts for the Bellis process of heat-treating high-speed and other steels. For high-speed steels a triple-unit furnace, shown in the illustration, is used. Though burners are supplied for all three chambers, those in the outer chambers are for the purpose of bringing the furnace quickly to working temperature, after which they may shut off and the relative heats maintained by the flame from the central chamber. Either gas or oil burners are used. They are set tangentially in circular chambers, so that the flame does not impinge directly upon the crucibles. Crucibles for the higher temperatures are made double, with an outer shell of special refractory material and a lining of steel, which does not react chemically to the molten heating compound.

Coiling Machine, Ring No. 3

Wallace Supplies Manufacturing Co., 412 Orleans St., Chicago, Ill.

"American Machinist," May 12, 1921



The machine is intended for the manufacturing of rings and coils. The rolls are removable and can be changed to suit the character of the section to be bent, handling angles, channels, tees, tubes and bars of standard or special section. Angle iron 2 x 2 x ¼ in. in size can be bent cold to a circle as small as 30 in. in diameter, while lighter sections can be bent to smaller circles. Twisted or deformed structural bars can be bent, as in the forming of helices such as are used for reinforcing concrete columns. The position of the upper roller is adjustable by means of a hand-operated screw to give the required diameter to the coil or ring. The machine occupies a floor space of 42 x 54 in. and weighs 1,200 lb.

Drafting Outfit

Simplex Tool and Instrument Co., 820 N. Third St., Camden, N. J.

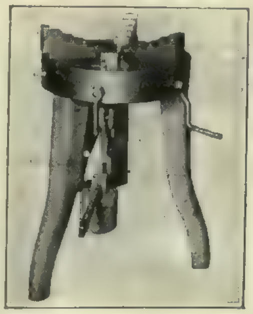
"American Machinist," May 12, 1921

The equipment consists of a frame carrying the board, on which is mounted the parallel-ruling device holding the scales. The board may be placed in either a horizontal or a vertical position. The sliding horizontal board shown underneath the main board forms a table to hold reference drawings up to 24 x 40 in. in size. Removable casters are supplied. A drawer and tray are provided at the side of the machine for holding pencils and drawing tools. At the top of the board is a track on which runs a carriage holding the bar that extends across the board. An indexing head is mounted on the bar. Two scales placed at right-angles are held on the head, the scales being swiveled easily by means of the left hand.

Chuck, Bushing, Grinding-Wheel

Commercial Welding and Machine Co., Inc., 21 Commercial St., Worcester, Mass.

"American Machinist," May 12, 1921

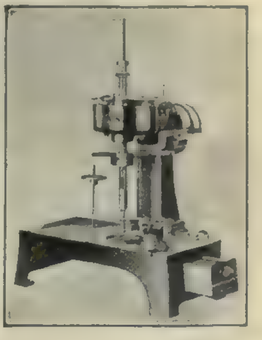


The chuck is intended for use in the bushing of grinding wheels. The device embodies two independent chucks, one holding the bushing arbor, and the other the wheel or part to be bushed. It is said that the work is centered accurately, and held so that the hole will be at right-angles to the side of the wheel. The device is dust proof. The work holding chuck is said to be very substantial, but adjustable to a fine degree and sensitive enough to hold delicate work without straining or breaking it. It is made in an 18-in. size, mounted on three legs. A lathe chuck is also made in a 12-in. size for turning abrasive wheels. Arbors on which to cast the bushings can be furnished in sets from ½ to 5 in. in diameter. The arbor chuck and the wheel chuck are adjusted by means of wrenches on separate screws on the periphery.

Boring Machine (Re-), Cylinder, No. HM7

Hinckley-Meyers Co., 19 N. Michigan Ave., Chicago, Ill.

"American Machinist," May 12, 1921



The machine will rebore open-head cylinder blocks not exceeding 20 in. in height and having cylinder bores from $2\frac{13}{16}$ to 5 in. in diameter. The table is low, so that the motor blocks can be easily placed in position. The pilot bar is lowered through the cylinder, centering in a hardened bushing in the table. A hardened, split and tapered centering fixture is used to locate the cylinder block. The cutter head contains three adjustable cutter blades. It is mounted on the boring or cutter bar, which is maintained in its proper relation to the cylinder by traveling over the pilot bar. The cutter bar is driven at the speed of about 40 r.p.m. It is fed automatically and is provided with an adjustable stop collar. The machine consumes only about 1 hp. in operation. The floor space required is 50 x 40 in. and the weight 1,500 lb.

Furnace, Hardening, Tool

Advance Furnace and Engineering Co., Springfield, Mass

"American Machinist," May 12, 1921

The furnace is of the semi-muffle type in which the flame chamber is located below the floor of the heating chamber, the heat being conducted to the latter by flues. The burner is located in the rear of the furnace and may be adapted to the consumption of either gas or oil fuel. The door is suspended on three radius rods, so that when it is lifted it does not drag the hot firebrick lining against the furnace front, but swings away in a long arc, and comes to rest against the furnace front again when it reaches the full open position. The furnace shown is for handling carbon steel only. Furnaces for heating high-speed steel have an additional heat-insulating covering and a sheet-iron jacket.

Truck, Industrial, Crane, Electric

Elwell-Parker Electric Co., Cleveland, Ohio.

"American Machinist," May 12, 1921

This low-bed electric industrial truck has been equipped with a crane, thus adapting it for loading, hauling and tiering. It is said that the crane can pick up 2,000 lb., and can stack material to a height of 8 ft. The truck itself can carry a load of 3,000 lb., and travel from 300 to 400 ft. per minute. The revolving crane column is carried on large ball and roller bearings and can be swung by hand. The boom may be raised or lowered and locked in any position desired. The power for this movement is obtained from the same motor that winds the cable, the hoisting mechanism being so mounted as to counterbalance the load. All four wheels are used for steering and the two rear ones for driving. The crane may be fitted with an 18-in. magnet for the handling of scrap material.

Match Plates, Metal

St. Louis Machine Tool Co., 932 Loughborough Ave., St. Louis, Mo.

"American Machinist," May 12, 1921

This line of steel and aluminum match plates is adapted to light and medium foundry work. The patterns are secured to the plates, thus insuring that the cope and drag parts of the molds will fit each other properly. The plates consist of flat sheets of metal, each provided with clamps and guides for fitting the flask pins. They are made either round, rectilinear or in any shape desired, and with the ears in the center or at diagonal corners. They are ordinarily used for work done in large quantities, and usually in connection with a molding machine. The plates are made in ten standard sizes. The steel plates vary in thickness from ⅛ to ¼ in. The aluminum plates vary from ¼ to ⅜ in. in thickness, and are said to be lighter than the steel plates and non-corrosive.

Clip, paste on 3 x 5-in. cards and file as desired

Business Items

The contract for a $60,000 factory has been placed by the Multiple Storage Battery Co., Jamaica, N. Y. Plans call for a structure one story high, 60x125 feet.

The Cumberland Machinery Co., Cumberland, Md., has established a modern machine shop for the repair of automobiles. About thirty mechanics are employed.

The War Finance Corporation has announced that it has agreed to make an advance of $250,000 to an exporter for the purpose of assisting in financing the exportation of sugar mill machinery to Cuba.

The Oxford Steel Products Co., Boston, Mass., has been incorporated with $300,000 capital by Clarence E. Dodge, Maurice T. Viall, Cranston, R. I., and Edwin C. Burbank, Malden, Mass.

The George C. Herron Co., Boston, Mass., has been incorporated to deal in power machinery with $20,000 capital by George C. Herron, I. J. Herron and Arthur H. Herron, Jr.

Lockwood, Greene & Co., Boston, Mass., mill engineers, are making plans for a steel frame, limestone front, fireproof, 11-story, 80x70-ft. building, of which they have leased the nine upper floors for occupancy.

The Maynard Co., Chelsea, Mass., has been incorporated to deal in machinery, tools, apparatus, etc., with $25,000 capital by Raymond P. Maynard, B. E. Bixby, Waverly, Mass., and Frederick C. Parow.

The L. A. Derby Co., Lowell, Mass., has been incorporated with $50,000 capital to handle electrical and mechanical engineering work by Lucius A. Derby, Frank H. Derby, Morton V. Loud and others.

The Boston & Maine railroad (offices at Concord, N. H.,) has let the contract for the erection of a brick and concrete roundhouse, office building and sandhouse to cost $200,000.

The International Marine Life Saving Equipment Corp., New York, N. Y., marine specialties, has been chartered with $520,000 authorized capitalization by Michael Johnell, John E. Ellys and others.

The Adams Distributing Corp., New York, N. Y., with $30,000 authorized capital, has been incorporated for the distribution of hardware and other articles. The incorporators include H. J. Otis, C. A. Borhein and others, 30 Pine Street.

The Lancaster Machine and Auto Repair Co., Lancaster, Ohio, has been incorporated with $8,000 capital stock by Paul Herbert, Joseph Welsh, James Walter and George W. Vorys.

The Marcy Tool Works, Inc., 79 Walnut St., Putnam, Conn., has recently incorporated with a capital stock of $100,000. The incorporators are A. W. Marcy, M. Marcy and H. Devine, all of Putnam.

Reliance Boiler Works, Pittsburgh, Pa., capital $40,000, has been chartered to erect and repair steam boilers by H. C. Feldstein, Raymond M. Collins and William Oloen.

The capital stock or the Oilgear Co., Milwaukee, Wis., a comparatively new concern, has been increased from $200,000 to $300,000 of preferred and 5,000 shares of non-par valued common shares.

Articles of incorporation have been filed by the Acme Valve Grinding Machine Co., Milwaukee, Wis., organized with $25,000 capital stock by B. A. Roberts, George W. Leitsch and George A. Fullips, 3507 Chambers Street.

The Southern Iron & Steel Co., Louisville, Ky., with $100,000 capital, has been incorporated by M. O. Curd, E. M. Drummond, James Drummond and others, all of Louisville.

The National Slag Production Co., Hamilton, Ont., has secured premises here and will establish a plant. Slag from the plant of the Steel Co. of Canada, Hamilton, will be utilized. The company is capitalized at $300,000 and is headed by Edwin J. Robertson.

Builders Steel Works Co., Pittsburgh, Pa., with a capital of $50,000 to manufacture iron, steel and metal products, etc., has these incorporators: William H. Miller, Bellevue; B. B. McGinnis, Pittsburgh; Roscoe H. Brunstetter, Wilson, Pa.

The Lindquist Engineering Works, Portland, Conn., has recently incorporated the business under the State Laws of Connecticut. At a meeting held last week the following officers were chosen: C. O. Hedstrom, president; T. C. Flood, treasurer and secretary; E. A. Lindquist, vice-president.

The plants of the Delco Light Co., Dayton, Ohio, manufacturer of electrical appliances and lighting plants, and the Burnett-Larch Manufacturing Co. report increase in sales of their products. The increased demand necessitated the employment of about 600 additional men.

The Tulsa Stove and Foundry Co., Sand Springs, Okla., manufacturer of grey iron, brass and aluminum castings, has completed a new plant and the old plant has been taken over by the Sash Weight Foundry Co. for the manufacture of sash weights.

Announcement was made last week of the sale of the plant of the Ungar Sheet Metal Products at Youngstown, Ohio, to Fred S. Ullman and Samuel H. Weinreich. It is understood that Ullman and Weinreich will incorporate a new company with a capital of $50,000 to manufacture all kinds of sheet metal products.

The Yonker Manufacturing Co. has been chartered with a capital of $50,000 to manufacture and deal in machinery, machine tools, etc. The incorporators are C. F. Souder, F. H. Newton, John H. Yonker, Harry L. Christ and LeRoy H. Geller, all of Toledo, Ohio.

Stringers Bros Co., Gadsden, Ala., which is incorporated for $200,000, has a new plant under construction. The company will purchase equipment for a brass and iron foundry suitable for the production of plumbing specialties. Charles C. Stringer, Chicago, is president, and F. G. Wineman is treasurer.

The Alabama Power Co., Birmingham, Ala., plans erection of a hydro-electric power plant at Duncan's Riffle, on the Coosa River. This will call for a dam 1,800 feet long and 74 feet high. It is estimated the entire cost will be approximately $25,000,000.

The suggestion system at the plant of the National Cash Register Co., Dayton, Ohio, originated by John H. Patterson in 1894, has resulted in total payments of more than $92,000 for suggestions. Nearly 83,000 suggestions have been submitted by employees, and more than one-third of these have been adopted.

During the last suggestion contest about 6,400 suggestions were received. Eight thousand dollars in prizes will be awarded to employees who made the best suggestions

Improvement in conditions in the iron and steel industries in the Alabama district is indicated by the fact that the melt of pig iron in the district is on the increase. Cast iron pipe makers, manufacturers of radiators, and the various sanitary pipe plants in the district are experiencing a gradual increase in business, and while this is not sufficient to bring about much improvement in the buying of pig iron, the plants are purchasing as their needs present themselves and improvement is noted that portends better times in the near future.

Pipe makers in the district are now operating on a 60 per cent capacity basis on the average. The building boom throughout the country is having a favorable effect. Men of the industry believe there will be a considerable demand for pipe and fittings the remainder of the year, and that the melt of the necessary metal may start up shortly on a lively scale.

Personals

Ernest T. Clary, assistant works manager of the Whitin Machine Works, of Whitinsville, Mass., has recently been chosen production manager for the plant.

Donald P. Hess has become general manager of the Columbus plant of the Timken Roller Bearing Co., succeeding C. N. Replogle, resigned. Mr. Hess has been connected with the Timken company at its Canton, Ohio, plant for almost three years.

W. K. Swift, manager of the New England sales branch office of the Ingersoll-Rand Co., New York, N. Y., for the last eight and a half years, has resigned. Mr. Swift has not announced his plans for the future.

Roy Davey, who has been manager of the Detroit Branch for the American Bosch Magneto Corporation, has been promoted to the position of manager of the manufacturer's trade department. Mr. Davey will be located at the main office at Springfield, Mass.

W. R. Milner, body engineer of the Cadillac Motor Car Company, has resigned to join the engineering staff of R. H. Collins, who recently withdrew as president and general manager of the Cadillac Motor Car Company to build a high-grade automobile bearing his own name.

E. B. Germain, for three years general manager of the Harlan plant of the Bethlehem Shipbuilding Corporation, has been advanced to a more responsible and important position with the Bethlhem interests in connection with its general sales department. W. Weaver, of Wilmington, Del., who has been superintendent of the Harlan yard, will be advanced to Mr. Germain's position.

Stuart F. Brown, for several years in charge of the production department of the Whitin Machine Works, Whitinsville, Mass., has become agent for the Whitinsville Spinning Ring Co.

Henry D. Warner, a former manufacturer in Bristol, Conn., who has been selling second hand machinery in that state for several years, has established new headquarters at 26 High Street, Hartford, Conn.

F. E. L. Whitesell, who for some years was with the sales department of the Railway & Industrial Engineering Co., Greensburg, Pa., has been appointed its New England representative with headquarters in Boston.

W. H. Jackson has been elected president of the Pittsburgh-Des Moines Steel Co. to succeed E. W. Crelin, retired. O. E. Guibert and W. W. Hendrix were elected vice-presidents and George A. Smith, secretary and treasurer. Mr. Smith will be located in Pittsburgh, and A. C. Pearsall has been appointed general manager of the Des Moines branch.

Charles N. Holdredge, for the past 15 years assistant superintendent of the Hemphill Mfg. Co., Central Falls, R. I., builder of machinery, has resigned to enter business.

L. C. Bewsey, electrical and mechanical engineer and an expert on railway construction and operation has been appointed superintendent of the Michigan Railway company's lines in Kalamazoo, Mich.

Henry C. Walker and John A. Lind will open the Walker Machine Works, 2126 Folsom Street, San Francisco, Cal. The shop will be equipped with a complete set of lathes and machines for the conduct of a general machine shop.

John L. Key, Call Building, San Francisco, Cal., has been appointed the Pacific Coast representative for the Forges de La Providence Societe Anonyme), Marchienneaupont, Belgium, and will handle the full line of steel products manufactured by that company.

William L. Urquhart, export manager for the Hart & Hegeman Mfg. Co., Hartford, Conn., has been appointed British vice consul for the port of Hartford. He is the first British vice consul in any Connecticut city. Mr. Urquhart will retain his position with the Hart & Hegeman Mfg. Co.

E. A. Keithley, Rialto Building, San Francisco, representing the Central Foundry, Essex Foundry, Milwaukee Brass Mfg. Co., H. O. Canfield Co., G. M. Davis Regulator Co. and the Pittsburgh Valve Foundry & Construction Co., has opened offices in the Alaska Building, Seattle, Wash. Mr. Keithley's son, E. L. Keithley, has been appointed manager.

Norman W. Warren, for the last five years western manager of the Dominion Bridge Co., Ltd., with headquarters in Winnipeg, has been promoted to general manager for the Dominion of Canada of the company and will be located in Montreal, Canada.

H. C. Dickinson, who has been for some years chief of the automotive investigations division of the Bureau of Standards, has been granted a year's leave of absence from the bureau to become director of research of the Society of Automotive Engineers. He will, however, continue in some measure to co-operate in the Bureau of Standards investigations by giving a small amount of his time to conference and direction of the work of this division. Work of the S. A. E. on research will not include any experimental investigations by the society itself, but will deal rather with an exchange of research information, the general study of research in progress within the industry, and of interest to it, and an effort to secure proper arrangements for additional research work which is not now adequately cared for.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Grinders, Power-Head

J. L. Austin Mfg. Co., Milwaukee, Wis.

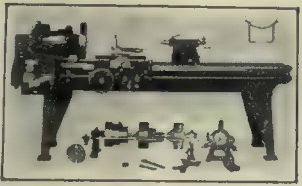
"American Machinist," May 12, 1921

The machine is made in three sizes to carry wheels 8 x 1 in., 10 x 1½ in., or 12 x 2 in. in size, respectively. It can be furnished either with or without the pedestal, and with single-pulley or double-pulley drive, the latter being used on the machine shown. The arbors are of high-carbon steel and run in babbitted bearings that are split to take up wear. The collars are pressed onto the arbors, and counterbored for the purpose of excluding dirt and dust from the bearings. The rest arms are equipped with both an angle and a bevel tool rest, and the back bracket is eliminated for the purpose of allowing more room around the wheel. The wheel guards are one-piece grey-iron castings.

Lathe, Quick-Change, 14-Inch

A. V. Carroll Machine Tool Co., Norwood, Cincinnati, Ohio.

"American Machinist," May 19, 1921

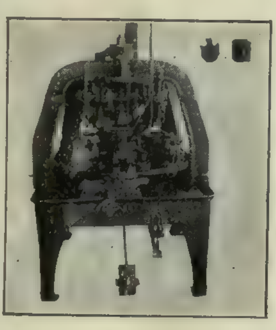


The chief feature to which the maker calls attention is a gap by which the swing over the ways is increased to 19 in. for chuck and face-plate work. The gap in the bed is not visible from the front or the back of the machine, since only the inner ways are broken. The small sketch at the upper right-hand corner of the illustration shows the construction used for the gap bed. The drive is by belt on a cone pulley. Either double or single back gears can be furnished. By the positioning of one knob and handle, 24 changes of feed, either right or left, can be obtained. The lead screw has a 4-pitch thread, and is adjusted by means of a threaded collar. The machine can be furnished in lengths of bed of 6, 8, 10 and 12 feet.

Drilling Machine, Multiple-Spindle, Automatic, Special

Langelier Manufacturing Company, Providence, R. I.

"American Machinist," May 19, 1921

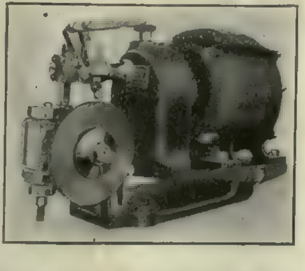


This is a six-spindle machine of the dial type for drilling the tumbler holes in pin-tumbler lock cylinders. The machine operates upon the progressive principle. Seven positions are provided, one for each of the six holes and one for unloading and reloading. The jigs are so arranged as to open and close automatically. A slide at each position carries a short, horizontally projecting arbor fitting the plug-hole in the cylinders to be drilled. A bushing plate guides the drills. The main drive of the machine is by belt to the pulley at the upper end of the vertical, central shaft, from which all the movements are derived. The spindles run at 5,000 r.p.m. and are mounted upon ball bearings. The dial is moved by a modified form of the "Geneva" gear.

Attachment, Milling and Grinding, Thread, "Universal"

Automatic Machinery and Equipment Co., 1110 Land Title Bldg., Philadelphia, Pa.

"American Machinist," May 19, 1921



The machine is intended for attachment on the tool block of a lathe for use chiefly in milling and grinding threads and worms. The machine will mill, flute and grind a tap in one setting, besides milling worms and cutting gears and ratchets. The illustration shows the Size "A" machine, fitted for grinding. There is a spindle, shown at the bottom of the spindle head, for holding the milling cutter. The head can be swung to bring the spindle in the desired position, it being graduated for the full 360 deg. to facilitate setting. The driving motor is mounted on a base hinged on the main base, so that the spindle can be raised or lowered. The length of the machine is 14½ in., the width 6 in., and the height 8 in. The weight is about 45 lb.

Table, Indexing, Rotary

Rhodes Manufacturing Co., Hartford, Conn.

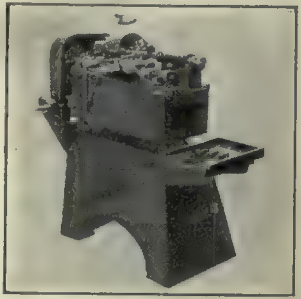
"American Machinist," May 12, 1921

The table is intended primarily for use in connection with the company's shapers, but is equally serviceable on a milling machine or drill-press. Slotted ears on three sides of the base and a hole through the index bracket on the fourth side provide a way to bolt the device to a machine table. Three index plates are provided, with which any number of divisions up to 360 may be obtained. Adjustable plugs of hardened steel provide means of compensating for the wear of the worm and the wormshaft bearings. The table is graduated in degrees, thus enabling the operator to make angular settings. Four clamping plates hold the table firmly in any position, when desired. The diameter of the table is 8 in., and the total height of the device above the machine table, 2½ inches.

Lathe, Screw-Cutting, Precision

Alfred Herbert, Ltd., Coventry, England, and 50 Church St., New York, N. Y.

"American Machinist," May 19, 1921

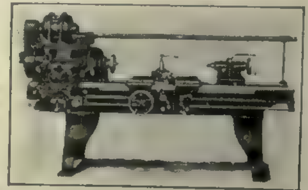


The bed of the machine is of box section and rests on three balls so secured to the base as to allow free expansion or contraction with temperature changes. The headstock is fitted with a three-step cone pulley, driving the spindle through gears with a speed reduction of 4 to 1. The lead screw is, in turn, geared to the spindle. The work center does not revolve. The tailstock has a fine adjustment across the bed. The saddle carries two slides, the top one having an eccentric bushing which permits adjustment of the height of the tool. The lead screw has a square thread, there being eight threads per inch. It is placed between the V's of the bottom slide and is ⅞ in. in diameter. A solid nut is used. A pitch-varying attachment is provided.

Lathe, Geared-Head

Morris Machine Tool Co., Court and Harriet Sts., Cincinnati, O.

"American Machinist," May 19, 1921



The company has fitted with a geared head and single-pulley drive its quick-change lathe. The machine is driven by an individual motor mounted on top of the headstock. It is made in swings of 16, 18 and 22 inches. The head provides twelve spindle speeds. The speed range for the 16-in. lathe is 12 to 347 r.p.m., while it is 10 to 297 r.p.m. for the 18- and 22-in. lathes. All speeds are secured through sliding gears and one positive back-gear clutch. The only friction clutch used is in the pulley at the initial drive. When releasing the friction clutch in the pulley a brake can be applied by the same pull to stop the idle rotation of the spindle. The geared head is interchangeable with the cone head and arranged to receive the motor-drive unit.

Gage Block Holder, Micro-

Van Keuren Co., 361 Cambridge St., Allston, Boston, Mass.

"American Machinist," May 19, 1921

This set of accessory measuring tools is for use with combination micro-gage blocks. The device is a holder for the gage blocks and the measuring points, forming a caliper. The micro-gages, which are round in shape, permit the use of a light steel tubing for the frame or clamp to hold them and the jaws. The micro-gages are inserted in the lower or open end of the tube, and the jaws are inserted in ½-in. slots. The clamp has a range up to 7 in. Small dimensions are secured with the jaws in the central slot. For long combinations the two end slots are used. The set includes two flat jaws, two plain and two scribing plugs.

Clip, paste on 3 x 5-in. cards and file as desired

The Belgian Machine Tool Market

(Acting Commercial Attaché Samuel H. Cross, Brussells, in Department of Commerce Reports)

While it would appear natural that a country in which transformative industries are as important as in Belgium, and which presents a highly developed iron and steel industry, would produce a large variety of machinery, Belgian production in this respect has been limited to certain special lines. The tendency to restrict production, except in the case of heavy machinery, to relatively small shops has naturally prevented standardization, while the limited character of the home market provided little stimulus in this direction. Bulk production has therefore been confined heretofore to articles that best sustain foreign competition in export markets on account of their low labor cost and superior quality.

The best-known branch of Belgian mechanical construction is locomotive and engine building, which centers in the Hainaut section, Ghent, and Liege. Beside standard and narrow-gage railway locomotives, the industry produces steam turbines, gas and oil engines for marine and industrial purposes, compound marine engines, and horizontal engines for river craft. Gas engines are generally used in Belgian metallurgical plants, and produce in some cases as high as 8,000 horsepower. Diesel motors are also constructed at Ghent, and are admitted to compare favorably with similar engines of German construction. Belgian steam engines and locomotives are well known for their relatively low coal consumption. Since the armistice, however, owing to the lessened repair and construction facilities of Belgian locomotive shops, the Belgian State railways ordered locomotives both in the United States and in England. The American locomotives have now been delivered (150 in number), and are, according to official statements by government engineers, rendering superior service.

Electrical construction, though a field of more recent development, is represented by large plants at Charleroi, Ghent, and Antwerp, turning out dynamos, motors, transformers, storage batteries, switchboards, telephone apparatus, cables, and a varied line of accessories. American capital is considerably interested in this branch of Belgian industry, which employs approximately 8,000 workmen.

Machine Tool Production

There are only four important Belgian plants manufacturing machine tools, two located in Brussels, and one each at Liége and Bruges, producing a relatively limited variety of implements. One of the Brussels plants specializes on lathes of 14 to 40-in. dimensions, while the other, which is now increasing its installations to a capacity of from 1,000 to 1,200 machines a year, builds lathes, shapers, and pneumatic hammers of good quality. The Bruges plant, aside from refrigerating machinery, turns out several models of boring mills which are considered equal to any similar makes produced outside the United States. The principal export markets for Belgian machine tools are France, England and Italy. Belgian toolmakers have frequently imitated American machines, and one case is noted where an imitation of a small American drilling machine sells for 650 francs, in comparison with 1,200 francs asked for the original. The prices for Belgian tools run in general from one-third to one-half of those charged for their American equivalents. For instance, a plant at Liége turns out a wheel lathe selling for one-third the price of a well-known American make. On the other hand, its weight also is only one-third of that of the American machine, and it may be reasonably supposed that its comparative durability is in proportion.

There is also one fairly large Belgian plant producing woodworking machinery, mostly of lighter sorts in comparison with the products of Swedish manufacture. This factory, which has an annual turnover of 15,000,000 francs, relatively large for a Belgian enterprise of this nature, is reported practically to control the French market for machines of this type.

Competition with American Tools

Local machine tool dealers state that before the war 70 per cent of all machine tools imported into this country were of German origin. For reconstruction purposes after the armistice, however, American machine tools of all classes, from the smallest millers to the heaviest grinding wheels and boring mills, were sold in Belgium in large numbers. The War Department alone disposed of $3,500,000 worth of tools through the co-operative known as the Construction Métallique, and it is estimated that fully as large a sum was spent on machines purchased privately. Though these large American sales created a temporary advantage, this preferential position was rapidly lost as soon as German machines, at relatively low prices, re-entered the field. While it is generaly recognized by Belgian machine tool users that German products are not of the same high quality (lathe beds, in particular, being made of inferior metal), local enterprises are now making stop-gap purchases of German tools to hold them over until a fall in the dollar makes it possible to acquire American tools at what they consider a more reasonable price. Several agents for American machine tools who carried large stocks suffered severe losses during the latter part of 1920 and owing to the readier sale of German products, one such agent at least has taken an agency for German machines. The sale of American tools must obviously suffer from this practice if it spreads further. The sale of German machine tools, except in this instance, is in the hands of relatively small and unimportant commission houses whose sharp methods and price cutting render matters difficult for the more reputable agents. While German manufacturers have been demanding cash with order, they rarely insist on this condition when a sale depends upon concessions.

Market Conditions

The shop and factory supply business, so far as American products are concerned, is now more profitable than the machine tool field. American wheels and small tools of most sorts sell with relative ease, but the market is practically closed to American twist drills. Not only do English twist drills offer some active competition, but prohibitive offers from German firms are beginning to appear. While there are in Belgium numerous small shops producing brass valves, the native product is not able to compete with the standardized American article.

German competition is particularly active in measuring tools and on small carbon steel articles. In the latter branch German manufacturers undersell American products in the local market by over 80 per cent. A 36-millimeter carbon drill is being offered in Brussels for 6.25 francs in comparison with 35.15 francs asked for a well-known American drill of the same size. It is the local practice to use carbon steel up to one-half inch diameters and above that dimension to employ high-speed steel. German price offers on micrometers are almost as exclusive as on drills. A German product, not of extremely high finish but of entirely accurate construction, is sold in Brussels for 31.20 francs, while the price asked for the corresponding American micrometer is 96 francs.

German tools of this sort placed on the local market bear no device or mark indicating their Teutonic origin, and even for an order of one such micrometer, the German manufacturer will stamp on it the name and address of the local purchaser free of charge.

Value of Farm Implements Manufactured Last Year

Gas tractors to the number 203,000 with a total value of $193,000,000; more than 1,000,000 plows with a value of over $40,000,000; 225,000 farm wagons with a value of nearly $25,000,000; and 412,000 haying machines with a value of nearly $25,000,000, were manufactured in the United States during the year 1920, according to detailed reports from 583 manufacturers summarized by Bureau of Public Roads, United States Department of Agriculture. The total value of implements manufactured was $537,000,000, and gas tractors constituted more than one-third of the total.

Southern Iron Stocks

Conviction is growing in the Birmingham district that the bottom has been at last reached in the iron and steel markets, and that price hammering is about to stop. Generally speaking, the present period seems to be regarded as one between tides, the ebb having been completed and the inward tide being about to start.

Stocks of iron in the yards of the producers are small and production is at a minimum. These yard stocks are reported to be becoming more and more ill-assorted, so that the melter finds it difficult to secure iron the analysis of his choice. Many shapes and lengths of cast-iron pipe are not in the yards. Some steel products are in the same condition.

Five mills of American Sheet & Tin Plate Co., at Cambridge, Ohio, resumed operations.

Small Tools Moving

Small tools are moving in a quiet way, but no large lists recently have appeared on the market. In the majority of cases machinery and tool prices remain unchanged, but dealers state that a reduction of approximately 10 per cent has gone into effect on twist stock carbon and wood boring drills. The revised discount is now 42½ per cent.

Technical Catalogs and Magazines Wanted

The director of the Government industrial school for mechanicians and commercial students at Vigo, Spain, would be pleased to receive any catalogs and magazines (preferably, but not necessarily, in Spanish) having to do with machinery and mechanics, that American firms may care to send him. Some funds are available for subscriptions to magazines, and after seeing specimen copies, the director will choose those that are most suitable. Send communications to the following address: El Sr. Director de la Biblioteca Escuela de Artes y Oficios, Vigo, Spain.

Forthcoming Meetings

The third annual convention and exhibition of the American Society for Steel Treating will be held in the Manufacturers Building, State Fair Grounds, Indianapolis, Ind., during the week of September 19 to 24 inclusive.

The annual congress of the National Safety Council will be held at Boston, Mass., during the week of September 26. C. W. Price, 168 North Michigan Ave., Chicago, Ill., is general manager.

A joint meeting of the American Society of Mechanical Engineers, the Society of Automotive Engineers and the Army Ordnance Association will be held at Aberdeen, Md., Friday, October 7.

The National Machine Tool Builders' Association will hold its Fall Meeting at the Hotel Astor, New York City, October 18, 19 and 20.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A firm in Norway desires to purchase a complete equipment for sand and gravel plants, especially conveyers and conveyer belting. Quotations should be given c.i.f Norweigian port or f.o.b. Atlantic port. Cash to be paid. Reference No. 35230.

A manufacturer in Mexico desires to purchase machinery for making tin cans and containers for alcohol, petroleum, etc. Quotations should be given c.i.f. Mexico or f.o.b. factory. No reference offered. No. 35235.

A merchant in the Dutch East Indies desires to purchase cocoanut shredding machinery, soap-making machinery (laundry soap only), and machinery and equipment for a tapioca mill. Quotations should be given c.i.f. Batavia. Terms: Cash against documents in New York. Reference, No. 35,242.

A development corporation in Sumatra desires to purchase machinery for the manufacture of barrels for the transportation of palm oil. Quotations should be given c.i.f. Sumatra. Reference No. 35251.

An industrial company in Belgium desires to purchase 500 to 1,000 household hand pumps and 500 to 1,000 semirotary valve pumps. Quotations should be given f.o.b. American port or factory. Designs of the pumps are requested. Reference No. 35252.

A municipality in a Central American country is soon to install a modern water and power system and requires piping, fittings, tools and other equipment. Quotations should be given f.o.b. American port. Cash to be paid. Correspondence preferred in Spanish, though English may be used. No. 35254.

NEW *and* ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Conn., Bridgeport—M. J. Dowling & Co., 586 Gurdon St., manufacturer of building supplies and equipment—one 12 in. x 5 ft. lathe (used), and a small planer.

Conn., Bridgeport—W. Stowe & Bro., 10 Madison Ave.—small lathe for garage.

N. J., Camden—The Bd. Educ., City Hall, will receive bids until Aug. 22 for equipment for machine, forge, sheet metal, foundry and woodworking shops.

Ill., Greenfield—The Bd. Educ.—manual training equipment for the proposed high school.

Mich., Saginaw—Niles Machine Co.—one 10 spindle $\frac{5}{8}$ in. multiple spindle drill.

Ala., Birmingham—Welded Products Co., 2701-9 North 7th Ave., E. Moses, Pres.—combined punch and shear of capacity $\frac{3}{4}$ in. holes in $\frac{5}{8}$ in. plate, might consider one for $\frac{1}{2}$ in. holes in $\frac{1}{4}$ in. plate, approximate depth of throat 6 in. Short lathe with 20 in. swing. Lathe with approximately 8 to 0 in. swing.

Fla., Gainesville—M. W. Smith, P. O. Box 388, M. W. Smith, Purch. Agt.—internal and external grinders.

W. Va., Huntington—The West Virginia Fdry. & Stove Co., 17th St. and 1st Ave., . C. Boggess, Mgr.—tumbling mill.

O., Columbus—Union Boiler Wks., 57 South Center St., J. J. Borger, owner—machinery for proposed plant on West Goodall St.

Wis., Luck—A. Jacobson and D. Crawford—machinery for auto repair work.

Wis., Milwaukee—J. Biedrzycki, 684 3rd Ave.—lathe 16 in. swing, for garage use.

Wis., Milwaukee—Junek Bros., 3022 North Ave., plumbers, J. Junek, Purch. Agt.—pipe cutters and threader.

Wis., Milwaukee—Razor Blade Knife Co., 504 First Natl. Bank Bldg., P. R. Newcomb, Purch. Agt.—machine tools to manufacture knives.

Wis., Milwaukee—U. S. Auto Radiator Co., 185 4th St., M. Wald, Purch. Agt.—one 30 in. tinners' folder.

Ia., Dubuque—Bd. Educ., c/o N. Palen, Secy., Bank and Insurance Bldg.—manual training equipment for proposed high school.

Mo., Joplin—Joplin Iron and Metal Co., and May Sts.—tools for cutting scrap iron.

Tex., Lockhart—W. K. Harris, P. O. Box 51, manufacturers of patented mechanical device, W. K. Harris, Purch. Agt.—die press to produce parts from metal about $\frac{1}{16}$ in. thick, using dies and formers as large as 12 in. square.

Thirty-nine dies and formers from $\frac{3}{8}$ in. wide and 5 in. long to 9 in. wide and 11 in. long, to cut and form metal parts from sheet metal about $\frac{1}{8}$ in. thick.

One $\frac{3}{8}$ in. and one $\frac{5}{8}$ in. steel rod, uniform in size, smoothly finished for use as shafts.

Cranks with $\frac{5}{8}$ in. bore, 6 or $6\frac{1}{2}$ in. radius, equipped with nicely finished wood, fiber or vulcanized rubber rotating handle.

Automatic enameling equipment.

Cal., Los Angeles—Union Bank & Trust Co., Garland Bldg.—equipment for auto service station on South Main and Adams Sts.

Man., Winnipeg—The Winnipeg Public School Bd.—equipment for workshops of the Daniel McIntyre College on Alverstone and Wellington Sts.

Pa., Philadelphia—The Hancock Coal Co., 1330 Belmont Ave.—one 46 or 48 in. circular rip saw.

S. C., Anderson—Masters Welding Shop, C. F. Masters, owner—complete welding equipment.

W. Va., Fairmont—Marion Constr. Co., 214 Professional Bldg.—complete machinery for wood-working plant.

Mich., Ironwood—Peninsula Granite Co.—granite and marble working machinery.

O., Cincinnati—Hyde Park Dairy Co., 3755 Edwards Rd.—ice machine.

Wis., Eagle River—Wisconsin-Michigan Lumber Co., E. W. Ellis, Mgr.—planing mill machinery.

Wis., Milwaukee—The Amer. Metal Products Co., Burnham St. and 3rd Ave., G. Staal, Purch. Agt.—light traveling crane.

Wis., Milwaukee—Weimer Welding Co., 252 5th St.—one spot welder.

Wis., Oconomowoc—E. O. E. Otto—rip saw, band saw and jointer for wood working shop.

Mo., Clinton—A. W. Vanderford—machinery for refrigerating plant near Weaubleau.

Ont., Hamilton—The Bd. Educ., R. H. Foster, Secy.—Machinery for technical school.

Metal Working Shops

NEW ENGLAND STATES

Conn., East Hartford (Hartford P. O.)—D. A. Miner, 7 Spruce St., Hartford, has awarded the contract for the construction of a 1 story, 100 x 150 ft. garage and service station, on Conn., Blvd., here. Estimated cost, $65,000.

Conn., Hartford—L. & H. Motors Co., 98 High St., has awarded the contract for the construction of a 2 story, 32 x 90 ft. addition to its garage on High St.

Conn., Hartford—The Prospect Garage, 585 Prospect Ave., has awarded the contract for the construction of a 2 story, 50 x 90 ft. addition to garage.

Mass., Everett—The Builders Iron & Steel Co., Garvey St., has awarded the contract for the construction of a 1 story plant. Estimated cost, $75,000.

Mass., Holyoke—J. F. Cleary, Jr., 112 Maple St., has awarded the contract for the construction of a 1 story machine shop on Maple St. Estimated cost, $15,000.

N. H., Concord—The Boston & Maine R.R. Co., North Sta., Boston, has awarded the contract for the construction of a 1 and 2 story roundhouse on Hall St., here. Estimated cost, $200,000.

Pa., Philadelphia—S. Alexander, c/o I. W. Levine, Archt., Victory Bldg., is having plans prepared and soon receives bids for the construction of a 2 story, 48 x 132 ft. garage and hall, on 4th and Seigel Sts. Estimated cost, $80,000.

Pa., Philadelphia—The Hurley Motor Co., 219 Broad St., has awarded the contract for the construction of a 10 story, 80 x 100 ft. sales and service station. Estimated cost, $350,000.

Pa., Philadelphia—L. Rubin, c/o Neubaurer & Supowitz, Archts., 929 Chestnut St., has awarded the contract for the construction of a 1 story, 97 x 200 ft. garage on 41st and Poplar Sts. Estimated cost, $90,000. Noted June 30.

SOUTHERN STATES

Ala., Birmingham—The Jaffe Iron & Metal Co., 211 North 28th St., plans to construct its 3 story building which was recently destroyed by fire.

MIDDLE WEST STATES

O., Columbus—The Columbus Forge & Iron Co., foot of West 1st St., will receive bids until Aug. 17 for the construction of a 1 story, 70 x 200 ft. and 110 x 123 ft. factory. Estimated cost, $80,000. Brown, Fleming, Knollman & Prior, 233 South High St., Archts. Noted June 2.

O., Columbus—The Union Boiler Wks., 57 South Center St., plans to build a new plant on West Goodall St.

Wis., Milwaukee—The Van Buren Garage Co., 174 Ogden Ave., is having plans prepared for the construction of a 2 story, 60 x 127 ft. garage on Van Buren St. Estimated cost, $75,000. R. E. Oberst, 307 Grand Ave., Archt.

WEST OF THE MISSISSIPPI

Ark., Stamps—The Louisiana & Arkansas Ry. Co. is having plans prepared for the construction of a 1 story locomotive shop. Estimated cost, $150,000. Harrington, Howard & Ash Co., Orear Leslie Bldg., Kansas City, Mo., Archts.

La., New Orleans—Crane Co., 913 West 22nd St., Chicago, Ill., manufacturer of steam fitters supplies, has awarded the contract for the construction of a 5 story, 100 x 160 ft. distributing plant; the main building, sheds and garage will cover 159 x 370 ft., on South Front, Peters, Erato and Gaunnie Sts. here. Estimated cost $224,778.

THE WEEKLY PRICE GUIDE

This Week's Market

Steel prices remain unchanged in New York markets, with the exception of cold finished steel shafting or screw stock and flats, square and hexagons, which have dropped 20c. per 100 lb. Cleveland reports drop of 15c. in steel shapes, bars, plates and hoop steel; long terne plate quoted at $5.50 as against $6.85.

Tin has advanced from 26¾c. to 27⅜c. per lb. in New York. Copper sheets have been reduced ½c. and solder ¼c. per lb. in Cleveland.

Market for shop supplies continues soft, with tendency to sell at least 10 per cent under quoted prices. Although a reduction of ½c. per lb. is shown in certain grades of scrap metals, quotations in these materials are nominal only.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.80
Northern Basic	25.50
Southern Ohio No. 2	25.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	32.26
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75	27.26
Virginia No. 2	*27.00
Basic	†25.00
Grey Forge	24.40
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern, sil 2.25@2.75	28.67
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	24.96
Basic	23 46
Bessemer	24.96

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$2.88	$2.74	$3.03
Soft steel bars	2.78	2.64	2.93
Soft steel bar shapes	2.78	3.85	2.93
Soft steel bands	3.43	....	
Tank plates	2.88	2.74	3.03

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh (refined)	$2 50
Warehouse, New York, delivered	2.78
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
Blue Annealed				
No. 10	3.10	3.53	3.25	3.68
No. 12	3.15	3.58	3.30	4.18
No. 14	3.20	3.63	3.35	3.78
No. 16	3.30	3.73	3.45	3.88
Black				
Nos. 17 and 21	3.75	4.05	3.80	4.70
Nos. 22 and 24	3.85	4.10	3.85	4.75
No. 25 and 26	3.90	4.15	3.90	4.80
No. 28	4.00	4.25	4.00	4.90
Galvanized				
No. 10 and 11	4.00	4.25	4.00	5.70
No. 12 to 14	4.10	4.35	4.10	5.80
Nos. 17 and 21	4.40	4.65	4.40	6.10
Nos. 22 and 24	4.55	4.80	4.55	5.75
No. 26	4.70	4.95	4.70	5.80
No. 28	5.00	5.25	5.00	5.90

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb.	$4.23	$4.63	$4.00
Flats, squares and hexagons, per 100 lb.	4.73	4.63	4.50

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	55@60%
Cleveland	55%
Chicago	50%

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 1/32, 8½c. per lb.; ⅛, 7.15; 3/32 to ¼, 6.75. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel	5.00	6.50	8.25
Spring steel	8.00	6.50	10.50
Coppered Bessemer rods(base)	8.00	8.00	6.20
Hoop steel	3.88	3.29	3.83
Cold rolled strip steel	7.50	8.25	7.90
Floor plates	4.85	3.09	5.78
Special best cast steel	....	15.00	....

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of July 7, 1921:

BUTT WELD

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
1 to 3	64½	52	¾ to 1½	39½	24½
LAP WELD					
2	56½	44	2	34½	20½
2½ to 6	60½	48	2½ to 4	37½	24½
7 to 12	57½	44	4½ to 6	37½	24½
13 and 14	45	37	7 to 12	35½	22½
15	42½	32			
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	62½	51	1 to 1½	39½	26½
2 to 3	63½	52			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	54½	43	2	35½	22½
2½ to 4	58½	47	2½ to 4	38½	26½
4½ to 6	57½	46	4½ to 6	37½	25½
7 to 8	53½	40	7 to 8	30½	18½
9 to 12	48½	35	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	13@13½
Tin in 5-ton lots	27.37½
Lead	4.75
Zinc	5.00
ST. LOUIS	
Lead	4.35
Zinc	4.60

At the places named, the following prices in cents per pound prevail, for 1 to or more:

	New York	Cleveland	Chicag
Copper sheets, base	20.50	21.00	23.5
Copper wire (carload lots)	15.50	16.50	19.5
Brass sheets	15.75	18.00	10.7
Brass pipe	16.50	22.00	23.5
Solder (half and half) (case lots)	18.00	20.25	16.5

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 2 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	13 7
Cleveland	16.0
Chicago	18.0

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel

Ingots and shot	
Electrolytic	

Monel Metal

Shot and blocks	35	Hot rolled rods (base)	
Ingots	38	Cold drawn rods (base)	
Sheet bars	40	Hot rolled sheets (base)	

Special Nickel and Alloys

Malleable nickel ingots	
Malleable nickel sheet bars	
Hot rolled rods, Grades "A" and "C" (base)	
Cold drawn rods, Grade "A" and "C" (base)	
Copper nickel ingots	
Hot rolled copper nickel rods (base)	
Manganese nickel hot rolled (base) rods, "D"—low manganese	
Manganese nickel hot rolled (base) rods "D"—high manganese	

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots.......... 10.00

	Warehouse	
	In Casks	Broken Lots
New York	11.50	12.00
Cleveland	11.15	11.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	5.25
Chicago	6.00
Cleveland	6.75

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	9.50	9.50	$10.00
Copper, heavy, and wire	9.00	9.00	8.25
Copper, light, and bottoms	7.00	7.00	7.00
Lead, heavy	3.25	3.50	3.00
Lead, tea	2.00	2.50	2.00
Brass, heavy	5.00	5.00	7.25
Brass, light	4.00	4.00	4.25
No. 1 yellow brass turnings	4.50	4.00	4.50
Zinc	2.50	2.50	2.75

ALUMINUM—The following prices f. o. b. shipping point in cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	25.00	25.00@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	19.50
Chicago	23.00
Cleveland	22.00

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	38.50	35.00
Commercial	30.00	13 50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

This market is very soft, and our quotations for the present are useful only as a guide.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	2.00	$2.25	3.00
Hot pressed hexagon	2.00	2.25	3.00
Cold punched hexagon	1.50	2.25	3.00
Cold punched square	1.50	2.25	3.00

Semi-finished nuts, $\frac{9}{16}$ and smaller, sell at the following discounts from list price:

	Current
New York	75%
Chicago	50%
Cleveland	80%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in.	50%	60-10%	50-5%
1⅛ and 1¼ in. by 3 in. up to 12 in.	40%	50-5%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York...... $3.00 Cleveland...... $4.50 Chicago....... $4.00

For cast-iron washers, ¾ and larger, the base price per 100 lb. is as follows:
New York...... $4.25 Cleveland...... $3.75 Chicago....... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	50%	60%	55%
Larger and longer up to 1 in. by 30 in.	45%	50-10%	50-5%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40-10%	10%
Chicago	net	net
New York	50-10%	25-10%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel $\frac{7}{16}$ and smaller	50-10%	60-10%	45%
Tinned	50-10%	60-10%	30%

Structural, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.40 Cleveland...$3.90 Chicago....$4.88 Pittsburgh..$2.65

Boiler, same sizes:
New York...$4.50 Cleveland...$4.00 Chicago....$4.98 Pittsburgh..$2.75

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	19.00	24.00	25.50
Brass	16.50	22.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in., inclusive in rounds, and ⅛-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$5.50 per 100 lb.; New York price is $7.50.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	7.50@10.00	8.50@11.00	11.00
Colored mixed	5.50@ 9.00	6.50@10.00	10.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.00
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$2.90@ $3.00
Prompt foundry	4.00@ 4.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.80	$0.83	$0.87
5-gal. cans	.83*	.98	1.12

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	12.25	13.75	12.25
25 and 50-lb. kegs	12.50	14.00	12.50
12½-lb. keg	12.75	14.25	12.75
5-lb. cans	15.25	16.75	15.25
1-lb. cans	17.25	18.75	17.25

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount. Business is good in white lead.

Minn., Duluth—The Duluth Auto Exch. Co., 201 East 1st St., has had plans prepared for the construction of a 2 story, 100 x 140 ft. garage. Estimated cost, $65,000. A. Rose, 500 Builders Exch. Bldg., Minneapolis, Archt.

Mo., Joplin—The Joplin Iron and Metal Co., B and May Sts. plans to build a 1 story iron plant on West A St. Estimated cost, $25,000. Private plans.

Mo., Kansas City—M. D. Woodling, Reliance Bldg., has awarded the contract for the construction of a 10 story, 100 x 124 ft. garage at 1219 Wyandotte St. Estimated cost, $600,000.

Mo., St. Louis—The St. Charles Garage Co., c/o T. S. Kirkpatrick, 5510 Cates Ave., is having plans prepared for the construction of a 4 story, 130 x 160 ft. garage on St. Charles and 11th Sts. Estimated cost, $350,000. N. B. Howard, Arcade Bldg., Archt.

WESTERN STATES

Cal., Los Angeles—The Oil Well Equipment Co., c/o La Barr & Noyes, Archts., 524 West 9th St., has awarded the contract for the construction of a 50 x 80 ft. factory on 50th and Santa Fe Sts., for the manufacture of oil well supplies. Estimated cost, $10,000.

Cal., Los Angeles—The Union Bank & Trust Co., Garland Bldg., has awarded the contract for the construction of a 1 story, 133 x 139 ft. auto service station on South Main and Adams Sts. Estimated cost, $40,000.

General Manufacturing

NEW ENGLAND STATES

Conn., Ansonia—The Ansonia Electric Co., 55 Main St., has awarded the contract for the construction of a 2 story, 60 x 200 ft. factory. Estimated cost, $250,000. Noted June 23.

Conn., Hartford—The City, Health and Charity Dept., has awarded the contract for the construction of a 2 story, 43 x 63 ft. laundry and heating plant on Holcomb St. Noted July 21.

Conn., Hartford—Case, Lockwood & Brainerd Co., 141 Pearl St., is having plans prepared for the construction of a printing plant. Lockwood, Greene & Co., 60 Federal St., Boston, Mass., Archts. and Engrs.

Conn., Hartford—The Graphic Arts Co., 74 Union Pl., has awarded the contract for the construction of a 3 story, 60 x 82 ft. printing plant on High St. Estimated cost, $75,000.

Conn., Middletown—The Forest City Laundry Co., 56 Hamlin St., has awarded the contract for the construction of a 1 story, 40 x 100 ft. laundry on William St. Estimated cost, $20,000. Noted June 23.

Conn., New Britain—J. Niedzwiki, 215 Farmington Ave., has awarded the contract for the construction of a 2 story, 45 x 65 ft. bakery on Farmington Ave. Estimated cost, $30,000.

Conn., New Haven—C. W. Murdock, Inc., 505 Grand Ave., has awarded the contract for the construction of a 1 story, 55 x 160 ft. trimming mill on Grand Ave. Estimated cost, $15,000.

Me., Gardner—Lockwood, Greene & Co., Archts. and Engrs., 60 Federal St., Boston, Mass., are receiving bids for the construction of a 3 story addition to shoe factory, for R. P. Hazzard Co., 421 Water St. Estimated cost between $60,000 and $70,000.

Mass., Gardner—The Gardner Reed & Rattan Co., 322 Pleasant St., has awarded the contract for the construction of a 2 story, 40 x 70 ft. factory on West Bway. Estimated cost, $10,000.

Mass., Malden (Boston P. O.)—Potter Drug & Chemical Corp., is having plans prepared for the construction of a 2 story, 50 x 85 ft. factory. Estimated cost, $40,000. Lawrence & Wambolt, 6 Beacon St., Boston, Archts.

Mass., Shirely—The State Industrial School will soon award the contract for the construction of a 1 and 2 story, 35 x 140 ft. kitchen and laundry building. Estimated cost, $65,000. Densmore & Le Clear, 88 Broad St., Boson, Engrs.

Mass., Waltham—The Waltham Bleachery will build a 1 story, 70 x 115 ft. plant. Estimated cost, $30,000. Private plans.

N. H., Seabrook—The Atlantic Bldg. Assn. has awarded the contract for the construction of a 3 story, 40 x 170 ft. shoe factory. Estimated cost, $75,000.

R. I., Providence—The Ward Baking Co., 461 Eddy St., has awarded the contract for the construction of a 2 story, 50 x 115 ft. addition to its bakery. Estimated cost, $50,000. Noted Jan. 20.

R. I., West Warwick—The Pawtucket Valley Dyeing Co., Phenix, has awarded the contract for the construction of a 1 story, 50 x 900 ft. dye house, here. Estimated cost, $75,000.

MIDDLE ATLANTIC STATES

N. Y., New York—P. Lorillard Co., 119 West 40th St., manufacturer of tobacco, has awarded the contract for the construction of a 4 story factory on Ave. A. and 72d St. Estimated cost, $500,000. Noted July 7.

Pa., Philadelphia—A. T. Abbott & Co., Berkley Ave., has awarded the contract for the construction of a 5 story, 73 x 170 ft. textile mill on 23d St. and Allegheny Ave. Estimated cost, $100,000. Noted July 28.

Pa., Philadelphia—The Brighton Worsted Co., Tioga and D Sts., has had plans prepared for the construction of a 3 story, 32½ x 55 ft. factory. Estimated cost, $60,000. Private plans.

Pa., Philadelphia — The Logan Baking Co., c/o T. F. Miller, Archt., 1012 Walnut St., is having preliminary sketches made for the construction of a 3 story bakery and power plant in Logan section.

Pa., Uniontown—The Uniontown Hospital has awarded the contract for the construction of a 2 story, 30 x 50 ft. laundry and boiler house. Estimated cost, $35,000.

SOUTHERN STATES

Fla., Lake City—Treasury Dept., Wash., D. C., will receive bids until Aug. 30 for the construction of a laundry and refrigerating plant, etc., at the United States Pub. Health Serv. Hospital, here. J. A. Wetmore, Supervising Archt.

MIDDLE WEST STATES

Ill., Joliet—Zimmerman, Saxie & Zimmerman, Archts., 64 East Van Buren St., Chicago, will receive bids until Aug. 15 for the construction of a 2 story, 47 x 64 ft. manufacturing plant for the Coal Products Mfg. Co. Estimated cost, $75,000.

Ill., Niles (Chicago P. O.)—St. Hedwigs Industrial School for Girls has awarded the contract for the construction of a 2 story printery and infirmary. Estimated cost, $150,000. Noted July 14.

O., Canton — The Canton Oxygen Co., recently incorporated with $200,000 capital stock, plans to build a 2 story factory on Louisville Rd. Estimated cost, $50,000. W. Stolzenbach, Official.

O., Cincinnati—The Hyde Park Dairy Co., 3755 Edwards Rd., is receiving bids for the construction of a 2 story, 32 x 85 ft. dairy. Estimated cost, $40,000. H. W. Voelz, 86 Michigan St., Milwaukee, Wis., Archt. Noted June 25.

O., Cleveland—J. A. Moffet Co., 4539 Hough Ave., (Millwork) plans to build a 1 story, 40 x 60 ft. addition to factory. Estimated cost, $10,000. Private plans.

O., Cleveland — The Tinker Concrete Vault Co., 1700 Urbana Rd., will build a 1 story, 44 x 100 ft. addition to its factory. Estimated cost, $10,000. Private plans.

O., Kenmore—The Palmer Match Co., recently incorporated with $600,000 capital stock, has purchased a site, and plans to build a match factory. Estimated cost, $500,000. C. H. Palmer, Official.

O., Troy—J. Stickel, Market St., plans to build a 2 story ice plant, 20 tons daily capacity. Estimated cost, $50,000. Private plans.

Wis., Green Bay—The Investment Corp., c/o L. M. Hansen Co., 113 West Walnut St., has awarded the contract for the construction of a 4 story, 100 x 200 ft. cold storage plant. Estimated cost between $75,000 and $100,000.

WEST OF THE MISSISSIPPI

Ia., Ames—C. J. O'Neal, manufacturer of ice cream, has awarded the contract for the construction of a 2 story, 50 x 120 ft. factory. Estimated cost, $25,000.

Ia., Cedar Rapids—F. A. Buchard is receiving bids for the construction of a 1 story, 70 x 140 ft. laundry. Estimated cost, $35,000. R. R. Mayberry, Granby Bldg., Archt.

Kan., Galena—C. W. Squires will build a rock crushing mill, 225 ton capacity. Estimated cost, $10,000.

Kan., Pittsburg — Fabler Bros. have awarded the contract for the construction of a 1 story, 92 x 94 ft. cold storage plant and warehouse near Bway. Estimated cost, $25,000.

Mo., Springfield — The Welsch Packing Co., has awarded the contract for the construction of a 3 story, 120 x 160 ft. packing plant. Estimated cost, $131,000. Noted May 26.

Mo., St. Louis—The Excelsior Laundry Co., c/o G. P. Shaum, Grand and Belle Sts., has awarded the contract for the construction of a 2 story, 119 x 127 ft. laundry and power plant on Grand and Washington Sts. Estimated cost, $200,000. Noted May 5.

CANADA

Ont., Chatham — The Rennie Seed Co., Richmond St., plans to rebuild its seed elevator which was destroyed by fire. Loss $100,000.

Ont., London—The London District Milk Producers are preparing plans for the construction of a co-operative dairy in East London. Estimated cost, $250,000. Private plans. J. C. Nichol, R. R. 2, Wilton Grove, Pres.

Ont., St. Marys—St. Marys Milling Co. plans to rebuild its mills which were recently destroyed by fire. Estimated loss $150,000. H. L. Rice, Mgr.

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American Machinist

Volume 55 NEW YORK, AUGUST 18, 1921 Number 7

5119

Training Leaders For Foremanship Classes

Fundamental Factors Involved in Training Leaders — Outstanding Characteristics of the Typical Foreman — Importance of Follow-Up Work in Organizing Courses

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AMONG the many perplexing questions which have arisen in connection with foreman training is that of finding men who are competent to conduct classes in this field. There are those—and they are not few in number— who maintain that whether or not the foreman training movement is to succeed or fail on the whole, will depend primarily upon the quality of leadership established and maintained and upon the finding of some effective means of preparing the right kind of leadership.

It was shortly after the work in foreman training was launched on a relatively large scale by certain agencies, that the writer foresaw the absolute necessity of finding and training candidates for carrying on such work. At that time (June, 1919) I believed and stated that it is possible to train a man from each industrial plant so that he can organize and conduct foremanship classes within the plant represented. An experience of two years has caused me to modify this point of view. I now take the position that it is possible and desirable to train one man or more in each plant to an intelligent appreciation of the scope and meaning of foreman training work, even to get him to the point where he knows how to proceed to build up a training course which is suitable for the foreman in his plant. But I no longer believe that the average executive may be satisfactorily prepared by means of short unit training courses for organizing and conducting classes for foremen. It is one thing to select and organize suitable material and quite another thing to make proper use of this material while standing in front of a group of foremen. Many can do the former, but few the latter.

THE FUNDAMENTAL FACTORS INVOLVED

The following article sets forth briefly the fundamental factors involved in training leaders of this type; also the most important conclusions reached after an experience of two years. One point should be clear, however, before proceeding further, namely, that the task of training leaders for foremanship classes, as considered and referred to herein, is in no sense incidental or subordinate to something else, a position obviously given to it by some, shall I say, superficial students in the field. It is a real, honest-to-God job which must neither be left undone, nor done improperly, if the whole movement is to progress as it should.

When the work of training leaders for this work was faced, some fundamental questions had to be answered, among them being: (1) What should go into a foreman training course? (2) How should the material in a training course be organized? (3) How should foreman classes be conducted? (4) What constitutes good foremanship?

In answering these, the reverse order was followed. In other words, the first thing attempted was to get clearly in mind who the good foreman is, what his chief characteristics are, etc. Following this came a study of the needs of foremen as revealed by and through their shortcomings, this, in turn, giving way successively to a consideration of how to get hold of proper material for a course, how to get this material into shape for class or conference purposes, and, finally, how to conduct the class conference. In endeavoring to answer these, others of equal, if not greater importance, arose, such as: (1) What fundamental traits, habits, attitudes, etc., of foremen must be considered by one who is to conduct foreman classes? (2) In what respects does a good foreman differ from a poor foreman? (3) What are the most important characteristics of the type of foreman that training courses are expected to produce?

OUTSTANDING CHARACTERISTICS OF THE TYPICAL FOREMAN

While helpful discoveries resulted from the consideration of each question, doubtless the most important contributions came from a study of how to conduct a class or conference successfully. The major factor to be reckoned with in this connection, as well as in connection with the organization of the material for the class, it was found, had to do with the inherent nature of the typical foreman as a subject for training. To a majority of the candidates, this analysis of the foreman from the standpoint of how he must be dealt with, in order that good results might be realized, was decidedly a new thing.

The analysis referred to revealed the typical foreman as possessing the following outstanding characteristics: (1) He is mature both in mind and body; (2) he is a "self-made" executive, his schooling having been obtained chiefly in the "university of hard knocks"; (3) he usually has plenty of confidence in himself and his ability; (4) new ideas or methods are not ordinarily welcomed by him; (5) one of his most pronounced weaknesses is inability to analyze; (6) he has little use for theory, practice being his strong point; (7) above everything else, he enjoys "talking shop"; (8) his best thinking is done when he is cornered; (9) he is extremely jealous of authority; (10) he will not co-operate heartily with any one in whom he does not have utmost confidence.

The importance of the above principles to one who contemplates carrying on foreman training work of any kind need not be pointed out. Observance of them is imperative not only to success in conducting classes or conferences, but as well in selecting and organizing subject-matter.

What better clue does one need, for example, regarding the source of subject-matter for a training course than that formen enjoy "talking shop"? Does not this speak volumes for "home-grown" rather than for imported courses? Below appear samples of foreman problems contributed either directly or indirectly by foremen through their executives.

(1) When an employee is absent on account of sickness or accident, and the foreman finds that the substitute employee is superior to the regular one, should he reinstate the regular one when he is again ready for work?

(2) Should foremen ever attempt to discipline employees by transferring them to distasteful jobs?

(3 What should be the order in which a foreman should recommend the following types of workers for wage increase?

(a) One who has not had a raise for six months or more; (b) one who has somehow managed to increase his efficiency since the prevailing rate was fixed; (c) one who is a "good fellow" in the department; (d) one who is steady and reliable; (e) one who is doing as good work but is not drawing as high a wage as the others in the department.

(4) How should a foreman deal with a man who is an excellent workman, but who is always carrying matters over the foreman's head?

(5) An important question of transfer: Would you favor transferring a man who had been thoroughly trained for work in your department and who is giving excellent service, to a position in another department which could not at the time be considered a promotion, but which obviously has greater future possibilities in it?

(6) If a worker asks his foreman for information regarding the work which the foreman is not qualified to furnish at the time, which of the following courses should the foreman take:

(a) Admit his inability to answer the question and assure the worker that he will find out and let him know as soon as possible, or (b) give some sort of answer, in other words, "bluff it out," and run the risk of being found out later?

(7) How is a foreman to meet the practical problem of getting workers to appreciate the importance of their work, e.g., handling hard iron carefully?

(8) What method should a foreman pursue in trying to lead a man to have a higher regard for both his own and for his fellow-workers' welfare?

(9) How should a foreman attempt to manage workers (a) who deliberately "kill" time in order to make the job last longer, and (b) who have the habit of taking it easy whenever the "boss" is not around?

(10) What would be the best way for a foreman to meet a situation like the following: Due to negligence or incompetence on the part of the inspection department, extra operations are made necessary in a certain foreman's department, the cost for which is, of course, charged against him.

(11) A problem of discipline: How can a foreman cut down (a) tardiness and (b) absenteeism in his department?

(12) How is a foreman to plan and carry out a schedule of work consisting of short orders when he has only piece-workers in his department?

(13) How are foremen to keep their men "sweet" during a period when satisfactory piece-work prices are being determined; also during a "try-out" period when piece rates are being modified?

(14) What would be the sensible thing for a foreman to do when a reduction in working hours has reduced the weekly wage of his men, as a consequence of which they are demanding an increase in wages?

(15) A foreman is "up against" the demand for increased production when his machine capacity is limited. What should he do?

(16) This is a foreman's problem. How should he solve it? A new piece-work price has been sent on a certain job; his men before giving it a proper trial, protest that the price is too low for them to make the established rate.

(17) What should a foreman do when one of his men who has produced defective parts refuses point blank to re-operate the parts in order to correct the defect; this re-operation, of course, to be done without pay?

(18) How should a worker be dealt with of whom the following is true:

(a) Too many just complaints are coming in against the work he is doing; (b) he has been cautioned several times regarding the quality of his work; (c) temporary improvement followed each warning; (d) he is otherwise a capable man, one that would be hard to replace.

(19) What would be the best course for a foreman to take when, following the establishing of a new rule regarding methods of handling the work, a delegation of twenty workmen wait on him and protest against the rule?

(20) A question of policy: In case the management is operating "open shop," should a foreman, when lack of orders necessitates reducing the working force, recommend for discharge those workers who are known to be union members or labor agitators, regardless of their workmanship ability?

(21) Another question of policy: If at the time of hiring an employee he is told that his rate will be increased if he "makes good," what should a foreman do when the following conditions prevail: The man works conscientiously and his production steadily improves, but it does not yet equal the average of men on the next higher rate. The foreman is satisfied that the man will make a good employee. The man thinks he has "made good" and requests his increase.

(22) The manufactured product is very delicate in nature. Employees are paid by the hour. How can a foreman put over the idea of waste prevention successfully?

(23) An employee goes home at 10:30 a.m., leaving a note for his foreman claiming that he is sick; but fellow-employees state that no signs of sickness were observed. Should he be reprimanded or discharged?

(24) What should be done with a man who repeatedly ignores safety and sanitation rules?

(25) In case men quit without giving previous notice and want their money before the regular pay day, is a foreman justified in refusing their request? Or should he yield to such demands?

(26) There is no dead wood in the department, but due to lack of work it is necessary to reduce the working force 25 per cent. On the basis of a square deal and with an eye to resuming operations again, which man should be laid off?

(27) Two groups are working on jobs very similar in nature. One job requires several times more actual handling than the other, which is largely an automatic machine product. The first group, due to the greater amount of handling time necessitated, are able to increase their earnings through increased efficiency. The second group, however, cannot do so because the automatic machine speed cannot be increased. What should be done to correct the inconsistency?

(28) Temporary lack of work in the department means reducing the number of men in the department, all of whom are active and valuable workers. Shall the department work part time or shall part of the force be paid off, permitting the remaining ones to work full time?

(29) In a plating department it is necessary to transfer castings from tank to tank. The workers are paid upon a piece basis and have been lifting the equivalent of 35 pounds at a time. This affords a sufficient speed to earn a consistent weekly wage. They now complain that the work is too hard. What should be done?

(30) A separate operation costs one-half cent per piece. A fixture can be provided to include this operation with another without increasing the cost of the former operation. The fixture would cost $900. What factors should be analyzed before the foreman recommends expenditure for the new fixture?

(31) A machine hand is working at a machine flooded with oil. He is a good operator and the class of work he is doing permits very consistent compensation. The contact with oil, however, causes obnoxious skin eruptions, which medical treatment does not correct. What action should the foreman take?

The field of foreman training, it was found, breaks up nicely into five divisions, namely: (1) The economics of business, or, in other words, the various factors involved in making it a going concern; (2) managing men; (3) scientific methods of production; (4) technical knowledge, that is, science, mathematics, drawings, etc.; (5) getting one's ideas over to the other fellow, or instructional ability.

It will be easily apparent that one need not go further than these same fundamental principles in order to find a clue for organizing his material for class use and for conducting the class or conference. If a good foreman must think straight and if, as is pointed out, he does his best thinking when he is "cornered," is it not obvious that the discussion rather than the lecture method should predominate in class? And if he is "self-made" or largely so, and is unreceptive to entirely new points of view, hasn't one adequate reason for assuming that the method should be one of discussion which is directed but not dominated by the leader? Finally, if foremen, as a class, analyze poorly, what more does the prospective leader need in the way of a warning that he must think the points through before taking charge of a class and must see that the successive steps necessary to a thorough analysis of the topic are taken by the members of the group?

Below are summarized the main points on method revealed through our analysis of the problem. It will be observed, of course, that certain of these apply more particularly to some than to other types of training courses. For example, technical information courses must be conducted more or less by the lecture method, while a course on managing men would lend itself nicely to discussion.

1. Be thorough but not pedantic. Get down to fundamental principles but do not overwork them. Think the unit of work through rather than trust to inspiration.
2. Get something worth while accomplished at each session.
8. Make use of the foreman's daily problem.
rather than by expressed opinion.
4. Be sensibly sympathetic but not afraid to take and defend a position for the sake of argument.
5. Make much use of developmental method. Get the men to think for themselves.
6. Give practical assignments at least occasionally. Make it difficult for the men not to think of their jobs in a new way between sessions.
7. See that the men stick to the point of discussion.
8. Make use of the foreman's daily problem.
9. Suggest current articles appropriate for reading.
10. Study the members of the group constantly.
11. If lectures constitute a part of the course, see that they are well organized and that questions for promoting discussions are provided.
12. Above everything else do not give the impression that you are trying to tell them something they do not know.

There yet remains the final and very important step, namely, that of helping representatives from industrial plants, who have completed the first unit of the work, to compile and organize material for their respective foreman training courses. In fact, it is here that one of the greatest services can be performed. Briefly, this is what takes place: The plant representative gets hold of as many as possible of the foremen's problems, those things which cause them trouble day after day. After these are analyzed and classified, they are organized into units or topics for class use.

I consider this "follow-up" work if anything more important than the so-called main course, since experience has proven that with rare exceptions, however well disposed and ambitious the industrial executive is, he tends to overlook or undervalue certain principles of method which are vital to success. If, as has been authoritatively asserted on different occasions, the supreme weakness of the scientific management movement was its emphasis of the material to the detriment of the more important human side of production—an assertion which is undoubtedly well founded—it stands to reason that any movement which has for its purpose the focusing of merited attention upon the key-man and all, rather than a part of his problems, must not make the mistake of stopping short of its goal.

It is the writer's conviction that educational institutions will miss one of their greatest opportunities to serve society if they do not increasingly endeavor, through such practical methods as herein set forth, to make their accumulated experience and information, particularly in the fields of psychology, sociology, and pedagogy, function in practical industrial situations; and that likewise industry will pay a heavy penalty if it does not welcome this opportunity for co-operative effort in overcoming obstacles which, to say the least, are extremely baffling. Let not the common mistake however be repeated, namely, of trying to get the job done in thirty days. It may not be generally appreciated but it is nevertheless true, that industrial executives, as a class, lack the patience necessary to make a thoroughly scientific study of a problem. There is no one class of men who have greater need for and can make greater use of a knowledge of psychology and its application to their numerous problems.

Machining the Wrigley Automobile Transmission Gear

II. Using Mechanical Conveyors to Eliminate Handling—Progressive Machining of Automobile Parts—Inspection Tools and Methods for Rough and Finished Parts

By I. WILLIAM CHUBB
Editor, European Edition, *American Machinist*

TURNING to the details on machining operations, it may be mentioned that Newall "A" limits are worked to, except as to ball races where Hoffman sizes are used. To pass the job from one machine to the next either roller-ways or light band conveyors are used, according to the weight of the article to be moved; only on rare occasions is it carried by a man. In the case of the roller-ways, gravity is employed, the rollers, which are of drawn tube 2½ x 14 in. wide with 4-in. pitch, being set, of course, on an incline and running on ball bearings. The incline can be adjusted by screw to insure correct speed. The endless bands employed are about 12 in. wide, driven by gearing and overhead shafting. In some cases a man standing at his station simply removes the job that tends to pass him; in other cases chutes of sheet metal are formed, into which the job is trapped, the belt passing underneath the chute.

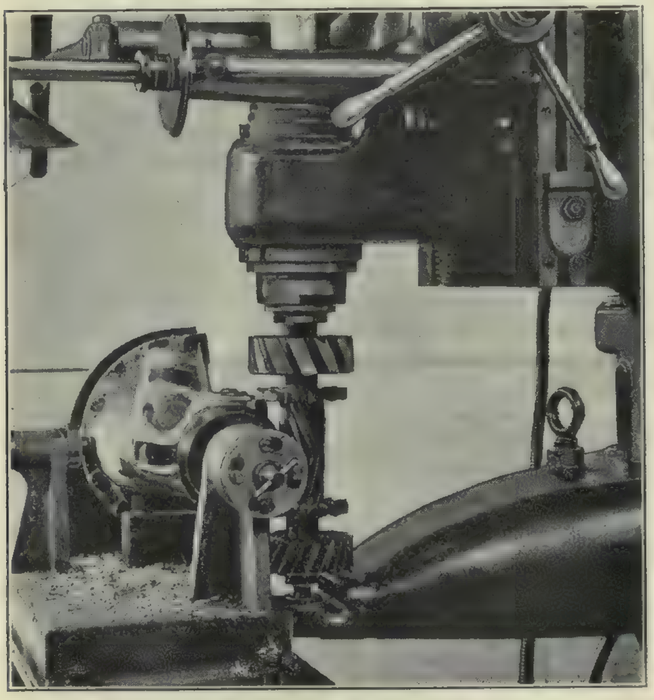


FIG. 8. GEAR BOX MILLING TOP COVER SEATING AND SIDE BOSSES

MACHINING THE GEARBOX CASE

The gearbox case is an aluminum casting, the machining of which calls for operations in six stages, all of about equal times. The first operation, see Fig. 8, is gang-milling in a Herbert No. 8 vertical machine, the surfaces tooled including the top face, the side bosses and the foot-brake bracket seatings. The box is placed in an angle fixture, as shown, bearing on the cone chamfer at the engine end and the fixture picks up through the casting on the large flange at three points with adjustable studs. The plunger opposite the 3-point support of the cone is forced up by a screw. The slot between the webs is important because of the hole subsequently to be bored there. This hole is for the lay-shaft bearing and adjustment is effected by two jacks below, the three studs at the large cone end and one at the side taking the pressure. As regards the gang of cutters, two operate over the top cover face, two over the bosses, and the outer cutters take the two side faces, one facing the seating for the foot-brake bracket, the other to help line up with the engine. In a No. 9 Rockford miller the same operation also mills the primary shaft-housing face. The face previously milled is used to locate the box in the fixture, a

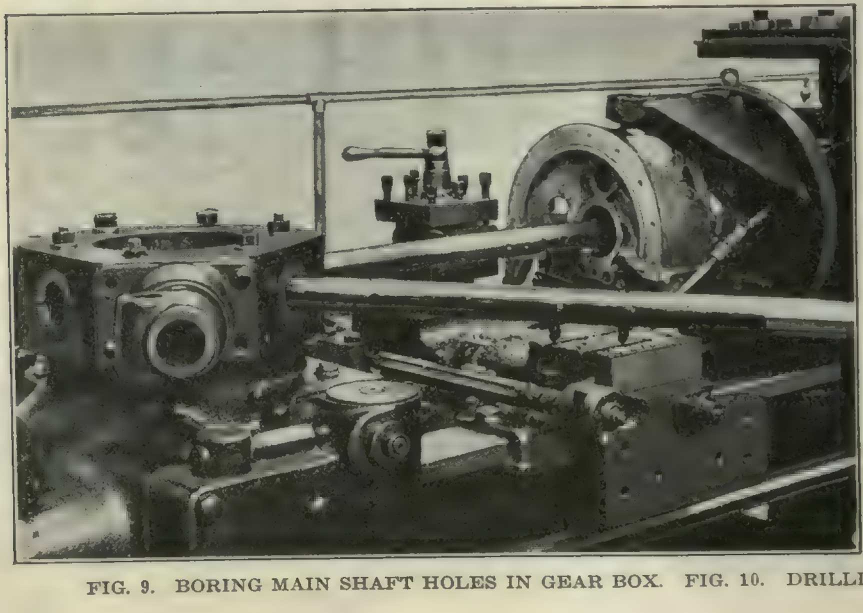


FIG. 9. BORING MAIN SHAFT HOLES IN GEAR BOX.

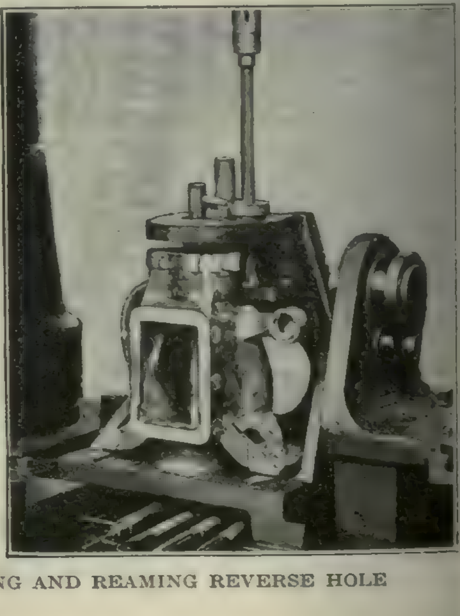


FIG. 10. DRILLING AND REAMING REVERSE HOLE

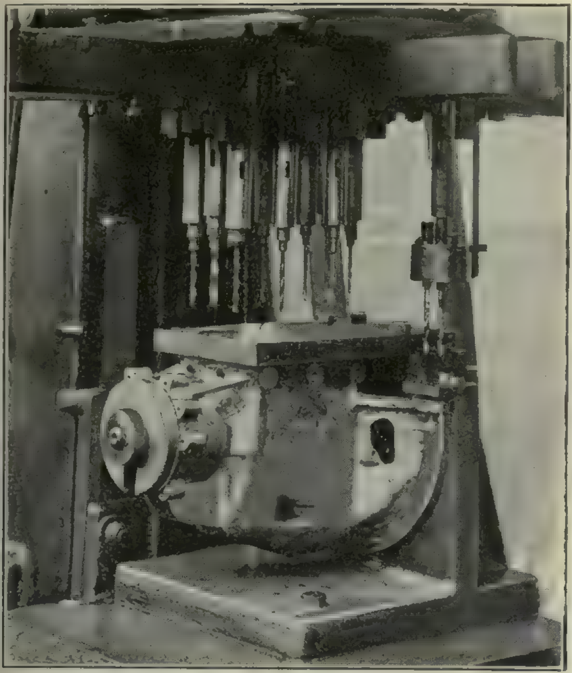


FIG. 11. MULTIPLE DRILLING TOP COVER SEATING.

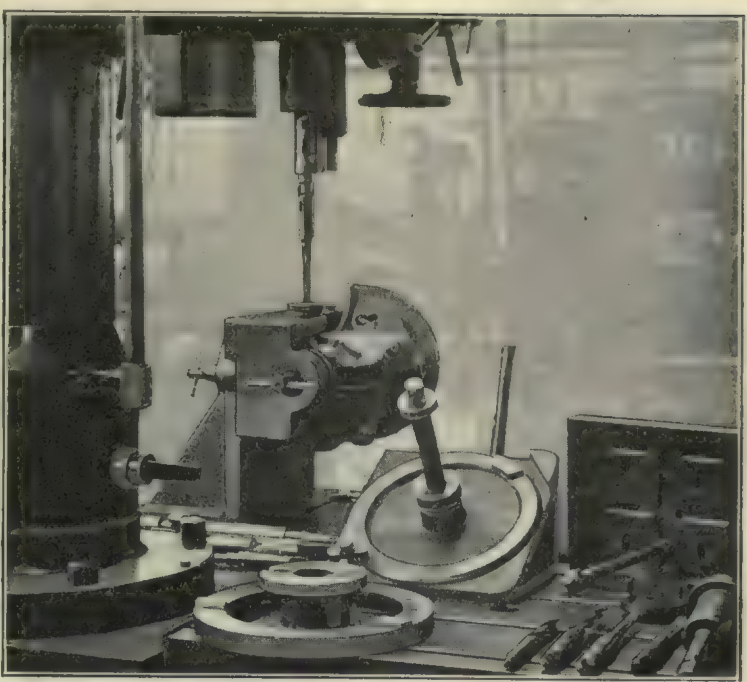


FIG. 12. DRILLING JIG FOR SPEEDOMETER HOLES, ETC.

gage of fixed height being used for setting the cutter. The milling head is brought down to this, with a 0.005-in. feeler interposed so as not to damage the cutter. The gaging position is of course not in line with the traverse of the cutter. A gage bearing on a finished surface on the fixture insures equal thickness of wall for each box and prevents the gears fouling when fitted.

BORING THE MAIN-SHAFT HOLES

The next operation is subdivided into two, both done on No. 9 Herbert turret lathes. They are, respectively, boring for main shaft and turning flange, and boring and facing for the universal joint housing. The boring for main-shaft holes is shown in Fig. 9, the job being located on the three milled faces, resting against the base and being pinched in position by screws at the sides. The bars are set to cut the correct diameters, and the facing is done by the cross-slide. In the next lathe the same man takes the job and mounts it on a projecting mandrel, which takes a bearing in the two bores previously machined, the box being clipped to the plate of the fixture. A 4-ft. 6-in. Asquith radial drill is then used for drilling, reaming, counterboring and chamfering the lay-shaft hole, drilling and reaming the change-speed lever shaft holes and drilling, reaming, facing and chamfering the lock lever detent plate hole. Advantage is taken here of the side faces on the box, the job being located off the main bore by means of a plug, the reamer for the lay-shaft bore having to pass through the two webs mentioned in connection with the first operation. The holes for the sliding-selector rods are picked up by a plug on the main-shaft hole and an additional plug, with spring for the lay-shaft hole. The job is held only by these, the top of the main hole in the box being first bushed by a flanged bush for locking. To prevent seizing-up of bars and reamers, all pilot portions have wide and deep spiral oil grooves.

For the fourth set, also done on an Asquith radial drill, the operations are drilling, reaming and facing reverse-shaft hole, drilling two tapping holes, drilling, facing and tapping for filler hole, and drilling an oil-feed hole. For the first (Fig. 10) the jig locates by the main- and lay-shaft bores by means of plugs, the main hole being bushed as before. The two shafts are worked off in order to get the gear centers correct. The work is then moved to a rig at the front of the machine for drilling the two tapping holes, for which a contour jig only is employed, an expanding plug tightening in the bore and the jig being moved round to suit the shape of the casting. The hole for the oil feed is for the lay-shaft bearing and is part of the self-oiling system. The job is held in the main bores by a plug and a rotating jig is employed.

The next set of operations includes three drilling operations and two milling. The first one—drilling nine flange-holes—is done under a Fox multi-spindle drill. The job is held by a central bolt, being pushed

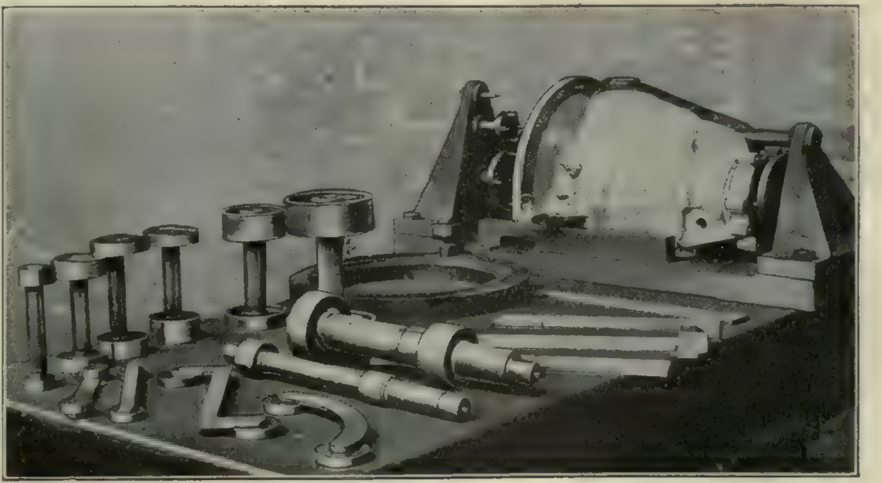


FIG. 13. GEAR BOX INSPECTION TACKLE

against the end locating face in order to get the holes in correct relation to the engine flange. The job is located in the bore by plugs and pushed round in the jig by screws bearing against foot-brake bracket faces. Next the holes are drilled in the top cover face (Fig. 11) and for the third drilling operation the multi-spindle Baush machine is used, the work being done in two sections, namely, drilling all holes in the universal joint housing flange and all holes in the primary housing face. The box is dropped into a base at the large end, with the drill plate registering in the joint ring housing and the lay-shaft bore, with a central bolt, gap washer and nut to secure. The second drilling operation for this is similar, the box being turned upside down and located roughly on the joint housing and held by a bolt. A drill plate at the top locates by the main and lay-shaft bores, this jig providing for the eight holes in the primary shaft housing face and in the lay-shaft face. For the two positions the machine is fitted with special star handles, one on each side.

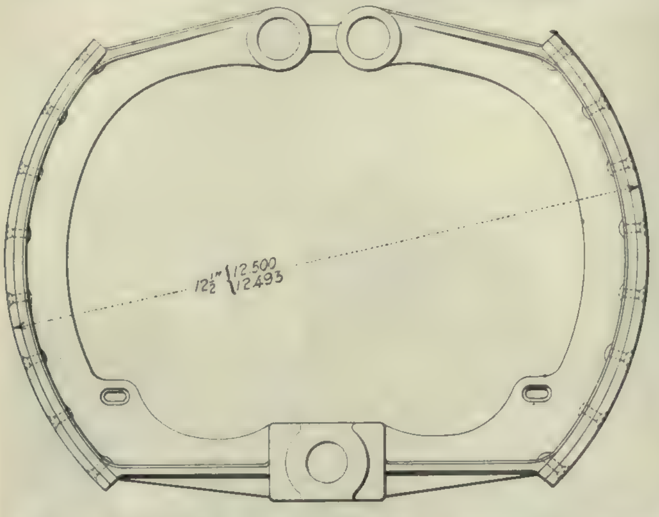


FIG. 14. BRAKE SHOE SUB-ASSEMBLY BEFORE HALVING

Two milling operations are done on Brown & Sharpe machines and have for purpose respectively the surfacing of the lugs on the large flange for securing to engine and on the universal joint housing. The job is dropped on a circular table and located by the main- and lay-shaft holes and secured by a central bolt. The height of the cutter is again obtained by means of a setting face on the jig and the job is moved round by worm and wormwheel. Owing to the interference of the end web it is impossible to mill the faces for the two corner holes. This is done subsequently by spot-facing. The machine used for this sub-operation is a vertical miller, a horizontal miller being used for the next process. The job is located on the joint housing on a vertical plug in an ordinary dividing head which is indexed round for spot-facing back of the lugs.

The final operation on the gearbox consists mainly of drilling and facing holes, done under an Asquith radial, as shown in Fig. 12. A jig with horizontal spindle is employed for drilling two holes for the brake bracket on both sides and then a crosshole for the speedometer drive gear, as illustrated. Location is again by main- and lay-shaft bores, and a long pilot reamer is needed to bring the two holes for the speedometer driving gear in line. On a side table at the same machine is a rig for spot-facing the holes previously missed. Further, in connection with the oiling system for the universal joint housing, two holes are drilled on an angle, the box being placed on a suitable angle plate and swiveling against two stops for the two holes. The drill is guided by a plate positioned off a key in the central locating bar. When the spot-facing has been done a peg hole is put in to prevent moving of the joint housing. For the fourth operation here, namely, drilling and tapping the drain hole, the job is simply bolted to an ordinary standard angle plate.

The job is finally moved to an Archdale sensitive radial drill adapted for tapping, the box being placed in a jig and all holes tapped by a rotating fixture except the filler and drain holes.

The section inspector then tests the box for every operation, checking the centers, etc., and also finally checking the whole box before it goes to the finished stores. The section viewer can pick up any job at any operation. In particular the drilling of centers for shafts is examined carefully, but generally the jigs and operations will show whether the job is working out properly, a jig rapidly locating a fault. Otherwise the only supervision is that of discipline. Finally, every gearbox is tested for the distance between the centers of the main and lay shaft by high- and low-limit plugs, the tolerance allowed being 0.003 in. Before machining the castings are checked by rough viewing apparatus to insure that they will machine out properly, the job simply being placed on a faced slide and plugs carrying centers being pushed in position to test the casting. Fig. 13 shows the rig for a finished box, a similar one being used for the rough box.

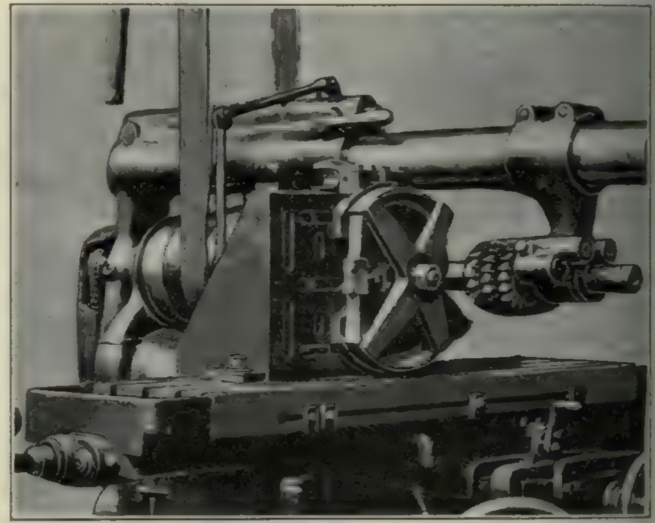


FIG. 15. GANG MILLING FULCRUM AND CAM HOLE LUGS

The brake shoes are shown in Fig. 14, the two halves being cast in iron in one piece. The first operation is to straddle-mill (Fig. 15) the fulcrum and cam-hole lugs in a Brown & Sharpe horizontal machine, using an indexing fixture giving two positions. Three cutters produce the two gaps necessary. The machine is worked between two stops for the two positions and the job is held against a vertical face, as illustrated, and indexed round. For the second operation, drilling and reaming three $\frac{13}{16}$-in. holes in a pillar drill, the job is put down on the machined faces on a circular-plate jig, roughly held on the diameter, and located by the two boss contours, a quick-release chuck being used for drilling and reaming without stopping the machine.

Then, for turning complete in Herbert & Ward cap-

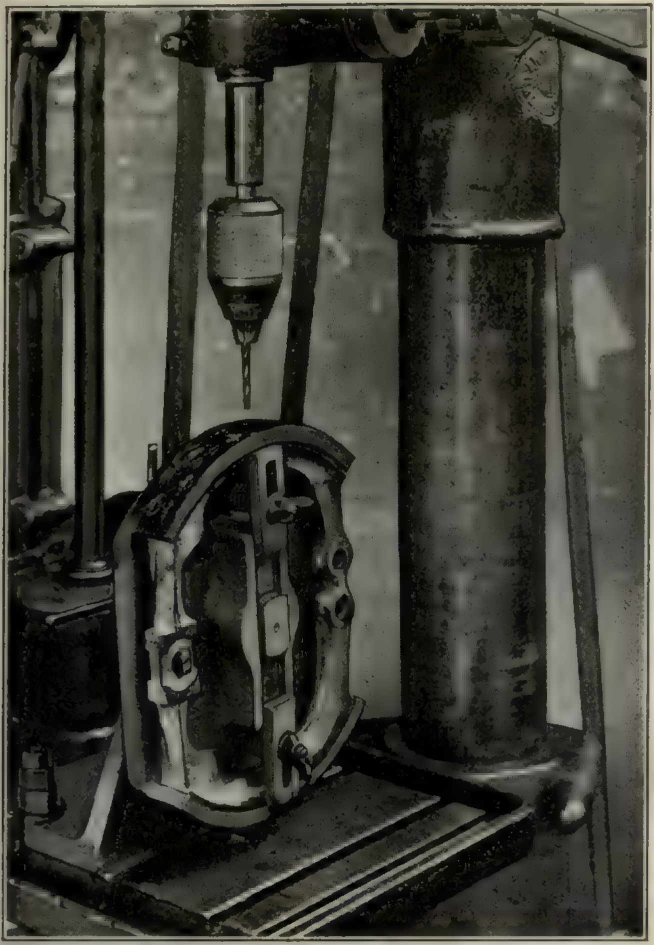


FIG. 16. DRILLING RIVET HOLES FOR BRAKE LINING

stan lathes, the job is secured by straps to three pegs on a faceplate fixture and turned on the outer diameter. The cross-slides are used for roughing and finishing the sides, the rough scale on the diameter being removed by a single-point tool on the cross-slide and this surface finished by the turret. Duplicate machines are needed as this process takes twice the unit time of the section operation. Next, for drilling the rivet holes for the Ferodo (brake) lining a turntable jig is employed, in the form of a vertical plate with flange turned inside to suit the brake diameter, the job being clipped as shown in Fig. 16. The jig moves across the table for the two sets of holes needed, the total number of holes being twenty. The brake lining is fitted and riveted as the work progresses, the work being undertaken by the same operator, who has a clamping piece which presses the Ferodo and shoe tightly together. A machine has been tried but hand work is quicker. The shoes are then split on a horizontal miller, Fig. 17. Two sets of cutters are used of varying widths, the job being swiveled by an eccentric device from one to the other. The final operation on the brake shoe is to mill a slot to suit the brake cam. A duplex fixture is employed to hold one piece on each side of a central wall, the job being located on one of the drilled holes and bedded down on its own diameter, the pressure of the cut being taken by setscrews. Two half shoes are milled simultaneously, the cut being taken across.

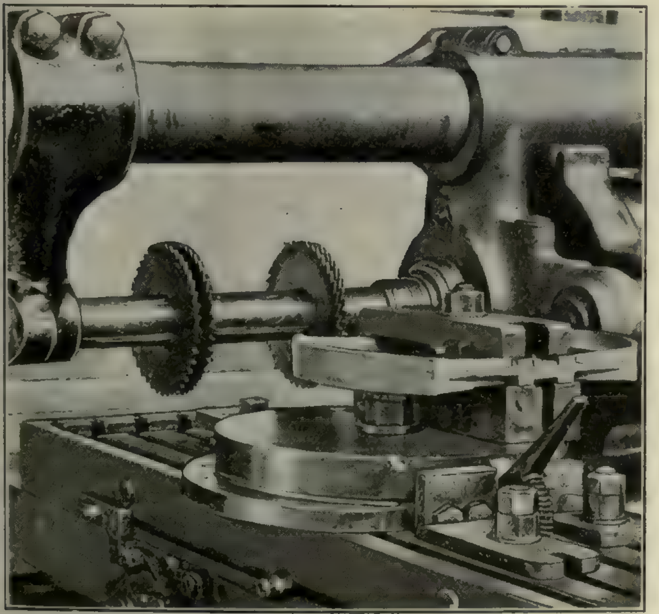
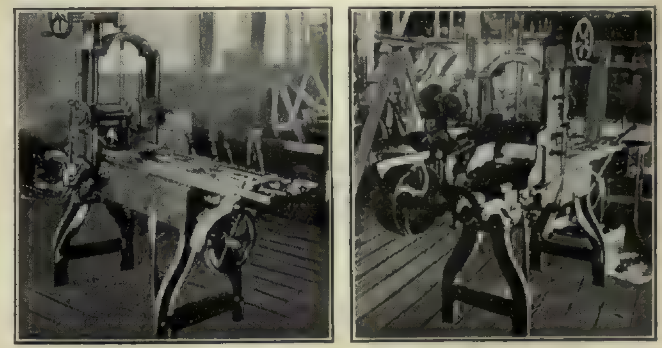


FIG. 17. SLITTING BRAKE SHOES WITH ECCENTRIC FIXTURE

An Old Screw Planer

By Milton Wright

The illustration shows front and back views of a small screw planer that evidently dates from the early days of the machine-tool industry. The movement of the platen is obtained from a very coarse pitch screw that, in turn, is driven by the arrangement of bevel gears shown in the back view. A single belt drive is used, the belt passing across an idle pulley at each shift, and driving the screw first in one direction and then the other by reason of the fact that the bevel pinions are located on opposite sides of the screw. The higher rate of return speed is provided for by properly proportioning the ratio of the bevels.

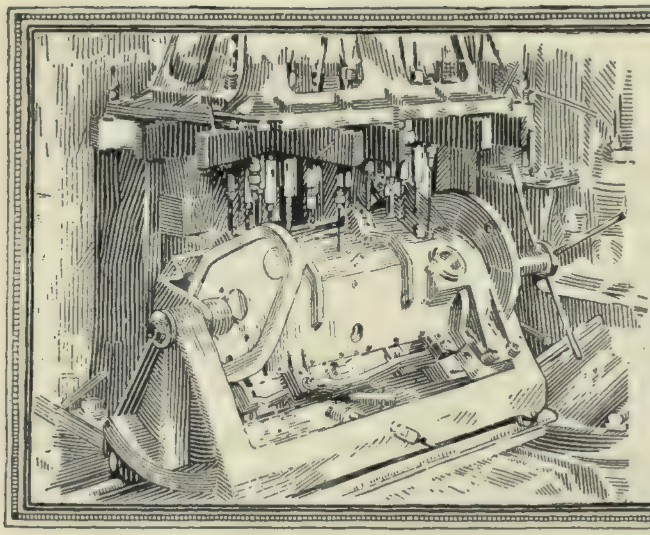


AN OLD SCREW PLANER

The crossrail has a single elevating screw located at the center of the housing. The feed rack and pawl are on what would seem to be the wrong side of the machine, while the table reverse is on the other side where it should be; thus making it a rather unhandy machine to operate, as a man could hardly be expected to be on both sides at once.

The large spur gear shown in the front view is driven by a pinion on the end of the screw and is keyed to the end of a shaft that passes nearly to the other end of the machine, where it operates the train of gears that constitutes the feed works.

At some period of its career the machine evidently had been found too unstable to resist the shock of table reverse and the twisted braces of iron had been added at each end to steady it. The machine was built by H. Gage, Nashua, New Hampshire.



Tool Engineering

By

Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
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Design of Profiling Fixtures—Principles Involved—Types of Profiling Machines— Cam Milling—Irregular Forms—Methods of Roughing and Finishing—Multiple Fixtures

THE cutting of irregular forms is generally done on a profiling machine or a cam cutting machine. In the manufacture of rifles, pistols, sewing machines, and many other small mechanisms, these machines are used to produce parts which would be difficult to make by any other process. The cutters used for this work are milling cutters of various forms to suit the particular piece of work to be manufactured. Profiling machines are, in fact, nothing more than milling machines so arranged that the tables or spindles can be moved freely in any direction. In some cases the table moves in two directions while in others the table is moved in one direction and the spindle in another. Several types of profiling and cam cutting machines are shown diagramatically in this article in order to familiarize the tool designer with the general principles on which they work. It must be understood that these diagrams are intended only to show principles and are not by any means construction drawings of the machines.

BENCH PROFILING MACHINE

Fig. 161 shows a type of bench profiling machine very useful for small light work. The machine consists of a base and column *A* on which is mounted an adjustable slide *B* carrying a spindle *C*, at the lower end of which, at *D*, the cutter is located. The table *E* is so arranged that it has two movements at right-angles to each other, one of which is obtained by means of the lever *F* while that in the other direction is obtained by means of lever *G*. The work is mounted on the table at *E* and a suitable former is placed in relation to it in such a way that a former pin can be placed in either of the holders at *H* or *K*. The head can be lowered to the correct position by means of the lever *L*.

Provision is made at the rear of the head so that different heights of work can be accurately machined by placing suitable blocks between the adjustable points indicated at *M*. This type of machine is very convenient and does not take up much space.

For the majority of work to which a profiling machine is adapted a single cut is sufficient to produce it within the required accuracy, for which a single spindle profiling machine such as that shown at *A* in Fig. 162 can be used. When work is to be roughed and finished it is sometimes desirable to use a two-spindle machine similar to that shown at *B*. In general construction these two machines are similar, the difference between them being in the number of spindles and former pins utilized.

In the example *A* the table *C* is moved in one direction by means of the handle *D*. The handle *E* moves the head *F* which contains the spindle *G* and the holders for the former pins at *H* and *K*. A lever is provided at *L* to raise and lower the slide *F*. When work is handled on this type of machine, the former can be placed either at the right- or left-hand side of the cutter spindle, according to the nature of the work and the fixture that is being used.

The two-spindle machine shown at *B* is identical in general form with that previously described, excepting that there are two spindles *M* and *N* on this machine and three holders having former pins at *O*, *P* and *Q*. When work is to be roughed and finished in the same fixture, two former pins can be used and a suitable allowance made in setting the pins to provide for the amount of finish required.

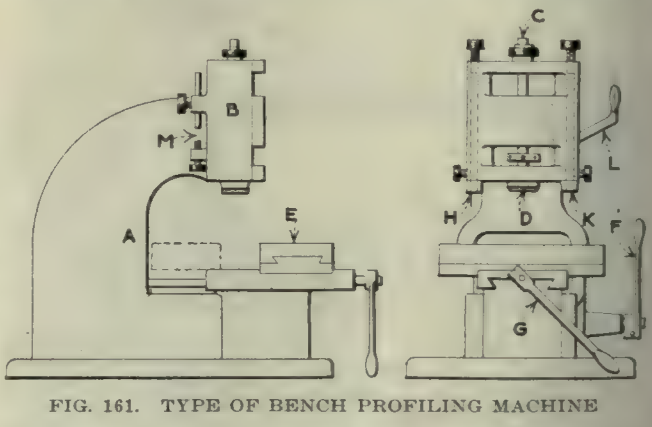

FIG. 161. TYPE OF BENCH PROFILING MACHINE

It is well to call attention to the fact that the spacing of former pins in relation to the spindle on profiling machines is a fixed dimension as indicated at *X*. Hence all fixtures must have the work and former plate located in accordance with this dimension. When roughing

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For authors' forthcoming book. All rights reserved.

and finishing cuts are to be taken the allowance between the two cuts is determined by raising or lowering one of the pins.

CAM-CUTTING MACHINES

Cam-cutting machines belong to the same classification as profilers, although they are usually arranged so that their operation is automatic instead of by hand. Two diagrams of cam-cutting machines are shown in Fig. 163. *A* shows a general diagram of one machine having two tables, *B* and *C*, on the first of which the former plate is mounted, while on the second the work is clamped in place. The two tables are geared so that they revolve in unison and it is therefore evident that the spindle *D* will follow the form controlled by the pin *E* which can be adjusted along the slide *F*. The weight *G* attached to the carriage *H* keeps the former pin in contact with the former at all times. The action is automatic after the work has been placed in position. By means of suitable attachments, either flat or cylindrical cams can be cut in this type of machine.

Another machine for cutting cams of either cylindrical or plate variety, is shown at *K*. In this case a roller or former pin is placed at *L* so that it remains in contact with the master cam *M* while this is revolved. The revolution of this cam causes the slide *N* to move up and down according to the shape of the master cam. The work *O* is suitably mounted so that it will revolve in unison with the master cam. It is evident that the cutter *P* carried in the slide *N* will be controlled so that it will reproduce a form according to the contour of the "master" used. This machine can be adapted for cutting a plate cam by the use of attachments.

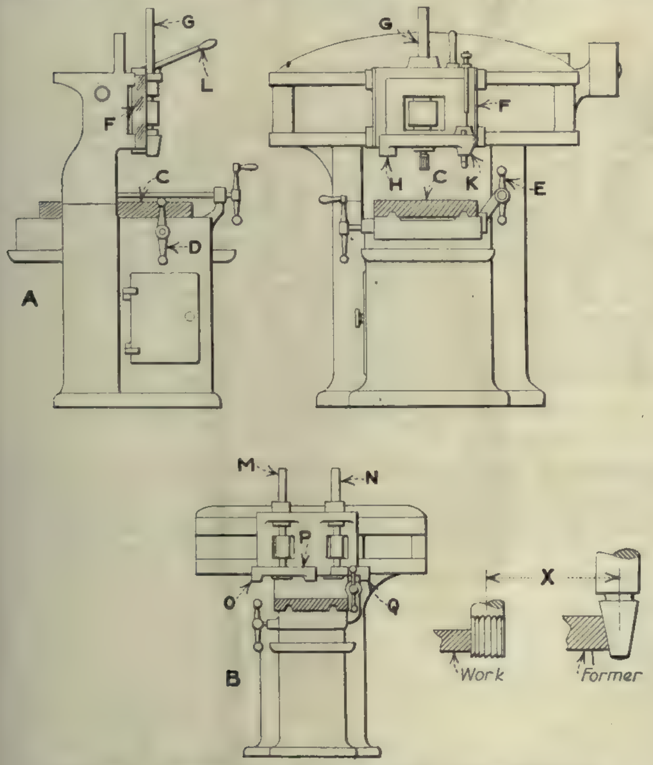


FIG. 162. DIAGRAMS OF ONE- AND TWO-SPINDLE PROFILING MACHINES

DESIGN OF PROFILING FIXTURES

In general design a fixture for profiling is one of the simplest, and yet it is very easy for an inexperienced designer to make serious errors, unless he is familiar with the general principles involved in the use of profiling machines. Several important points are given herewith.

(1) General shape of the work. It does not always follow that because a piece of work is irregular in shape it is more profitable to profile it, as it may be found a better production proposition to mill it with a formed cutter. Careful analysis must be made before reaching a decision as to the most profitable way to handle the work. (2) Accuracy required. If a piece of work is to be held within very close limits it is possible that two profiling cuts may be necessary in order to keep it within the required tolerance. If the work is to be hardened and ground, these points must also be taken into consideration and suitable allowances made. (3) Location of work. Provision should be made for locating any work which is to be profiled by drilling and reaming suitable locating holes or by providing other means according to the contour of the work to be machined. When a number of pieces of the same general shape are to be profiled, a single fixture may sometimes be adapted to handle all the work, providing that a standard method of locating is used and that the former plates are made interchangeable.

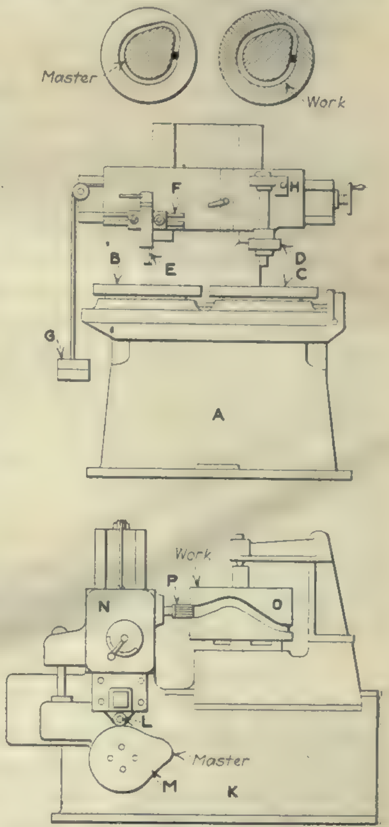


FIG. 163. DIAGRAMS OF TWO AUTOMATIC CAM-CUTTING MACHINES

(4) Position of work. As practically all profiling machines have a fixed relation between the cutter spindle and the former pin, and as the height to which the head can be raised is limited, it is evident that the designer must be careful to keep within the dimensions specified and make suitable allowances so that the work can be removed and replaced without difficulty. Profiling fixtures are usually built very low on account of the limited head movement permitted.

(5) Chip accumulation. Care must be taken in the design of fixtures to see that the former plate is so placed that chips will not get into a pocket and cause inaccuracy in the work. If a slotted plate is used as a former, suitable openings must be provided so that chips can be cleaned out from time to time as they accumulate.

FORMS OF PROFILING CUTS

A number of conditions are possible in profiling: (a) There may be a plain simple form on one side of a piece of work; (b) it may be required to cut an irregular form completely around a piece of work; (c) a more or less irregular slot may have to be finished on both sides and this slot may be continuous or it may be interrupted—it may be circular or angular; (d) the inside of a piece of work may be of such shape that it must be profiled to a given form; (e) a series of bosses or surfaces of various heights may require facing.

There are also occasional peculiar cases which cannot be covered by general notes, but when problems of this kind occur they can usually be solved by application of the various principles which will be mentioned in this article.

Fig. 164 shows several varieties of profiling cuts. The work *A* is a plain surface which is to be profiled instead of milled because there are protuberances on the casting which would make it inconvenient to use a milling machine. Furthermore, the cost of a vertical milling machine suitable for work of this kind is much more than the cost of a profiler, and therefore greater economy is obtained by using the latter machine. The example *B* illustrates step profiling in which the surfaces *C* and *D* are to be held in a fixed relation to each other so that the dimension *E* will be within certain limits. In machining work of this kind the profiler can be used to advantage by the application of a suitable block between the points noted on the diagram in Fig. 161.

The work shown at *F* is a plate which is to be profiled inside as indicated by the finish marks. Work of this kind is frequently found in general manufacturing.

EXAMPLES OF SURFACE PROFILING

Work similar to that shown at *A* in Fig. 165 can be handled to advantage on a profiling machine. In this case the bosses *B* are so arranged that they cannot be faced conveniently on an ordinary milling machine. On a profiling machine the work can be held in a fixture similar to that shown at *C* and the cutter slide can be locked so that it will remain at a certain height. The operator can very rapidly pass over the various bosses with a cutter as indicated. A simple type of fixture can be designed so that the work locates on the finished surface *D* and is clamped against the locators at *E* by means of the swinging clamp *F*. Many cases similar to this are found where the profiler can be used to advantage. No forming plate is necessary, as the operator controls the movement of the cutter by means of the handles on the machine. In certain cases it may be advisable to provide a guard plate to prevent an accidental movement of the handle which might cause the cutter to gouge into the work, but in most cases this is unnecessary.

STEP PROFILING

The profiling machine is particularly useful where several different heights are to be machined on a casting. A case in point is shown in Fig. 166. In this case the work has been previously machined at *B* and the hole *C* has been drilled and reamed. It is necessary to face off the bosses *D*, *E* and *F* so that they will bear a certain relation to each other. The work is set up on a fixture locating on a plug *C* having shoulders at

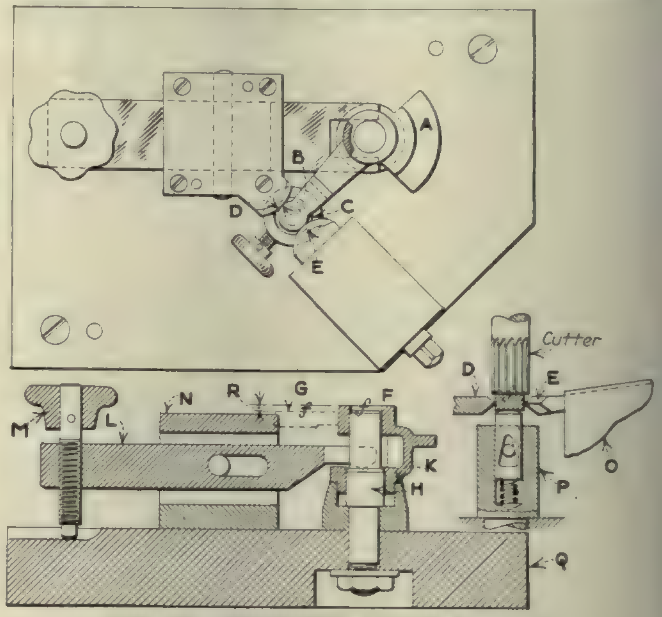


FIG. 167. PROFILING FIXTURE FOR A DELICATE OPERATION

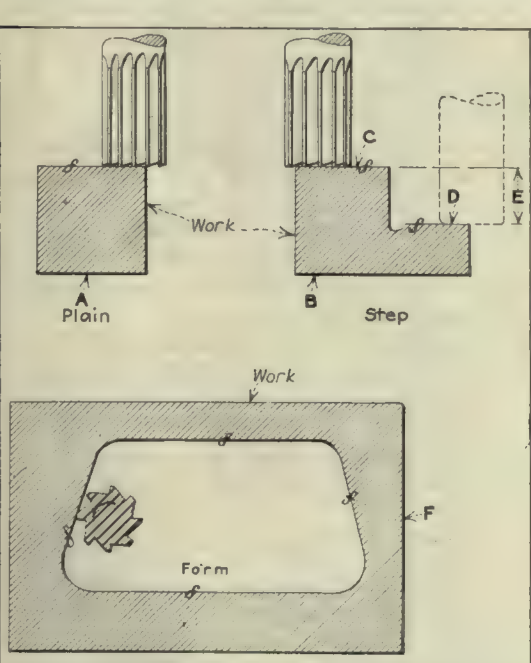


FIG. 164

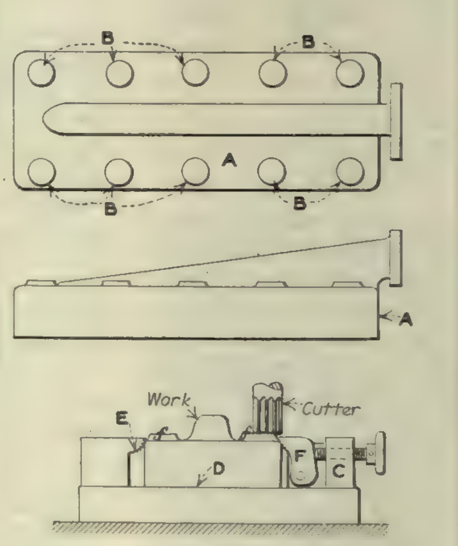


FIG. 165

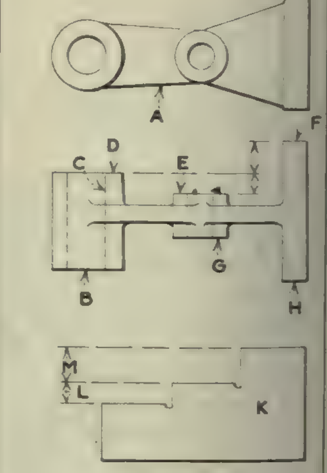


FIG. 166

FIG. 164. SEVERAL FORMS OF PROFILING CUTS. FIG. 165. SURFACE PROFILING. FIG. 166. STEP PROFILING

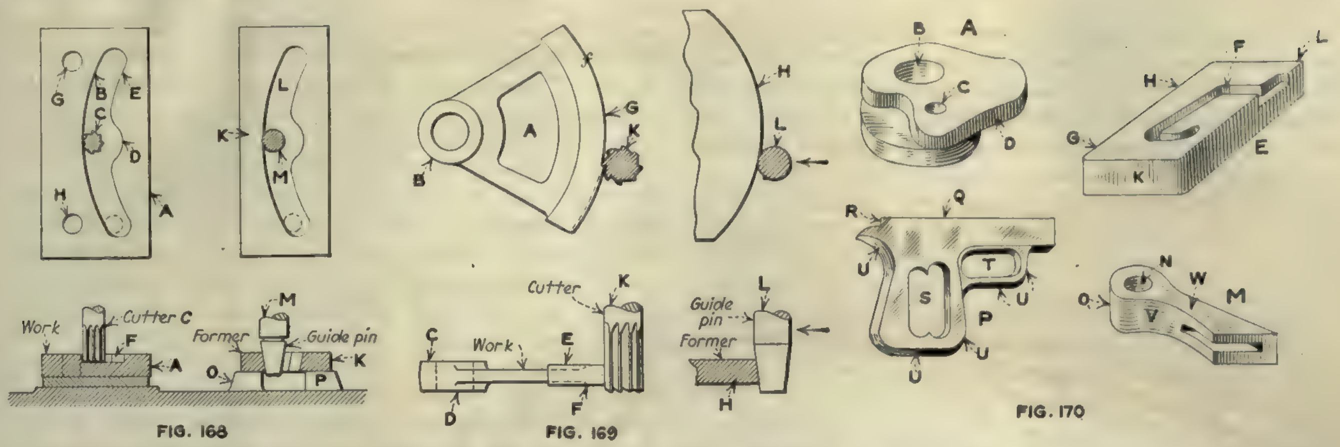


FIG. 168 FIG. 169 FIG. 170

FIG. 168. SLOT PROFILING. FIG. 169. CIRCULAR PROFILING SHOWING METHOD OF ADJUSTMENT USED FOR ROUGHING AND FINISHING. FIG. 170. EXAMPLES OF SHAPES SUITABLE FOR PROFILING

B. Suitable adjustable supports are also provided at points *G* and H and the work should be clamped in such a way as to not interfere with the cutter. In milling the various surfaces a step-block can be used like that shown at *K*. The various shoulders are obtained by using the setting as indicated at *L* and *M*.

In the first article of this series Fig. 7 showed an operation sheet on the part *A* indicated in Fig. 167, and it will be noted by a reference to this sheet that the second operation consisted of surfacing the small end *F* to length and milling one side of small arm *G*. The work is located on a stud *H* and against the previously finished surface *K*. A sliding clamp *L* operated by the thumbscrew *M* straddles the locating plug and clamps the work down firmly. This sliding clamp is located in a block *N* which has a knife-edge on one side as indicated at *D*. The side of the boss *B* is forced against the point mentioned by means of the knife-edge clamp shown at *E;* this clamp being similar in construction to one which was illustrated and described in a previous article. The action at this point is shown clearly in the detail view at *O*. A light spring jack support is used at *P* under the arm *B*. The base of the fixture *Q* is so arranged that it can be fastened with screws to the table of the profiling machine.

When using this fixture the dimension *R* is preserved by using a size block to regulate the difference between the two cuts. This piece of work required extreme accuracy and the fixture shown was designed with great care in order to preserve the relations of various surfaces to each other.

SLOT PROFILING

When an irregular slot is to be profiled it is not advisable to use a cutter exactly the size of the slot which is to be machined. Much better results will be obtained by using a smaller cutter so that each side of the slot will be milled separately. The advantage in using this method is that the cutter diameter need not be held accurately to size, slight variations being compensated for by adjustment of the former pin. In slot profiling it is evident that the cutter must always be smaller in radius than any corner or fillet that is to be profiled. A sharp inside corner cannot be profiled, but it may be cut to the radius of the cutter and afterward broached, shaped, or filed, according to circumstances.

An example of slot profiling is shown in Fig. 168. In this case the work *A* must be machined on the sides *B* and *E* and the recess *D* must also be profiled. The work locates on two dowel pins at *G* and *H*, and is clamped in place by means of ordinary strap clamps which should be so arranged as not to interfere with the action of the cutter. The slot does not extend entirely through the work but is shallow as shown at F. The former pin *M* controls the movement of the cutter *C* as it is guided along the slot *L* in the plate *K*. This plate is mounted on bosses at *O* and *P* so that chips will not accumulate in it and thus cause inaccuracies in the work. Openings at the sides allow the chips to be readily cleaned out as they accumulate.

CIRCULAR PROFILING

It is sometimes more economical to profile a segment of a circle than to machine it on a lathe, because the lathe operation would be an interrupted cut. An example of this kind is shown in Fig. 169. The work *A* has been previously finished in the hole *B* and also on the sides *C*, *D*, *E* and *F*. The radius *G* is to be cut in this operation and the cutter *K* leaves a small amount to be removed by the hob when cutting the teeth. This amount can be regulated by the position of the former pin *L* in relation to the former *H*. This method allows the operation to be accomplished much more rapidly than it would be if done on an engine lathe or other similar machine.

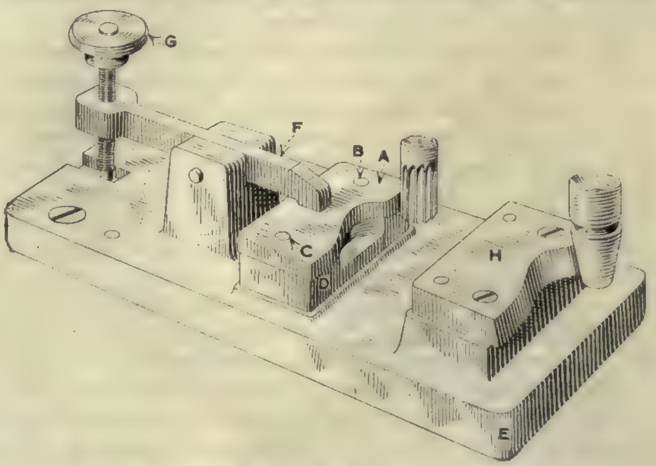


FIG. 171. EXAMPLE OF WELL DESIGNED PROFILING FIXTURE

EXAMPLES OF SHAPES SUITABLE FOR PROFILING

Fig. 170 shows a variety of work requiring profiling operations. The cam *A* is to be profiled on the surface *D*. It has been previously bored and reamed at *B* and the locating pin hole *C* has been drilled and reamed; it is therefore necessary to locate the work both from the center hole *B* and the locating pin hole *C*, and the clamp used must be of such form that the cutter can pass entirely around the work. The natural arrangement for clamping a piece of work of this kind would be by means of a C-washer and nut.

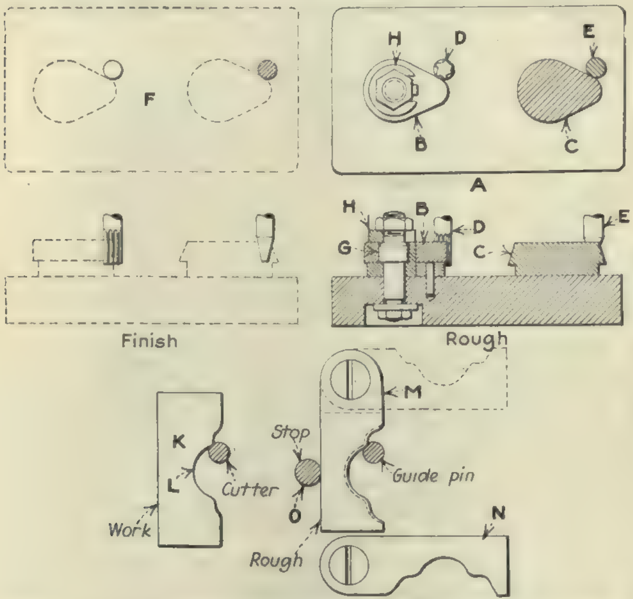


FIG. 172. DIAGRAMS ILLUSTRATING METHODS USED FOR ROUGHING AND FINISHING WORK ON PROFILING MACHINES

The work *E* is a special cam plate having an irregular slot in it as indicated at *F*. As this piece has no pin holes on which it could be located, it would be necessary to provide other means of assuring correct location. A natural method would be to place locating studs at the points *G*, *H* and *K* and force the work into position by means of a screw or clamp at *L*. Methods of clamping have been described which could be applied to this piece of work without difficulty.

The pistol frame shown at *P* is an excellent example of a piece of work which requires several profiling operations. The work is located against the finished surface *Q* and also at *R* by means of pins. The operations to be done are profiling of the slots *S* and *T* and the outline *U*. This work can be done by means of a multiple fixture on an automatic type of profiling machine, the fixture for which will be described later in this article.

Another example of a piece of work requiring a circular profiling operation is shown at *M*. This piece has been finished on both sides and the hole has been reamed at *N* so that good location is assured. The operation to be done is the profiling of the round portion *O* and the sides at *V* and *W*. There should be no difficulty in designing a fixture for this piece of work as good locating points can be easily obtained and suitable clamps can be applied without trouble.

WELL-DESIGNED PROFILING FIXTURE

Due to the fact that profiling fixtures are so similar in their general construction, the writers have not attempted to show many designs in this article as many of the principles of clamping and locating that have previously been described can be easily applied to the design of profiling fixtures.

Fig. 171 shows a very clean-cut design of fixture which is not only rapid in its operation but economical in its upkeep. The work *A* locates on dowel pins at *B* and *C*, these pins being set in a hardened plate *D* on the base of the fixture *E*. The work is clamped in place by a sliding clamp *F* operated by the thumbscrew *G*, the clamp being so arranged that it can be slid back out of the way when replacing or removing work. A suitable former is applied to the fixture at *H*.

It may be well to state here that profiling fixtures are usually located on the table by means of dowels and screws and there are occasional cases where a locating slot is also provided on the table. Factories where a number of profiling machines are used generally standardize their tables both in regard to the slots and also in their relation to screw and dowel holes, so that fixtures made for profiling can be changed from one table to another. A suitable jig is also provided in order to make sure that the hole locations are correct.

METHODS USED FOR ROUGHING AND FINISHING WORK

The diagrams in Fig. 172 illustrate several methods which can be used when it is necessary to rough and finish a piece of work at the same setting. At *A* the cam *B* is to be machined, using the former *C* to obtain the correct contour. The cutter and former pin are indicated respectively at *D* and *E*. A two-spindle profiling machine is used for this work, the sliding head of the machine being brought over for the second operation so that the work takes the position shown by the dotted lines at *F*. The sectional view shows the method of locating the work *B* on a stud *G*. The C-washer *H* is used for clamping.

Occasionally a two-spindle profiling machine is not available for doing both roughing and finishing operations on a piece of work. A method which can be used for a case of this kind is shown below, where the work *K* is to be profiled at *L*. It is easily possible to arrange two forming plates such as those shown at *M* and *N* so that they can be successively swung into the position indicated against the stop *O*. These forming plates can be identical in size or they can be made

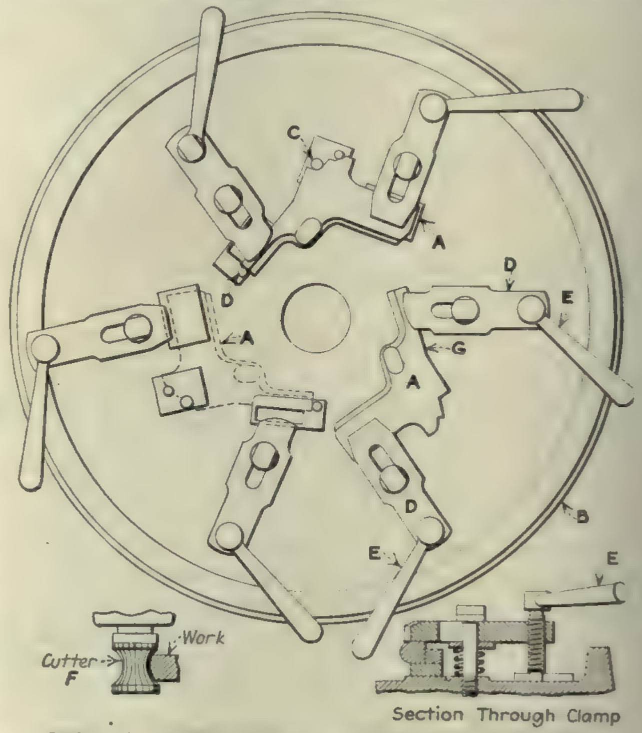


FIG. 173. FIXTURE FOR AUTOMATIC PROFILING

so as to allow the required amount for finish. If they are made the same a vertical adjustment of the head can be made to take care of allowances in roughing and finishing cuts.

FIXTURES FOR AUTOMATIC PROFILING

Economies can frequently be effected in profiling operations by using a multiple fixture on an automatic profiling or cam-cutting machine. A fixture of this kind is shown in Fig. 173, the work being an automatic pistol frame, shown at *A* in the illustration. Three pieces are set up on the faceplate *B* which is of special design having a rim around it which serves as a pan so that cutting lubricants can be used, the lubricant running off through a hole in the center of the table. A wire basket catches the chips and allows the lubricant to percolate through and return to the pump.

The type of machine on which this fixture was used is a Pratt & Whitney automatic profiling machine. The former plate which is generated on the machine from a model of the work, is fastened to the under side of the fixture. It is not shown in the illustration.

It will be seen that each of the parts *A* locates against pins at *C* and *D*, these pins being located in hardened supporting plates. The work is held by the sliding clamps *D*, the binder handle *E* being used to pull back the clamps. The construction of these is clearly shown in the sectional view. The cutter *F* used in this operation is formed in order to produce a rounded surface on the work as shown in the detail view. In order to show the method of clamping and locating more clearly, one of the parts *A* is indicated by dotted lines and the clamps are shown removed from the work.

Another fixture, of a similar kind but holding 4 pieces instead of 3, is used for the next operation which consists of forming the surface *G*. This fixture is not shown but it may be stated that the work is set up so that the four surfaces *G* form the sides of a square inside of which the forming cutter operates. Fixtures can be designed for automatic profiling when the work is of such a nature as to permit setting up to advantage. Certain forms are more adapted to these machines than others and the adaptability of various machines should be considered before attempting to design fixtures for profiling.

A Movement for Sound Industrial Relations

The Merchants and Manufacturers Association of Los Angeles, Cal., in support of its slogan, "Los Angeles Straight Ahead via Sound Industrial Relations" has recently issued to its members a bulletin on "placement" embodying the following suggestions and principles:

1. Men affected should be given all of the notice possible. A month is none too long—a week is the minimum that is decent. Every man must be given every possible opportunity to adjust himself to changed conditions.

2. In every case be dead sure that any action you may take is absolutely justifiable, necessary and based upon sound judgment rather than momentary expediency.

3. Explain to each and every man affected, in personal conference with him, the causes, the reasons, the future outlook and your regret that such action on your part is necessary. Don't use bulletins or pay envelope notices. They are peremptory and are thoroughly objectionable.

4. Ask each man how he would handle the situation if he were in your shoes. Consult *with* him. You may get some valuable and helpful suggestions—it has happened many times—and at any rate you will have the satisfaction of knowing that you are playing square and practicing sound human engineering.

5. If a man has been in your employ, it should be evidence that he is at least a fairly good man. If you must lay him off, thank him personally for the service he has rendered you and give him a letter of appreciation, explanation, commendation and recommendation that he may use in securing employment elsewhere. Such a letter pleases others as it would please you.

6. Send him to the Industrial Relations Department of the Merchants and Manufacturers Association. The Industrial Relations Department will do its best to help him to get a job. That's one of the functions of the department.

7. We believe the above recommendations constitute sound industrial relations—it is the newer philosophy and method in labor matters. We *talk* a lot about it all. Here is a chance to *do* some of it. It *pays* and pays *big*.

The High Cost of Talking

By John H. Woodhull

It has been a convention that conversation has been accepted and paid for as a companion of labor. Few employers care to run a jail and forbid all conversation between whistle blows. But there is indubitably a point at which the employer is justified in seriously considering how much irrelevant conversation between employees he can afford to pay for. It is coming to be agreed that employers cannot afford to pay for conversation between an employee and friends who share his society but not his labor. And to this end is the rule excluding visitors from factories firmly enforced.

For the rest, most employers prefer that enlightened self interest shall guide the employee to a realization of the high cost of mere talking. While foremen and executives are sometimes beguiled into making conversation, the continuance in positions requiring activity in responsibilities precludes the possibility of indiscriminate surrender to the lure.

Life is a training school—and all too few are the opportunities for advancement and usefulness. The man or woman of good intentions cannot fail to be sensitive to those things that interfere with the objects of life. It is a truism—albeit we must iterate and reiterate it—that man created for a good purpose has no right to waste any of the gifts with which he is endowed.

It is the worst sort of crime against one's self to stay with a job that offers no future; in which one is so uninterested that mere talk unnoticed by the boss can be mixed as an essential component.

The tongue of man and tail of dog—each wags when the owner is happy. It would be well if the tongue like the tail ceased wagging under different temperamental conditions.

There is no need to enlarge on the evils attendant on jealous, envious and malicious language in business. How great are the losses due to irritation at passing remarks the most perfect cost system can never measure.

Talk is a currency with which rich and poor are abundantly supplied; but with which no one can afford to be extravagant.

Organization and Management of the Small Shop

III. Methods of Market Analysis—Different Ways of Reaching the Ultimate Consumer—Importance of Establishing a Definite Sales Policy

By ELMER W. LEACH

MANUFACTURERS made a significant stride forward in the advancement of industry when they convinced themselves that factory production should be predetermined. The old idea was to place with the foreman or the superintendent the responsibility of seeing that the men were kept busy and that the work was turned out.

No special effort was made to see that different parts went through the shop in the proper proportionate quantities. There was no attempt made to figure ahead so that a man could know before he was finished with one job what his next job was to be. No one seemed to realize the possibility of being able to base future plans on past performances.

But now, in all modern plants, whether they be large or small, those conditions do not obtain. Toward the close of the year the management decide what the production during the next year shall be, and the superintendent, or whoever may be in control of factory management, arranges a definite schedule to provide this production.

He knows just how many men he will need. If his equipment is inadequate, he knows just where he must add new tools so that the work will go smoothly through each department. Castings are ordered from the foundry, raw materials from outside sources, and parts are put through the various processes and operations according to a definite plan of routing; so that the assembly departments will receive all materials in proper proportionate amounts.

The machine work on each part is divided into certain definite operations, and records are kept of the machines on which each operation should be performed. The time for each operation is also carefully figured and tabulated.

By means of such methods as these the work can be routed through the plant, to each department and even to each machine, for weeks in advance, and necessary requirements of men and materials anticipated well ahead of the time they are needed.

This is planning production. It is scheduling the output of a shop. In some large plants entire departments are necessary to do this work. In small shops it should be done just as carefully and as accurately though the systems used need not be so elaborate.

Until a few years ago, managers thought they had reached the height of possibility in predetermining business requirements; but each year sees an increasing number of firms who exercise the same care in studying probable sales that they do in planning future output.

This is an unusual condition, for it has always been supposed that because sales are to a certain extent beyond the control of the seller, they cannot be estimated to any degree of accuracy.

But recent market surveys by sales managers show that not only can sales of a product be predetermined each year with surprising correctness, but the probable sale of a new article can be investigated in the same way and with the same profitable results.

In investigating the market for your product you must make a note at the very start to distinguish unmistakably between *fact* and *fancy*. It is proven indisputably by the experiences of others that it is of extreme importance that you have a definite plan for merchandising your goods. In studying the methods of others and arriving at the best probable method for yourself, be guided always in your analyses by the *facts*, and give secondary importance to opinions and theories.

Of course, you will want to give due consideration to the opinions of successful business men who may offer to assist you in analyzing your marketing problem, or whose thoughts on that subject you may read in some book or trade magazine. But their opinions will be based on statistics from their own business careers; so that when they suggest a certain safe course for one embarking in business, it will probably be the course which they adopted, and which later results showed to be a sound one.

When I suggest that you be wary of theories and opinions I do not mean to discourage you from devoting as much time as you can to a study of what big business men have to say on the subject of merchandising. But I do mean to guard you against trying to determine your sales policies by simply sitting around a table and having each one say, "I think it ought to be done this way."

The moment you find yourself and your associates trying to arrive at a decision in that way you should adjourn the meeting until a later time when you can have some real data on which to base your judgment. If you do not, you will be a mere debating society, not a group of business men dealing with problems in a businesslike way.

SELECTION OF TERRITORY FOR DISTRIBUTION

The first step toward ascertaining the market for your product is a study of the territory in which you will extend your sales efforts. Your own geographical location will have a certain limiting effect on the extent of your distribution. Obviously, you are most fortunately located for national distribution if you are in the central part of the country.

There are some products, a great many more than one would at first suppose, which because of their very nature cannot enjoy national distribution. Machinery for the cotton industry would have only the Southern states for its territory, farm products would not sell in New York City, nor would a machine for laying pavement interest those in the rural districts.

Most products, however, can be distributed throughout the entire country if your capital and your production will permit that territory.

You must bear in mind the carrying charges on your goods. Unless your goods are very superior to similar goods made in other sections of the country you cannot expect that users in those sections will pay high freight rates and wait several weeks for deliveries. So if you plan to cover the entire country, it will be necessary for you to present special reasons why people in some sections should prefer your goods.

One good way to determine the size of your territory is to study the mailing lists of addressing companies. These houses will gladly send you their catalogs, and such books contain a vast fund of information that is not only interesting but possible of profitable application. Even though you may plan to market your product throughout the entire country, it is very unlikely that you will cover that entire territory at the outset; it is almost certain that such a policy would be unwise.

Analyzing the Market

Just as you must try out your product by actual tests, so you must experiment with your territory in the same way. If there are 50,000 persons or businesses in a certain state that you may believe are good prospects for your goods, do not start right off with a bang by sending literature out to that entire group. Pick any 1,000 names at random and try your advertising on them. Give them a fair chance, and if the results do not justify the effort, you will know that the other 49,000 will probably be the same.

These mailing lists will enable you to select the states or districts best suited for your initial sales efforts. In the catalog of the Ross Gould Co. of St. Louis, for example, we learn some very interesting facts about possibilities of certain states in certain lines. The following table will illustrate this.

	Georgia	New Jersey	Oklahoma	Washington
Auto owners	103,000	141,500	105,000	120,870
Farmers owning autos	39,580	35,815	61,083	44,779
Truck owners	6,855	20,500	6,000	9,550
Motorcycle owners	1,050	11,300	1,700	6,100
Ford owners	49,144	48,270	51,960	48,470
Garages	1,684	2,505	2,460	1,817
Auto dealers	871	1,427	1,612	731
Ford dealers	129	161	159	140
Truck dealers	45	190	70	100
Accessory manufacturers	6	124	2	11

Here we have four states in different sections of the country which have approximately the same number of automobiles, and in each state about half the cars are Fords. The Ford dealers, too, are pretty evenly divided so that each dealer has sold between three hundred and four hundred cars on the average.

In Oklahoma there are twice as many farmers owning automobiles as there are in New Jersey, and yet in New Jersey there are more than three times as many trucks as in Oklahoma, and more than seven times as many motorcycles. In Oklahoma there are only two manufacturers of automobile supplies and accessories; in New Jersey there are one hundred twenty-four.

Such information will give you facts about your territory. Facts in themselves do not prove anything. It is only your own reasoning based upon facts that will give the solution of your problem.

In conjunction with a determination of the extent of your original territory you will want to make a study of the demand for your product. It may seem unreasonable, but if you investigate the demand for your product thoroughly enough, you can actually tell what volume of your goods you can sell in a given territory before you start selling And hundreds of concerns throughout the country are doing that very thing. They not only learn whether there is a sale for their product, but just how extensive the demand will be.

Predetermining Extent of Demand

Quite naturally there are some fundamental principles to be guided by in making a study of demand. No matter what product you may be selling and no matter how you may be marketing it, the same conditions govern the demand for your goods.

Is there really any demand at all for your product?

If your product does not possess any true value, if it is not something that someone can use to advantage and profit, all the money in the world cannot create a demand for your goods. The only thing to do is to switch your energies over into the development of some other product that people will want to buy.

Is the demand limited?

Your product may possess unquestionable value, and there may be a very real demand for it; yet if you investigate the market carefully you may find that the demand is not heavy enough to support a business. If that is the case, you must let this product be one of several—make it a side line to some other goods on which the volume of production can justify the operation and maintenance of a factory.

Is the demand natural?

A great many times I have said to myself after a salesman has left, "Well, he took my order, but he didn't sell me." Such salesmen offer goods for which they must create a demand in each individual instance. The demand is only artificial. If that is the case with your product, you will not only have to meet the problem of selling the trade to the value of your idea but of keeping them sold. That is a long process of education and requires constant prodding and stimulation. If the demand is natural you can look forward to the time when "repeats" will form a large percentage of your sales.

Is the demand seasonal?

The demand for skates is seasonal; so is the demand for straw hats or fur coats. At the same time you are considering this feature of demand, however, investigate the possibility of your changing that condition. You cannot change facts, but you can change tendencies and inclinations.

Stabilizing the Demands

One local manufacturer of ice cream put across a unique campaign of advertising to increase the volume of business during the winter months. While he of course was not able to create the same demand in January as in August, he did do a great deal to overcome the impression that ice cream was entirely a seasonal commodity.

Shoes are not worn out so fast when there is snow on the ground as when the cement sidewalks are uncovered. Jobbers of leather and shoe findings used to use this as a weak alibi for relaxing their efforts during winter months on the sale of repair-shop equipment.

But manufacturers of such products have changed that condition. In winter they call attention to the oncoming spring rush when the snow will be gone and when people put away their rubbers and overshoes. In summer they advise repairmen to prepare for early fall when the little folks, who have been going barefoot all summer, will be returning to school. And in other ways they have been able to stabilize the demand for their goods so that it is distributed evenly throughout the year.

Do not be misled by local conditions. People in Illinois do not buy many automobile tires during the cold months; but out in California motorists do not have to worry about putting their cars into "dead storage" for the winter.

Is the demand permanent or temporary?

If you are marketing some novelty or thing-a-ma-jig that will only appeal to passing fancy, it will be poor business judgment for you to invest much money in buildings and equipment for its manufacture. If you do, you may some day find yourself with your plant and equipment but without any business—the demand for your fad will die out as quickly as it was created.

Is your product a necessity or a luxury?

It is said that food, clothing and shelter are man's only three necessities. But "necessity" and "luxury" are two mighty difficult words to define, as we learned during the war when the Government attempted to classify non-essential industries and non-replaceable employees.

A necessity is something you have got to have, no matter what it costs you. A luxury is something you would like to have if you could afford it, but something you can get along without it if you choose.

Our classification of luxuries and necessities is ever changing. The telephone, the dictating machine, the typewriter and the adding machine are articles which every office considers as necessities. A great many household articles are now looked upon as necessities which only a few years ago were not even dreamed of.

That your article may fairly be classed as a necessity does not mean, however, that you have a monopoly on supplying the demand for it. The mere fact that there is a natural and insistent demand will mean that you are entering a crowded field in which you can expect to find the keenest kind of competition.

The chances are certain that a great many other men have tried to meet that demand long before you attempted it. Some of them are now heads of large and influential organizations. Their particular makes of products are well known to the trade, they have established incalculable good will. You will enter this sort of field unknown. It will call for the best that is in you.

All of your brain power, your energy, your ability must stand ready to aid you in your struggle for recognition. By your integrity and fair dealing, by your persistent advertising, by your policies and by new angles from which you present old propositions you can enter into the field of competition without fear of failing to find the demand, meet it, and increase it to proportions which your most worthy competitors had not dared to think possible.

When you have convinced yourself that there is a definite, permanent demand for your goods, you must investigate the various ways of getting your goods to their consumers—or, in other words, the different methods of marketing your product.

GETTING THE GOODS TO MARKET

In general, there are only two main classifications into which all marketing policies are grouped. Either you will sell direct to your consumer, or you will sell through some intermediate distributor.

Bear in mind that I say "*Through* some intermediate distributor" instead of *to* him. Whatever the details of your marketing method may be, the person you have got to sell *to* is the ultimate user of your goods. If you prefer to reach him through dealers or jobbers, you cannot adopt the short-sighted belief that your interest in the sale ends the moment your goods are sent to your dealer and your invoice put into the mail.

It is true that a shipper's responsibility over goods ceases the moment those goods are delivered to the carrier, because it is provided by law that your express company or your railway company must exercise the highest degree of care in passing your goods along to the next party.

But jobbers are not by law required to do a single thing with your goods, and so your responsibility is quite different. This does not mean that you cannot pin any faith to distributors, that you should look upon them merely as a possible convenience; but I do wish to emphasize the fact that you must sell your goods to the consumer, and whether or not to employ the assistance of any group of organizations besides your own is the vital question to be investigated in determining the plans and policies upon which you will establish your claim for business.

It is obvious that any suggestions which I may make on this problem must necessarily be of a somewhat general nature, for your product may be so vastly different from mine, and some other reader may have a product entirely different from either of ours, that one could hardly be expected to lay down any hard and fast iron-clad rules from which you should not dare to deviate.

So we can best approach the problem of a marketing policy and expect to provide some applicable information by explaining the advantages and disadvantages of these two main marketing plans—direct and indirect selling—and trust that such an exposition may enable you to investigate your problem broadmindedly with a conception of the good and bad points about the possible methods from which you must make a selection for your own business.

ESTABLISHING A SELLING POLICY

I presume, of course, that you appreciate the absolute necessity of forming a definite policy and sticking to it religiously. You cannot sell to "anyone" and expect to develop any repeat business or establish any real good-will. If you decide to sell direct, do so; and don't mix in with the jobbers and spoil the field for some fellow who is loyally using them as his distributive means.

If you conclude you will be best insuring success and progress by selling through jobbers, adopt that method, work with your jobbers heart and soul, and don't figure you are losing profit by turning over to some jobber the usual discount on an order which may happen to come in direct from a customer in his territory.

A selling policy has got to have a backbone to it, or it will never stand on its own feet and hold its head high. A selling policy is in that respect somewhat similar to a guarantee. The value of a guarantee does not depend so much on what it says as on who says it and how carefully it is carried out. The public is not particularly interested in the mere phrasing of the short expression, "Fairbanks O.K.," but it does bank on the word of the Fairbanks-Morse organization.

Don't be content with a half-hearted policy, for that will only prove to be temporarily successful, if it is lucky enough to be successful at all.

It will be a bit difficult for me to present an impartial discussion about direct selling, for I have a personal prejudice against that method, and believe its disadvantages outweigh its merits.

If you plan to work direct with your customers, there are three general ways in which your sales promotion work can be accomplished, and those are by mail, by salesmen, or by branch offices.

The first method requires the smallest outlay of money. I do not mean that it is the least expensive per sale, but it can be conducted on a small scale with modest expenditures which the other methods, by their very nature, do not permit.

Your direct-by-mail sales efforts would consist of one or all of form letters, printed matter such as circulars and catalogs, and trade paper advertising. The value of any of these forms lies in their continuity. You cannot expect to run an ad in some trade paper for only a single issue and attract the attention of every interested party. There are a great many who will not notice your first advertisement just as there are some who will not read your first letter or look through your first circular; but if you keep pounding away and driving at them, sooner or later you will convince them that you are submitting something that is at least worth an investigation.

Salesmen have a great advantage by being actually on the job. They come in personal contact with your customers and can learn the attitude of the trade toward your goods. In actual results, too, they will do better than the same money spent in printed matter or space, for I shall never be convinced that actual personal interviews can be beaten for getting business.

If you cannot afford at first to keep a salesman on the road, it is quite probable you can arrange for your goods to be presented as a sideline on a straight commission basis. If your products have real merit, and have possibilities of big development, you may be able to find a good, gilt-edge man covering a wide territory who will handle your line of goods along with his own. In that way you need not worry about salary or traveling expenses; for he will be paid only in proportion to actual sales, and you will usually find that the percentage which you must pay in commissions will not run so large as your percentage of sales expense if you figured the total cost of one of your direct mail campaigns in proportion to the dollars of orders received in return.

Having your own branch offices in different cities or sections is of course the most satisfactory direct selling arrangement, although it is also the most pretentious.

However, the men in your branch offices will be unlike jobbing distributors in that you will be their employer, and they will have a very direct obligation to you as employees. If results are not forthcoming you can make a change in personnel and eliminate those who are not justifying their position as your representatives.

Ordinarily, the farther you are removed from the ultimate users of your goods the more pleasant will be the management and conduct of your business. If you deal direct with your consumers, there will be a great deal of C.O.D. business, and a multitude of small accounts that hardly justify the bookkeeping expense involved.

It is possible the class of people with whom you must deal will be individuals not financially responsible, or small business men whose ratings may not be any too good; and so you cannot expect to be without credit and collection problems.

If you sell through jobbers they will undoubtedly be established, well listed concerns who discount their bills; so that under normal conditions you can expect your money will come in when due.

Some concerns, yes, a great many, who sell direct feature the idea to their trade, "cut out the middleman's profit." They appeal to their customers on the basis of lower prices because they do not have to pay any discounts to jobbers.

That, I believe, is a fallacy. You will have a selling expense no matter what the details of your sales policy may be. If you sell direct there will be extensive advertising expenditures or traveling expenses which you would not have if you worked through jobbers. And yet, with that method there would be the jobbing discounts. And in a large majority of businesses I think it is six of one and half a dozen of the other.

You will hardly be able to "cut out" any expense or increase your profit by going direct to the user and getting full list price for your article instead of accepting a somewhat smaller payment and letting the difference remain with your distributor to compensate him for his efforts.

COMPETITION WITH ESTABLISHED FIRMS

Remember also that you are organizing a new company. If you happen to be located in Chicago and someone in Baltimore receives your letters or sees your ads, your name will carry no prestige whatever, for you will be an entire stranger to them. On the other hand, a salesman for some large Baltimore wholesale house might go to that same prospect and his words would carry a great deal of weight. If his house were an old-established firm with a reputation for selling only quality products he could say to your prospect, "By George, here's something made out in Chicago that's absolutely the best yet. Just a new concern, but they've got something; you mark my word, they won't be little very long," and your prospect would be likely to be favorably impressed and convinced.

Prestige and good will are the most valuable assets which appear in the financial statements of some of our largest corporations; and in your first statement they cannot be listed at any value whatever. If you can have your goods presented by concerns with both those assets, they are just as valuable to you as though they were in your own books.

Of course, you will not find that jobbers will receive you with open arms. You cannot help but expect that they will be somewhat skeptical, and reluctant to add to their many lines one which is not well known to the trade. And that is why I stated that the person you must sell *to* is the actual consumer.

Use enough direct advertising (directing inquiry of local jobbers) so that customers will come to the jobbers in their territory and say, "I've been getting some literature on so-and-so, do you handle their goods?" And if you can get enough people to do that, you can readily obtain the co-operation of the jobber in selling your goods for he will have been convinced right at the outset that there is a demand for them.

HOW TO ADVERTISE

Then let your advertising take the general form of "dealers helps"; that is, advertising which will help your jobber sell more of your goods. May be it will be printed matter which he can distribute in his mail. If it is mailed direct by you, or if it is magazine or newspaper advertising under your name, you need only to direct the inquiry or order through the local distributor in order to convince him that you are really working with him earnestly.

It is interesting that in a recent issue of *System* there were exactly 100 advertisements of manufactured products. Of these 100 ads 12 said nothing about how or where to obtain the goods advertised. In 20 ads some remark was made to direct the sale through a local distributor, such as "Your stationer can supply you," or "Dealers in all cities." Four ads stated "Dealers wanted"; these by probable new companies anxious to establish agencies. "Branch sales offices in principal cities" appeared in 16 ads, and among these were the Addressograph, Dictaphone, Multigraph and similar well-known office equipment. This leaves 48 ads, and in this number there was some coupon or statement which said in substance, "Write to us."

FROM MANUFACTURER TO CONSUMER

This seems to indicate that more than half the concerns manufacturing office equipment sell direct to the consumer. However, I believe that in a number of those cases (as I have found by actual investigation) it is only the appeal that is direct. I have written to several of those concerns and many times the reply says, "We have referred your inquiry to The Blank Co., our representatives in your city, and have asked that one of their salesmen call on you to explain the merits of our products."

And, of course, when they write to their jobber they emphasize the fact that my writing direct to them for information indicates that the jobber is not combing the territory as thoroughly as possible to reach all customers.

You must not overlook the fact that there are some classes of people who almost insist on doing business with the manufacturer. They believe they can get better treatment, better service and a better price by going direct to the factory. Then, too, a farmer, for example, prefers to transact business with some individual he knows rather than with a corporation in some far-distant city.

How to market your product is just as important as how to build it. You should proceed very cautiously in establishing a sales policy; but once that policy is established, let it be your policy in *every single sale*, and your buyers will not fail to develop a confidence in your dependability, which will find expression in the volume of your sales and the growth of your business.

A Lapping Paste for Motor Bearings

By I. B. RICH

The costumer's satisfaction on a motor overhaul job depends largely on the way both the main and connecting rod bearings are fitted. And in order to give the best results the repair man should know the different motors and the methods of lubrication. Force feed and splash oiling feed require different treatment.

Where splash oiling is used, the bearings are fitted as tightly as they can be run and when they wear a very few thousandths of an inch there is usually a pound or knock. With the force feed a definite allowance is made for oil between the crankshaft and the bearings, usually from 0.001 to 0.0015 in. This allows a space for the oil which, being forced in under pressure, actually keeps the metal surfaces apart and greatly prolongs the life of the motor.

For the splash oiling motor there is probably no better method than that of "burning-in" which was developed at the Ford plant and is used in Ford service stations. With this method the shaft is run until the bearing metal softens and starts to flow, which is only a matter of seconds, usually less than a minute. This, if carefully done, gives a good bearing which is better in every way than a scraped surface. It is probable that this method could also be used for a force feed bearing by putting in the proper shims after "burning-in."

Care must be taken to allow sufficient end play and yet not so much that the oil pressure cannot be maintained in the bearing. In other words, if the oil can flow too freely without being restricted by the thrust collars or fillets, the pressure may be reduced below that necessary to keep the metal apart. If on the other hand, the oil cannot flow out the ends, it soon burns up and there is little or no lubrication.

HOW THE BEARING WAS LAPPED

One of my friends who is an expert on racing motors, fits his bearings in a very simple and interesting manner. He carefully calipers the crankshaft for each bearing and reams the bearing as near that size as possible. Then he takes out a very thin shim, puts a special lapping paste on the bearing, screws down the cap and makes a few turns of the shaft or connecting rod. He then wipes out the bearing, examines its surfaces, and if satisfactory, puts the shaft back with a pair of shims under the cap to give the proper thickness of oil film. If it isn't quite right, he repeats the lapping until it is.

His whole secret of success is in the kind of paste he uses. He doesn't use emery, carborundum, alundum or any of the ordinary abrasives. He keeps a cake of Sapolio handy, shaves a little of it off into a small dish, mixes it with either water or kerosine so as to make a paste and finds it the best lapping mixture available. He insists that it does not embed itself in the bearing metal, that it loses its abrasive qualities in a few seconds and has no bad after-effects. It does not cut the shaft, only the white metal bearing. As proof he points to many racing motors he has fitted up in this way and run them at top speed almost as soon as they were put in the cars.

I've seen cylinders lapped with Sapolio years ago, before the days of grinding, with good results. There may be other uses for Sapolio lapping paste that will save both time and money.

Metal Cutting Tools—XIV

By A. L. De Leeuw

(Continued from last week's issue)

IF THERE were no other elements to be considered except the lubricating qualities of the liquids used and the nature of the chip, the whole matter would be fairly simple. But there is another item which has already been mentioned and which plays a great part in the function of a lubricant, and that is its capacity for cooling.

COOLANTS

The object of the use of a coolant is to prevent the tool from getting so hot that its temper will be drawn. There are various ways in which a tool may break down. The pressure may be too great for the cross-section and overhang of the tool and cause failure by breakage; or the material to be machined may be gritty and act on the cutting edge as a grinding wheel would, except that instead of grinding the tool in the way we desire it to be ground, it would in all probability grind it in such a way as to destroy its usefulness. This manner of failure is quite common with grey iron or steel castings containing sand pockets. Again, it may break down by wear, caused by the chip rubbing over the tool surface under high pressure. At first such wearing of the tool may make it actually more efficient, as was pointed out when speaking about lathe tools in general; but finally the section of the tool which has to support the pressure of the chip becomes too small and failure results either from the breaking out of a part of that section, or else because the cross-section is no longer sufficient to carry off the heat. Finally failure may result from the inability of the tool to dissipate the heat generated by the action of cutting.

Ordinary tool steels lose their hardness when heated to about 600 deg. We say about 600, because there is quite some variation possible with different grades of carbon tool steel. Good high-speed steels lose their hardness at about 1,200 deg., and there is more variation in the temperature at which the hardness disappears with high-speed steel than with carbon tool steel. It would seem at first glance that the high-speed steel would be able to do about twice as much work as the carbon steel. But as a matter of fact, it will do even better than that. A little thought will show clearly that this must be so. Suppose we had a piece of material which would lose its usefulness at 100 deg. and another piece of material which would fail at 200 deg. and suppose further that the temperature of the room in which we make our experiments is 70 deg. Then the additional temperature which may be taken up by the first piece of material before failure is 30 deg. and for the second piece 130 deg., as the increase in temperature is practically proportional to the amount of heat taken up, we may say that the second piece can take up an amount of heat more than four times as much as the first piece before failure.

But even this does not entirely express the greater ability of the second piece to stand heating without failure. This proportion would be correct if we place the two pieces of material to be tested in an oven; or in other words if we place them in a position where the surroundings are heated up to the same temperature as that to which we wish to test the pieces. However, this is not the way in which a tool takes up heat. It is surrounded almost entirely by air at the temperature of the room, 70 deg. When the cutting action, that is, the separation of the chip, the breaking up of the chip, and its flowing over the tool surface, causes heating, this heating only takes place at a small portion of the tool, whereas the rest of it, being surrounded by air at 70 deg. will try to carry off this heat. If we should heat the piece to 90 deg. and then stop heating it further, it would be some time before the temperature had dropped to 80 deg. This drop in temperature does not take place evenly. It is more rapid when the piece is at a temperature of 90 deg. than when it is at a temperature of 81 deg. because the rapidity of the change in temperature depends on the difference in temperature between the piece and the surrounding medium.

Similarly, when a piece of high-speed steel is heated up to 1,100 deg. (that is, somewhere near the point where it would break down), it will dissipate heat very much more rapidly than when a piece of carbon steel is heated to about 550 deg. This, again, makes the high-speed steel more effective than the carbon steel. There may be a point during the use of a tool when it dissipates heat as rapidly as it receives it. When this equilibrium is established below the point where the tool would soften, there is no danger that the tool will burn out. If on the other hand it receives heat more rapidly than it can dissipate it, the temperature will keep on rising until finally a point is reached where the tool loses its hardness. We can well imagine a case where the excess of heat generated is quite small, but even under those conditions a point must finally be reached where the tool will be overheated. In such a case it would be easy to prevent the tool from burning out by a small amount of coolant. As a rule, however, the point of equilibrium is not so fixed that we can say with absolute certainty that there will be no trouble if we take a cut at 60 ft. per minute, and that there will be trouble when we run it at 61. In other words, there is a wide danger zone.

Coolants are used to keep the temperature of the tool with a fair factor of safety below this danger zone. They are used to assist in dissipating the heat the machine receives. It must not be forgotten that the heat generated is normally carried off in various ways. The tool itself conducts some of the heat to the machine where it is readily dissipated on account of the large radiating surface; part of the heat is carried away with the chips, another part is carried off by the work, and still another part, and generally a very small one, is carried off by the surrounding air.

A further point to be remembered is that the heat is really generated in the chip and at the point where it is being separated from the work. The tool itself does not generate heat, because no change is taking place in the tool. The chip does not have its highest temperature at the point where it is split off from the work; because some time later, that is when it flows over the tool, it is still further deformed and broken up. Close observation will show this very readily. We see, then, that the heated chip bears heavily on the tool and that the fact that the work carries off some of the heat does not assist us much. The highest temperature of the chip being right above the tool it becomes necessary either to interpose a coolant between the chip and the tool or else cool the chip at the point where it strikes the tool. Better yet, do both.

It would seem at a first glance as if interposing a film of lubricant between chip and tool cannot have much effect on the cooling because it must necessarily be extremely thin if it can exist at all. In the discussion of what a lubricant does when we take a cut, we saw that the lubricant flows into the small triangular opening between work chip and tool and we can readily imagine how it must be carried along by the chip and be spread out in a thin film between chip and tool, provided, of course, that the lubricant has the necessary body to stand the heavy pressure of the chip. Thin as such a film may be, it interposes a material between the chip and the tool which prevents the heat from being carried over by direct convection. This would not help much if the little film of lubrication were stationary as it itself would very soon be heated up. But as a matter of fact this film is constantly renewed and flows over the tool as rapidly as the chip; so that the effect is the same as if a chip coated on the under side with a film of oil were flowing over the tool. We see, then, that, a lubricant also has some effect as a coolant.

The greater part of the cooling effect, however, is obtained by pouring a mass of coolant over the heated chip. One sees often how the operator directs his stream of coolant on the work. This, of course, has some effect because it cools the work itself and therefore allows the heat from the chip to flow more rapidly into the work. Nevertheless, the point of highest temperature remains right over the tool point, and this is the point which should be struck by the stream of lubricant. A relatively small stream at that point will have more effect than a heavy stream on the work. This does not mean, however, that a small stream of lubricant is to be recommended, for the practical difficulties of directing such a small stream would be such as to make it very uncertain whether the proper spot would be struck. It is therefore advisable to use a large stream of coolant and direct it as nearly as possible on that portion of the chip which bears heaviest on the tool.

If the liquid used had to meet no other requirements than its ability to cool the chip, water would be the best material to use. Not only does water conduct the heat more rapidly than oil, but it has a greater capacity for heat than practically any other material; that is to say, it takes more heat units to raise the temperature of a pound of water one degree than for practically any other material. As a result the liquid which, of course, is used over and over again, remains cool for a greater length of time and therefore retains its ability to carry off the heat.

There is still another point in its favor. Oil can be raised to a very high temperature and remain oil. If the temperature is raised too high the oil will decompose. It is possible, therefore, when using oil as a coolant to raise this coolant up to a temperature where it is no longer useful as such; and, when this happens, there is a great possibility that part of the oil has been decomposed, leaving a sediment in the remainder of the oil. This makes the oil unfit for further use or, at the best, it must be cleaned before it can be used again successfully.

Water, on the other hand, cannot be raised to a high temperature. When the temperature reaches 212 deg. F., water turns into steam which escapes, leaving the remainder of the water as it was before. At all times water retains its ability to carry off heat, provided the chip to be cooled is hotter than 212 deg. which, of course, is the case when it is at all necessary to use a coolant. When water has reached the temperature of 212 deg. it evaporates and this evaporation will carry off more heat. If, for instance, the temperature of the water is 62 deg. at the beginning of the operation and it is gradually raised to 212 deg., each pound of water will have taken up 212 — 62 = 150 heat units.

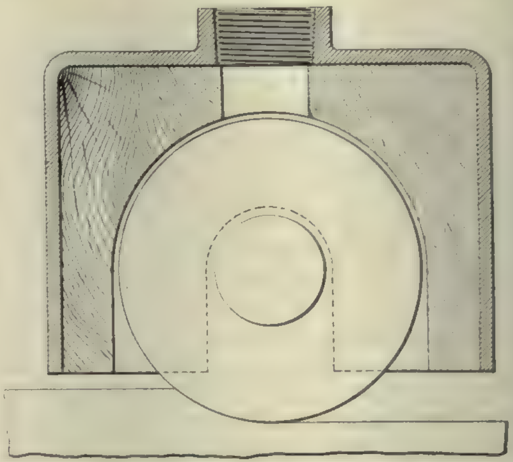


FIG. 229. CAST IRON AND WOOD BLOCK SHIELD FOR COOLANT STREAM

If this pound of water is now evaporated, 970 heat units are required to convert the water into steam; so that a pound of water is capable of absorbing 970 + 150 = 1120 heat units without being raised above 212 deg. If we should use olive oil, a pound of this coolant could take up only 52.5 heat units before it is raised to 212 deg., because the specific heat of olive oil is 0.35; so that one pound of this material, in order to have its temperature raised 150 deg. would require 150 x 0.35 = 52.5 heat units. Under similar circumstances paraffin oil would absorb 78 heat units; ordinary machine oil 60 heat units. This shows clearly how very much superior water is as a coolant compared to various oils.

Water alone cannot be used in machining operations because of the corrosive effect it would have on the machine parts, and it is therefore customary to mix it with some ingredient which will prevent or minimize this corrosion. Soda and soap are commonly used for this purpose. Though most excellent as a coolant, water lacks lubricating qualities, so that where it is necessary to provide for both lubrication and cooling, pure water or soap or soda water does not meet the requirements. In late years various so-called soluble oils have been developed which permit of an oil being mixed with water. The proportion of water determines the extent to which the mixture is useful as a coolant and as a lubricant. Many of these soluble oils leave a residue which is liable to get into the machine bearings and to interfere with the proper action of the machine. In recent times, however, cutting compounds have been put on the market which have, to a high degree, the qualifications required of a lubricant and which can be mixed either with water or with some oil of high specific heat, such as paraffin oil. Such cutting compounds have been used very successfully both as coolants and as lubricants.

The foregoing paragraphs explain to a certain extent the action of a liquid for the purpose of cooling or of lubricating. We can see how such a liquid permits us to raise the speed or increase the feed without overheating the tool, we can also understand why less power is required when using the proper lubricant, but no light has been shed on the manner in which a liquid affects the finish of the piece, nor why the size of a piece should change with a change of cutting compound. That this is so was very forcibly illustrated to the writer when he made some tests of various lubricants to be used on an automatic screw machine. A piece was made requiring a form tool, and the condition of the machine, tools, etc., was such that pieces could be made within the given tolerance of half a thousandth of an inch. This was the case when the regular lubricant was used. In testing out a new lubricant the following procedure was adopted.

Twenty-four pieces were made with the old lubricant and then tested for size. The machine was then cleaned out and without changing any of the adjustments, twenty-four more pieces were made with the new lubricant. All the pieces made with the new lubricant were of a larger size, and not only that, but the variation in size was such that they were from 2½ to 5 thousandths of an inch larger than standard. In order to be sure that the tool had not dulled, the machine was emptied out once more and refilled with the old lubricant and again without changing the adjustments, after which a third lot of twenty-four pieces was made, which were found to be correct again. It might be possible to explain this matter, but to the writer's knowledge, so few observations have been made in regard to this subject that it is not wise to attempt an explanation at the present time. This matter is of great importance to the machine shop and should be nvestigated very closely.

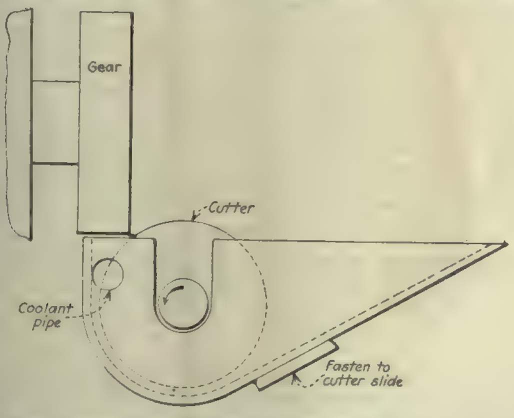


FIG. 230. COOLANT SHIELD FOR USE WHEN CUTTER IS BELOW WORK

A third use to which liquids are put is the ejection of chips. In deep drilling operations and in trephinng operations this use of a liquid is of great importance. In the article on drilling, it was shown how forced lubrication can be used to eject chips when drilling deep holes. The exact manner in which the ubricant should be guided to the drill point and the exact manner of exit of the chips must be studied in ach individual case, and depends largely on the shape f the tool which must be used for the operation.

The foregoing paragraphs considered the use of a single point tool, or, for that matter, a form tool. In all lathes, screw machines, planer and shaper operations, the tool point is embedded in the work—that is, covered by the chip—for a considerable length of time. When a long shaft has to be turned up the tool point is never relieved from work until either the job is completed or the tool requires renewal. However, there is another class of work in which this condition does not prevail, namely the milling operation; and we refer here to simple milling, gear cutting, hobbing, thread milling, etc. A tooth of a milling cutter passes through the work and then for the greater part of a revolution through the air. If a milling cutter takes a cut ¼ in. deep, and if it is 3½ in. in diameter, a tooth will be in the work during 31 deg. of its revolution or practically one-twelfth of the time. During the other eleven-twelfths of the time it runs through air or through the coolant and if we can manage to bring the temperature of that tooth down to its original temperature before it enters the work again there will never be any accumulation of heat. If, during its passage through the work, this tooth has not been heated beyond the danger point it will never be heated to that point. If the milling speed of the milling cut is 60 ft. per minute, that is, if the cutter makes 65 revolutions per minute, it will take a single tooth less than one-twelfth of a second to pass through the work. It cannot have been heated very much during this short time unless the cut taken is unusually heavy. It will be seen, therefore, that it should be possible to take heavy cuts and at extremely high speed if it is possible to cool a tooth down to its original temperature during the time when it is not embedded in the work. This consideration led the writer to the now well-known system of stream lubrication.

STREAM LUBRICATION

The method of stream lubrication is a method by which the cutter is surrounded for a large portion of its circumference by a coolant which is constantly renewed. Where the cutter is below the work it is possible to have it running in a bath of the coolant, keeping the bath filled by an inlet pipe and removing the surplus by an overflow. Such a condition may exist in a gear cutter or hobbing machine or in some special milling machine. As a rule, however, cutters are on a level with or above the work to be milled. In such a case the liquid cannot be kept in contact with the greater part of the cutter unless some special provision is made for this purpose. The arrangement used is as follows:

A shield is placed over the cutter, straddling the arbor and coming as close to the work as may be safe. The inside of this shield follows the outline of the cutter, allowing only a small amount of space between cutter and shield. The coolant is admitted at the top of the shield through a large pipe. It should be emphasized that this pipe must be large; in other words, that the amount of lubricant supplied per minute must be quite considerable, in order to apply this method successfully. If the opening of the pipe is greater than the opening between cutter and shield, that is, if the inlet is of greater capacity than the outlet, then all of the space between cutter and shield will always be filled with coolant, and yet this coolant will be continually renewed. This system was applied for the first time on the Cincinnati semi-automatic milling machine which, as a matter of fact, was designed with this system in view. Some of the results obtained were described in the *American Machinist*, issue of April 16, 1914. Relatively heavy milling cuts were taken at a speed of 835 ft. per minute, or about ten times the speed which would ordinarily have been used for such a cut.

Every size and shape of cutter requires its own shield so as to keep the space between cutter and shield down to a minimum. In order to avoid the necessity of making an almost unlimited variety of shields, they are made of a cast-iron shell with an inserted block of wood and the space for the cutter is made by milling out a cavity in the wood by means of the cutter itself. The shield is filled with a solid block of wood, clamped to the table of the milling machine, after which the knee is raised. When the cutter has dug itself into the wood to a sufficient depth, the table is fed by hand a short distance to the right and to the left and also forward and backward, giving a small amount of clearance all around the cutter. In this manner a few sizes of cast-iron shields will meet all requirements (See Fig. 229).

One of the most important things to keep in mind when applying stream lubrication is the necessity of using the liquid under low pressure. The higher the pressure the greater the amount of liquid required per minute to keep the space between cutter and shield filled, and the greater the disagreeable effects of splashing. It is advisable, therefore, to use some kind of pump with constant pressure, such as a centrifugal pump. In a gear pump the ultimate pressure which may be reached depends entirely upon the fit between the parts. The better the fit the greater the pressure which may be reached. Gear pumps are in use now which will furnish pressure up to 700 or 800 lb. per square inch. If a gear pump were used for stream lubrication and the pipe were partly choked off, the pressure would naturally rise. The ideal condition would be to use a pump with a head only a few inches above the outlet opening into the shield, and to use a pipe large enough to permit the passage of all of the liquid the pump will furnish.

Generally speaking the use of low pressure is to be recommended for almost all machining operations. Deep hole drilling, some cases of trephining—in other words, cases where the chips must be expelled by the pressure of the lubricant—are the exceptions. It might be thought that where a liquid is used for the purpose of lubrication only, high pressure might be of some advantage because this pressure would assist the liquid in penetrating into the small triangular opening between chip, tool and work; but the heaviest pressure we could use in practical operations would be very small indeed as compared to the force which compels the oil to enter by the adhesion between oil and metal, and against this small advantage we would have the very great disadvantage of most of the oil being deflected by the surface of the metal without being of any use. When a large stream of coolant is thrown on a tool and especially on a revolving tool, such as a milling cutter, only a few drops come in actual contact with the tool because the stream is broken up, due to the very pressure which we employ; whereas if we use a very low pressure we will have a solid stream and every particle of the liquid will have some share in carrying off heat.

When a coolant is used without a shield it is customary to direct the stream of liquid on that part of the cutter which is about to enter the work. This is wrong. It should be thrown on the cutter at the point where it leaves the work, in other words, on the hottest part of the tool.

Besides the advantage of increasing the possible speed of the cutter, a shield acts as a safety guard and for this reason alone should be used wherever possible.

In cases where the milling cutter is below the work, a shield can be applied underneath the cutter and this shield will naturally be filled with coolant. On the other hand, the chips will also drop into this shield, and very shortly fill it up unless some provision is made to carry them away. If the cutter runs at a very high speed it will throw the chips a considerable distance. All that is necessary, then, to keep the shield relatively free from chips is to make one side of the shield with a long taper. See Fig. 230. As soon as the shield is filled with chips far enough to allow the cutter to touch them, they will be thrown out, provided that the rear side of the shield is not too steep. This action takes place only if the cutter has sufficient speed, so that with a shield below the cutter, stream lubrication is not a complete success unless we use very high speeds, whereas with the shield above the cutter any speed can be used successfully.

Where very large amounts of liquids are used for coolants or lubricants, the liquid is also used for washing out jigs and fixtures and for cleaning the table of chips. For this purpose again a low head (low pressure) is required. High pressure of the liquid will drive fine particles of chips into corners and keep them there. Low pressure will float them off.

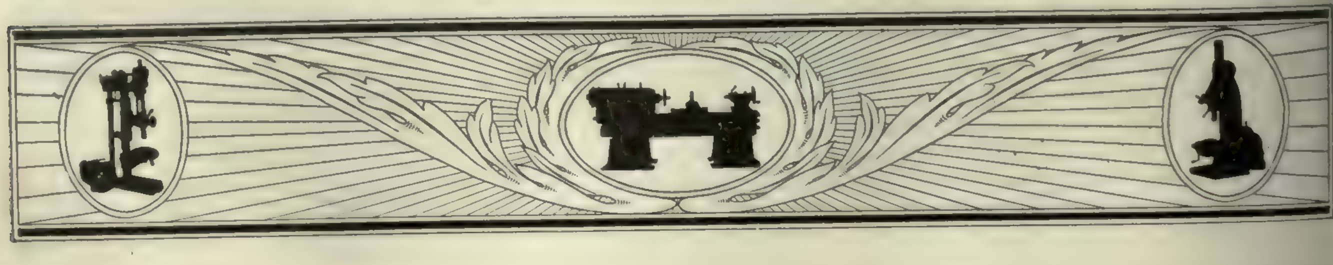
Are Hollows Worn in Hammer Handles by the Fingers of the User?

BY JOHN D. RIGGS

In vol. 54, page 980, of the *American Machinist*, L. L. Thwing asks the above question.

Some time ago Morris Devlin used a carpenter's hammer in nailing together "spools" on which barbed wire is wound. This man succeeded in wearing grooves about $\frac{1}{8}$ in. deep in the handle of one hammer and had begun on a second hammer when I last saw him. He was keeping the hammer with the worn handle as a souvenir.

Morris Devlin made spools for a wire factory at Lawrence, Kansas, from about 1884 to 1898. I saw him last in 1895.



The Oilgear—A Variable Speed and Feed Control System

Machine Operator Maintains Complete Control Over Speeds, Feeds and Quick Returns—An Infinite Number of Variations Easily Made Without Stopping Machine

SPECIAL CORRESPONDENCE

THE search for a speed control system suited to the variety of uses for which variable speed power transmission is needed in the industrial field has led to the development of many interesting experiments.

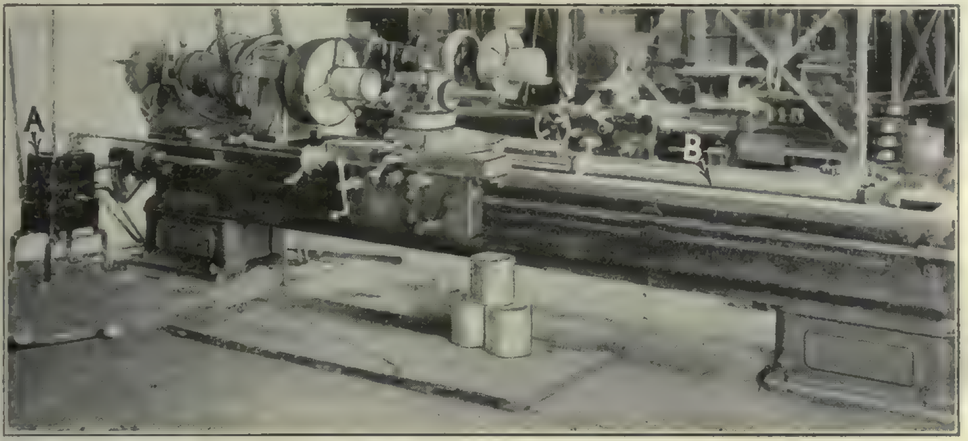
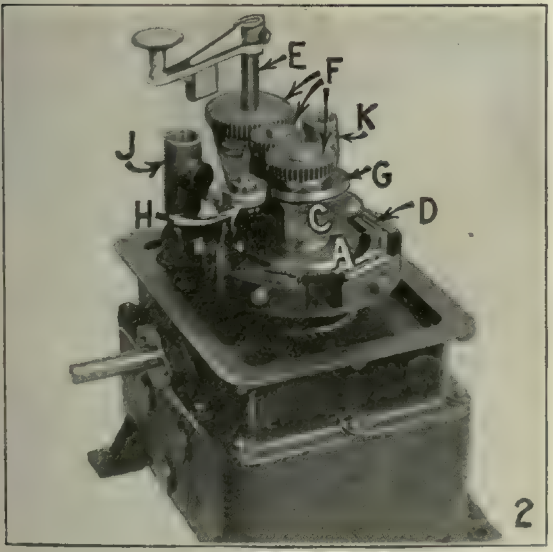


FIG. 1. LATHE EQUIPPED WITH "OILGEAR" FEED

Aside from the development of the variable speed electric motor, probably the greatest amount of inventive effort has been directed toward the application of hydraulics to this problem, a late development being known as the "Oilgear" system, recently brought out by the Oilgear Company, Milwaukee, Wis.

All devices of this class consist essentially of a pump which can be adjusted through a large range of delivery capacity, and a motor driven by the working fluid received from and returned to the pump. The working parts of the Oilgear system were developed with special reference to improving the feeding and driving of machine tools, although its application need not be confined to this field. The units herein described may be found available for a wide range of purposes, such as driving variable speed machinery in textile and paper mills, chemical industries, and for automatic control of stokers, etc. In combination with simple mechanical construction, this system employs some principles of automatic hydraulic control that are unusual in their features.

In the usual hydraulic plant a pump is used to generate the maximum amount of pressure which may be required, and the speed of the motor (usually a direct acting hydraulic ram) is not fixed by any relation of the working parts, but is adjusted by wire drawing the working fluid through a throttle valve, wasting a large part of the power originally generated. The speed of the motor is fixed by the operator when he sets the stroke of the pump, and the pressure of the working fluid driving the motor rises and falls directly with the resistance which the motor encounters—the pressure never being greater than actually necessary to do the work. The power input to the pump is directly proportional to the demands of the motor, and the speed of the motor is definitely fixed by the position at which the operator adjusts the control lever, which sets the stroke of the pump. If a satisfactorily simple embodiment of these principles can be attained, very wide fields for possible development will be opened. The *American Machinist* has already called attention to this matter in an editorial appearing in the issue of June 17, 1915, and on various other occasions.



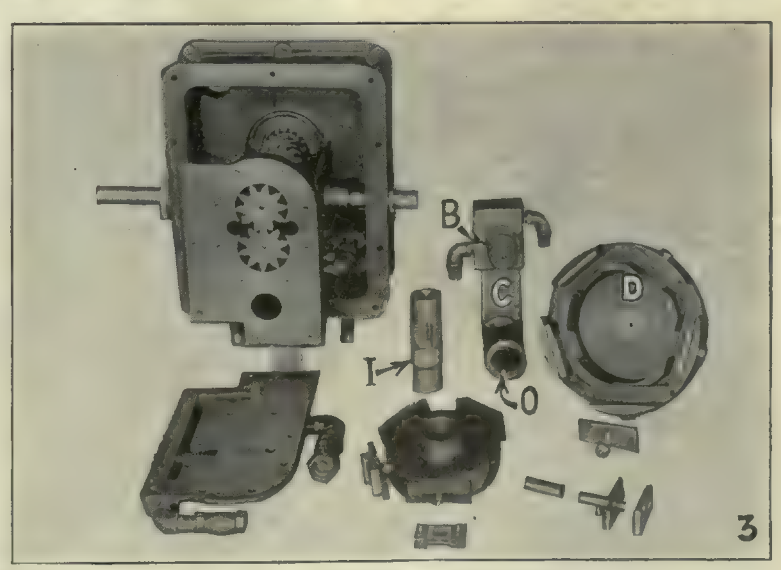
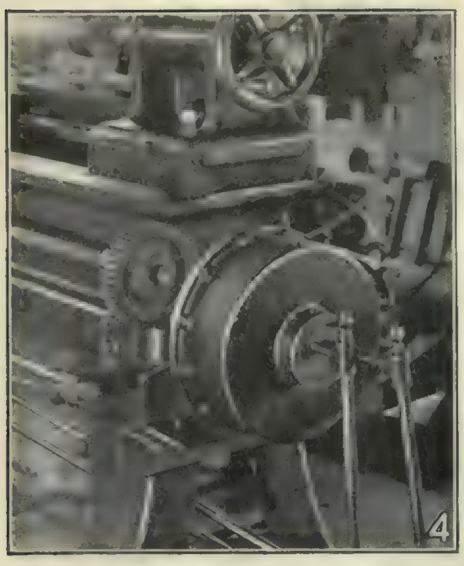


FIG. 2. CONTROL BOX WITH COVER REMOVED. FIG. 3. THE WORKING PARTS



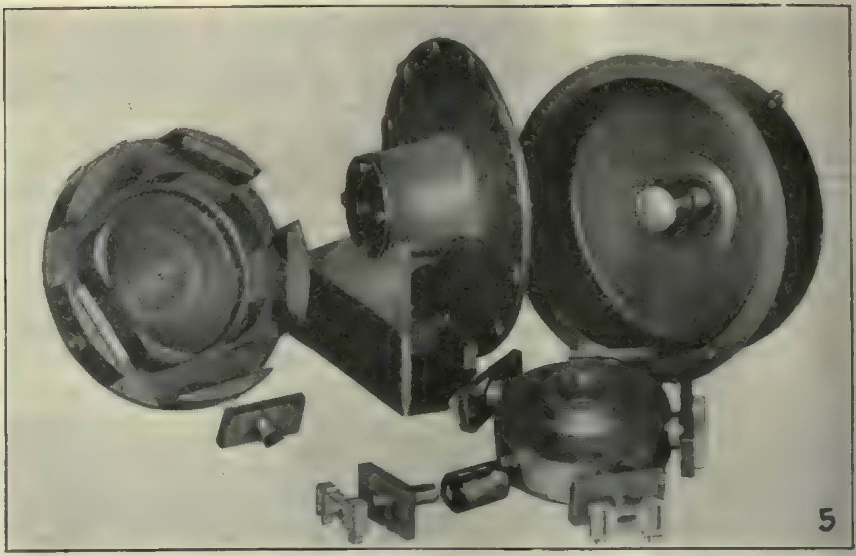


FIG. 4. THE ROTARY MOTOR FOR FEED SCREWS. FIG. 5. THE PARTS OF THE ROTARY MOTOR

Every hydraulic transmission system consists essentially of a pump which receives the power and transmits it to the working fluid, and a motor driven by the working fluid and transmitting the power to the machinery to be driven. The pump is the most highly organized unit and may be considered as the heart of the system, as the motor may frequently consist merely of a simple direct-acting hydraulic piston or plunger. The pump unit of the Oilgear system comprises a revolving driver carrying five or seven crossheads and plungers, with a corresponding cylinder barrel revolving with the driver, and carrying the cylinders in which the plungers reciprocate. By shifting the center of the cylinder barrel the stroke may be varied to suit the conditions to be met. This stroke variation may either be made directly by the operator's hand, or may be controlled by an outside influence, such as pressure, temperature, centrifugal force, etc.

The motor unit may either be a simple plunger as mentioned above, or a revolving multiple plunger unit similar to the pump, except that in the motor the plungers generally have a constant stroke, so that stroke changing mechanism is absent. Consequently, the speed of the motor is dependent upon the rapidity with which the working fluid is delivered by the pump, and as the stroke of the pump is increased or diminished the speed of the motor is correspondingly influenced. In all of the applications herein illustrated a third unit or element is employed generally called the gear pump, and mounted in connection with the main pumping unit. This gear pump acts as a make-up pump for the system, drawing working fluid (generally oil) from the surplus supply in the pump, and keeping several pounds pressure constantly on the intake line of the main pump. In the typical hydraulic power transmission the capacity of the gear pump is small, as it only needs to return the leakage, and in some cases also to furnish a small amount of power for operating the stroke changing mechanism. In other applications (especially the feed control system illustrated herein, and in many forms of hydraulic press, etc., where plungers are used) the gear pump is enlarged to have a capacity which may be many times that of the variable pump. In such cases the gear pump acts not only to return leakage, but also to rapidly traverse the motor rams or plungers at low pressure. In connection with application to machine tool feeds, the gear pump affords a means of rapidly traversing the tool carriage at a speed many times the speed required for feeding.

The feed control system shown is especially designed to apply to the feeding and rapid traversing movements of machine tool carriages and rams. The principal unit is the feed controller, shown at *A*, Fig. 1, as applied to a production lathe, and shown in greater detail in Figs. 2 and 3. The controller is essentially a casing including a small variable delivery pump having a capacity suitable for the small volumes called for in feeding tool carriages, a much larger constant delivery pump (gear pump) for rapid traverse, a stroke changing mechanism whereby the operator can accurately set the variable pump stroke and thereby control the rate of feed, and a control valve associated with the stroke changing handle, and operating to selectively connect one or the other of the two pumps to the feeding motor, according to whether feeding movements or rapid traverse movements are required at the moment.

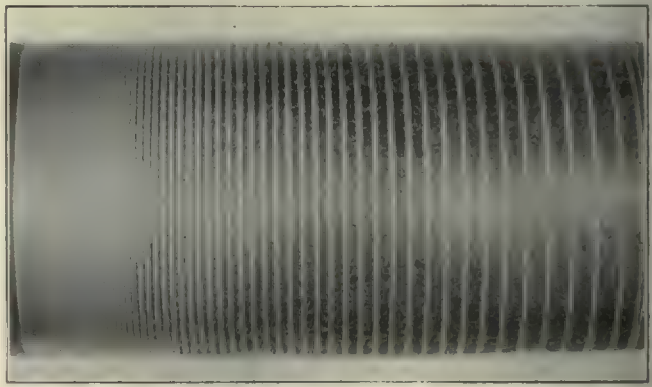


FIG. 6. AN EXAMPLE OF FEED VARIATIONS

The controlling casing is made up of three sections. The bottom section is merely an oil pot, provided to enable the controller to be applied to existing machine tools. The middle section carries all of the machinery, and can be incorporated without change into the original design of any machine tool, by merely casting a suitable oil pot into a headstock or housing. The top section is a cover only. The removal of the cover exposes the pump units as shown in Fig. 2. The plungers are fitted in radial reamed cylinders in the circular cylinder barrel *A*, closely fitted for rotation on a hardened and ground ported pintle *B* (Fig. 3) and fitted into a swinging arm *C* by means of which the revolving cylinder barrel may be shifted from one side to the other of the revolving driver *D* carrying and operating the plungers. Both driver and cylinder barrel continuously revolve around centers which coincide when the swinging arm is placed in central position and whose distance from one another may be increased in either direction by swinging the arm either to right or left. As the cylinder barrel axis is moved to right or left the length of stroke of the plunger is correspondingly increased, and results in a flow of oil through the pump in direct ratio to the length of stroke. This mechanism also gives a reversal of the flow, oil passing through the pump in one direction when the swinging arm *C* is moved to the right, and in the opposite direction when it is moved to the left. The shifting of the swinging arm to increase or diminsh the length of stroke is controlled through the shaft *E* and gears *F* operating the cam *G* (Fig. 2). As this cam is rotated it acts against the fixed roller *H* to change the position of swinging arm *C* and hence shifts the center of the cylinder block as described. The cam *G* has other functions in connection with the operation of the control valve *I*, co-ordinating the stroke changes of the variable delivery feeding pump with the functions of reversal of rapid traverse, make-up of leakage, etc., all of which are controlled by valve *I*.

Cam *G* is made with extreme accuracy, giving a speed variation for the tool carriage capable of the finest degree of adjustment. Moreover, after the cam has been swung about through a certain angle it again returns the cylinder barrel to neutral position, thus cutting off the flow from the high pressure pump and preparing the way for further swing of the control valve which connects the flow from the gear pump to the feed motor, to effect the rapid traverse.

The feed cylinder or motor on a machine tool must have hydraulic fluid on both sides, and the entire system including pipe connections must always be full of fluid under a moderate pressure to exclude air and insure an absolutely steady movement of the tool carriage. The maintenance of this make-up pressure, return of leakage, etc., is an additional function of the gear pump.

Fig. 2 shows the assembly of the variable delivery pump. To right and left are relief valves, *J* and *K*, which permit the feed motor to be run against a stop or other obstruction without damage. The eccentricity between the revolving driver *D* and the cylinder barrel *A* causes the reciprocation of the plungers. The completely assembled controller with the cover removed is also shown in this view. The stroke changing cam, reacting against a stationary roller and operated by gears from the control handle which extends downward and ends in the control valve, is distinctly shown.

Each little plunger, *L* Fig. 3, is a hardened and ground sleeve or thimble with one end closed, and is fitted closely into a reamed bore in the cylinder barrel *A*. In order to prevent any possible binding due to mis-alignment, and also to avoid the necessity for extreme accuracy in indexing while machining, each plunger is driven by a loose fitting pin *M* screwed firmly into the crosshead *N*.

The hardened steel crossheads attached to the push pins, pressed steel roller cages containing rollers against which these crossheads deliver the plunger thrusts, and the outer roller thrust plates (duplicates of the crossheads) are all distinctly shown. The outside diameter of the revolving driver is about 8 in. The feed pump has a capacity sufficient to deliver a force of 5,000 lb. at any feeding speed up to about 24 in. per min., 10,000 lb. at any speed up to about 12 in. per min., 20,000 lb. at any speed up to about 6 in. per min., etc. By using different sized hydraulic feeding motors, the same feed controller may be used to feed a very large range of medium and heavy machine tools. Fig. 3 shows on the left a bottom view of the body casting with rapid traverse pump (gear pump) cover removed. The control valve seat *O* is shown empty, with the control at *I*. The group of detailed parts on the right comprise all of the working parts of the machine, and it is noticeable that they are all of simple cylindrical and plane form, readily manufactured by ordinary machining and grinding processes. The plungers, crossheads, rollers, and roller plates are all hardened and ground alloy steel.

Two types of feeding motors are employed; the direct acting pushing cylinder, and the rotary motor. The former is used when space conditions permit, as, for instance, on the lathe shown in Fig. 1, where the pushing cylinder *B* is mounted on the unoccupied part of the lathe bed with its piston rod attached directly to the lathe carriage. It is usually necessary in equipping old lathes to mount the pushing cylinder at the rear of the bed behind the headstock, the piston rod extending toward the tailstock and being bracketed to the rear part of the carriage.

The rotary type of motor is shown in Fig. 4, geared to the lead screw of a lathe. This form of installation is necessary for very long machines, and frequently for cross feeds where it is necessary to have a screw control of the tool slide. The rotary motor is of essentially the same construction as the variable

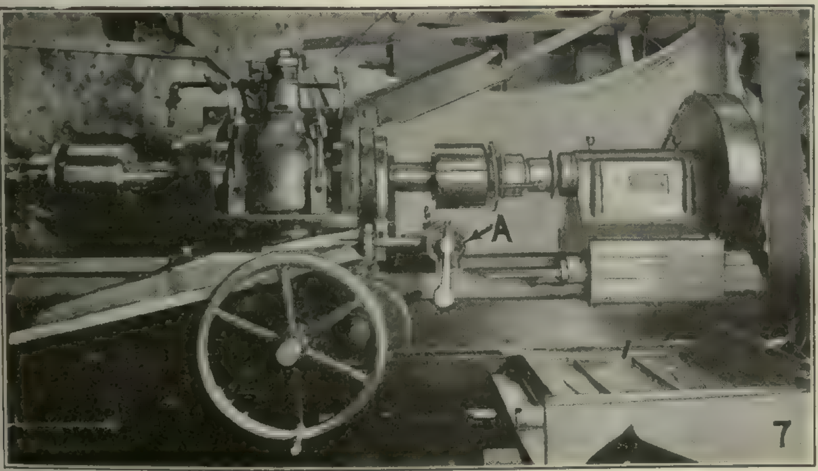


FIG. 7. APPLIED TO BORING AND TAPPING REAR AXLES.

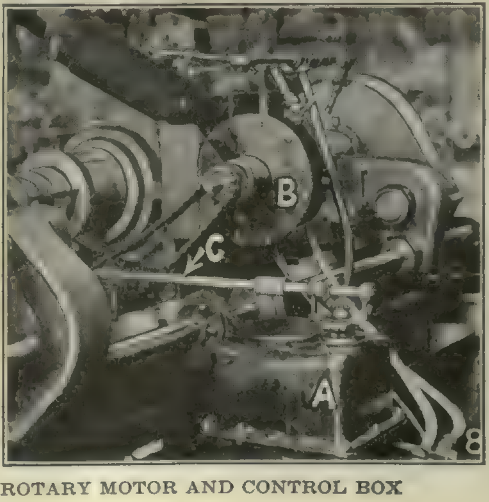


FIG. 8. ROTARY MOTOR AND CONTROL BOX

stroke pump, except that the swinging arm is omitted and the stroke remains constant. All of the working parts of the rotary motor are shown disassembled in Fig. 5. The gradual change from a very fine feed (0.003 in.) at one end to a very coarse feed (5/16 in.) at the other end, which this feed control gives without changing any gears or stopping the spindle, is graphically shown in Fig. 6. One of the advantages claimed for this type of feed gear for heavy machine tools is the rapid traverse movement, which is obtained without any additional mechanism, enabling the operator to move heavy carriages and rams promptly and without fatigue. The hydraulic feed enables the operator to readily increase the feeds when cuts become lighter, back out the tool for examination of cutting edge, and return it quickly into the cut without any disconnection of friction clutches, etc. Another prominent advantage on many production jobs is the ability to use two or three different feeds in quick succession on short cuts. In many cases the improvement to be effected justifies an installation on machine tools already in operation. Such a case is the double-headed boring and tapping lathe for automobile axle housings, Fig. 7, which shows the control handle of the Oilgear feed at *A* within easy reach of the operator. Fig. 8 shows the feed controller *A* and motor *B* installed at the rear of the lathe, with feed control rod *C* extending through to the front. Before this installation was made the operator had to turn the large hand wheel, Fig. 7, more than 70 turns, requiring more than one half minute of hard work in every eight-minute period to back out the tools and place a new casting in the jig. In addition, the facing cut had to be fed by hand as the cycle was too short to permit changing to a suitable facing feed.

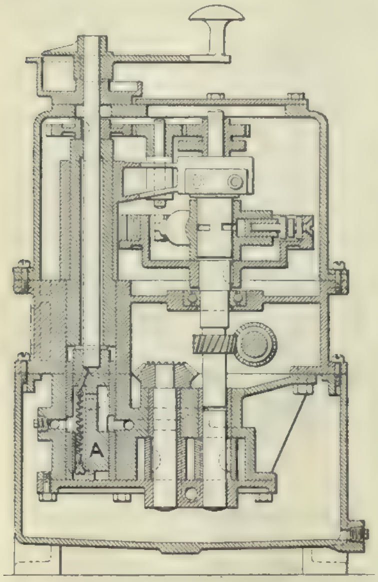


FIG. 9. VERTICAL SECTION THROUGH CONTROL BOX

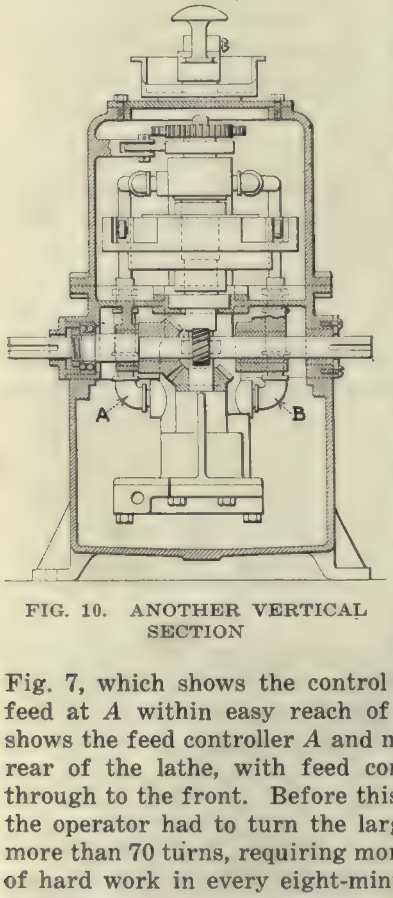


FIG. 10. ANOTHER VERTICAL SECTION

This rapid traverse is now affected in about 12 sec. by power. From ½ to ¾ of a min. of time is saved on every cycle besides the fatigue of the operator. It is also noticed that the operator is no longer reluctant to run the tools back for occasional examination.

Figs. 9 and 10 show two vertical sections of the assembled feed controller which will enable those interested in the detailed operation to trace the relations of the various parts previously shown. *A* and *B*, Fig. 10, indicate the two main pipes, which receive the discharge of both the variable delivery pump and the gear pump, under conditions determined by the position of the control valve *A*, Fig. 9. The leads from these main pipes extend out through the casing and are taken to the two pipe connections of the feed motor. As previously stated, this motor may be either a direct acting pushing cylinder or a rotary plunger motor. In any case, delivery of fluid from the feed controller, varied in quantity and direction, compels the feeding motor to perform exactly the function desired by the operator. The pressure in the system may be large or small according to the resistance offered to the cutting tool, but the feed motor moves at the exact rate of speed called for by the operator without regard to the pressure which it must exert to do the work. If this pressure rises above the maximum required for feeding, one or the other of the relief valves shown in Fig. 2 will open and permit the feed motor to come to a standstill without damage. This function is made use of in locating shoulders, etc., in work to be machined; as it is only necessary to set rigid stops and let the carriage run against them.

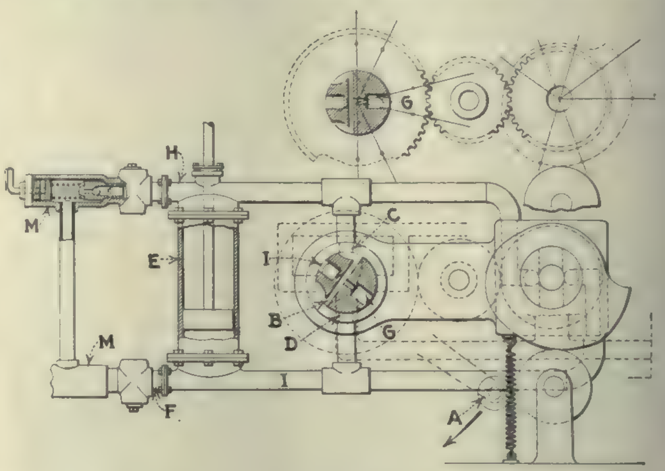


FIG. 11. A TOP VIEW SHOWING CAMS

Fig. 11 diagrammatically shows the control valve of the feed controller in one of its feeding positions, with the control handle *A* turned about 35 deg. from neutral. When in neutral position the by-pass *B* connects the two opposite ports *C* and *D*, thus permitting the tool carriage to be moved by hand. The typical feed motor is indicated by the pushing cylinder *E*. *M* indicates the relief valves which prevent excessive pressure.

In the position shown *F* is the high pressure main, into which the feed pump is delivering, while the gear pump discharge, is connected to a vertical duct *G* in the control valve which is in communication with the low pressure main *H* and acts to replace leakage and maintain an absolutely full system. It will be seen that if handle *A* be turned in the direction of the arrow until it is 90 degrees from neutral position, the delivery port *G* which receives the gear pump discharge will register with port *D* discharging into main *F*, while an opposite port *I* in the control valve will register with port *C* on the opposite side, and thereby communicate with main *H*. The pump now delivers a large volume of oil into one of the mains, causing rapid traverse of the feed motor *E*, which is reversible.

Incentive or Production Basis of Wage Payment

II. The Reward for Standard Accomplishment—Variations in Types of Incentive—The Aristocracy of Skilled Labor—Individual and Group Reward

By HENRY H. FARQUHAR

THE previous article in this series dealt with the part which the management must play in properly administering work in process and in establishing standards of production whereby a measure of the efficiency of operation might be secured. It was pointed out that such measures lie at the very foundation of modern management, and that with them properly functioning the question of adding an incentive method of pay was to a certain extent incidental or at least debatable. Granted that payment according to production is deemed desirable, however, and having reached an understanding on production standards for the various kinds of work, the next step is the determination of the type and amount of reward which shall be held out as an incentive for doing the work as specified. The first requirement in this respect follows:

(6) *The type of reward must be adapted to the standard determined upon.*

Most of us are probably familiar with the experiences of a group of American engineers who attempted to increase the production of Mexican laborers by installing a production bonus similar to one that they had used at home. Production increased satisfactorily—up until Thursday night when the peons had done the customary week's work and earned the usual week's pay. Their standard of living was very much more stable than is the case with most American workmen, and a desire for more money had little place in their scheme of things. A somewhat similar thing occurred at the outbreak of the war, when it was desired to double the South American harvest of crude rubber, and to stimulate the energies of the natives the price per pound previously offered was doubled. Thereupon the amount of rubber harvested immediately fell to one-half what it had been before. It was not more money in this case, but more *leisure* that they wanted. We, who are so accustomed to thinking in terms of money, are prone to overlook the fact that others may not see the matter as we do. The reward must take the form, be it in money or otherwise, that the workmen most appreciate.

ADAPTING PLAN TO CONDITIONS

One more illustration will impress the importance of fitting the type and amount of the reward to the specific conditions to which they are to be applied. I recently encountered a case where an incentive method of pay on an individual job basis had been discarded, not because it is not a perfectly good system under conditions suitable to its use, but because in this case the attempt had been made to use it where thorough standardization had not and could not be secured, with the result that bonus was occasionally lost through neither the men's nor the management's fault.

Such cases as these must not be interpreted as arguments against incentive payment as such, or as an indictment of any particular plan of incentive payment. No plan is sufficiently comprehensive to meet all conditions, and every set of conditions must be analyzed with a view to selecting or devising a type of reward which will fill the bill. The variations in detail which may be incorporated under one or another set of circumstances are limited only by one's imagination and ingenuity in meeting his specific problem. Thus in some cases no financial incentive whatever is offered for accomplishing the standard amount of work, but a stimulus is furnished through detailed individual records and a public posting of individual performances. Another practice which has been found both simple and effective in certain cases illustrates the variety of choice one has in adapting the reward to local conditions. This consists in paying all employees a straight hourly rate according to the class of work and the employee's ability to perform it. Each job has set against it a minimum rate of pay, and also a higher standard rate, and each task has a carefully determined standard in amount and quality of production. If the worker accomplishes the standard over a specified period of time he is rated as a *Class A* man with the standard hourly rate of wages pertaining to this class of work; if he does not accomplish the tasks set, his pay reverts to the minimum rate. This plan has much to commend it, particularly when dealing with certain groups of employees.

REWARD MUST BE PROPORTIONATE

Somewhat akin to the foregoing is the consideration of the amount of the reward as related to character of service required:

(7) *The amount of reward must be proportionate to the skill and effort required for standard performance.*

The pride of the average workman in any degree of skill which he possesses over his fellows is much keener than many of us realize, and the gulf between the "skilled" and the "unskilled" is exceeded only by that between the possessor of a job and the jobless. I will not attempt to indicate just how these differences are to be recognized under different conditions, but will simply emphasize the fact that they must be recognized and provided for in fixing the reward for each class of work. It goes without saying that in all cases an extraordinary amount of work must be recognized through an extraordinary amount of reward.

Having determined the amount of reward which differentiates between various classes of work, the next step is to check the effects of the proposed payment on the cost of goods produced. The regulation therefore follows:

(8) *The amount of reward must bear a proper relation to the total cost of production.*

The payment of an additional amount of money for a specified high production should not ordinarily increase total cost over what it was before, since one of the objects of such payment is to lower the cost of production. Saving in direct labor cost through increased production may often be given entirely to the workmen where the proportion of overhead to total cost is high, or may at least be shared equally between management and men. Just how much we can afford to pay as a reward over regular wages for a specified output must be accurately figured out in each case.

In connection with the reward for the exercise of qualities which the standard is supposed to bring out and measure, it must be remembered that there are two kinds of effort which in certain cases may seem to be antagonistic, yet which in every case it is extremely desirable and often indispensable to develop. The next two topics cover these two kinds of effort—individual and collective.

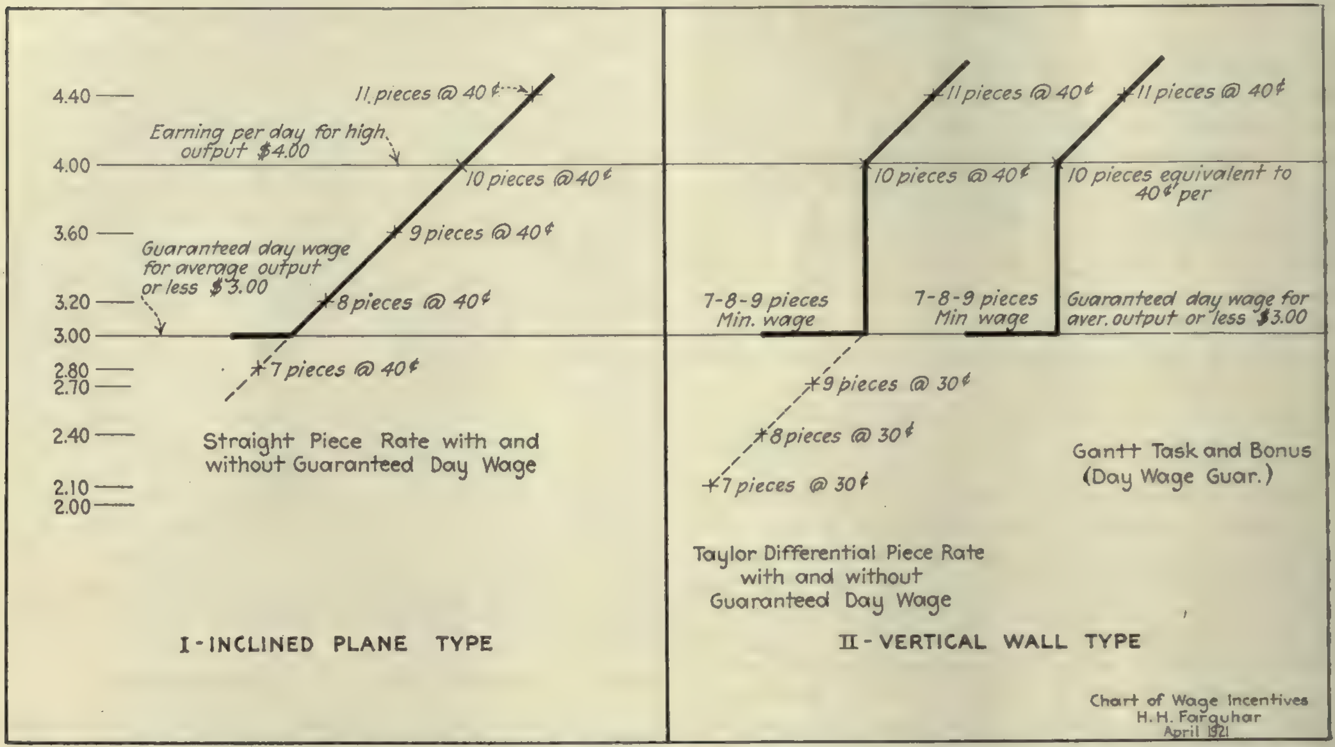


Chart of Wage Incentives
H. H. Farquhar
April 1921

FIG. 1. THE TWO TYPES OF INCENTIVE WAGE PAYMENT, ILLUSTRATING THE ADDITIONAL "PULL" WHICH THE VERTICAL WALL (TASK) TYPE HAS OVER THE SLIDING SCALE TYPE. THE WORKMAN DOES NOT HAVE THE OPPORTUNITY WITH TASK WORK TO BE CONTENT WITH MEDIOCRE EARNINGS BECAUSE NONE ARE PROVIDED FOR: HE MUST GET ALL THE WAY TO THE TOP WHERE HE GETS A BIG REWARD, OR ELSE ACCEPT ONLY THE REGULAR DAY WAGE

(9) *The reward, in the first place, must be dependent on individual effort.*

Whiting Williams[1] has brought out forcibly the desire of the workman (or of any other normal human being) for individual as well as group recognition and reward. Although we are essentially a gregarious people, our desire for the welfare of the group is founded, I believe, on an enlightened self-interest in the welfare of the individual *ME*. Certainly this desire for a feeling that we individually are a going concern irrespective of our relation to a particular group is not only worthy of development, but is of such a fundamental nature as not to be capable of suppression. Each man should be made to feel that he can in some way through his own individual efforts affect the quality or quantity of production, or both, and if so then through the operation of the payment plan each man must have individual opportunity, responsibility, recognition and reward for so doing. Otherwise it is not clear that he should be included at all in the group of incentive payment workers.

This requires that the method of rewarding high production, no matter what it is, shall provide as the fundamental basis that the accomplishment of each individual workman, so far as possible, be reflected on the record of that individual, through the pay envelope or otherwise. In many kinds of work, such as riveting, for example, it is impossible or impracticable to measure the performance of each member separately from the performance of the gang as a whole. As a corollary to this rule, however, should be added the requirement that there should be as few men working interdependently as possible and that where gang work is necessary the gang should be small and treated as a separate unit for the determination of efficiency of performance. Each workman or gang, furthermore, should if possible be recognized in direct proportion to actual performance in so far as this performance is within the power of the worker to influence, regardless of *all* other factors which he cannot influence, such as volume of work provided through the sales department, interruptions to the flow of work due to poor purchasing or planning, the shortcomings of inferior fellow workmen, and so on. In other words, the result of the exercise of his own abilities should be kept entirely distinct from the net results due to the dependent sequence of his own and others' ability or lack of ability.

Since not only individual initiative but also team play and co-operation are desired, it is often advisable to supplement the individual reward with another in proportion to the work of the group, department, or plant as a whole. The suggestion is therefore made:

(10) *The reward, in the second place, should be dependent on group effort.*

There should be an additional reward for departmental co-operation, according to the degree to which the department as a whole attains the standard set for it, so as to make it to the advantage of each man not only to do his own work properly but also to see that every other man does his share and to be of assistance in helping others wherever and whenever possible. The measure of the whole department's performance is the sum of the respective performances of each individual within the department, and the reward usually takes the form of an additional sum of money which is proportionate in amount to the degree to which the department standard has been attained, this sum being divided on the basis of regular earnings or otherwise among those employed, and constituting a payment in addition to and on top of each man's individual earnings through his own individual work.

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[1] Whiting Williams: "What's on the Worker's Mind," *Scribners'*, 1920.

The net result of adhering to recommendations Nos. 9 and 10 is that we have two incentive payments instead of the customary one, each distinct and each based on production delivered, but one pertaining strictly to individual while the other pertains strictly to group efficiency.

In order that the respect of the workmen for the incentive appeal be continuously retained, two additional measures must be incorporated in its operation —both very obvious but both rather difficult to enforce in practice because of the tendency to relax under pressure. These are given in the two following rules:

(11) *The reward should be attainable only by persons who, after the necessary period of training, prove they are first-class operatives at the particular work.*

The reward must not be cheapened through its easy attainment. As stated in the preceding article, topic 4, the standard itself should be a high one, not easy of attainment except to one who is really fitted for the work to which it applies and even then the reward should not come too soon.

All incentive methods of pay may be classified from the psychological standpoint into two groups: One the *inclined plane* where the reward is placed in small installments up along the incline so that the workman may pick up a little at each step as his performance increases, the other the *vertical wall* type where a large lump sum reward is placed on top of the wall and the workman gets none of it unless and until he gets clear to the top. These two types are illustrated graphically in Fig. 1. The straight piece rate is an example of the former, the Taylor differential and the Gantt task and bonus are examples of the latter. My experience with various methods has demonstrated two outstanding advantages from the standpoint of the management which the vertical wall type (task work) possesses over the inclined plane or sliding scale type: first that the task tends to pull a man up to high production sooner and hold him there more consistently than is the case with other methods, and second, that if the task is properly set for men adapted to the work it furnishes an accurate if not the only reliable means of fitting the man to the job, since one who, after a reasonable period of training, proves he is not fitted and does not scale this particular wall, may be transferred and trained until the class of work on which he can go over is found. It is usual, of course, to guarantee a specified minimum day's pay during the period of training and probation.

The stipulation that in any given case you must be a pretty capable man to earn consistently the additional reward offered, creates an aristocracy for each class of work which seems in many cases to mean as much to the men as does the extra pay they get for "belonging."

(12) *The reward must be allowed only on work up to required quality.*

This rule is so manifestly evident that it is unnecessary to point out what will happen if it is not enforced strictly to the best of one's judgment. The difficulty comes through the fact that quality is a relative matter, depending in the last analysis on what someone says is sufficient under the particular circumstances. Where incentive payment is backed up with adequate inspection, however, it has been found almost without exception, so far as I know, that the quality of work actually improved over what it was before.

It follows from rules (11) and (12) that with the vertical wall plan extreme care must be exercised in allowing a reward which was, for any reason, not actually earned when the work was done. Corrections of poor work of any kind should ordinarily be made on the workman's own time. A strict policy in this respect exerts a bracing effect on the management.

Finally, to enforce all of the preceding rules, particularly the first and most important of the lot, one last requirement as regards type of reward must be fulfilled:

(13) *The plan of reward must bring pressure to bear upon the management for the proper discharge of its duties.*

Whenever anything goes wrong and a man, after once getting up to standard, fails to earn the additional reward offered, this fact should become known at once at headquarters, just as when we step on a nail we are notified immediately that something is wrong below. If the workman's failure is due to shortcomings on the part of the supervisory force there is no fact which the sympathetic management should be more eager to know, and the operation of the plan of reward should provide an automatic messenger service in this respect. In other words, the workmen should suffer in some degree for the mistakes of the management as well as for their own for the admitted purpose of making them bring pressure against the offending official. One of the shortcomings of the straight piece rate method of pay is that a man's failure to get to the top is not brought forcibly to the attention of the management, since he usually accepts his small financial loss (due to doing eight or nine instead of the standard ten pieces) rather than make a fuss. With the vertical wall type of plan, however, his financial loss is so large that if the fault is not his own he is pretty sure to be heard from—which is exactly what his superiors should desire. It is a courageous management which will deliberately adopt this policy and take the resulting knocks, but it is simply one of those give-and-take features of incentive payment upon which mutual confidence and success is based.

Ideas From Practical Men

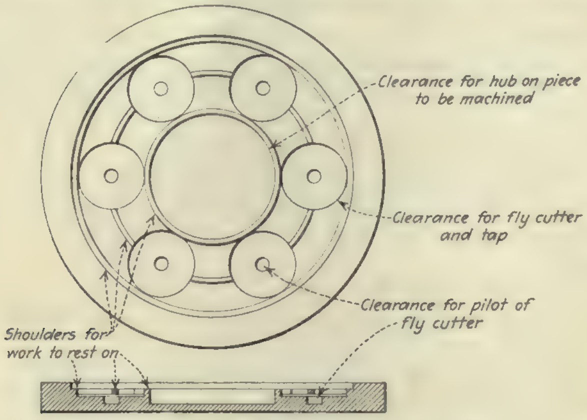
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

How Would You Machine This Disk?

By Richard F. Moore

On page 959, Vol. 54, of the *American Machinist,* P. Arter shows a piece to be machined which is exceptional to say the least. But I think it can be machined most satisfactorily in the following way:

The rough disk should be machined on the outside diameter to the correct size and shape first. This could be done with an end mill on a vertical spindle milling machine by strapping it on the table.


Clearance for hub on piece to be machined
Clearance for fly cutter and tap
Clearance for pilot of fly cutter
Shoulders for work to rest on

FIXTURE FOR HOLDING THE DISK

Next its straightness should be verified so as to be sure it will "clean up" at ⅜ in. in thickness. Then procure a piece of steel or cast iron and machine it all over as shown in the illustration. This piece will serve as a fixture for holding the work while machining. Said fixture can be left strapped on the faceplate of the lathe where it was machined. Remove faceplate and lay flat on the bench with fixture on the top. Then apply heat by the aid of several blow torches until it is hot enough to melt beeswax. Enough beeswax is then put in to fill it a trifle above the shoulders.

The piece of brass to be machined, which has been preheated so as not to cool the wax too much, is then placed in the fixture and care must be taken that there are no bubbles or air under it. The whole idea of this holding arrangement is that the piece is allowed to "float"; that is, there are no strains on it when the wax cools and hardens. Consequently, when the piece is removed, it will maintain its straightness when it has been machined. I doubt, in fact I don't believe, this piece could be held with any kind of clamping fixture without distorting it.

I think that the side with the hub on it should be machined first. I should say that the tapped holes should be put in next, before removing after machining the first side. That could be done on a drill press by driling ½-in. holes first where the big holes are going and then use a sort of fly cutter with a ½-in. pilot. Most mechanics are familiar with this tool which is often used to make disks.

The tapped holes are of extraordinary dimensions—5½ in. diameter and three threads in length. But I think the job could be done with the right sort of tap and by taking great care. It could be done in drill press while the work is located for boring the hobs.

Of course the boring could be done in a lathe if there was one large enough on hand, but I'll assume there is not. After machining, the disk can be reheated and turned over, and this time care must be taken that it rests on the shoulders of the fixture all over; and if it does it is bound to come parallel.

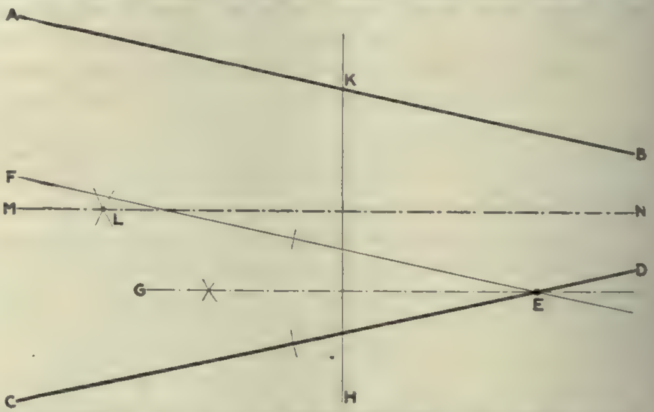
Its straightness after removing will depend on the care taken not to create any strain by heavy cuts, etc. The cuts can be measured by scraping away a little of the beeswax in one of the tapped holes and using a depth micrometer, the depth of the clearance hole being previously measured.

After the last cut has been made the fixture and all can be located on a vertical spindle milling machine and the six slots machined. The other holes can be drilled and countersunk in a drill press. The trouble with this job is it is light work, but it must be done on large machines, being of such extraordinary dimensions. It makes no difference how I go into detail, the job requires the services of a first-class mechanic.

Bisecting An Angle Whose Vertex Is Inaccessible

By W. S. Ayars

This is a brief solution of a geometrical problem that came up one day. While there is nothing hard about it, it may be that many shop men have run against the same problem and did not know how to solve it quickly:



BISECTING AN ANGLE WITH VERTEX INACCESSIBLE

Let *AB* and *CD* be two converging lines, whose intersection is inaccessible, and the angle between which it is desired to bisect. At any point *E* on *CD*, draw *EF* parallel to *AB*. Bisect the angle *FEC* in the usual manner, by *GE*. At any convenient point *H* draw *KH* perpendicular to *GE*. With any convenient radius and center at *K* and *H* strike arcs intersecting at *L*. Through *L* draw *MN* parallel to *GE*; *MN* bisects the angle between *AB* and *CD*. The reasons why are so simple that they need not be stated.

Economy in Cutting Drawing Paper

By William H. Kellogg

The factors that generally determine the sizes of sheets upon which drawings are made, consist of convenience in handling, conformity with filing requirements, conformity with the nature of the work represented and economy in using the paper and tracing cloth.

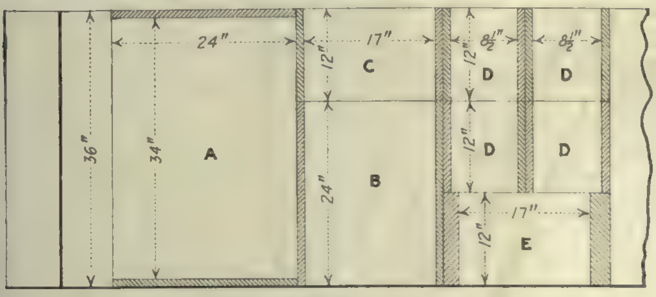


FIG. 1

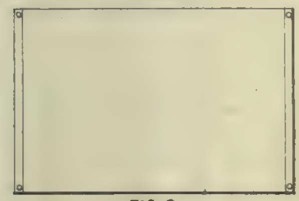


FIG. 2

FIGS. 1 AND 2. ECONOMICAL SYSTEM OF DRAWING SIZES

A plan which the writer has used on his own work is to make the two dimensions of the sheet such that the different sizes in the same system will always be in proportion to each other. The rule for determining such a proportion is to multiply the smaller dimension, or divide the larger by the square root of two, which is 1.414. Thus, if the smaller dimension is 8½ in., the other would be found by multiplying 8½ by 1.414, which equals 12.019, and disregarding the small fraction, 0.019, we get a sheet which is 8½ x 12 in., which would usually be the smallest size in the system, and the sizes would then be as follows: 8½ x 12, 12 x 17, 17 x 24, 24 x 34, 34 x 48 inches.

The dimension of 12 in. and its multiples makes it easy to conform to the usual widths of paper and tracing cloth, the most common width being 36 in. The smaller dimension, 8½ in., being the same width as a standard sheet for letters, makes it convenient to use the smaller size drawings in connection with correspondence, and if an inch of margin be reserved at the end of the sheet for binding blueprints in book form, this margin can be cut off when the sheet is to accompany a letter as the size will then be 8½ x 11 in., which is identical with the standard letter size.

The illustrations show how sheets for drawings may be cut in a most satisfactory and economical manner from paper or cloth of the width mentioned above. In Fig. 1, the shaded portions represent the margins of paper that are usually left on the piece on which the drawing is to be made, to be later trimmed off in order to bring the adjacent edges at right-angles to each other. These margins also serve as a space in which to place the thumbtacks, and to test the drawing pen in the usual manner of draftsmen. Some draftsmen prefer to have such a waste margin on all four sides of the sheet, but by taking care in cutting the first two edges, it is not necessary to have more than two edges for trimming, especially with tracings. However, the plan here shown would not hinder anyone from leaving four edges if he so desired.

A sheet 24 x 34 in. in size is represented by *A*, Fig. 1. *B* and *C* represent two sheets, 17 x 24 in., and 12 x 17 in. respectively, that are to be cut from a section the full width of the roll. The four sheets shown by *D* and the one sheet shown by *E* are also all to be cut from a similar section. It will be observed that six sheets the size of the *D* sheet, or three the size of the *E* sheet, could just as well be cut from the same section, but the illustration is intended to show how easy it is to get a number of varying sizes of sheets, when one size throughout is not desired at the time of cutting.

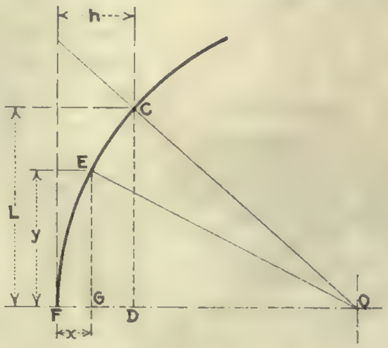
The two margins are, of course, left on the sheet until it is finally trimmed after the drawing is finished, and Fig. 2 shows how the sheet shown at *A* in Fig. 1 is tacked down to the board, the margins for trimming being at the sides only. It will be seen that on some of the other sheets shown in Fig. 1, the margins would be at the top and bottom instead of the sides, provided the long edges run horizontally as in Fig. 2.

It may be noted that the waste margin on the *E* sheet is larger than would be necessary if the *D* sheets were not cut from the same section. Hence it is desirable to cut as many sheets of one size as can reasonably be done at one time.

Laying Out a Circular Arc When Center Is Unknown or Unavailable—Discussion

By George Warmington

The solution of the problem of laying out a circular arc when the center is unknown, as given on page 112, Vol. 54, of the *American Machinist*, is much more difficult than is necessary. A shorter method is as follows:



$$OC = R \quad CD = L$$
$$OD = R - h$$

From triangle *COD*

$$R^2 = (R - h)^2 + L^2$$
$$R^2 = R^2 - 2Rh + h^2 + L^2$$
$$R = \frac{L^2 + h^2}{2h} \text{ and } R^2 = \left(\frac{L^2 + h^2}{2h}\right)^2$$

Also, $EO = R$ and $FO = R$

From Δ *GEO*, $x = R - \sqrt{R^2 - y^2}$

By substitution, $x = \frac{L^2 + h^2}{2h} - \sqrt{\left(\frac{L^2 + h^2}{2h}\right)^2 - y^2}$.

IN THIS ISSUE

During the several recent years when production was the essential thing, shop methods and systems received the larger part of the attention of everyone. At the same time there was demonstrated the importance of the personnel in industry. A system might be perfect yet it would not produce proper results of itself; it had to have back of it and operating it correct management from president to foreman. It may be that some writers and investigators have recently overemphasized the importance of management and personnel relations in industry, but even so they should receive little blame for their zealous attempts to improve what is known to be weak in many ways. Now that we no longer have the incessant demand for immediate production more careful attention is being given to training and developing the personnel. Managers are studying themselves and their organizations, superintendents are realizing more than ever the importance of those ranking below them, and so it goes all along the line. The result is going to be that when we get back to the point where the orders are coming in regularly, management is going to have a much clearer realization of its own possibilities.

Each plant has its own management and personnel problems which it is up to the organization of that plant to work out. But management problems may be very properly generalized, the generalizations forming guides for the solution of specific problems. Such guides are available in the form of articles in the engineering and technical press. The *American Machinist* is carrying this week three such articles: Training Leaders for Foremanship Classes, by D. J. MacDonald; Incentive or Production Basis of Wage Payment, by Henry H. Farquhar; and Organization and Management of the Small Shop, by Elmer W. Leach. The MacDonald article is the first in the issue, the Leach article begins on page 262 and the Farquhar article will be found on page 275.

Coming Features

The series on economics, about which there was a brief foreword last week, will begin in our next issue. There will be ten installments, no one over two pages in length. Accompanying the first will be an introduction to the series by Ernest F. DuBrul, General Manager of the National Machine Tool Builders' Association. The author is Prof. D. A. McCabe, Ph.D. The general title is "Economics of Production," and the sub-title of the first article is "Demand and Production."

Tool Engineering and Metal Cutting Tools are to be the other series articles in the next issue.

The complete articles will be five in number, two of them by Colvin and one each by MacNab Mawson and Hunter. They treat of the making of drag saws, the manufacture of automobile pistons, grinding fixtures, shop work on locomotive cylinder and valve parts, and the handling of materials in an automobile plant.

The second article of Chubb's short series on machining the Wrigley automobile transmission gear shows how mechanical conveyors are used to eliminate handling, indicates the routing of parts through the machine shop and describes inspection methods and tools for both roughing and finishing component parts.

Once again we are furnishing more than we properly should of Tool Engineering. The installment this week takes up the design of profiling fixtures, and the subject is so absorbing and so full of opportunity for ingenious and economical arrangements that we simply couldn't stop it off in our usual three and a half or four pages. There are included this week, beginning on page 256, data on cam milling, machining irregular forms, methods of roughing and finishing, the use of multiple fixtures, and very briefly, the types of profiling machines.

Beginning with 267 there are four pages of the fourteenth of DeLeeuw's Metal Cutting Tools. You will remember that this article takes up the use of liquids when cutting metal, showing when liquids should be used for lubrication, for cooling, and for washing out chips.

A variable speed and feed control system known as the "Oilgear," developed by the Oilgear Company, Milwaukee, Wis., is described in the article beginning on page 271. This system embodies the application of hydraulics to speed and feed mechanisms.

Several months ago we announced the death of William D. Forbes who has for a number of years been a contributor to the *American Machinist*. At that time we had on hand two or three articles by Mr. Forbes one of which has been prepared and is presented herewith, page 284. "How A Blind Man Makes Drawings," explains how Mr. Forbes, who was a designer and draftsman before he became blind, continued his work by the use of a typewriter and later by dictating his drawings to his daughter.

A welcomed article will be the twentieth of Modern Production Methods, "What Does it Cost to Sell?" page 286. After reading so much about the cost of producing a commodity it is a relief to get into this article of Basset's. His opening gun is the statement: "Profits more often fail to materialize because it costs too much to sell than because manufacturing costs are too high." It appears to be a big caliber gun and there will be some who will think he is wasting ammunition. But not so! It is going to take big guns to stir up the proper realization of the cost reductions that are going to be necessary to meet the competition that is coming.

EDITORIALS

Indiscriminate Buying

THERE are two kinds of indiscriminate buying. One is to buy everything in sight regardless of price; the other to buy as little as possible and at the lowest price, regardless of quality.

Our boom period gave us shining examples of the first method. As a result many firms are still overstocked with machines and tools for which they have no immediate use. We recently saw a list of twist drills sent out by a large user to the makers of twist drills. It was a list of thousands of dollars worth of new drills. The customer wanted each maker to take back the drills of his own make, at the current price, to be either paid for or credited against future orders.

Such a condition is far from encouraging to makers of drills and comes from indiscriminate buying a year or more ago.

As a reaction to this we have a return of the old type of purchasing agent in some quarters. He was aptly described, years ago, as the man who "knew the difference between ninety-nine cents and a dollar—and that's covering every d—— thing he does know." This tendency to buy on price alone is becoming apparent in places. The inefficiency of it hardly needs comment. It means limiting the output of a ten-thousand-dollar machine to save a few dollars on cutters. It means increasing the cost of production at a time when lower manufacturing costs are imperative.

The banker too, at times, is playing a part in delaying the return of normal buying. In one instance a firm wanted to buy a new machine which would make a considerable saving in the cost of production. It had the money available and believed it a wise investment. But the banker on the board vetoed the purchase—the bank was not encouraging any purchases of new equipment, no matter how efficient.

This "sit tight" or "stand pat" attitude is not helping to restore business to normal. And the failure to buy may be called just as indiscriminate as the failure to buy properly.

The way to resume business—is to resume—as Horace Greely said so many years ago regarding currency. Waiting for George to buy first doesn't help business in the least.

What Is Normal Business?

WE HAVE reached the stage where we can measure length within limits of millionths. We can weigh the scratch of a pencil on paper by means of a good chemical balance. We can test materials physically to extremes of accuracy. But to do so we must first establish standards with which to compare the things we measure, and to do this is one of the most difficult of tasks. So much so that there has been for years a government agency devoted to the purpose.

But if the determination of a physical standard is hard, that of a standard for volume of business is infinitely harder. If business were governed by laws as inflexible as those of natural philosophy and every business man were compelled to keep close records of all his transactions, it might be possible to arrive at some common point upon which to base comparisons; but as it is, the only alternative is compromise.

Ask a man how his business is and ten chances to one he will say, "rotten." If you pin him down to figures he may say that he is doing about twenty-five per cent of normal. This sounds most discouraging until you inquire as to what he considers normal and then you are more likely to learn that "normal" was the peak of his wartime production. If you are sufficiently inquisitive to trace the records back to 1910, '12 or '14 you may even find that he is doing more business now than he did then. Allowing for normal growth every going concern ought to be doing more than it did ten years ago, but when we consider that we are in the throes of reconstruction following the greatest war of history, it would almost seem that a man might be satisfied to hold his own.

We must not lose sight of the fact that many companies have no reliable records of the volume of business done before the war—they may have been too small or too badly run. Every statistician is up against this snag and we consequently find that 1919 has to be taken as the standard year for some products because the earliest figures available are those for that year.

Let us not be too hasty, then, in accepting production percentages as unassailable until we are sure of what they are based on. The times are hard enough, in all conscience, without making them worse by bad arithmetic.

Honoring an Engineer

THERE are many instances where the engineer behind an industry, whose ingenuity and training have made success possible, remains hidden and unknown, while the man with the check-book receives and appropriates all the glory as well as the financial rewards. It is, therefore, particularly gratifying to note the action of the Franklin Automobile Co. in proclaiming to the world its indebtedness to John Wilkinson, the designer of the Franklin car and the engineer whose perseverance made the air-cooled motor a successful commercial proposition after so many had failed and abandoned the idea.

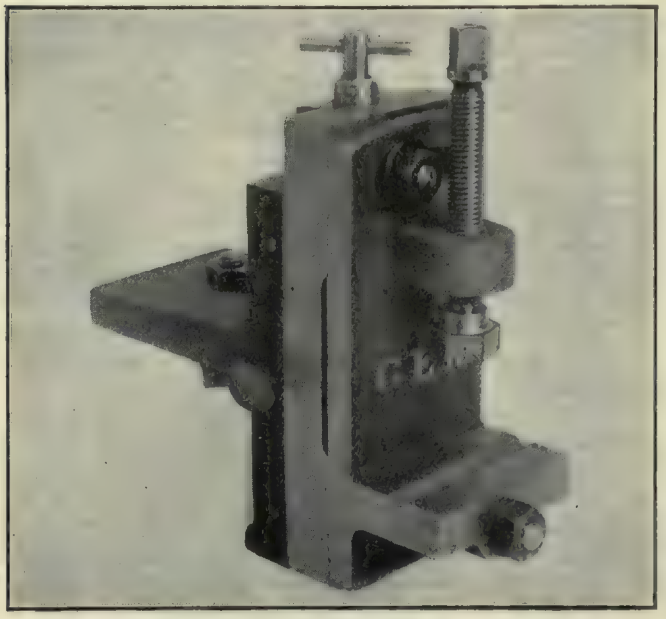
In a neat little booklet entitled "In Honor of John Wilkinson" issued on the twentieth anniversary of the Franklin car, is the story of the development and the perseverance which made it a success. A brief outline of the development is given as is full credit for the achievement. Other engineers, of course, added the results of their experience, but to John Wilkinson belongs the major credit for the success achieved.

If more concerns followed this practice of publicly crediting their engineers and designers with their successes, there would be a much greater feeling of loyalty than now exists in too many instances. The sooner large concerns learn that in honoring their engineers they also honor themselves, the better co-operation they will receive.

Shop Equipment News

Kiddle "Gem" Milling Attachment for Lathes

The Richard H. Kiddle's Machine Tool Works, Kinsman, Ohio, has recently placed on the market a device, shown in the illustration, for attachment to lathes to enable the performing of milling operations. It is said to fit most lathes from 10 to 17 in. swing, the toolpost being removed and the attachment secured in its place. A tie bolt can be furnished to fasten the attachment to the cross-slide when it is used on the Gem lathe.


GEM MILLING ATTACHMENT FOR LATHES

The device holds the work to be cut and is provided with adjustments to permit of moving it relative to the cutter. An arbor, 12 in. long and made to hold a 1-in. B. & S. cutter, is furnished. The outfit is said to be particularly useful in a garage or jobbing shop for performing small odd jobs of milling. It is said to be capable of cutting keyways ⅞ in. wide, or even wider, and 7 in. long without re-setting. The taper ends of automobile axles can be squared and the keyways cut by the use of the device.

Cochran "Metaloid"

The Cochran Metaloid Co., Moffat Building, Detroit, Mich., has recently placed on the market a material known as "metaloid," for use in repairing holes and cracks in metal. It is especially intended for use in garages for repairing cracked cylinder heads, water jackets and transmission cases, although it can be adapted to the repairing of pipes, tanks, radiator connections and similar parts.

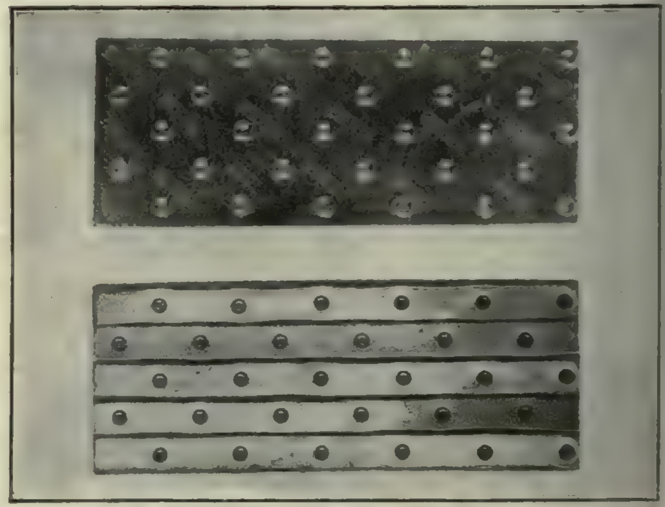
It is stated that the metaloid will fluxate with any metal that can be heated, including aluminum, brass, and gray and malleable iron. The part to be repaired is first cleaned of all oil and grease and then heated to about 200 deg. F., usually with a blow torch. The metaloid is then rubbed into the crack or hole, the parts allowed to cool, and the excess material filed off. It can be applied from the side or beneath, as well as above.

The metaloid will, after solidifying, withstand a pressure of 250 lb. per sq.in. and a temperature of 600 deg. It is not to be used where a high tensile strength is required. It is said to enable the making of permanent repairs very quickly. The heat required for its use is not sufficient to warp cylinders, as might occur with welding.

"Pieuvre" Belting

The accompanying illustration shows the two sides of a type of belting which is the invention of M. H. Guillou, of Paris, France, and which is now being put on the American market by J. L. de Rabot, 191 Greenwich St., New York, N. Y. The chief claim made for the belting is its great power of adherence, without the use of adhesive belt dressing or of idler pulleys. The belt combines the use of oak-tanned and chrome-tanned leathers, the latter being in contact with the pulley. The oak-tanned leather, such as ordinarily used for belting material, is valuable because of its tensional strength, its resistance to wear and the facility with which joints may be made. Its power of adherence, as to a polished cast-iron pulley, is stated to be much less than that of chrome-tanned leather, which has but little tensile strength.

In the combination of the two kinds of leathers, the oak-tanned material takes the pull and the chrome-tanned gives the adherence. The belting consists of oak-tanned leather or, in some cases, of a "Balata" backing, to the under-surface of which are attached narrow longitudinal strips of chrome leather. These strips are held in position by means of hollow brass rivets, the heads of which project above the outer surface of the belting, and which are clenched well home on the under side into the chrome leather. The depressions surrounding the rivet ends, combined with the blind holes in the rivets, are said to act as suckers during use and to augment the adherence. The name

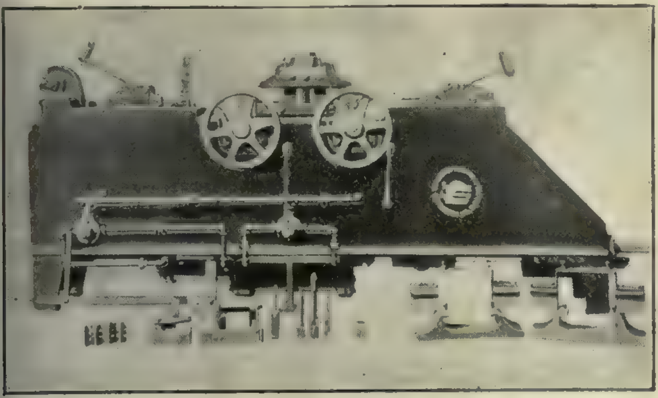

PIEUVRE DOUBLE BELTING

of the belt, meaning "octopus," was given because of the gripping action.

The advantages which the high co-efficient of friction give to the belt are, of course, that it can be run at a lower tension, thereby avoiding excessive wear and tear on bearings and shafting, while the work of the belt is practically all useful effort. Only tallow is used as a dressing.

Covington Hose Machine

The machine shown in the illustration has recently been placed on the market by the Covington Machine Co., Covington, Va., for assembling and dismantling hose. It is intended especially for use in railroad shops for work on air brake, signal and steam hose, replacing hand methods of performing such work. It is claimed that the machine does not damage the fittings and clamps when assembling or dismantling, permitting of a saving in this regard. The work is said to be better than that performed by hand, and to be done at a great saving of time and labor. It is stated that on a test run one man dismantled 100 air hose in one hour, and assembled 25 of them ready for service in the same length of time.



COVINGTON HOSE MACHINE

The illustration shows the entire equipment of tools required for performing the complete range of work. The change from any operation to another is said to average less than two minutes. Air and signal hose are handled by the same tools, except the nipple puller, which it is said, can be put in place within ten seconds. To change from air and signal hose dismantling to steam hose dismantling requires less than one minute, it is said; to equip the machine to strip short ends of air and signal hose, less than three minutes; from air and signal to steam short ends, less than ½ minute; and to change from dismantling to assembling, less than ½ minute. In assembling fittings into new hose, no injury can result to the hose, as it is held rigid without clamping.

Foundry Building at an R. A. F. Depot, England

By J. B. Nelson

During the World War the British Air Service organized repair depots all over the country, to which were sent damaged air machines and engines to be made fit for service.

These depots were complete engineering establishments, having shops for all the various trades, well equipped with every appliance and well supplied with skilled mechanics who were all enlisted soldiers and under military law.

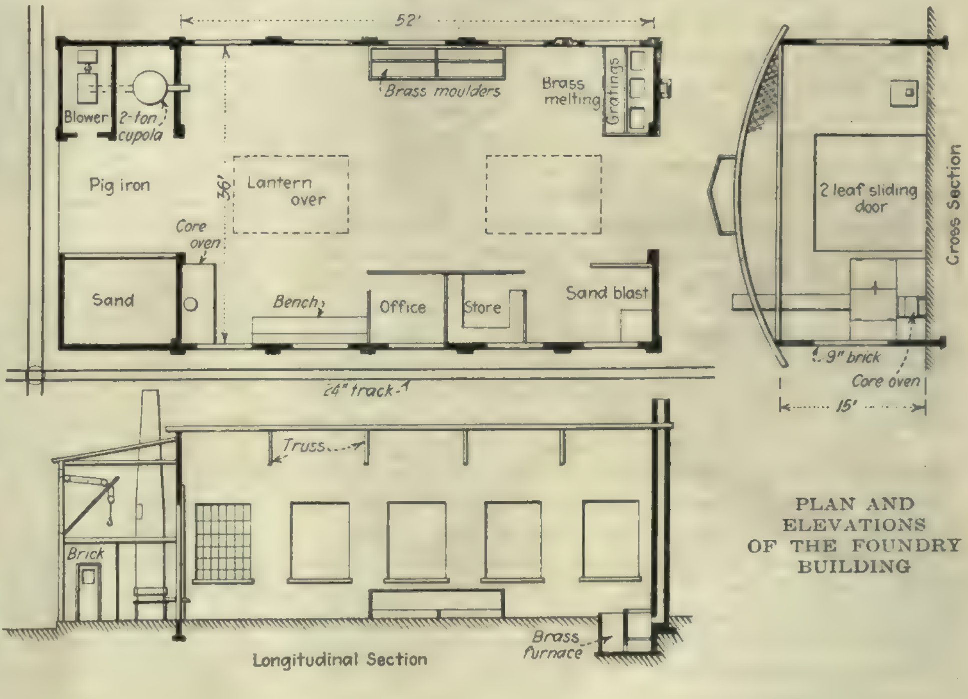
The following description of a foundry building at one of the depots may be of interest:

Castings in iron, brass and aluminum were required, as well as a general run of machine-shop castings. No castings of great weight were ever needed, as no repair parts weighed over 100 lb. All the equipment, with the exception of the motor and blower, was made at the depot—the cupola was built from a second-hand steel chimney stack and ore was raised to the charging platform by a hand hoist. The core drying oven was of sheet steel with the usual shelves, and was set on a brick foundation in which was provided a fire grate. The brass furnaces were of standard type, fired from below, and had provision for three crucibles.

The building shown in the illustration was of brick with roof carried on "Belfast" timber-trusses and had two lanterns. The interior was well lighted and proved to be ample in floor area for the work to be done.

The management of the plant was vested in a commissioned officer, who was solely responsible for the quality and quantity of the castings turned out, as well as for the conduct and general discipline of the men employed. He was aided by two non-commissioned officers who directly supervised the work of the molds.

Nine molders of different grades were constantly employed and their rate of pay was graded according to their experience and skill. The wages paid varied from four to eight shillings per day.



PLAN AND ELEVATIONS OF THE FOUNDRY BUILDING

How a Blind Man Makes Drawings

Visualizing Machine Parts and Movements—Drawing on a Typewriter—Dictating Drawings to a Draftsman—Describing Machines and Drawings

BY WILLIAM D. FORBES

"NEEDS must when the devil drives," is an old saying and the engineer who finds himself in a position where the tools are lacking to carry out his work, has often to get up some makeshift to help him out, or else acknowledge himself beaten, something no one likes to do. When I suddenly became blind some few years ago I thought that my days of designing and drawing were over, but inactivity was far from my liking and my inclination to design machinery could not be stopped by blindness. I had for years worked on machine guns and, a new idea coming to me while sitting in darkness, I began to visualize the parts. After a while I had the conception of each piece firmly fixed in my mind, and I determined to have a drawing made of the weapon. Most fortunately for me, I have a daughter who knows how to use drawing instruments, as I had taught her to trace for me. I dictated to her my ideas, and a model gun was made from her drawings. The arm functioned, not perfectly, of course, but well enough to show me that the design was worth while developing further.

One thing that very much surprised me at first was the fact that I could make far better progress in dictating drawings to my daughter than I could if I employed a skilled draftsman. This fact is easily explained, however. With my daughter, no line was made except as I dictated, so that I knew exactly where I was. A trained draftsman would get ahead of my dictation, as he knew perfectly well that a further line would be needed and he would lay it in. Then I would be at sea, as I might tell him to number the last line I had dictated, and he would put the number on the last line he had made.

LEARNING TO USE A TYPEWRITER

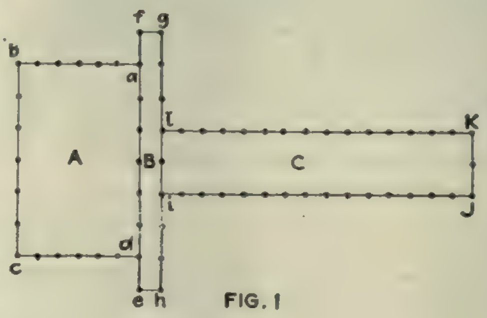
Having learned with little trouble to knit articles for our boys across the seas, I thought that I might learn to use the typewriter. I got a book on the touch system and, to my astonishment, I learned the key board in about three days. Now I can write about as fast as a fair typist, and of course they are all fair—at least they and their male friends think so.

I do not use raised letters, but use my fingers just as do typists who have eyes, depending like them on position only. I did, however, put some little sealing-wax dots on the letters *t* and *y*, and also on *g* and *v* and on *a* and *l*, as these letters located the position of my fingers on each row. After a while I found these indicator points of less and less use, and now I do not need them at all, although they were a help at first. Let me say right here that the often-made assertion that a blind man can do some things as well as a man with sight is all bosh. The only thing that a blind man can do perfectly is to sleep. Asleep he is anybody's equal.

As I could not always have my daughter at my side, and wanting to make details which she could take and assemble, I started trying various ways to make sketches. I could make but little progress until at last I hit on a plan, employing the typewriter for my work. A detail drawing so made is shown in Fig. 1. The sketch would be worthless without the text that goes with it, just as it would be if the figures were not put on it. Here is demonstrated the fact that a blind man can not do any work as well as one with eyes, as the text takes time to read, so that time is lost. Yet, I think that any mechanic will say that with the sketch and text there would be no trouble in producing the piece or pieces.

DRAWING ON A TYPEWRITER

The drawing is made on an Oliver typewriter fitted with a back spacer and a tabulating pencil arm. Referring to Fig. 1, I began the drawing at the point *a* by bringing the pencil down to the paper. Then I backspaced a given number, arriving at the point *b*, turned the roller of the machine a certain number of notches, arriving at the point *c*, and fed the pencil along the line by the spacer bar to the point *d*, counting the spacings to make them the same in number as the first back spacing. The point *d* was directly under the starting point *a*. Turning the roller over one notch gave the point *e*, and from this point I retraced the track one notch by turning the roll towards me.



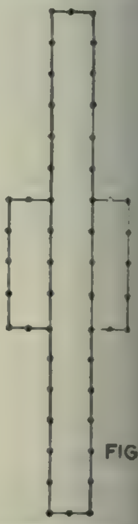


FIG. 2

FIG. 1. DETAIL DRAWING MADE ON TYPEWRITER, WITH ACCOMPANYING DATA

Material, mild steel.
Number wanted, 2.
A is ½ in. in diameter and ½ in. long.
B is ¾ in. in diameter by $\frac{1}{16}$ in. thick.
C is ¼ in. in diameter by 1½ in. long.
A is to be a light drive fit in the steel tube sent.
B fits nothing and is just a collar.
C is a nice running fit in the steel gear sent.
In the end of *C* a small hole is to be drilled and tapped. A round-head screw must be provided, also a brass washer ½ in. in diameter and $\frac{1}{32}$ in. thick, with a hole in its center to fit the screw.

FIG. 2. EXAMPLE OF DICTATED DRAWING

Material, aluminum.
Number wanted, one.
Make pattern, set no core.
Diameter of pulley, 3 in.
Face of pulley, ⅜ in.
Hubs project, ¼ in.
Diameter of hub, ¾ in.
Length of hub, ⅞ in.
Hole in hub, ⅜ in., reamed.
In the face of this pulley a semi-circular groove is to be cut. ⅛ in. deep and ¼ in. wide.
Finish all over, but do not polish.

Remembering the number of notches I had revolved the roller from *b* to *c*, I clicked the roller that number to arrive at the starting point *a*. Going one notch further gave *f*, and one pressing of the regular spacer brought the pencil to the point *g*. One click of the roller brought me to a point just to the right of the starting point. By continuing to turn the roller and to count the clicks to make them equal to the number from *b* to *c* with one additional gave the point *h*, and one back space gave the point *e* again. Returning to *h* and turning the roller one click towards my left put the pencil just opposite the point *d*. As I remembered that the number of spaces or clicks of the roller from *b* to *c* was six, I clicked twice, giving the point *i* on the line *g-h*. By fifteen spacings on the spacer bar, the point *j* was reached. Two clicks on the roller gave *k* and fifteen back-spacings *l*. It was a simple matter to put the letters *A*, *B* and *C* in their places. The sketch was hen complete. The small letters I did not put on, as hey are not required for making the part.

CONCENTRATING ON THE WORK

This description would seem to indicate that I took quite some time to make the actual sketch but this is not so. In fact, I think that I can make such a simple ketch as quickly as a man could with a T-square and riangle, or even more quickly. Of course there is no rouble in typewriting the text. Memory is the thing which may play me false in carrying out my work, but it must be remembered that a blind man can remember what he is doing far more easily than can a man with eyes. Why? Just this, I keep my mind on my work without effort, and all the pretty girls in the city may walk by with ever so short dresses and I still have my attention on my job—and I defy almost any man with eyes to do the same.

I have not as yet been able to devise a way to make circles, but I have a scheme in mind now that will, I think, enable me to make circles and even assemble a drawing from the separate sketches, although I would have to ask for some figures if the drawing amounted to much. If my typewriter had the teeth of the roller spaced evenly with the regular shift made by spacing, I could make far better sketches; and this feature I shall have added to my machine.

MAKING A DESIGN

A man with eyes making a design gazes at what he has drawn and measures here and there. Few men have absolutely fixed in their minds the exact form of a piece for a machine. Usually, the designer has some idea, of course, but he always fits the work in, and draws what seems to be right, often taking the measurements from the drawing after he has laid it in. Now, a blind man must sit in darkness and get absolutely fixed in his mind just what he is going to draw before he lays down a line; and he must, also, have figured out all the dimensions, or very close to them. If he loses his train of figures and gets confused as to the position of the pencil point, he must start all over again, so it is wise or him to make but one sketch on a sheet.

In Fig. 2 is shown a sketch that is also one intended to be worked from later. In it, I made the long central parallelogram first in the way I have already described; and then, counting down to the position of the upper line of the hub, this line and the corresponding line in the opposite side of the long parallelogram can be asily produced. The right-hand end of the hub was hen made, followed by the lower lines of the hub and the nal left-hand line. The sketch was quickly produced.

With regard to dictating a drawing the instructions given the draftsman would be as follows for the part shown in Fig. 1: "Draw a fine center line about 2 in. from the upper left-hand end of the paper, beginning about 1½ in. from the edge. About ¼ in. from the left-hand end of this center line cross it with a vertical line extending ¼ in. above and ¼ in. below. From the ends of this line extend two horizontal parallel lines ½ in. to the right. Join the ends of these lines with a vertical line, and extend this line ⅛ in. above and below them.

"From the ends of this vertical line draw two horizontal lines to the right 1/16 in. Join the ends of these short lines with a vertical line. Lay off on this last vertical line above and below the center line a distance of ⅛ in. From these two points draw two horizontal lines to the right a distance of 1½ in. Close the ends of this parallelogram. Put figures on the various parts." From this, it can be seen that dictating a drawing is not difficult.

UNDERSTANDING DRAWINGS AND MACHINES

In dictating drawings, the work is to a certain extent easier than drawing them, as by having lines lettered or numbered you can leave one part of a drawing, go to another, and return to the original point, or go on to another with ease—that is, if your memory does not fail you. While this sketching is not difficult, it is quite another matter to understand a description of a blueprint, even if given you by an expert; but with a few forms cut in paper and a lot of patience on the part of the reader I can understand most drawings sent me.

In examining machines, there is no difficulty in understanding any single piece on which you can lay your hands, but the trouble lies in getting the relations between the various parts. If the machine is small enough to reach several of the main members at the same time, then there is no trouble in obtaining a good idea of the entire tool or machine.

DESCRIBING DRAWINGS

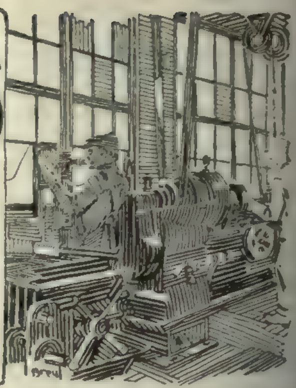
The power to describe a drawing to the blind is almost a gift, but it can be learned, one of the most important points being to give a general description of a piece before giving the details. Thus, my daughter might say to me, "Imagine a piece that looks like a button hook with a hook at each end." That would give me at once a mental picture. Girls have their own ways of giving a definition and usually they make a very clear presentation, especially to the woman mind.

One girl was asked to describe a tangent. She said it was the way a thread leaves a spool of thread when you pull on it. Now, that is certainly a very clear presentation of a tangent and most admirably suited to the mind of a woman. A few pieces of annealed wire can be used to advantage in dictating drawings or in understanding them, but cut-out forms are after all the best means to make a blind man understand a drawing thoroughly.

Concentration, memory and patience are three attributes needed by a blind person to make sketches, or in fact to do anything. To my mind, if these same qualities were more seriously studied and worked by the people who have eyes, they would find that their daily work would soon become easier and would be far better done. One very pleasant thing that the blind learn is that down in the hearts of men there is much kindness, as every one is ready to help a blind person.

MODERN PRODUCTION METHODS

By
W R. Basset
of
Miller, Franklin, Basset & Co.



XX. What Does It Cost to Sell?

Inaccurate Methods of Determining Selling Costs—Items Included in Selling Expense—Each Sales Problem an Individual One

PROFITS more often fail to materialize because it costs too much to sell than because manufacturing costs are too high. And yet the progressive man who insists on knowing just what it costs him to make a product will commonly lump his selling expense in the crudest way. He maintains clerks to gather the actual amount of labor and material that go into each part—even into each nut and bolt; he uses admirably logical reasoning to arrive at the correct way to allocate the various and intricate elements of overhead; all to the end that he may know just what profit he makes on each line and size of his product. Then he off-handedly throws all selling expense—salesmen's salaries, advertising, shipping, credit department and a dozen other diversified items into one pot and says, "My total selling expense—$100,000—is 5 per cent of my total sales, therefore, I shall say that 5 per cent of the selling price of any item is the cost to sell it."

It *may*, by pure chance, cost him exactly $500 to sell a $1,000 machine against stiff competition to a man who buys only from good entertainers. But it will hardly cost $20 to sell a $400 repair part, which no one else makes, to a man who owns one of his machines. Such contrasting sales conditions as this show plainly the error of considering that the sales price is an accurate measure of the cost of selling. But the man who contemplates this subject is apt to let his thoughts carry him into considering other factors that affect the difficulty—and hence the cost—with which sales are made. They are so diverse and require so much definite knowledge of subjects on which little knowledge exists that he humanly decides to use an easy method, though knowing it is wrong. Hence the percentage of price method of allocating selling expense.

I find that when figures on any phase of business are lumped in an offhand way the method is not only wrong but usually well known to be wrong. Therefore it is not surprising to find that selling expense, which by many concerns is disposed of most easily of all overhead items, is worthy of careful analysis, and is in fact the most intricate of all and the most difficult to handle correctly.

Of course there are exceptions. Some businesses are so fortunately situated that the old-fashioned way of bulking the selling expense will be safe, although by no means accurate. I should say that if a machine shop found its total selling expense to be under 2 per cent of its selling price, and the manufacturing profit of each item to be 20 per cent or more of the selling price, it would be safe to assume that each line was making a profit. In such an event I would hesitate to recommend much detailed study of selling expense, unless I had reason to believe that it would turn up new markets for the product.

One reason, very likely, why more study has not been made of this subject is because the marketing factor in each business is peculiar. The manufacturing problems, whether of costs or of production, are fundamentally alike for all machine shops. That is why a series of articles on machine-shop production and costs is worth reading. The principles are applicable with slight change of method to any shop. But the selling problems are exceedingly different. The data on which a manufacturer of milling machines could apportion his selling expense may have utterly no bearing on that problem for the maker of lathes. In fact, to get figures which will be of appreciable value I believe requires a study of each man's product, market and sales methods. Therefore, in this article all I hope to do is to indicate what factors affect the selling expense and how. I can only start you thinking on the problem in straight lines. Perhaps I can only indicate to you that such a problem—one well worth study—exists in your business.

First, let us list the items that commonly go into the selling expense pot.

(1) Salesmen's salaries and expenses.
(2) Commissions and trade discounts to agents.
(3) Magazine advertising.
(4) Direct mail advertising and catalogs.
(5) Supervision of salesmen—the sales manager and his office staff.
(6) The advertising manager and his office staff.
(7) The clerical cost of entering and billing sales.
(8) The credit and collection department.
(9) Shipping and packing expense.
(10) Share of rent, light, heat, etc.

Now what is it that can be learned from an analysis of these items? First, selling cost by lines of product; second, the relative skill and activity of salesman; third, the relative productiveness of territories; fourth, the relative effectiveness of the kinds of advertising. The selling cost by lines of product is put first because to most men it will seem most important. It is actually one of the last to be determined because it is so complex. For example, it might be found that the selling cost for one item varies for every territory. For one reason or another the concern's product may be highly thought of in the Detroit district and the selling expense be proportionately low. In the Cleveland territory the same type of user may lean toward a competitor's tool and our manufacturer would find it hard to sell there. That may be due to the fact that the advertising has been concentrated more in the Detroit district. Any number of reasons exist for such a condition. If the prospective buyers are more numerous in one territory than another, a lower cost per call and hence per sale may result.

SELLING PRICE NOT SAFE BASE FOR SELLING COST

Then there is the undoubted fact that it is not always as easy to sell one item as another. This has been recognized, in fact it probably is the reason why the percentage of selling price methods has been so widely used, for superficially it may seem that it is twice as hard to sell a $10,000 item as it is to sell a $5,000 one. Actually, though, it is easier to sell some buyers the higher priced one, for not a few assume that price is an index of quality. Most anyone will, after a little thought, agree that it is harder to sell a $500 machine to each of twenty buyers than a $10,000 machine to one. So that the gross sales are not a guide.

The realization of these inaccuracies in his methods led one manufacturer to reason that between two of his machines it was harder to sell the one that carried the wider profit margin. That is, if a $10,000 machine gave a profit of $1,000 and another type of machine selling for $5,000 gave the same profit, the same selling expense was charged to each. In some cases that might be a fair assumption, for wide margins of profit attract competition and the presumption is that the competition encountered would be more intense in the high profit lines. But these lines often carry wide profits because of patent monopoly. So we can properly consider the margin of profit as an influence upon selling expense but not as an accurate direct measure.

The fallacy of using either selling price or profit as a measure of the cost of selling comes from considering the selling expense as a lump sum. Actually, as we have seen, it consists of a number of diverse charges incurred for entirely different activities, all of which, however, are for the purpose of selling, or which inevitably result when a sale has been made.

We have already pointed out that the sales dollar is not the logical way to apportion the expense of the direct selling effort, which consists of the salesman's salary and expenses, a share of the sales manager's salary for supervision and the office correspondence with the prospect, for a salesman in one territory may make a $10,000 sale on a single call, while another salesman may reach the $10,000 mark only by virtue of twenty sales of $500 each, which may have resulted from fifty or more calls. Certainly, no one will disagree that it has cost the company more to make the twenty sales than it did the one.

A more nearly accurate method for handling the direct items of selling expense seems to be on the basis of a cost per call. Therefore, as a preliminary to building even approximately correct selling costs, we recommend that fairly minute and accurate reports be required from each salesman. Where this has not already been required, the salesmen may be expected to protest against being required to do clerical work.

It is a common failing of salesmen to look on themselves as supermen of a sort and they often fool themselves into believing that common business practice does not apply to their work, and that sales result from a sort of mysterious magic. The aversion of salesmen to doing even a small amount of simple clerical work is not insuperable. It is being required by some of the largest concerns, and those concerns are invariably found to have most accurate information as to their selling costs, as well as the best selling methods. I know of several concerns in different industries which supply the salesmen with very comprehensive report sheets on which they are required to list not only the calls made each day but the length of time spent with the prospect and the length of time it takes them to go from one prospect's office to another's. In fact, the entire seven hours a day which they are expected to put in is accounted for. In addition, these reports list the reasons why goods were sold or were not sold, as well as the objections put forward by the prospect.

The objection of salesmen to filling out reports of this sort has been successfully overcome; in fact, I very much question whether it is any more of an obstacle than is invariably met with in the shop when proper cost systems are installed. The average mechanic feels much the same way about reporting his time as a salesman does and yet thousands of manufacturing plants are successfully obtaining time reports from their workmen.

I strongly feel that most valuable information can be obtained by requiring salesmen to strip the mystery from their activities and making them tell their employers definitely how they spend their days. With such data as this, the manufacturer can escape the tyranny of the successful salesman. With the information he will get he can put selling more nearly on the scientific basis that he already has achieved in manufacturing.

COST OF SALESMEN'S CALLS

The average calls per day as developed by these records will be an indication of the activity of the salesman. Of course, in dense districts the calls will run much higher than in those districts where prospects are sparse. Consequently, the cost per call will be lower. This leads, naturally, to an accurate study of the market possibilities of the product—information which few manufacturers have. I recall a manufacturer of incandescent lamps who insisted that whenever one of his salesmen saw a factory chimney, he was to call upon the owner of the chimney, for it was assumed that every manufacturing plant was a prospect for electric lamps. As a matter of fact, in those days only about half of the factories used electricity. It should be obvious that a manufacturer of a special machine cannot safely assume that every machine shop is a prospective buyer. Again, it is very difficult to determine in the bulk the total possibilities of a district, because it is hardly possible to predetermine how many machines each buyer can comfortably absorb.

It is my firm belief that until a manufacturer has very much more accurate knowledge as to the absorptive power of his various sales districts than is now the rule, it will be difficult to get even an approximately accurate selling cost by lines and by districts. It is however entirely possible to make surprisingly accurate analyses of markets. The difficulties are much more apparent than real.

In some lines, it should be possible to obtain a record which will be an accurate indication of the closing ability of the salesman. This might take the form of a report showing the number of items sold per call made, although that in some instances might be more nearly a reflection of the absorptive power of the district. When the salesman sells to a single buyer several items at a single call, probably as fair a way to divide the selling expense as could be devised would be to take the salesman's judgment as to the relative difficulty of selling the various items. With a comprehensive report, such as I have already recommended, this would be easily determined.

After data has been gathered for a few months, it should be possible to determine for each territory the normal cost per call and a normal selling cost per item. These figures, naturally, would have to be revised from time to time to meet changes in the cost of traveling. It should be approximately uniform with a district, regardless of the salesmen's salaries, for the presumption is that as a man's salary is increased his selling ability also increases at least in proportion. With such a figure we are in the same position as regards direct selling expense as we are for the overhead expense of the various productive departments; that is, we have a normal figure, subject to revision at fairly long intervals, with which we can compare the actual direct selling cost of each man and thereby have a rather fair line on the relative merits of the salesmen.

When the data have been gathered, it may seem feasible to assign a unit value to various lines in the different territories by means of which the selling cost of all lines in all territories may be brought down to a common basis for purposes of comparison. Here it is well to keep in mind that while it may be more difficult to sell one machine than another, it is seldom more difficult to sell a large machine of a given type than a smaller one. Whether a prospective buyer purchases an eight-inch lathe or a sixteen-inch lathe depends entirely upon the customer's needs and not upon any special effort put forth by the salesman to sell the higher-priced lathe. This is another proof that the application of selling expense on the sales dollar is misleading, for, while the sixteen-inch lathe sells for more than the eight-inch lathe, the same degree of difficulty in selling would probably be encountered with each.

Certain expenses that result after the sale has been made, such as those in the billing department, order department, the accounts receivable, ledger clerks and so on are most accurately charged as so much per item. It admittedly takes as much effort to enter a sale of a $10 repair bill as for a $10,000 machine. Where each item is made to carry the same charge I frequently find that concerns discover that they have been fooling themselves on the profit which they have been making on their repair parts. It is not unusual to find that the clerical expense required to handle repair parts very often eats up the possible profit.

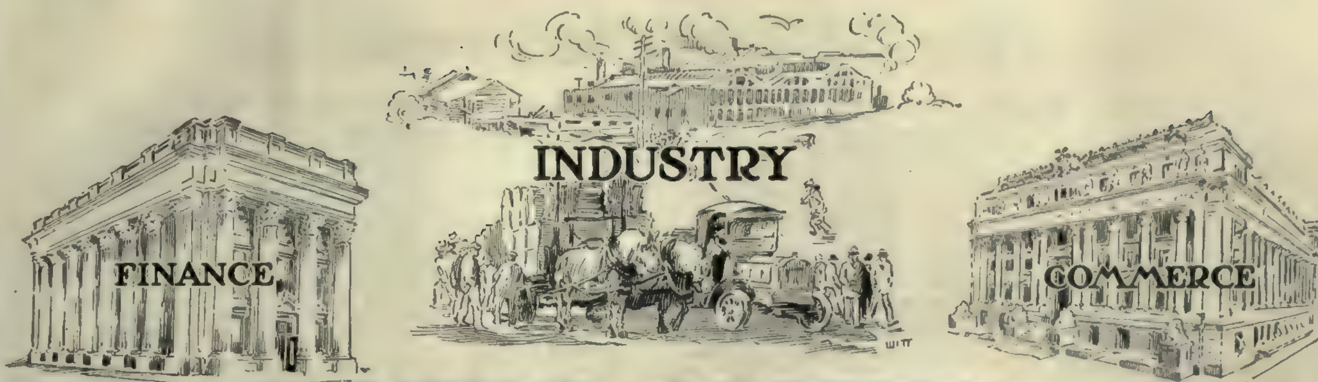
The bad debts of a business can usually properly be charged as a percentage of the total sales. In certain cases they will, however, be found to follow them, less closely than they do the number of accounts handled. The cost of passing on credits, as well as the cost of collecting slow accounts are in like case with the bad debts. As a general rule the volume of sales will dictate how much effort the credit department must put forth.

The shipping and packing expense is, in some businesses, a large one which, if incorrectly allocated, will bring serious errors into the selling expense. The effort involved commonly depends upon the conditions peculiar to the district in which the goods have been sold. If the sale is made to a next-door neighbor, perhaps it will not be necessary to pack the goods at all. If to a point a thousand miles from the factory, fairly strong packing may be required, while if the sale is to a foreign country, more expensive packing still will be needed. I have recommended several times, with good results, that a normal shipping and packing cost be developed for each territory and for each item which is salable in that territory.

Further difficulties arise when an attempt is made to distribute advertising expense. This will very largely depend upon the nature of the advertising. If the magazine advertisement pushes a single line of product, it is of course possible to divide it over the units of that item sold. To be entirely just, however, the amount of the magazine's circulation in the various sales districts should be determined and a normal advertising cost per sale for each district developed. Where more than one magazine is used, the problem is of course complicated, but is still subject to handling on the same basis. When it is possible to key the advertisement in the various magazines so that the relative pulling power of each can be determined, valuable information can be arrived at, but that is oftentimes difficult. When the magazine advertising does not push one line of product over another, but is along institutional lines for the good of the business as a whole, it is still possible to normalize the advertising expense by districts and then divide the cost among the various lines of product in much the same way as I have suggested for handling the direct selling expense by lines. Direct-by-mail advertising may be handled in the same way, although more easily than the magazine advertising because the mailing list will show exactly how many mailings go to each territroy.

When the entire output of a plant is sold through jobbers or commission representatives, the problem of properly allocating selling expense is easy for the manufacturer for he is practically throwing the burden of determining it upon his agent. So far as the manufacturer is concerned in such a case, it is entirely proper to allocate the selling expense as a whole as a percentage of the selling price, for it is common practice to bill the jobber at the list price less the discount. The discount is of course the selling cost so far as the manufacturer is concerned.

As I have said before, little can be done accurately to allocate selling cost unless very definite knowledge is had as to how much business in different lines of product each territory should produce. I have repeatedly seen cases where the so-called "star salesman" has been shifted to another district and shown himself to be a complete failure. Many a selling reputation has been made because the man was fortunate enough to have an exceedingly easy territory, and on the other hand I have no doubt but that many a potentially good salesman has decided that his forte was truck-driving, after a few months' effort to sell in a barren territory. While an accurate knowledge of his markets is seldom possessed by the manufacturer, it is entirely possible for him to get this information. Until he knows what each territory should produce, he is going by guess, a method which he would hardly use in the manufacturing end of his business.



NEWS SECTION

Tool Plants Prepare for Future Demands

By AUGUST H. TUECHTER

President of the National Machine Tool Builders' Association

The machine tool industry is one that must reckon with recurring periods of intense activity and relatively deep inactivity. These conditions are inherent in the nature of the industry. Just at present the depression is relatively greater than ever before. The present period of inactivity gives plenty of time to bring plants up to date, to make all needed repairs, to readjust and refit the very accurate machinery required in the production of machine tools and to study every possibility of improvement. It is along these lines that the machine-tool industry is conducting its affairs at the present time.

The industry is faced with many serious problems as an aftermath of the war. The World War was a war of machinery, and to build the war machinery and to make the war munitions the countries of the world had to depend on the machine-tool builders of the world. In all the warring countries the consequence of this excessive demand was a large increase in the capacity of machine-tool shops. Very few American machine-tool shops were increased at Government expense, their additional capacity being provided with their own funds, as a rule.

The consequences of having this extra large world capacity are very numerous, not the least of which is the almost complete absence of foreign demand. Before the war the foreign market was estimated to absorb about 30 per cent of the output of American machine-tool shops.

It is anticipated that the next period of activity will be one of keen competition in all lines. Manufacturers of every class of goods must look to their costs of production, and this means that they must use the most modern equipment of every kind if they would stay in the running. With plenty of time now for consideration of improvements, the machine-tool industry is preparing itself for that condition, and is urging the manufacturers in other lines to realize this fact so that they, too, will be in position to produce most economically when the demand again returns for their products.

One activity now being undertaken by the association is the serious and comprehensive study of the economic conditions of the industry not only at the present time, but in relation to past cycles, for the last twenty years.

All statistical organizations find the movement of pig iron to be intimately related to general business activity. The machine-tool business is closely correlated to iron, and surveys of the past have developed the typical fact of sales of machine tools dropping off a full year ahead of pig iron. This is most natural, when fundamental conditions are understood, and will be of significance to other industries whose reaction does not come on as fast as in machine tools.

The industry, due to the character of the product, will throw a valuable light on general industrial conditions, at least as a wave of prosperity begins to approach its culmination.

It is our belief that our quota will be significant quite a while in advance of many other distress signals that begin to be apparent to business men making and selling goods for more general consumption. All authorities agree that stabilization of production and demand will be greatly promoted by more careful measuring and weighing of economic forces, and by better adjustment between supply and demand, which is possible only after the real facts are known. Statistical study by different industries affords the only means for developing these facts, on which alone can sound judgment be based. — *Philadelphia Public Ledger.*

Ford Buys Steel Plants

Henry Ford has closed negotiations for the purchase of the Superior Steel Co. and the Union Electric Steel Co., according to strong reports from Pittsburgh financial circles. Both companies have their plants in Carnegie.

Confirmation of the reported purchase could not be had here today in the absence of officials of both companies authorized to speak.

The Superior Steel Co. is one of the largest independent plants in the Pittsburgh district, turning out the finer grades of steel. More than 5,000 men are employed in the two plants when they are operating on full time.

It is rumored that the former Remington Arms Co. plant at Eddystone, Pa., is to be converted into a great fabrication plant for a big automobile concern. Henry Ford is named as the genius back of the deal.

Dormant since the days when the United States Government relinquished the extensive property as a storage plant, the buildings are being cleaned and all machinery is being removed to the empty plant of the former Eddystone Munitions Co. on the river front.

"Adria" Car To Be Built

The Adria Motor Car Corporation has taken over the plant of the Gray Machine Tool Co., at Batavia, N. Y., and will manufacture automobiles. The new product will be known as the "Adria" car, and is said to be designed along unique lines in-so-far as the springs are concerned, the purpose of the special design being to take the load off the driving axle.

The officers of the company are Louis F. Vremsak, of Cleveland, Ohio, president; A. E. Fowler, Buffalo, N. Y., vice president; Willard C. Wheeler, Buffalo, N. Y., secretary. Mr. Vremsak designed the car.

National Structural Society Meets

An important meeting of the National Structural Steel Society, an organization of steel fabricating companies of the Central States, was held at Massillon, Ohio, last week. The business sessions were held in the offices of the National Pressed Steel Co. Fifty delegates of the company representing the largest steel fabricating companies in Ohio, Indiana, Iowa, Illinois, Wisconsin, Minnesota, Nebraska and Missouri attended the meeting.

Karl E. Vogel, of the Omaha Company of Omaha, Neb., presided.

All speakers at the regular meeting emphasized the fact that all of the prices of building and construction materials had dropped to the lowest figure, compared to the price scales of 1914.

Mr. Vogel in his address said that the steel prices were now stabilized. He urged a national co-operation of the efforts of construction steel men.

Other officers of the society are A. L. Denison, of the Rochester Bridge Co., Rochester, Ind., vice-president, and C. J. McIntosh of the Federal Bridge and Structural Co., of Waukaska, Wis., secretary.

Southern Iron Plants Resume Operations

While the number of men still unemployed by the iron, steel and metal trades industries in the Birmingham district is still exceptionally large, more men were at work the early part of August than for several months past, with every indication that the turning point for the better has come at last, and that there will be steady improvement from now on until the metal industries of the district have again attained the condition of normalcy.

The early part of August witnessed the resumption of operations at a number of the larger plants, and the giving of employment to hundreds of workers, most of whom have been idle for several months.

One of the outstanding features of the district's trade development in the past few months has been the extension of commercial relationship by the metal trades industries with the Pacific coast. Iron and steel products of all kinds, mainly the products of the pipe-making shops of the district, have been finding a ready market on the Pacific coast, and the development of this trade is one of the main reasons why the industry has operated in Birmingham and vicinity more extensively all during the period of depression than in other sections of the country. Shipments are made out of Mobile through the Panama Canal.

Recent reductions in the prices of steel products by subsidiaries of the United States Steel Corporation are also expected to materially revive the demand for such of these products as are manufactured in the Birmingham district.

A survey of the iron-making industry in the district shows that there are eight furnaces that could be placed in operation in 24 hours should the revival of business merit it; five that could be gotten in readiness in a week's time; while there are six others that would require from 60 to 90 days. The bins are so well stocked with raw material that no time would be lost on this account.

The policy of buying pig iron for immediate needs only, or the "hand-to-mouth policy" as it is termed, is one of the main things that is holding up the market in this district. Many of the smaller industries are melting iron right along, and, but for this policy, which has been in vogue several months, there should be a heavy demand for pig iron.

Operations have been resumed at the plant of the Bessemer Foundry & Machine Co., Bessemer, Ala., after a brief shutdown. This plant has operated steadily all during the period of industrial depression, though on a curtailed basis.

It is also reported that one of the furnaces of the Republic Iron & Steel Co., at Thomas, Ala., will shortly be placed in blast, and that the Semel-Solvay coke plant, at Ensley, Ala., will resume operations Sept. 1. This will give employment to about 350 men who have been idle for several weeks.

The American Steel & Wire Co. has increased operations at its Fairfield, Ala., plant to six days weekly, while the tie plant of the Tennessee Coal, Iron & Railroad Co., at the same place, will shortly double its present production.

Will Do Some Adding

The Wales Adding Machine Co., Wilkesbarre, Pa., has received an order from the F. W. Woolworth Co., New York, for 800 machines at a cost of more than $200,000, this being the largest single order the company ever received.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
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There has been a strange recrudescence of pessimism throughout the country during the week, though there is nothing in the news to warrant it. It may be seasonal, as the present period includes the "dog days," but I am more inclined to go back for an explanation to Woodrow Wilson's contention of seven or eight years ago that business depressions are largely psychological.

During my entire career I have never known a time when the minds of men were more receptive to unfounded rumors of bad news. Last week the postponement by J. P. Morgan of his departure for Europe, though it was caused only by private business matters and by his desire to be in New York while his partner, Henry P. Davison, underwent a critical surgical operation, was seized upon by the rumor mongers and used as a peg on which to hang vague reports of financial trouble in high quarters. These found lodgment in minds predisposed to accept them and they had, I believe, more influence than any actual happenings of the week in precipitating the decline in the securities markets, in halting the advance of cotton, and in keeping down the price of wheat despite the bullish government crop report and the expectation of higher prices which is so general among traders.

Mental unsteadiness is quickly translated into financial unsteadiness in the speculative markets. For this reason I do not believe that the stock market is the reliable business barometer it is generally thought to be, for while its reaction from a long rise generally indicates forthcoming business contraction, its recovery from a long decline is delayed by the pessimism which its own depression engenders so that instead of heralding business recovery it barely keeps pace with it. I indulge in this somewhat theoretical discussion because this, I believe, is the relation which exists between the stock market and business at present.

If the specific developments of the seven days were put into a balance, favorable on one side and unfavorable on the other, they would be separated something like this:

Favorable

Continued evidence of improvement in many industries, including building, iron and steel, silk, cotton and woolen goods, automobiles and tires.

Increased freight car loadings.

Slightly more active wholesale markets and a steady good volume of retail buying.

Firmer prices of a few commodities, especially foodstuffs, which have been too low in relation to other commodities.

The decision of Congress to cut $555,000,000 off the nation's tax bill.

Unfavorable

The passing of the dividend on the American Sugar Refining Co.'s common stock, and other evidences of decreased corporation earnings.

The probable postponement until Congress reconvenes in the autumn of action on the President's plan for funding the railroad's debts to the Government, while paying the Government's debt to them.

That what Bismarck called the "imponderable" factors have outweighed the more concrete and positive evidences of business improvement brought to light during the week is discouraging, but should not shake the faith of those who believe in the ultimate triumph of fact over fiction.

Of the news that has been construed as unfavorable, the statement that the Railway Refunding Bill probably will be postponed exerted the most influence on sentiment. Counted on to make $500,000,000 available for the roads, its introduction in the Senate immediately brought forth sharp criticism from the leaders of the agricultural "bloc." Eugene Meyer, Jr., managing director of the War Finance Corporation, which is charged with the administration of the plan, explained clearly that it is not a loan to the roads, but an extension of Government aid in marketing their securities, and the beneficial results which may be expected to follow its adoption seem so obvious that the opposition ought to be quickly stilled. If the Senators persist in holding out against it, they are likely to work as much harm to their own constituents as to anyone else, for as has been previously pointed out, the railroads are the largest purchasers of commodities in this country and when they resume buying, industry in every section will feel the stimulation.

Railroads Improving

Credits extended to the railroads will never become "frozen." They will be used not for carrying commodities,—but for making purchases, and the $500,000,000 in securities now in the Treasury vaults can be converted into a powerful tonic to business simply by turning them into cash, as the bill proposes, and allowing the roads to use the proceeds. The activity which their buying would engender would be felt throughout industry because it would make possible the payment of other debts, the employment of more labor, and the buying of more raw materials. Five hundred millions, put into circulation, represents the addition of several billions to the business turnover of the country. Mr. Meyer estimates that a million idle men will be reemployed if the plan is adopted.

Despite the setback caused by this postponement, the traffic reports made by the railroads are uniformly good. June returns from all but one of the Class 1 roads show a net operating income of $51,778,000, compared with a deficit of $14,612,000 in June last year. For July, estimates indicate that net earnings will be even higher. Car loadings are steadily increasing.

Tax Reductions Welcome

The decision to effect a reduction estimated at $550,000,000 in the national tax bill is welcome, though it has been long deferred.. The details of the proposed revision need not be stated here; they are fully given in the daily press. The proposed reduction in the heavier surtaxes may weaken the market for tax exempt bonds, the further issuance of which is prohibited in a constitutional amendment that has been offered in Congress, but has small chance of ratification even in the distant future. The supply of such securities is meantime undiminished and bonus bills passed or under consideration by state legislatures contemplate the distribution of $375,000,000 among the soldiers. The House is expected to pass the tax revision bill by Saturday, when Congress has decided to adjourn for a month. Most business men are enviously pleased by the decision. The money market is static.

	End of Last Week	End of Previous Week	Last Year
Bank Clearings (Bradstreet's) in thousands	$51,769,431	$6,548,228	$7,450,751
Business failures	329	319	147
Security prices, N. Y. Stock Exchange			
20 Industrials	66.42	69.50	84.75
20 Railroads	71.30	73.97	73.40
40 Bonds	77.66	78.27	74.14
Commodity Prices			
Wheat, No. 1 spring	$1.66	$1.62	$2.80
Corn, No. 2 yellow	.77	.76½	1.83¼
Beef, good dressed steers	16.25	16.25	23.50
Pork, mess, bbl	24.50	24.50	33.50
Sugar, refined	.0615	.06	.1710
Coffee, Rio No. 7	.06⅞	.07 3/16	.09⅜
Cotton, middling	.1325	.1345	.3910
Print cloths	.04⅝	.04½	.13
Wool, domestic average	.4173	.4021	.....
Silk, No. 1, Sinshiu	5.75	5.70	5.80
Rubber, crude, plan	.14	.15	.31
Hides, pack, No. 1	.14	.14	.28
Iron, No. 2, Phila	19.84	21.35	49.50
Steel billets	30.00	30.00	55.00

Federal Reserve Stronger

Borrowers in good credit should have no difficulty in obtaining the accommodation they need at reasonable rates if Governor Harding of the Reserve Board and Governor Strong of the New York Bank are right in the optimism they express. The "Golden Flood" continues and the Federal Reserve Banks have increased their gold reserves by $23,000,000 during the week. The reserve ratio stands at 65 per cent, the highest in three years.

In industry the effects of the steady retail consumption which has kept up throughout the period of depression, are being shown in increased activity. New York is crowded with buyers. The demand for textiles is very active and is reflected in the full employment reported by most cotton mills. Silk consumption during July was the largest in a year and a half. Even steel, best barometer among the industries, and coal, the chief laggard, show signs of recovery, for in steel both mill operations and orders are above their figures of a few weeks ago and in coal there is a firmer tone to prices and evidence that some of the largest consumers are preparing to place their contracts. Building during July, according to "Bradstreet's," was 4.2 per cent above the June total. A number of automobile plants report increased production. Southwestern flour mills are operating on the largest scale in a year, a majority of them working twenty-four hours a day, seven days a week. General improvement is reported from the shoe industry.

Foreign Trade Declines

July's foreign trade showed sharp declines from a year ago, but strangely enough the balance of trade in our favor is larger than it was then. Exports totaled $322,000,000, compared with $651,136,478, and imports $178,000,000 against $537,118,871, leaving a balance of $144,000,000, which compares with $114,017,507 for July, 1920.

The market for foreign exchange continues to puzzle the experts and defy the comprehension of the uninitiated. In a few hours last Tuesday sterling advanced ten points on an order to buy five hundred thousand pounds. Bills for other currencies rose sympathetically, but most of the improvement was soon lost. The fact seems to be that as a result of the decline in exports and imports the supply of bills is very much reduced and the market is becoming a very narrow one in which a great many speculators have been caught. Its future is inscrutable and cautious merchants will be careful to buy or sell their exchange before committing themselves on transactions which involve drawing or remitting to Europe.

The news from abroad is more favorable than unfavorable. British July trade showed a further increase in exports and decrease in imports and the textile outlook is so much improved that many Lancashire mills are increasing their output. Both Great Britain and France report reductions in note circulation, but in Germany the total is climbing week by week, and reports of reviving German prosperity should be read with due allowance for inflation. The release of American prisoners from Russia and arrangements to relieve the famine have proceeded without a serious setback.

On this side of the Atlantic the Mexican Congress has at last started consideration of the Constitutional provision nationalizing petroleum deposits, which is the chief bone of contention with the United States. Reports to the Department of Commerce indicate improving business conditions throughout the world.

Balancing these various developments against each other, I see more cause for hopefulness than for depression, provided we do not let fear get the better of courage in acting upon the facts, which indicate steady progress in reconstruction on both sides of the Atlantic.

Business Conditions in England

BY OUR LONDON CORRESPONDENT

With the settlement, for the time being, of wages of engineering workpeople—they submit to a reduction of 6s. a week in two monthly steps each of 3s.—and the ending of the coal dispute, a hopeful feeling is more common and some day soon material improvement will, it is expected, be noted. But not just yet. For a long spell the weather has been against anything strenuous and the ordinary holiday period is upon us. Prospects of lower prices for coal are not particularly promising, although in Glasgow a decline of 10s. a ton has been reported and in certain districts no alteration has been made; whereas in London the prices have been increased by from 3s. to 5s. a ton, according to the quality; this despite the fact that miners receive a reduced wage and that the industry is being subsidized by the nation to the extent of £10,000,000. It is true that the number of workpeople registered at the employment exchanges as unemployed of late showed a decline, and on July 22 were estimated at about 1,870,000, plus 760,000 on short time. While the improving industrial conditions have helped, on the other hand some of the names have been removed from the lists simply because people have gone out of benefit, having received the full number of doles and donations to which they were entitled. Wages all round tend to a reduction—even the printing trades are now agreeing to this. The official records showed that the June changes affected about 1,060,000 persons, of whom about 14,000 received advances, the net effect being a weekly reduction of £420,000 reckoned on full-time working. These figures, of course, do not include the engineering or mining workpeople referred to above. In fact during the first six months of the year the wage reductions officially recorded apply to 4,300,000 workpeople to the extent on full-time working of £1,770,000, with increases for 350 000 workpeople of £83,000. It is indicated that government employees, agricultural laborers, domestic servants, clerks, shop assistants and salaried persons are excluded from the return. Wages of iron and steel workers in particular have dropped as the result of the sliding-scale system, whereby wages depend on prices obtained, the drop for blast furnace workers being 73 per cent from the 144 per cent by which wages exceeded standard. No further reference need be made to industrial disputes except to mention that according to an estimate, the aggregate duration of these as recorded during the first six months of the current year was about 77,000,000 working days. The cost of living figures remain stationary; that is at an increase of 119 per cent above the figure for July, 1914. Quite possibly no further reduction will be recorded for another month.

Apropos the price of coal and the starting of blast furnaces, according to a reply in Parliament, of the 400 out of 500 blast furnaces in Great Britain which are regarded as effective, not one was in operation at the middle of July.

Meanwhile, despite falling trade, decline in prices, labor disputes and political uncertainty, the leading London banks report their half-year dividends of 14 to 20 per cent. But deposits have shown a (relatively small) decline, acceptances a marked decline, the holdings in bills have definitely increased, and the figures for loans and advances have been reduced.

The overseas trading of Great Britain has naturally declined during the current year, the value of the imports for the first six months being approximately £572,000,000, or rather more than half the value as compared with the corresponding period of last year. The exports for the six months are valued at rather less than £369,000,000, and re-exports at less than £50,000,000, the exports total exceeding £418,000,000 which, like the imports, means something more than half the figures for 1920. June exports were in quantity somewhat more than one-third those of June, 1913, and in value about one-third those of June last year. Imports, at £88,000,000, almost doubled the value of total exports during last month and at that were of only about half the value for June, 1920.

The machine tool exports greatly outvalue the corresponding imports, although the values per ton as a matter of fact have during the last few months tended to become equal. British-made machine tool exports have been fairly steady at about £150 per ton, while imports have fallen to near that figure from £275 per ton, the value four or five months ago. During the current year Great Britain imported 2,243 tons, or not one-third the weight imported during the corresponding period of 1920, while the value, £509,571, is also about one-third the figure for last year during the same period. British exports of machine tools during the current year have been valued at £1,885,151, a 50 per cent increase as compared with 1920, while the weight was 12,977 tons against 9,035 tons.

According to a return compiled for the European edition of this journal by the Board of Trade, taking the items for the six months to the end of June last, the number of drilling machines exported, manufactured in the United Kingdom, was 1,145, valued at £254,347; grinding machines 395, valued at £87,094; lathes 1,681, valued at £610,751; milling machines 446, valued at £130,754; planing and shaping machines 420, valued at £212,001; and presses, punches and shearing machines 329, valued at £136,118. Other machine tools numbered 1,404, the value being £428,971. As to parts, that is chucks and other work holders, the total value of these is given as £25,115.

Turning to the corresponding imports, the items include drilling machines 788, valued at £41,269; grinding machines 211, valued at £29,525; lathes 571, valued at £61,362; milling machines 91, valued at £34,087; planing and shaping machines 161, valued at £16,657; presses, punching and shearing machines 320, valued at £131,345; and other machine tools 901, valued at £179,581. As to parts, that is, chucks and other workholders, the total value of these is given as £15,745.

Casual examination of the figures makes one thing obvious, namely, that as compared with imports the machine tools exported by Great Britain are of the heavier order, excepting in the case of milling machines where imports and exports have about the same average weight. To take the first item, namely, drilling machines, the average machine imported does not very greatly exceed a quarter ton in weight, whereas the average drilling machine exported weighs more than one ton, and so on down the list.

The workpeople of England owe much to the Factory Inspection Department of the Home Office, and the annual report of this section is generally worth study by mechanical engineers, particularly by machine tool builders. The action of the inspection department in enforcing the employment of guards on milling cutters is comparatively recent and the report just issued mentions once again the difficulty experienced in persuading operators always to use them. A suggestion is that the practice might be extended of using an air blast for each machine for the purpose of removing cuttings, etc., thus avoiding the use of the brush, which is dangerous. Special reference also is made to abrasive wheels and the accidents they cause, nearly 30 per cent of which in the principal metal-working district were ascribed to excessive speed. It is urged that mounting and maintenance of grinding machinery should be specially deputed to a person responsible. The strength of the guards provided with these wheels is often criticised and in more than half the breakages investigated the guards were either absent or in this respect inefficient. The size of screws for fastening purposes also is, in some cases described as ridiculously small, and the engineering inspector concerned states that cast iron, unless very substantial, should not be used on account of its inability to withstand shock.

The financial returns of a few engineering companies as recently noted may perhaps be of interest. Armstrong, Whitworth & Co., in their latest report show a net profit on the year's working of £675,179, or apparently about two-thirds the average net profit of the four preceding years. Crompton & Co., Chelmsford, electrical engineers, who are associated with the Armstrong-Whitworth firm, showed a further expansion in profits and maintained their dividend at 10 per cent, the net available balance being £66,291 against £52,878 last year. This company reported new business extremely difficult to get, many inquiries being received but few orders resulting. The General Electric Co. show net profits from all sources of £796,148. Royce, Ltd., Trafford Park, builders of electric cranes, etc., showed a profit on the working of the past year of £14,931, the dividend being 5 per cent free of income tax. Greenwood & Batley, Ld., Leeds, mechanical and electrical engineers, report a net profit for the past year of £23,433. They also pay 5 per cent. A year ago the ordinary shares were doubled by the capitalization of reserves. Taking a shipbuilding firm, Hawthorn & Co., report a profit of £31,339, subject however to certain deductions, and the directors recommend that the balance be carried forward. During the past year apparently the cancellations of orders amounted in value to £261,200, and there has been "an almost complete collapse in the value of ships and a corresponding cessation of shipbuilding orders." Then, W. & T. Avery, Ltd., successors to the James Watt firm at Soho, Birmingham, report a divisible balance after certain provisions, of £95,890, the dividend on the ordinary shares for the year being 15 per cent. W. Asquith (1920), Ltd., the Halifax drilling machine manufacturers, as the result of their first year's working passed the dividend to ordinary shareholders, but paid the dividend on the 8 per cent preference shares.

Reductions in prices continue to be announced both of home and imported automobiles, this applying to cars at both ends of the scale, such as the 24 hp. Sunbeam and the 10 hp. G.W.K. The Buick chassis is reduced from £610 to £545, and the Briscoe car from £595 to £495. The 6-cylinder Nash is reduced by £55 to £595, and he Rolls-Royce chassis from £2,100 to £1,850, the reason given being the reduction of engineering wages and the price of material. It will be noticed that in several instances only the chassis price has been reduced. The cost of bodies is by many held to be one of the handicaps of the industry. The Daimler Co. is making a new 20 hp. 4-cylinder car at £750 for the chassis. This company has recently gone on full time after working two days a fortnight, or thereabouts.

Machine tool firms working full time could be counted on the fingers of one's hands and are chiefly to be found in the Manchester district; Hetherington's may be mentioned and also Spencer's of Hollinwood. The work is of the heavier type, for railway purposes, etc. But orders received in the somewhat distant past rather than really recent demands here fill the shops. Perhaps the largest lathe so far built in this country was recently completed by Shanks at Johnstone, namely, a double-bed lathe of 111 in. to 123 in. centres for turbine work, motor-driven and weighing more than 300 tons. No attempt has of late been made to introduce really new machines, no market existing.

Some reference has ben made above to the motor car industry. Of late several firms usually associated with the heavier cars have turned to machines of the 8 hp. order, and inquiries for this kind of automobile are reported from Japan. Makers of light-weight motor cycles seem to have done better of late, but trade in ordinary cycles has been quiet. It is suggested with some confidence that before long appeals will be made to the public in connection with motor-charabanc companies, and a warning has been issued that figures based on runnings during the present summer will not form a true guide to average conditions; the weather which behaved with so much unkindness to the miners had of course an exactly opposie effect on public motoring. Then too railway facilities were necessarily cut down, whereas the companies are now on the alert and are using all means available to increase traveling facilities. It has been decided that for the running of motor services they must obtain special powers from Parliament.

While talking of travelling a note may be made of the fact that freight charges to India are to be reduced, this arising from German shipping competition. A more general reduction of such charges is suggested and is held to be necessary if trade is really to revive.

Turning again to engineering, the makers of textile machinery in Lancashire seem to take a more hopeful view and orders have been reported from India as well as Japan and France. Most of the firms concerned are at least fairly well placed, but quite a number of orders received or offered involve financial risk which may not readily be accepted.

As to the London iron and steel exchange, buyers of late have generally been less prominent than sellers. The last report suggests that "in manufactured iron and steel the resumption of business is very gradual and although British quotations have in several instances been marked still lower, the continental material still has the advantage as regards price." The cost-of-fuel problem has not been solved and is all-important. Generally speaking, however, it is felt that the worst point has been passed. Although little that is tangible can be produced, still the future is looked forward to hopefully.

Business Conditions in Germany

BY OUR BERLIN CORRESPONDENT

The German Chambers of Commerce have recently filed a cumulative report on the business situation, with special regard to the effects of the sanctions and the reparations payments. Summing up the situation, the report says that while various branches of industry are showing evidence of a revival of business to some extent, which is ascribed to the recent depreciation of the mark, causing buyers to abandon hopes for an expected further reduction of prices, others, especially those strongly dependent on export business, show no improvement.

Foremost among the latter is mentioned the machine building industry. During May and in the first part of June business in this industry picked up, but hopes for a lasting improvement were soon disappointed. In the latter part of June another drop took place, affecting even quarters from which up to that time no complaints had been heard, such as the locomotive and railroad car industry, and several branches of the electrical industry. Even in lines where employment had been insufficient, the depression deepened.

From April to May the proportion of machine building works that had seriously reduced employment rose from 43 per cent to 46 per cent, and has now probably reached 50 per cent. It must be observed that the official standard of what constitutes seriously reduced employment is rather rigorous, allowing under that head only works which greatly curtailed working time and because of various other reasons exhibit manifest signs of distress. Only 21 per cent of all machine building works is reported to be working full time, while the remainder is placed in an intermediate category.

Decrease of Employment in Six Months

The following figures give a comprehensive idea of the decrease of employment in the machine building industry since the middle of November of last year. Starting from the 15th of November, the number of workmen unemployed increased as follows: To the 15th of December by 3 per cent, to the 15th of January by 21 per cent, 15th of February 35 per cent, 15th of March 49 per cent, 15th of April 68 per cent, and 15th of May 75 per cent. An indication of the growing difficulties is also given by the number of bankruptcies, which is increasing from month to month. The total in Germany was in April 267, and in May 284. Although the latter figure remains far behind the pre-war average, it is nearly treble the figure of the corresponding month of the previous year. The comparatively small number of bankruptcies may doubtlessly be ascribed to the fact that war gains are helping to tide over the present times, and that banks are more ready than ever to afford relief. Opinions are frequently heard that a large part of the machine building industry is already under the control of the banks, and that the private ownership of many proud firms has become merely nominal. The frequent transformation of such firms into joint stock companies, as the form of organization most convenient to banks, in spite of the heavy taxation to which such companies are subject, certainly gives support to such opinion. The significant fact that the industrial joint stock companies of the country alone required no less than 10,300,000,000 marks new capital in the first six months of the current year may serve as an indication of what enormous capital the whole German industry is absorbing. As such requirements evidently surpass the financial strength of private individuals, they can be satisfied only by the large money institutions of the country.

Influence of the Banks

Certain peculiar facts which are noticeable in the industry deserve mention in this connection. It can often be observed that works are losing old customers without any visible cause, and in spite of satisfactory quotations. The explanation is that firms dependent on a certain banking institution are directed to fill their demands among themselves regardless of better prices and old established connections. It is a fact that while the public mind has been focused on a number of trusts formed among large industrial works, a grouping has in all secrecy been taking place among the smaller fry, under the leadership of the banks, which now represent the heads of as many industrial trusts. They are diversified as to their nature, and absolutely informal in structure, but they are existent all the same, a fact made manifest by the radical readjustment of business connections noticeable everywhere. As the relief afforded by a strong leaning on banks and the co-operation amongst the members of such unofficial trusts are very valuable under the present stress, banking connections are sought for very eagerly, with result that the process of absorption resulting therefrom is visibly progressing. This fact deserves considerable attention outside of the country, as it explains many of the otherwise puzzling phenomena in German industry.

One of the phenomena is the confidence reflected in private as well as public discussions of industrial affairs, not to speak of the optimistic views held at the stock exchange. The hopes for a settlement of the Upper Silesian problem, the cancellation of the sanctions, and the revival of business in consequence of the settlement of the reparations payments, have so far been disappointed, but the confidence built thereupon has remained. This is peculiar in face of the fact that conditions in Upper Silesia are far from affording any gleam of hope, and the situation in the Rhineland is steadily growing worse. The Upper Silesian works are either still shut down, or if they are kept open it is only to provide employment. Products have to be stocked, business being absolutely at a standstill. Although coal mining is in progress to the extent of about 50 per cent of the previous average, many works have no coal on account of the complete stoppage of transportation. Even after the settlement of the Upper Silesian question it will take months before industry there will again come into swing, especially if, as must be expected, the industrial district is split up between Germany and Poland.

Conditions in the Rhineland Worse

The conditions in the Rhineland are also going from bad to worse because the procedure of making every single shipment across the Rhine barrier subject to license is acting as a severe check. As an illustration of the difficulties encountered both by the population and the commission for the control of traffic, it may be mentioned that from 80 to 100,000 applications for such licenses are received daily by the commission. Its personnel being inadequate to handle such volume of business, licenses are obtained only after considerable delay. This alone is sufficient to turn away business from the occupied territory, especially orders for quick delivery and urgent repair work. Moreover the cost of living in the big towns of the occupied territory has risen considerably. Wages in these towns are now as much as 15 per cent higher than in the adjoining unoccupied districts. It is stated on reliable authority that in May the total value of shipments of the machine building industry in the occupied Rhineland dropped by 30 to 40 per cent below that of April, which had been reported to be one of the worst months experienced. Finished goods are most affected by these conditions, raw and semi-finished products being only slightly less so. As a consequence, curtailment of working time is taking place in nearly all work. In the Düsseldorf district, working hours in April were cut down by 150,000 and in May by 200,000.

Industry in the interior of Germany is, of course, profiting by the crippled state of Upper Silesian industry and by the handicaps placed upon the Rhenish industry, and such improvement on the home market as is noticeable is probably due to these causes. On the other hand, the pressure which is weighing on the export market is still acting with undiminished force, which is perhaps the strongest disappointment the industry has experienced. The uncertainty with regard to the 26 per cent levy on export still prevails. The announcement that the Government is prepared to reimburse exporters was later interpreted as applying to Great Britain only, while a settlement of this important question with regard to the other Entente countries is still in suspense. The consequence is that business with Great Britain only is exhibiting signs of revival. A slight improvement is noticeable with regard to the Scandinavian countries, mainly Sweden, but it can be observed that European countries, especially the immediate neighbors of Germany, exhibit great reserve in buying.

Situation in the Machinery Industry

In the various branches of the machine building industry the situation is briefly the following: The best employed lines are those works manufacturing railroad materials, especially locomotives and railroad cars. But as has already been mentioned, business in these lines has lost some of its former briskness. The locomotive shops have a considerable number of foreign orders on hand, mostly for Spain and South America, and in a lesser degree for Russia. They have, however, been disappointed with regard to home orders, which have lately been issued for the requirements of the current year. They call for only 750 engines. As the large works like Borsig and Henschel alone are capable of turning out 40 to 50 engines per month, and the number of engines ordered by the German state railroads had to be distributed over some twenty factories, the domestic requirements are entirely insufficient to keep the locomotive industry in bread and butter. It can, therefore, be expected that this industry will soon appear as a keen competitor on foreign markets. The same may be said of the railroad car industry, which up to now has been fully employed, mostly on home orders. While the works in the north of Germany are reported to have sufficient work on hand, those in south and central Germany are raising complaints of insufficient employment.

The electrical industry, which in the low tension current departments enjoyed brisk business, is now also affected by the depression. An exception is apparent in the case of small motors, large numbers of which have been ordered by farmers and the makers of farming machinery. The demand for larger outfits has appreciably diminished.

Automobile and Other Industries

The automobile industry, which had hoped to profit by further depreciation of German currency, seems balked in its expectations. Austrian works, like the Austrian Daimler Company and the Austrian Arms and Ammunition Company (the latter manufacturing a good car built on American lines) have received large foreign orders, especially from Great Britain. But foreign buyers seem to have avoided German industry and only the foremost makes have orders on hand for several months ahead. The majority of the approximately sixty German automobile works have dropped into what is practically a hand to mouth existence.

In all other branches, including agricultural machinery and machine tools, business can be said to be still on the down grade. So far as single works enjoy good employment, it can be observed that this is due to their manufacturing types of special construction, or of such high quality as to lift them out of the general run. In fact, the 21 per cent of workers reported to be fairly well employed is in that class of factories. The present conditions and the gloomy outlook for the near future are clearly demonstrated by the business situation of the machine tool industry, which generally serves as an indicator of good or bad weather.

The slight revival of business mentioned in the last Berlin report in these columns was of no long duration. It was followed by a further decline. Even inquiries, which previously had maintained at least a certain semblance of business and a hope for better times, have diminished. The only demand noticeable is for specialties. The market for standard machines is declared to be absolutely dead. In certain classes of this industry the depression is taking proportions which are indeed serious. Your correspondent has met manufacturers who declare that they have not turned out a single tool in months. Most affected by the slump is the Chemnitz district, the home of the standard machine tool. With the exception of the works of Reineker, Pfauter, and the like, which are making special tools of high repuation, the works in the district seem to be in a state of neither being able to live nor die.

As a consequence of such conditions the demoralization with regard to price conventions and co-operation of industrial associations, already mentioned in previous reports, is progressing further. An unbroken front with regard to export business is still preserved in a number of branches. This is due to the influence of the industrial associations. The single manufacturer urgently desires decontrol of exports, in order to find an outlet for his product. The immediate result of decontrol would, of course, be a severe cutting of prices, as is proved by the case of lines which have lately been freed from export control. That price cutting has so far not taken larger dimensions because export prices have already been reduced to a very small margin above **domestic prices**, a margin which in most cases represents nothing more than the export tax levied by the German government. Foreign buyers in Germany can now have machines on quick delivery, at a price leaving the manufacturer a very small profit only, and at one of the most favorable rates of exchange in experience. That even such circumstances fail to elicit business in foreign markets, as is the case now, is considered one of the most disquieting features of the present day situation.

Germany Hopes to Sell France Reconstruction Material

Much is hoped, therefore, from the negotiations in progress between Germany and France with regard to the supply of reconstruction material. It will be remembered that Germany some time ago made France offers for such supply, totaling about 11 billion paper marks, or 800,000,000 gold marks. The allied countries have availed themselves of these offers to a very small extent. The orders which have actually materialized therefrom are rather small. The agricultural machinery industry and the locomobile works, for instance, received orders for 110 million gold marks. Only 12.6 million marks worth of machine tools, electrical machinery and small tools was ordered. Of these orders, only 128,000 marks worth has been shipped. Makers of railroad materials received orders amounting to 19,000,000 marks. These orders were placed through the government offices. By far larger quantities have, however, been ordered in direct communication between purchaser and maker.

The sanctions, with the uncertainty they created with regard to the export tax, have put a stop to this business. For this reason the outcome of the negotiations between the German reparations minister **Rathenau**, who it will be remembered is also the president of the AEG (General Electric Company) and his French colleague, is awaited with keen anxiety. Rathenau's chief endeavor is, of course, to change the reparations from payments in specie to payments in products. If, as seems quite likely at present, he will succeed in carrying his point that such supply is the only way for Germany to honestly carry out her reparation duties, a large amount of business will be forthcoming which will benefit all branches of industry. It is probably very fortunate that Germany has found in Rathenau a man keenly alive to the practical side of the problem. As past experience shows, the purchaser will not be denied direct contact with the dealer, and will go a long way to avoid official intermediaries. The problem for Germany to export goods instead of money can therefore not be regarded as solved, even if government heads agree, unless a satisfactory sort of clearing house is established, which probably presents the knottiest part of the whole question. If this task is delegated to German organizers recruited from officialdom, they may be trusted to erect a strong barrier between want and supply, which will frustrate the best intentions of the governments concerned and also the hopes of the industry built upon them.

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The German Labor and Wage Situation

The industries of Germany, from all accounts are in better condition than those of any other country in Europe, although there is a tendency in all other countries to overstate the situation and the advantage of Germany's low exchange rate. All of the industries are not prosperous and reports the works are running ten and twelve hours per day are incorrect. More than eight hours' work per day is forbidden by law, one of the reasons for it being to assure a distribution of work to all, which would not be an argument if there was plenty of work.

A well-informed writer in a recent number of the London *Economist* discusses at some length the labor situation in Germany and the tendency of wages. He throws light upon a subject very generally misunderstood. He says, in part:

"The underlying assumption that throughout a long term of years German cheapness, which is a vagary of the incalculable foreign exchanges, will prevail, is not justified by observation, any more than it is by economic theory. German gold prices, as I showed last week, have been overtaking the higher gold prices of the gold exchange countries. German nominal prices (commodities) are today almost exactly the same as they were in February, 1920, when the dollar exchange touched 104 marks; the dollar is today 69; and in the meantime the gold prices of the United States have fallen to about half their maximum. The belief that the German workman works for long hours is mistaken. He works for eight hours, in coal mines for seven hours; if a bill already submitted is passed he will work in all mines for seven hours, and last year in the Ruhr mines a general strike was threatened in favor of six hours. The assumption that German workmen work, and will work, for extremely low wages is based on confusion between nominal wages, gold wages, and real wages. German gold wages are very low. The German real wage, the only wage that comes into account in considering working-class "content," and "apparent acquiescence," is not low. It is considerably higher than before the war. The cost of living index (Statistical Bureau's) is 880; the Wages Index (Frankfurter *Zeitung's*) is 1,132; in other words, real wages are 30 per cent higher than before the war. Further, German workmen show the same persistency as British or American workmen in pushing up or keeping up wages. Between January, 1920, and April, 1921, the cost of living in Germany rose 50 per cent, whereas nominal wages, always as the result of agitation, rose 120 per cent, so that the present movement is altogether for a higher real wage. Naturally, in foreign trade competition it is not real wages, or nominal wages, but gold wages that count. But the German nominal cost of living is kept at its present level only by price-restriction and food-subsidizing. This is no permanent system; a great part of it has been abolished, and the rest is to be abolished; and should the cost of living in consequence rise there is no doubt that workmen will demand higher wages, as they did when cost of living was rising in 1920; and this, given a stable exchange, will mean a rise in gold wages. A new vagary of the exchanges (and the mark exchange in three months of 1920 rose 200 per cent) may upset all these calculations, so that calculations for 40 years ahead based on a present exchange level are not convincing. In fact, it is not easy to see how the reparations payments can be made unless the German workman does consent to work long hours for low wages; the difficulty is that German workmen show no consciousness of the necessity. The practicability of the plan to compel Germany to pay in certain kinds of goods which do not compete with British industry is doubtful. The coal output of Germany cannot be rapidly increased; for two years the attempts made have for labor and technical reasons, failed; potash is not being bought by America, the chief former customer, because it is already too dear, and France, the chief reparations claimant, is herself exporting potash; and the sugar abundance which Mr. McKenna points to does not exist.

The finances of the German Government are still in bad shape, with the volume of currency increasing, but too much emphasis should not be placed upon this. There is reason to believe that the situation is not so far out of hand as may appear, and that by doing away with food subsidies, placing the railroads on a self-supporting basis and other reforms the siuation may be rapidly improved.

The crops in Germany this year are very good, which will permit a reduction in food importations.—*Nat. City Bank (N. Y.)*

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The Economic Situation in Russia

The following is a summary of the economic situation in Russia, compiled by the Department of Commerce from various reliable sources.

The most acute famine area covers the Volga Valley from the Caspian Sea northward. The drought in this area would not be of such fatal character but for the general decadence of agriculture in reduction of surplus in other regions and in the decay of transportation, rendering most difficult the movement of such local surpluses as do still exist. Examples of reports from the drought area show the Province of Samara sowing this spring only 58 per cent of the acreage cultivated last year. In the Province of Kazan, 95,000 acres usually cultivated were not sown at all. To the west of the Volga Valley less than 50 per cent of the arable territory in the Province of Orel was sown, and in the Province of Tula, only 20 to 35 per cent of the necessary seed for sowing was available.

Overriding such local situations there has been a steady decline in agricultural production ever since the revolution owing to the lack of incentive to farmers to provide more than for their own needs. The urban population has produced little goods to offer in exchange and the currency depreciation through the increase of currency issues to over 1,000 billions of roubles has rendered their accumulation no attraction. From these causes Russia, before even last year's harvest, had declined from a state producing from six to ten million tons of food for export, to a condition where there was such an insufficient supply of food for the cities that the urban population has been reduced by about one-half.

There has been such deterioration of transportation that there is doubt as to ability to move the local surpluses that do exist in the richer grain producing provinces in Siberia and the south to those areas which normally depend upon them. The Volga region is even less accessible to transport of relief from abroad through the seaports than from Siberia. The north Russian shortage is due not so much to local famine as to general agricultural decadence and especially to breakdown in transport from the south and east. This area is nearer seaboard and can be relieved to some extent from the outside.

Railways

Out of a total of 19,106 locomotives in good condition before the war there are at present from 5,500 to 7,650 reported in working order by different authorities, or a decrease of motive power by 60 to 75 per cent. Of that number approximately 1,000 are idle owing to lack of fuel. Serviceable cars are reported at from 150,000 to 286,000, or a decrease of from 48 to 70 per cent of the pre-war number.

The roadbeds are reported in very bad condition and if large repairs are not made in the next few months, considerable sections will have to be closed to traffic. Accordig to the latest estimate at least 25,000,000 ties must be replaced and the present program calls for only 5,000,000 replacements. A considerable mileage of branch lines has been removed and used for repair material.

The fuel situation is very serious. Cessation in production of coal by 80 per cent and the deterioration of the mines has forced the railways to depend much more upon wood. Such wood must come from the forest of northern Russia and the haul is too long for supply to southern Russian railways. An effort has been made to change the locomotives on the southern railways into oil burners, but the gradual decline of oil production has limited this transformation.

Industrial Conditions

The following table shows the industrial production during the year 1920 in percentages of pre-war output:

	Per cent
Pig iron	2
Copper ore	0.6
Iron ore	2
Manganese ore	2.6
Salt	15
Rubber industry	5
Watch industry	15
Paper industry	20
Sugar industry	5
Printing	15
Production of coal	20
Cotton spindles operating	3
Woolen cloth	4

It is thus estimated that industry in general has decreased over 90 per cent.

Foreign Commerce

Under the impulse given by shipment of the former bank reserves of gold there has been some stimulation to imports. The total imports for six weeks, April 1 to May 15, are given as 60,000 tons or less than 4 per cent of pre-war averages for the same period. Exports, aside from pine logs, were reported as 1,700 tons for April or about one-twentieth of 1 per cent of the same period pre-war. Recent reports as to instructions given to foreign agents of the Russian Government indicate the practical exhaustion of gold and consequent reduction of foreign purchases.

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Trade Conditions in Shanghai

The trade of Shanghai is steadily improving, though still far from what it should be, according to a statement by Consul General E. S. Cunningham. Both financially and commercially Shanghai is much stronger than at this time last year, and "there is no wild gambling in exchange and shares to bring a calamitous aftermath later on in the year." Stocks are being reduced slowly, prices are generally in the ascendancy, and dealers are more inclined to buy than they have been for some time past; there has been an improvement in the export market, with some demand, and industrially there are many signs of genuine activity and progress.

Washington Notes

By Paul Wooton
(Washington Correspondent)

If the metal mining industry in the United States were to bring its underground mechanical equipment up to the same standard of development that has been achieved in mills, smelters and other surface equipment, it would be a long step toward overcoming the industry's present state of stagnation. This is the opinion of H. Foster Bain, the Director of the United States Bureau of Mines. He points out that an analysis of the costs in nearly any mine will show a disproportionate amount of costs in underground operations. The largest single item of cost underground is shoveling. Mechanical shoveling long since reached a high state of development. Its application to metal mines is entirely feasible, as has been demonstrated in actual practice. This is only one example of the unusual slowness on the part of metal mine operators to increase efficiency by improving their mechanical equipment. The mining industry more than any other is feeling the pinch of the shortage of unskilled labor. The immigration policy of the country has been in process of development for many years. The trend toward the exclusion of the rough labor element has been no secret. Other industries have met the situation by resorting to mechanical means of replacing common labor. If the mining industry is to operate on anything like a normal scale during the next few years it is believed that mechanical equipment must be used to a much greater extent underground than ever before has been the case.

Opposes American Valuation

The Bullard Machine Tool Co. is of the opinion that foreign valuation is preferable to any scheme for American valuation. A memorandum from that company declaring its opposition to American valuation has been filed with the Finance Committee of the Senate.

The tariff bill passed by the House contains full provision for the valuation of all imports at the prevailing prices in the United States. It is known that the Senate committee is almost equally divided on the American valuation proposal. A decision in the matter is to be made by the Commission, however, before opening hearings on other provisions of the House bill.

Artillery Carriages

The Chief of Ordnance has authorized the publication of the following:

Under the auspices of the Army ordnance department, there have just been completed by the Holt Manufacturing Company at Stockton, Calif., two new types of self-propelled gun carriages of the caterpillar design. One of them mounts interchangeably either the 75 m. m. gun or 105 m. m. howitzer of the models of 1920, and the other and larger type mounts interchangeably either the 155 m. m. gun or 8-inch howitzer of the models of 1920. Two of each type of carriage have been produced, and they are en route to Aberdeen Proving Ground, Md., for final proof firings and maneuvering tests. The smaller carriage for the 75 m. m. gun and 105 m. m. howitzer has a total weight of 13,000 pounds and a maximum speed of 30 miles an hour. This is the highest speed yet obtained by a caterpillar vehicle. It is driven by a 75 horsepower 8-cylinder engine. The larger carriage for the 155 m. m. gun and 8-inch howitzer weighs about 22 tons with the piece mounted thereon. It will have a maximum speed of 15 miles an hour on good roads, and it is equipped with a 250 hp. six-cylinder engine that provides sufficient power to enable the carriage to negotiate difficult grades in cross-country work. The five-degree traverse on the carriage either side of center is supplemented by easily operated traversing cranks that permit all-around fire to be delivered. The axis of the gun is only 64 in. above ground, allowing the cannoneers while loading and laying the gun to stand on the ground and thus rendering it unnecessary to provide a raised loading platform. Outriggers on the rear of the carriage to insure stability while firing may be dropped quickly into place upon reaching the firing point.

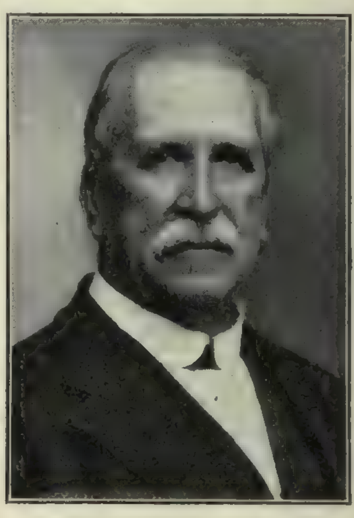
Coal Shortage Due

A serious coal shortage, similar to that of a year ago, which brought about speculation and exorbitant prices, faces the country during the coming winter, according to the Geological Survey's figures.

Coal buying seems to be for current use only, consumers apparently holding off in expectation of lower prices. The summer season is passing without the usual accumulations for winter, and warnings are becoming urgent that a coal famine may result later, particularly if there should be a revival of industry. Prices are demoralized, but still high as compared with prewar prices.—*Nat. City Bank (N. Y.)*

Death of Henry F. Colvin

Henry F. Colvin was born July 6 1838, in Plainfield, Conn., but moved at an early age to Scott, Pa., just north of Scranton. His first work was at gunsmithing, with his father, Davis Colvin, using the primitive tools and methods of that day. In 1856 he began firing a wood-burning locomotive on the Delaware, Lackawanna & Western Railroad, and became an engineer in 1859, at the age of twenty-one. During this time coal was introduced as a locomotive fuel, and he ran the old "Anthracite" much of the time during the Civil War.



HENRY F. COLVIN

The jar and the strain of twenty-four-hour service, as was common in those days, proved too much for him, and he next ran locomotives on smaller railroads having shorter runs, finally going to the Rhode Island Locomotive Works, in Providence, R. I., as a machinist. His knowledge of locomotive running and coal burning was responsible for his soon leaving the shop to go out on the road to erect new locomotives and to see that they performed satisfactorily in service. In this way he became well acquainted with railroading conditions in various parts of the country and made many lasting friendships.

Leaving locomotive work in about 1876, he became identified with the Rue Manufacturing Company of Philadelphia, Pa., makers of the Rue injectors. After traveling for this concern for about two years he moved to Philadelphia in 1878, and finally became general manager of the company, holding this position until his retirement from active business about twelve years ago. While there he patented several improvements in injectors and steam jet apparatus.

Soon after going to Philadelphia he joined the Franklin Institute, and was an active member until his death. He was a member of the Committee of Science and the Arts for twenty-nine years. Being a keen observer of mechanical details and possessing a remarkable memory, he became an authority on locomotive history and development, and was consulted by many in this connection.

Always deeply interested in locomotives and railroading, he followed the design of compounds very closely, and patented both the two-cylinder cross-compound and the tandem-compound built by the Pittsburgh Locomotive Works.

Among his intimate associates were M. N. Forney, John A. Hill, Angus Sinclair, D. A. Wightman, J. Snowden Bell and many others well known in mechanical circles, and his advice and experience were much sought by authors and others. This was always freely given, his great desire being to see that history of this sort was correctly written. His recollection of details was almost uncanny in its accuracy, as was frequently proved to the discomfort of those who thought differently, and his co-operation and helpful suggestions will be missed in many quarters.

He leaves a widow and a son by a former marriage, Fred H. Colvin, editor of the *American Machinist*.

Improvement in Employment Situation

In analyzing the employment situation during July, the United States Employment Service reports improvement in the vehicle industry, in railroad repair shops, in the leather industry, in textiles, in lumber manufacture, tobacco manufacture, and in the paper and printing industries, with the broad conclusion that indications everywhere point to the certainty of an approaching business revival.

Positive Lock-Bolt Co. Acquires Safety Nut & Bolt Co.

The Positive Lock-Bolt Co., Cleveland, organized with a capitalization of $250,000, has acquired the plant and assets of the Safety Nut & Bolt Co., at 6528 Carnegie Avenue, Cleveland. W. H. Burke, general manager of the new company, says that the factory will be completed and equipped within the next 90 days to manufacture the lock bolt and other specialties. Officers of the company are: President, C. C. Murphy; vice president, J. N. Leatherman; secretary, M. D. Neff; treasurer, Edna B. Craft; directors, H. J. Jollay and W. F. Koehm.

New President and Officers of the W. A. Jones Foundry & Machine Co.

A meeting was held July 29, at the Chicago offices of this company to elect a new president to succeed Mr. W. A. Jones, who died recently. Mr. T. A. Jones was appointed and the following officers were also elected: W. G. Jones, Vice President and Treasurer; J. A. Sizer, Secretary; G. W. Page, Assistant Secretary.

The general policy of the company is in no way altered by these changes, and Mr. W. G. Jones continues as general manager, in addition to holding his new position as vice president and treasurer.

Mr. T. A. Jones, the new president, has been associated with the company for many years as its secretary and treasurer.

Obituary

Ludwig Held, 81 years old, who has been connected with the Sinker-Davis Company, Indianapolis, manufacturers of machine tools for 31 years, died recently at his home.

Edward W. Clark, president of the Clark-Turner Piston Company of Los Angeles, Calif., died at his home in that city on July 30th. He was born in Rochester, Minn., in 1861. Before going west 21 years ago he was a mechanical and constructing engineer. The company which bears his name specializes in small pistons and has established a market in many parts of the world. Mr. Clark is survived by his wife, two daughters and three sons.

Julius H. Preston, a director of the Textile-Finishing Machinery Co., Providence, R. I., died unexpectedly at his home in that city July 19, aged 54 years. He was one of the founders of the United Lace & Braid Co., Auburn, R. I., and was also president of the Anchor Oil Co., Bakersfield, Cal.

William R. Whyte, superintendent of the Hartford Tube Products Co., Hartford, Conn., died at his home in that city July 16, aged 44 years. He was a native of London and had lived in Hartford for 20 years.

William P. Siebert, Jr., son of W. P. Siebert, of the Carnegie Steel Co., died at Roswell, N. M., July 29. At the time of his death, Mr. Siebert was eastern sales manager of the Weirton Steel Co., Weirton, W. Va., with offices at 30 Church Street, New York, and before locating in New York had been with the same company at its Clarksburg and Weirton plants.

Jonathan E. Porter, founder of the Porter Machine Works, Hatfield, Mass., and inventor of the well-known Porter lathe, died at his summer home in Crescent Beach, Conn., July 21, aged 72 years. A native of Hatfield, his first business venture was with the Prescott Piston Co., with which he remained for seven years. He then bought the foundry of H. Porter, which was burned, and in 1884 he built a factory for the building of lathes, which has grown to the present size of the Porter Machine Works.

Business Items

The Seaboard Iron & Steel Co., with offices at Baltimore, Ohio, has let contracts for a number of work buildings.

The Société Anonyme des Usines Giulini, Basel, Switzerland, manufacturer of Virgin aluminum ingots, notched bars, bar plates, and sheets, has appointed C. W. Leavitt & Co., New York, N. Y., its sole selling agents for the United States and Canada.

The Illinois Car & Equipment Co., Hammond, Ind., reopened Aug. 1 with employment for about 8,000 men. The concern has a large order for railroad repair work in the East.

The Westinghouse Electric and Manufacturing Company has received through a foreign subsidiary an order for $1,200,000 worth of apparatus for the Midi Railway of France, a large portion of which will be made at the plant at Worthessington, Pa. The order includes transformers, condensers, arresters and other substation equipment.

Commercial Attaché Carlton Jackson reports that $250,000 worth of sugar-mill machinery has been sold to an estate in the State of Puebla, Mexico, by an American firm. Mr. Jackson states that other purchases have been made by other mills, some from England, and that there is considerable activity on the part of sugar producers in rehabilitating their plants throughout the country.

According to D. J. Mullen, superintendent of motive power, the Beech Grove shops of the Big Four R.R., located at Indianapolis, Ind., have increased the number of men employed in practically every department. The locomotive shops are being operated at 72 per cent capacity, with about 900 men on the pay roll. Wage reductions amounting to about 10 per cent have been made since July 1.

The Toho Industrial Co., exporter, importer and manufacturer, has established a sales office in the Japan-America Trust Co. Bldg. (Nichibei Shintaku Bldg.), 18 Kitamaki-Cho, Kyobashiku, Tokyo, Japan. This building is situated in the center of the business district of Tokyo. Several experienced salesmen have been added to the staff.

The Oxford Steel Products Company, Boston, Mass., has been organized and incorporated with a capital stock of $300,000 to deal in steel and iron products. The president is Clarence E. Dodge, of Boston, Mass., and Maurice T. Viall, of Cranston, R. I., is treasurer.

Officials of the Berger Division of the United States Steel Corporation, Canton, Ohio, have been informed that E. A. Watson, of Cincinnati, a salesman for their division has been elected first vice-president of the auxiliary of the Ohio Sheet Metal Contractors' Association. The auxiliary was formed by the jobbers and salesmen who attended the convention last week.

Announcement was made last week of the opening of the Central Welding Co.'s plant of Canton, Ohio. The new plant will be located at 1002 Twelfth St., N. E. Glen E. Wilson is president and general manager of the new firm. He was formerly a salesman with the Oxweld Acetylene Co., of Chicago, Ill.

The Oxweld Acetylene Co., of Newark, N. J., manufacture of Oxweld welding and cutting equipment, announces the removal of the offices of its foreign sales department from Newark to No. 30 East 42nd St., New York City. Separate departments for sales, engineering, advertising, shipping and accounting have been established.

It is reported that machinery manufacturers in Indianapolis are planning to take a large part in the Indianapolis Industrial Exposition, to be held October 10 to 15 at the Indiana State Fair Grounds under the auspices of the Indianapolis Chamber of Commerce. The convention of the National Purchasing Agents Association to be held the same week in Indianapolis is adding an interest to the Exposition.

The Resilient Safewheel Co., Inc., Pittsburgh, Pa., has purchased the plant of the American Axe and Tool Works, at Glassport, Pa., and will manufacture automobile wheels. Officers of the company say that they have orders for 30,000 wheels. The new factory will be fitted up as soon as possible and will be in operation before Jan. 1.

The Worcester Automatic Sprinkler Co., of Worcester, Mass., has recently been incorporated to manufacture and install sprinkler systems for industrial plants, buildings, etc. Frank P. Ryan is president, Silas H. Lord, Worcester, treasurer.

The American Tube and Stamping Co., of Bridgeport, Conn., manufacturer of hot and cold rolled steel, etc., is planning the construction of large additions to its West End plant in Bridgeport during the coming year. The plant now occupied by the Porcupine Co., boilers and structural steel manufacturer, will be taken over by the company shortly also, which will be quite an expansion in itself.

Capitalized at $300,000, the Marks Steel Supply Co., Cleveland, Ohio, recently was incorporated and has taken over the business of the Leo. H. Marks Steel Supply Co., of that city. Officers of the new company are: President and general manager, Leo H. Marks; vice-president, Mort Marks; secretary and counsel, Reuben Shapiro. These men with the following compose the board of directors: J. H. L. Janson, J. A. Markley, H. T. Bernstein and Albert Singer.

After having been in partnership for 45 years, Ashland's (Ohio) largest industry, the pump and hay tool works of F. E. Myers & Bros. has become a corporation with an authorized capital stock of $6,000,000. The president is F. E. Myers; first vice-president, Philip A. Myers; second vice-president, John C. Myers; third vice-president, Guy C. Myers; secretary and treasurer, F. B. Kelloh.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A commercial agent in England desires to secure the representation of firms for the sale of wire rope, cables, electrical fittings, machine tools, engineers' goods (not technical), and printing machines. Quotatios should be given c.i.f. London or f.o.b. New York. Reference No. 35308.

A mercantile company in Scotland desires to purchase paper-box machinery for making 8-ounce and 1-pound tea bags, lined and unlined. Quotations should be given f.o.b. port of shipment. Cash to be paid. Reference No. 35309.

A firm of merchants and engineers in England desires to purchase galvanized corrugated iron in 22, 24 and 26 gage, preferably 24 gage, in 6 to 10 foot lengths, by the usual width of 2 feet 3 inches. Greater widths will be acceptable. Quotations should be given c.i.f. English ports. Payment: Cash and bank guaranties in advance. Samples will be acceptable. Reference No. 35311.

A merchant in France desires to purchase and secure an agency for the sale of all supplies for automobile construction, builders' hardware, building materials, carpenters' and locksmiths' materials, etc. Quotations should be given c.i.f. Marseilles or Lyon. Reference No. 35285.

A mercantile company in India desires to secure the representation of manufacturers for the sale of mill, gin, and railway supplies, sanitary wares, glazed and unglazed tiles for flooring, broken tiles and electrical goods. Reference No. 35286.

An importer in China desires to be placed in communication with exporters of copper and lead. No. 35287.

A company of Spanish importers established in Barcelona wishes to enter into business relations with manufacturers and exporters desiring to extend their trade to that country. Reference No. 35257.

A manufacturer in Mexico desires to purchase woodworking machinery for making hubs, spokes and complete wagon and coach wheels. Quotations should be given f.o.b. El Paso, Tex. Cash to be paid in United States currency. Catalogues and prices requested. Reference No. 35259.

A merchant in Ireland wishes to secure an agency for the sale of motor cars, motor accessories, aluminum ware and wire. Quotations should be given c.i.f. Belfast or Dublin. Reference No. 35263.

A commercial representative from South Africa, who is in the United States for a short time, desires to secure an agency for the sale of tractors and automobiles. Reference No. 35265.

A mercantile firm in Italy desires to secure an agency for the sale of automobiles and accessories, copper sulphate, agricultural machinery, tractors, surgical instruments, boots and shoes, lubricating oils and mineral oils. Reference No. 35271.

A merchant in Ireland desires to secure an agency for the sale of agricultural machinery, household aluminum ware, apiary suppies, building materials, clocks, safes, saws, stoves, lamps, sporting goods, toys, vacuum cleaners and wire. Reference No. 35272.

A mercantile firm in Ireland desires to secure an agency for the sale of electrical good, miscellaneous machinery, saws, toys, and woodworking machinery. Reference No. 35275.

A firm in Ceylon desires to have manufactured in the United States, rubber-tapping knives, like samples which will be furnished. Quotations should be given c.i.f Ceylon port. Terms: Payment to be made against documents through bank. Reference No. 35279.

A mining company in Chile desires to secure catalogues illustrating all manner of mining machinery, oil engines, pumps, rolling stock for railways and mines locomotives, electrical machinery and appliances, tools, lubricating oils, packings, wire ropes, steels and irons and explosives. These supplies are required for furnishing a railway, fleets of steamers, tugs and launches, workshops, foundries, power stations, farms, coal fields, etc. Quotations should be given c.i.f. Chilean port. Reference No. 35282.

A technical commission in Portugal desires to be placed in communication with firms in the United States engaged in undertakings such as electrification of railways and transmission of electric power; and to secure literature and catalogues from manufacturers of material and accessories pertaining thereto. No. 35284.

An advertising agency firm in South Africa desires to secure the representation of firms for the advertising of American goods in South Africa. Reference. No. 35293.

A request has been received from firms in South Africa for machinery for extracting oil from peanuts and cotton seed, as these products are available there in large quantities. Manufacturers of such machinery should forward catalogues, photographs, blue prints, and prices. No. 35295.

A commercial agent in Ireland desires to secure the representation of firms for the sale of any good selling articles of the hardware trade, ironmongery, etc. Quotations should be given c.i.f. Irish port. Reference. No. 35296.

A commission agent in the Netherlands desires to secure an agency for the sale of small tools, and accessories for motor cycles and motor cars. Quotations should be given c.i.f. Rotterdam. Payment to be made upon receipt of goods. Samples and catalogues are requested. References. No. 35300.

An importer in Victoria, Australia, desires to purchase advertising novelties and specialties. Quotations should be given c.i.f. Australian port. Payment to be made against documents. No. 35303.

Blue Prints on Axles for Railway Cars in Spain Received

Commercial Attaché Charles H. Cunningham, of Madrid, has transmitted blue prints for mounted axles desired by a combination of Spanish manufacturers. This material is on file in the Bureau's district office at 734 Customhouse, New York, N. Y.

Forthcoming Meetings

The third annual convention and exhibition of the American Society for Steel Treating will be held in the Manufacturers Building, State Fair Grounds, Indianapolis, Ind., during the week of September 19 to 24 inclusive.

The annual congress of the National Safety Council will be held at Boston, Mass., during the week of September 26. C. W. Price, 168 North Michigan Ave., Chicago, Ill., is general manager.

A joint meeting of the American Society of Mechanical Engineers, the Society of Automotive Engineers and the Army Ordnance Association will be held at Aberdeen, Md., Friday, October 7.

The National Machine Tool Builders' Association will hold its fall meeting at the Hotel Astor, New York City, October 18, 19 and 20.

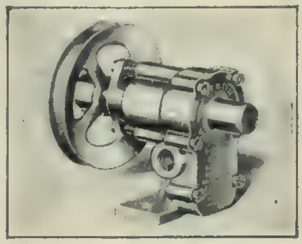
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Pump, Coolant, Universal

Alemite Die Casting and Mfg. Co., 2640 Belmont Ave., Chicago, Ill.

"American Machinist," May 19, 1921.

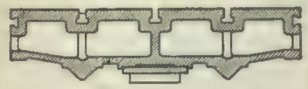


The pumps are made in five sizes with a range of capacity from ½ to 10 gallons per minute, when run at their rated speed of 300 r.p.m. They are adapted to the handling of different sorts of coolants, oils and heavy fluids. The parts are made chiefly of die castings of a hard metal having a high tensile strength. The drive shaft can be extended to receive any desired type of power transmission. There are only four-moving parts, the crankhead, rotor, oscillator, and the extension. The rotor is constantly kept in contact with the casing by means of a spring placed between the shaft and crankhead, which construction allows for the passage of any foreign substance through the pump.

Planer, Table, Box-Form

G. A. Gray Co., Cincinnati, Ohio.

"American Machinist," May 19, 1921.



The illustration shows the box type of construction used for the tables of the planers recently made by the concern. The objects which this design seeks to attain include ease in cleaning, freedom of the V's from chips and dirt, and a great degree of rigidity. In order to further stiffen the table, the top and bottom surfaces are tied together by a heavy, uninterrupted vertical wall of metal running the entire length of the table on its center line. On each side, posts of metal serve the same purpose. Heavy transverse walls at two-foot intervals provide against arching under the strains imposed by the clamps and stop-pins. The stop-pin holes pass entirely through the table top. The cleaning is done from the side. Wide and deep chip pockets are provided at the ends of the table, to safeguard V's and the gearing against chips.

Gage, Combination Square and Bevel

Scalbom Manufacturing Co., 11 S. Desplaines St., Chicago, Ill.

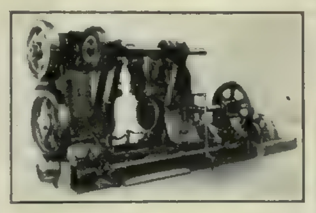
"American Machinist," Apr. 21, 1921.

This combination die square and bevel gage is intended for use in laying out tapers and angles on dies and similar work, the body of the tool being held while the blade is swiveled to the desired angle. A locknut is provided for clamping the blade in position. The tool is of steel throughout, hardened and ground, and the blades are furnished in a variety of thicknesses.

Seaming Machine, Double, Horizontal, Duplex

Niagara Machine and Tool Works, Buffalo, N. Y.

"American Machinist," May 26, 1921.



The machine is intended for double-seaming simultaneously both ends of sheet-steel barrels or drums. It is capable of seaming barrels from 18 to 36 in. in diameter, from 20 to 45 in. in height and made of No. 12 gage or lighter steel. It is handled by only one man. The right-hand column slides horizontally on the bed and is moved by a hydraulic cylinder. The pressure of the hydraulic cylinder clamps the barrel between the two chucks and forces the heads into their proper position. The curling rolls curl the seams and the flattening rolls finish them. Only about forty revolutions of the barrel are required to complete the seams. Twenty-five horsepower is required to operate the machine. The machine is 93 in. high, 62 in. from front to back and 211 in. from right to left. Equipped with one set of rolls it weighs approximately 21,000 lb.

Cutter, Milling, Helical, Savy

A. Savy, Jeanjean & Co., Courbevoie, near Paris, France.

"American Machinist," May 19, 1921.

The mill can be furnished in various sizes and numbers of teeth. The helix angle is 30 deg. The wide-spaced teeth are undercut, and have a rake of 10 deg. To sharpen, they are ground on the front faces only. Besides the high metal-removing capacity of the cutters, the following advantages are claimed for the tool: First, the 30-deg. helix angle eliminates the chatter, particularly with a deep cut; second, no chip breakers are required; third, the tooth is very much stronger than in a standard cutter; and fourth, the sharpening of the cutter does not decrease the chip space, but on the contrary it increases it.

Platform, Lift-Truck, Steel-Bound

Steubing Truck Co., 141 Fourth St., East Cincinnati, Ohio.

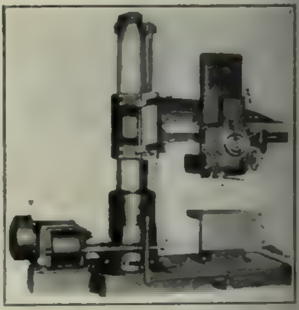
"American Machinist," Apr. 14, 1921.

This portable platform is made of oak bound with angle steel, and supported by steel legs which are made with broad bearing surfaces, so as to decrease the possibility of injuring floors. The bolts and nuts with which the platform is assembled bear on steel plates so as to save wear on the wood. The platform is made in sizes and can be furnished in box type, sectional bin type, stake type, table type, or other designs. The platform is said to possess strength and convenience of operation and to be adaptable to all type of lift-truck work.

Drilling Machine, Radial, Ball-Bearing, Heavy-Duty

Carlton Machine Tool Co., Cincinnati, Ohio.

"American Machinist," May 26, 1921.

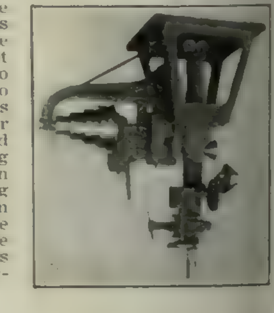


The machine is intended for general work, and is built in three sizes, having 4, 5 and 6 ft. arms, respectively. All running parts are mounted on ball bearings for both radial and thrust. An extension on the rear of the base serves for mounting either a variable-speed motor or a speed-change gear box and constant-speed motor. However, either type of motor can be mounted on an extension of the arm on the opposite side of the column from the head. The hollow cylindrical column is hung from the top on a ball thrust bearing, and a roller bearing is used at the bottom, so that the arm can be very easily swung. All gears are completely inclosed. The spindle head is said to be balanced on the ways of the arm.

Drilling Machine, Suspended

Reed-Prentice Co., 53 Franklin St., Boston, Mass.

"American Machinist," May 26, 1921.



The machine is suspended from the ceiling and fastened thereto by screws or bolts. There is nothing on the machine to interfere with work that may be brought under it. Owing to the construction of the frame, no trussrods are needed. The spindle is counterbalanced, has hand and power feed, a quick-return movement, and three changes of feed. The operating mechanism resembles that found on the usual type of upright drilling machine. The work can be held in any manner desired, because of the absence of the machine table. The machine is capable of drilling holes up to 2 in. in diameter. A countershaft is furnished.

Clip, paste on 3 x 5-in. cards and file as desired

Personals

Adrien Lambercier of J. Lambercier & Co., Geneva, Switzerland, agents in Switzerland for American machine-tool builders, has recently arrived in New York. While in America he will make his headquarters at the *American Machinist* offices.

Frank Miller has been re-elected president of the Burch Plow Works, Crestline, Ohio, J. L. Morrow, secretary and general manager and Miss Edna Volk, treasurer.

W. N. Roach, formerly engaged in patent work for the War Department, has left that service to start a private patent practice in Washington. Mr. Roach has been with the War Department since August, 1918.

Ralph C. Schwartz has taken over the Northwestern New York territory for the distribution and sale of Stewart industrial furnaces and appliances. Mr. Schwarz will be located at 921 Granite Building, Rochester, New York.

Hugo Diemer has been appointed director of the new Industrial Management Division of La Salle Extension University. This division will comprise industrial management efficiency, modern foremanship and production methods, and personnel management.

Adolph F. Soben, until recently assistant chief engineer for The American Machine & Mfg. Co., Atlanta, Ga., has opened offices in Los Angeles as consulting engineer and designer of special and automatic machinery.

C. Whitey Crosby has resigned as production engineer for the Automatic Signal Co., St. Paul, Minn., and has become associated with the Chas. L. Pillsbury Co., consulting engineers, of Minneapolis, Minn.

George McQuilkin, proprietor of the Enterprise Machine Works, Elkton, Md., will discontinue business owing to poor health.

E. C. Welborn, formerly with the Illinois Steel Co., first in structural shop work and engineering and from 1914 to 1919 as assistant manager of credits and collections and in charge of business and financial investigations and reports, has opened offices at 29 South LaSalle Street, Chicago, as a business and engineering counsel.

William H. Savage, Fitchburg, Mass., dealer in machine tools, has purchased the assets of the Powell Machine Co., Worcester, Mass., builders of planers, appraised at $247,000, and will sell them at private liquidation sale in lots to suit the purchasers.

Frank S. Spencer, 1265 Boylston Street, Boston, has been appointed representative in the New England district for the sale of variable section rolled products made by the Witherow Steel Co., Pittsburgh.

Alexander H. Holliday, manager of exports of the Jones & Laughlin Steel Co., Pittsburgh, with W. W. Ewing, a special representative of that company, have just returned from a business and sight-seeing tour in Mexico. They attended the first international trade congress held in Mexico City, June 20-26, at which Mr. Holliday was a special delegate of the United States Chamber of Commerce. While issuing no formal statement at this time, he looks upon Mexico as a fruitful field for the American steel industry.

Major Dwight K. Shurtleff, U. S. Army, has been decorated by King Albert of Belgium in appreciation of his services in obtaining machine tools for rebuilding Belgian factories.

Stewart C. Wilson has been appointed Pittsburgh district sales manager of the Whiting Corp., Chicago, succeeding Robert S. Hammond, transferred to the Chicago office.

Robert Wilson has resigned as superintendent of the Fabricated Steel Products Co., Leetonia, Ohio, and now is connected with the Adams Mfg. Co., East Palestine, Ohio.

Aldus C. Higgins, treasurer and general counsel of the Norton Co., Worcester, Mass., sailed from New York, July 30, for a three months' tour of Europe.

Samuel H. Vauclain, president of the Baldwin Locomotive Works, Philadelphia, left last week for Mexico City, where he will confer with President Obregon and other officials of the Mexican government on the railroad situation there.

Lawrence Johnson, factory engineer of the Collins Co., Collinsville, Conn., edge tools for 19 years, and now associated with Perin & Marshall, New York, consulting engineers, will leave for India next month where he will assume the position of works manager at the Jamshedpur plant of the Agricultural Implements Co., Ltd., Bombay.

George E. Harris, general manager of sales of the Falcon Steel Co., Niles, Ohio, has resigned to engage in the steel business in Detroit. Mr. Harris has been connected with the steel business, in both operating and commercial ways, for about 30 years. His successor has not yet been announced.

R. D. Love, former sales manager and buyer for the Betz-Pierce Co., Cleveland, Ohio, and more recently with the sales department of the United Alloy Steel Corp., Canton, Ohio, has been made manager of sales for the Warren Iron and Steel Co., Warren, Ohio.

J. Arthur Deakin, with office at 150 Nassau St., New York City, has been appointed sales representative for Greater New York for the Louisville Electric Manufacturing Co., Louisville, Ky., manufacturer of the Pioneer portable electric tools, including drilling machines, hand grinding machines, electric screw drivers and valve grinders.

Carl S. Neumann, assistant secretary of the Union Mfg. Co., New Britain, Conn., who has been on a European trip for about three months combining business with pleasure, will sail for home from Southampton, Eng., Aug. 3.

New Publications

The Federal Administration and the Alien. (A supplement to "Immigration and The Future"), by Frances Keller. Eighty 5¼ x 8-in. pages. Published by the George H. Doran Co., New York.

With the European countries in a more or less chaotic state in-so-far as industrial and living conditions are concerned, and with the United States richer than it ever has been, the rush of immigrants to our shores has developed a problem of such magnitude that Congress has already taken steps to limit and otherwise regulate the mad scramble. In "The Federal Administration and the Alien," Miss Keller presents the different angles of this problem, explaining the state of the present facilities for handling the immigrants and uncovering the weak spots in our present immigration policy.

The immigrant's side of the story is also presented, with what the immigrant's impressions must necessarily be as a result of being buffeted about through the confliction of state and federal efforts at regulation, and the obvious results of such impressions. The events of the past few years have impressed upon even the most casual observer the necessity of scientific regulation of immigration, and this volume will be interesting to those who are following the Government's efforts along this line.

Discussion of the National Electrical Safety Code. Handbook No. 4. Published by the Bureau of Standards, Dept. of Commerce, Washington, D. C. Three hundred and thirty 5 x 7½ in. pages, 38 line drawings, 2 tables.

This book contains a discussion of the rules of the National Electrical Safety Code as published in Handbook No. 3, including many items and suggestions which are not involved in the rules themselves, but which have bearing upon good practice and matters intimately related to the subject of rules. The rules discussed are those covering methods of protective grounding of circuits, equipment and lightening arresters for stations, lines and utilization equipment; rules for the installation and maintenance of electrical supply stations and equipment; rules for the installation and maintenance of overhead and underground electrical supply and signal lines; rules for the installation and maintenance of electrical utilization equipment, rules to be observed in the operation of electrical equipments and lines; rules for the employer, rules for the employee; and rules for commercial telephone and telegraph systems.

This publication is now ready for distribution and copies may be obtained by addressing the Bureau.

Technologic Paper No. 192 (Tests of Centrifugally Cast Steel). Bureau of Standards, Department of Commerce, Washington, D. C.

The production of metal castings by the centrifugal process may be said to have passed the experimental stage; at least in the case of certain non-ferrous metals and cast-iron shapes. However, very little appears to have been published concerning centrifugally cast steel. This paper shows the results of a detailed examination, made by the bureau, of six centrifugally-cast castings which were made by the Millspaugh process. This record of the results, which includes a comparison of the metal with that of the ordinary casting, is interesting. It is stated that the castings were sound and free from chemical segregation, and that with subsequent heat-treatment the metal in the castings would compare favorably with metal that has been forged.

A copy of this paper may be had from the Superintendent of Documents, Washington, D. C., at ten cents per copy.

Cam Design and Manufacture. By F. B. Jacobs. Cloth board covers, 118, 6 x 9-in. pages, 89 illustrations. Published by D. Van Nostrand & Co., 8 Warren St., New York.

In this book the author lays particular stress on the fact that cams, unless properly designed, will be noisy in action, especially when run at high speed. The reasons for this are thoroughly explained by the use of diagrams.

Methods of producing cams both by cutting and grinding are described and some of the machines used are illustrated. Naturally cams for automotive engines and the methods of their production are given much consideration. One of the features of the book is the total absence of mathematical formulas, diagrams being used in their place. This, to the average practical man, makes the problems treated much more easily understood.

The author is to be congratulated on having dealt with a complex subject in such a simple, yet thoroughly understandable manner.

Iron and Steel in Sweden. Edited and published under control of and in cooperation with Jernkontoret by Aktiebolaget, Svenska, Teknologforeningens Forlag, Stockholm, Sweden. One hundred eight-three 7¼ by 9½ in. pages, 79 reproductions from photographs, 9 maps and 3 tables.

This book is published for the purpose of supplying purchasers abroad with clear, easily accessible and correct information concerning the various products manufactured and exported by Swedish iron and steel works. A list of producers and products is included, which gives the names of the manufacturers who export the goods in question, with necessary information concerning postal and telegraphic addresses, codes, and export ports. The greater part of the book is given over to descriptions of Swedish iron and steel works, with illustrations of the plants and their various departments. Those who have use for a directory of this kind will find this volume both interesting and complete in the essential details. Copies may be had by addressing A. B. Svenska, Teknologforeningens Forlag, Postfack 644, Stockholm, Sweden.

Financing an Enterprise. By Hugh R. Conyngton, published by Ronald Press Co. Three volumes, cloth binding, 667 pages.

The author of this very practical work is the "Francis Cooper" who wrote the previous editions on this subject. The publishers state that the work will be interesting to those who desire to finance new enterprises as well as to bankers, lawyers and investors, and, by one who has read the books, it may be added that the work is full of value to anyone engaged in any commercial enterprise.

It is a perfectly natural thing that an author should, in the majority of cases, content himself with a discussion of how things should be done, but the writer of this review has found even more interesting those chapters which discuss the many ways in which things should not be done. There are numerous pitfalls, in the course of human affairs, which look very safe to the average man. The eternal succession of failures that have been caused by the same old troubles is the tragedy of modern business. That one should fail from time to time when testing new methods is no cause for surprise, and if the cause of their failure can be made known, they have contributed something, if nothing more than to hang out a sign "Detour," to those who would travel the same road.

Mr. Conyngton has given us all an opportunity to profit by the experience of a host of failures, brought about in almost every instance by what "anybody should know."

The book is easy to read and understand and in no sense does the author content himself with danger signs or "how not to do things." A major part of the work is just the reverse in that it shows the short cuts and the right way to accomplish one's legitimate desire. The outstanding features are how to determine if an enterprise is sound; the investigation, protection, organization, and incorporation; and the presentation, promoting and financing of the project.

THE WEEKLY PRICE GUIDE

This Week's Market

Warehouse prices in New York show little change since last week, but slightly larger orders indicate improvement. Mill shipments, New York, show no increased activity; structural shapes and plates quoted at $2.18 to $2.23, bars at $2.13. Pig iron prices down $2 to $6 per ton. The same prices on structural shapes prevail in Chicago as in New York. Electrolytic copper has dropped ¼c., copper sheets ½c., and copper bars 1c. per lb. in New York. Reductions of ¾c. per lb. on tin and ½c. per lb. on solder, are reported. Copper sheets have been reduced ½c., antimony ¾c. and babbitt metal 2c. per lb. in Cleveland.

Market for shop supplies growing firmer, reflecting no changes in warehouse prices. New York quotes long term plate at $7.25 as against $7.50; linseed oil reduced from 80c. to 78c. per gal. (5 bbl. lots).

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$23.50
Northern Basic	21.52
Southern Ohio No. 2	22.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	†30.26
BIRMINGHAM	
No. 2 Foundry	*19.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75	21.26
Virginia No. 2	†28.74
Basic	†20.26
Grey Forge	†22.26
CHICAGO	
No. 2 Foundry local	*20.00
No. 2 Foundry, Southern, sil 2.25@2.75	†26.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	21.46
Basic	19 96
Bessemer	21.96

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$2.88	$2.74	$2.88
Soft steel bars	2.78	2.64	2.70
Soft steel bar shapes	2.78	2.64	2.70
Soft steel bands	3.43	....	
Tank plates	2.88	2.74	2.88

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh (refined)	$2.50
Warehouse, New York, delivered	2.78
Warehouse, Cleveland	3.52
Warehouse, Chicago	2.78

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	3.53	3.25	3.53
No. 12	3.15	3.58	3.30	3.58
No. 14	3.20	3.63	3.35	3.63
No. 16	3.30	3.73	3.45	3.73
Black				
Nos. 17 and 21	3.75	4.05	3.80	4.45
Nos. 22 and 24	3.85	4.10	3.85	4.50
No. 25 and 26	3.90	4.15	3.90	4.55
No. 28	4.00	4.25	4.00	4.65
Galvanized				
No. 10 and 11	4.00	4.25	4.00	4.95
No. 12 to 14	4.10	4.35	4.10	5.05
Nos. 17 and 21	4.40	4.65	4.40	5.35
Nos. 22 and 24	4.55	4.80	4.55	5.50
No. 26	4.70	4.95	4.70	5.55
No. 28	5.00	5.25	5.00	5.65

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb.	$4.23	$4.23	$4.00
Flats, squares and hexagons, per 100 lb.	4.73	4.23	4.50

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	55@60%
Cleveland	55%
Chicago	50%

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 3/32, 8½c. per lb.; ⅛, 7.15; 5/32 to ¼, 6.75. Swedish iron in Chicago sells for 17½c per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel	5.00	6.50	8.25
Spring steel	8.00	6.50	10.50
Coppered Bessemer rods(base)	8.00	8.00	6.00
Hoop steel	3.88	3.29	3.48
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	4.85	3.09	5.23

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of July 7, 1921:

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
BUTT WELD					
1 to 3	64½	52	¾ to 1½	39½	24½
LAP WELD					
2	56½	44	2	34½	20½
2½ to 6	60½	48	2½ to 4	37½	24½
7 to 12	57½	44	4½ to 6	37½	24½
13 and 14	45	37	7 to 12	35½	22½
15	42½	32			
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	62½	51	1 to 1½	39½	25½
2 to 3	63½	52			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	54½	43	2	35½	22½
2½ to 4	58½	47	2½ to 4	38½	26½
4½ to 6	57½	46	4½ to 6	37½	25½
7 to 8	53½	40	7 to 8	30½	18½
9 to 12	48½	35	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	12¾@13
Tin in 5-ton lots	26.62½
Lead	4.75
Zinc	5.00
ST. LOUIS	
Lead	4.35
Zinc	4.60

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	20.00	20.75	22.50
Copper wire (carload lots)	15.50	16.50	18.50
Brass sheets	15.75	18.00	10.75
Brass pipe	18.50	22.00	22.50
Solder (half and half) (case lots)	17.75	20.25	17.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	13.75
Cleveland	16.00
Chicago	17.00

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel

Ingots and shot	41
Electrolytic	44

Monel Metal

Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold drawn rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Coid drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	[illegible]
Manganese nickel hot rolled (base) rods, "D"—low manganese	[illegible]
Manganese nickel hot rolled (base) rods "D"—high manganese	[illegible]

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots.. 10.00

	Warehouse	
	In Casks	Broken Lots
New York	11.50	12.00
Cleveland	11.15	11.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	5.25
Chicago	6.00
Cleveland	6.00

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	9.50	9.50	$9.50
Copper, heavy, and wire	9.00	9.00	8.00
Copper, light, and bottoms	7.00	7.00	7.00
Lead, heavy	3.25	3.50	3.00
Lead, tea	2.00	2.50	2.00
Brass, heavy	5.00	5.00	7.25
Brass, light	4.00	4.00	4.25
No. 1 yellow brass turnings	4.50	4.00	4.50
Zinc	2.50	2.50	2.50

ALUMINUM—The following prices f. o. b. shipping point in cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	25.00	25.00@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	18.50
Chicago	23.00
Cleveland	22.00

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	36.50	35.00
Commercial	30.00	13.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

This market is very soft, and our quotations for the present are useful only as a guide.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	2.00	$2.25	3.00
Hot pressed hexagon	2.00	2.25	3.00
Cold punched hexagon	1.50	2.25	3.00
Cold punched square	1.50	2.25	3.00

Semi-finished nuts, $\frac{9}{16}$ and smaller, sell at the following discounts from list price:

	Current
New York	75%
Chicago	50%
Cleveland	80%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	50%	60–10%	60%
1⅛ and 1¼ in. by 3 in. up to 12 in	40%	50–5%	55%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York...... $3.00 Cleveland...... $4.50 Chicago....... $4.50

For cast-iron washers, ¾ and larger, the base price per 100 lb. is as follows:

New York...... $4.25 Cleveland...... $3.75 Chicago....... $4.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	50%	60%	55%
Larger and longer up to 1 in. by 30 in.	45%	50–10%	50–5%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40–10%	10%
Chicago	net	net
New York	50–10%	25–10%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel $\frac{7}{16}$ and smaller	50–10%	60–10%	60%
Tinned	50–10%	60–10%	45%

Structural, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:

New York...$4.40 Cleveland...$3.90 Chicago....$3.68 Pittsburgh. .$2.65

Boiler, same sizes:

New York...$4.50 Cleveland...$4.00 Chicago....$3.78 Pittsburgh. .$2.75

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	19.00	24.00	25.50
Brass	18.50	22.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ½-2 in., inclusive in rounds, and ½-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$5.50 per 100 lb.; New York price is $7.25.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	7.50@10.00	8.50@11.00	14.25
Colored mixed	5.50@ 9.00	6.50@10.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.00
Chicago	2.65

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	2.75

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$2.90@$3.00
Prompt foundry	$4.00@ 4.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.78	$0.83	$0.84
5-gal. cans	.81*	.98	1.04

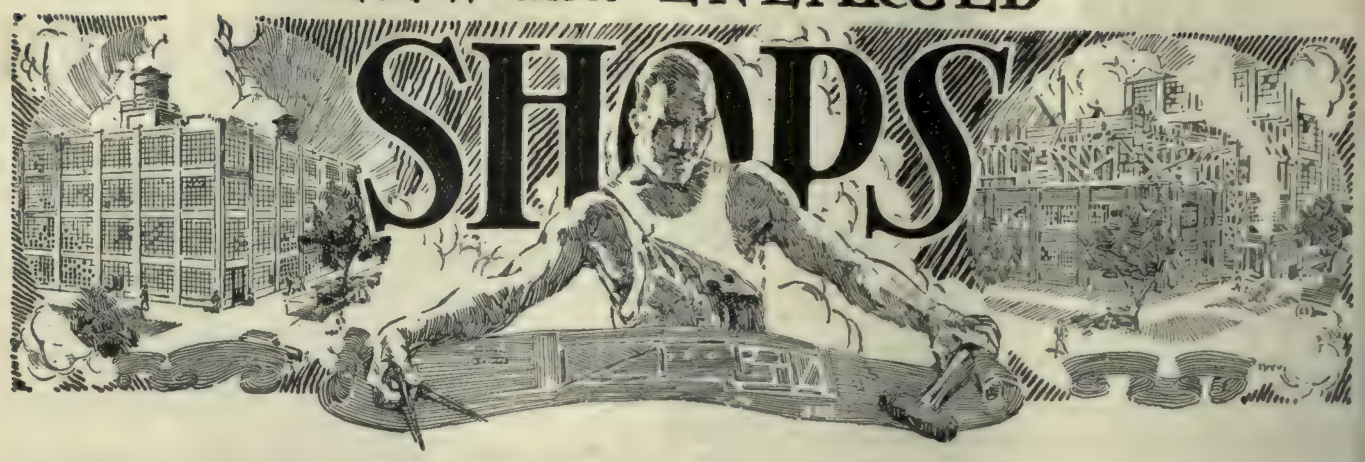
*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	12.25	13.75	12.25
25 and 50-lb. kegs	12.50	14.00	12.50
12½-lb. keg	12.75	14.25	12.75
5-lb. cans	15.25	16.75	15.25
1-lb. cans	17.25	18.75	17.25

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount. Business is good in white lead.

NEW *and* ENLARGED



Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Mass., Northampton—W. E. Quinn Co., manufacturers of saws—back geared power press

N. J., Camden—The Bd. Educ., City Hall —equipment for proposed printing shop including one 10 x 15 C. & P. job press.

N. Y., Niagara Falls—The Carborundum Co., Buffalo Ave. and 18th St.—one 20 in. back geared Buffalo drill press.

Pa., Philadelphia—A. Box & Co., Inc., 813 North Front St.—No. 7 Bardons & Oliver universal turret lathe, No. 2A Warner & Swasey universal turret lathe, No. 6 Warner & Swasey universal turret lathe.

Pa., Philadelphia—Phoenix Metal Stamping Co., 2823 West Fletcher St.—three power punch presses.

La., New Orleans — The Commercial Garage Co., 915-21 Conti St., F. M. Mills, Pres.—complete equipment for auto repair work.

Va., Bristol—Enterprise Fdry. & Machine Wks., Shelby St., C. P. Daniel, Vice Pres. and Gen. Mgr.—punch and shear, bulldozer, plate bender, wood planer, band saw, forges and forge blowers.

Va., Richmond—H. W. Staples, 600 West Marshall St.—drill press and lathe.

Va., Richmond—Wingfield & Hundley, 13 North Governor St., A. Wingfield, Purch. Agt.—medium size shaper for electric repair shop.

Ill., Chicago—Amer. Forge & Mfg. Co., 2433 West 48th St.—24 in. G. & E. shaper and hot or cold circle saw to cut 3 in. hot.

Ill., Chicago—Wilson Steel Products Co., 49th St. and Western Ave.—automatic riveting machine for riveting beaded cold rolled hoops.

Mich., Detroit — Bushnell - MacQueen - Bushnell Agency, 817 Kresge Bldg.—punch press weighing not less than 2,100 lbs., stroke not less than 3 in. (used preferred).

O., Columbus — Madden, Atkinson Auto Co., 160 South 17th St., R. P. Atkinson, Vice-Pres. and Serv. Mgr.—equipment for service station including lathe, drill press, grinders, shapers, etc.

O., Defiance—The Defiance Screw Machine Products Co.—Garvin duplex horizontal drill.

O., Mt. Gilead—Hydraulic Press Mfg. Co.—cut-off saw.

O., Toledo—The Natl. Supply Co., St. Clair and Washington Sts., manufacturer of boiler and radiation supplies—one 26 in. Barnes self oiling all geared drill with tapping attachment.

Wis., Edgerton—Highway Trailer Co., J. Menhall, Purch. Agt.—lathes and drill presses.

Wis., Milwaukee — Exceletone Phonograph Co., 860 Teutonia Ave., C. Kronis, Purch. Agt.—one 12 or 16 in. joiner, one 26 in. band saw and a 16 in. cross cut saw.

Wis., Milwaukee—Milwaukee Auto Service Co., 1520 Grand Ave.—speed lathe or small bench lathe for auto repair work.

Ark., Little Rock—Huckabee Tractor & Mfg Co., 704 South Valmar St., N. F. Wilson, Mgr.—One 14 ft. x 24 in. heavy duty engine lathe.

One 16 ft. x 32 in. heavy duty engine lathe.

One 8 ft. x 16 in. heavy duty engine lathe with taper attachment.

One No. 2 Universal cutter and grinder.

One 36 in. automatic spur gear cutter.

One 20 in. high speed crank shaper.

One 24 in. sliding head upright drill.

One No. 2 heavy Universal milling machine.

Ia., Ft. Dodge—Bd. Educ., c/o C. A. Helsell, Secy.—manual training equipment for proposed high school.

Mo., St. Louis—Fulton Iron Wks., 1259 Delaware Ave.—one 54 in. x 26½ ft. bed geared engine lathe and a 60 in. x 26 ft. geared head engine lathe.

Neb., Lincoln—The Bd. Educ., c/o J. G. Ludlam, Secy—manual training equipment for proposed high school.

Ont., Owen Sound—Deans Garage—garage and auto shop equipment.

Md., Baltimore—Co-operative Paper Box Co., 3502 Cottage Ave., B. F. Garrett, Press.—machinery for the manufacture of paper boxes.

Fla., Dade City—The Florida Cane Syrup Co., E. S. Slough, Mgr.—machinery for making syrup.

Fla., Sarasota—Sarasota Fruit Products Co., C. F. Conkling, 267 Main St., Hackensack, N. J., Purch. Agt.—machinery and equipment to manufacture fruit products, etc.

Tenn., Memphis—Stryker Kot-N-Wood Products Co., Inc., 510-12 McCall Bldg., manufacturers of building materials from cotton stalks, J. T. Stryker, Purch. Agt.—hydraulic presses, brick and tile machinery, shredding machinery to shred cotton stalks into fibers, incinerators, ovens, retorts.

Va., Portsmouth—Planters Mfg Co., Inc., manufacturers of fruit and vegetable crates, etc., W. W. Hargraves, 110 Mt. Vernon Ave., Gen. Mgr.—crate and basket stapling machines, cut-off, rip-saws, planer and veneer drier, 60 to 100 ft. long.

W. Va., Huntington—Huntington Coal & Mining Co., 601½ 9th St., J. M. Hall, Secy. and Treas.—machinery and equipment for 3 large coal operations.

O., Cleveland—Hart Mfg. Co., 2319 East 20th St., manufacturers of adjustable threading tools—machine for drilling ⅝ in. hole and larger.

O., Columbus—The Columbus Show Case Co., 423 North Grant Ave., W. F. Aschinger, Gen. Mgr.—saws and other wood-working machinery.

Wis., Appleton—Traas Candy Co.—machinery for making candy.

Wis., Madison—Capital City Pattern Co., 613 Williams St., W. J. Gregersen, Purch. Agt.—wood working machinery.

Wis., Milwaukee—The Best Block Co., 1228 Humboldt Ave.—cement block machinery.

Wis., Random Lake—Random Lake Co-op. Assn., L. L. Pierron, Pres.—cold storage retrigerating machinery.

Wis., Sheboygan—W. H. Gunther, 902 North 8th St.—ice machine.

Wis., Sheboygan—The Wald Mfg. Co., 18th St. and Martin Ave., manufacturers of bicycle and motorcycle accessories—Garvin die slotting machine.

Rolling machine for rolling cold round wire.

Double head bolt cutter equipped with lead screws 1 in. capacity.

Cal., Long Beach—Golden State Woolen Mills, Nadeau Bldg.—$150,000 worth of modern machinery for proposed mill.

Ont., Galt.—Galt Amateur Athletic Assn. —machinery for formation of an artificial ice surface, to be installed in the proposed rink on Shade St.

Ont., Windsor—Essex Provision Co., Ltd., 1120 McDougall St. — refrigeration machinery for proposed cold storage plant.

Metal Working Shops

NEW ENGLAND STATES

Mass., North Adams—Ward Bros., North Troy, N. Y., plan to build a 1 or 2 story garage, etc., on Lincoln and Center Sts., here. Private plans.

Conn., New Haven—Westcott Mapes, Inc., Archts. and Engrs., 207 Orange St., are receiving bids for the construction of a 62 x 142 ft. factory on James St., for the Natl. Folding Box & Paper Co. Estimated cost, $150,000.

MIDDLE ATLANTIC STATES

N. J., Camden—The Wilson Motor Co., 1721 Haddon Ave., has awarded the contract for the construction of a plant on Haddon Ave. Estimated cost, $40,000.

Pa., Beaver Falls—Ingraham & Richardson Mfg. Co., manufacturers of enamel ware, has awarded the contract for the construction of a 1 story, 95 x 129 ft. factory. Estimated cost, $60,000.

MIDDLE WEST STATES

Ill., Chicago—S. Buchsbaum & Co., 159 North State St. (jewelers), plans to build a 6 story, 100 x 175 ft. office and factory building on East Huron and Fairbanks Sts. Estimated cost, $300,000. Architect not selected.

Mich., Detroit—The Street Ry. Comn., 320 Murphy Bldg., will soon award the contract for the constructioh of a 1 and story car house on St. Jean Ave. Estimated cost, $1,000,000. W. C. Markham, 155 West Congress St., Engr. Noted June 2.

WEST OF THE MISSISSIPPI

Mo., Kansas City—The Grand Ave. Bldg Co., c/o E. H. Gill, Engr., Interstat Bldg., has awarded the contract for the con struction of a 2 story, 80 x 122 ft. garag at 714 Grand Ave. Estimated cost $100,000.

WESTERN STATES

Cal., Los Angeles—Buttress & McLean 205 North Los Angeles St., have awarde the contract for the construction of thre 1 and 2-story 60 x 280 ft. buildings o 51st and Santa Fe Sts., for the manufac ture of mining machinery. Estimated cos $38,000 each.

CANADA

Ont., Owen Sound—The Deans Garag plans to build a garage on Main St. to re place the one which was recently destroye by fire. Estimated cost, $75,000.

American Machinist

Volume 55 NEW YORK, AUGUST 25, 1921 Number 8

The Economics of Production

I—DEMAND AND PRODUCTION

By Prof. D. A. McCabe, Ph.D.

With introduction by Ernest F. DuBrul, General Manager, National Machine Tool Builders' Association

FIVE hundred and nineteen million dollars was the amount of money lost by failures in the United States for the last twelve months. This loss did not include stockholders' losses in concerns that were financially wrecked, but managed to keep out of court by reorganization and refinancing. Nor do these losses include the sacrifice of high cost goods sold on a declining market below the cost of production. How much more the latter classes of loss would amount to would be difficult to say, but it would not be surprising to find it more than twice the failure loss. A large part of all these losses is due to ignorance in low and high places; ignorance of very simple and easily understood facts and principles.

> What makes the producer's lot a hard one at times is that he must frequently prepare to meet the dictates of demand before he knows what those dictates are. That is, he must set his production in motion in anticipation of the demand. He must decide what to produce, and how much of it to produce on the basis of his judgment of what the demand will be when the goods are ready, and if he overestimates the demand, he is liable to have to suffer heavily for his mistake. It is not too much to say that in our day it is the estimated demand that controls the character and volume of production.

Not long ago it would have been strange to find in a technical journal articles written by a professor of economics explaining the fundamentals of economic theory. Technical journals have been largely devoted to questions of production, with some collateral matter devoted to the marketing of the product. But it is now realized that production men, as all others, ought to know something about the "WHY" of production. Some very distinguished engineers have recently been promulgating a formula to the effect that "The end of business must be service, not money; production, not profit." This half-baked gospel is gaining ground among men who seem to have given very little study to a few basic, human facts. The continued existence of these facts is evidence of the fallacious reasoning of these new apostles.

Any one with an elementary knowledge of business facts knows that the sole object of business is profit. If it does not make a profit, it dies. It can have no other object, and this one object can be realized only through service. The new apostles of service mistake the means for the end. The motto of a widespread business organization reads, "He Profits Most Who Serves Best." That motto is no meaningless shibboleth, rather it expresses a cold, hard fact. But if one tried to serve without profit, he would soon find his service ended.

Articles like Prof. McCabe's series are desirable to have in every medium reaching men engaged in business in any capacity, whether in production, marketing, or finance. Too many business failures are due to violation of these simple, underlying laws that are just as inevitable as the law of gravity, and just as inescapable. All business men should know these laws, and instead of trying to work against them, should try to work with them. Then the world would have more goods produced for the satisfaction of human wants, it would get better service from that production; and the business men responsible for the production would profit more by the better service.

If more salaried men and wage workers knew the same simple principles, it would be easier for business administrators to apply the principles at the right moment, and not be compelled to wait as long as they now must; to the great cost of everybody. As a result business would be less irregular, and employment would be steadier because all business would be running on a more even keel.

What causes business depressions? At bottom it is a maladjustment of demand and supply. This maladjustment occurs because not enough people know the workings of the law of supply and demand, and its effect on prices and costs. They do not know what these terms actually mean in describing basic business facts. They vaguely feel that the law of supply and demand does its work in some automatic, impersonal way just as does the law of gravity. They do not realize that human wills, motivated by certain desires to make profits or avoid losses, make the law of supply and demand act just as inevitably and inescapably as the law of gravity. But it is not automatic. No price moves by itself, but whether it moves up or down, some human will makes it move to the higher or lower plane. This movement may affect the welfare of hundreds or thousands of human beings, because of the action of one single will. How and why prices move is still a mystery to most of the men who move them.

Articles like Prof. McCabe's, dealing with these simple fundamental facts—demand, supply, price, and cost—articles written in the ordinary language of business, should greatly help to stimulate desire to know economic laws better. If, and when, men grossly violate economic law, they punish themselves. Economic law does not tolerate ignorance; it cannot be violated with impunity any more than can the laws of health, or any other natural laws. Every one earning a living, or spending money earned by himself or others, is subject to the workings of economic law. The more of us who know just how economic law works, the better off all of us are going to be. The more a man knows about watches the less inclined he is to want to take his own apart and rebuild it when it stops ticking. He knows that rewinding is generally the best cure for his trouble.

Ernest F. DuBrul.

It IS a matter of common observation that in our day and country production is carried on with the expectation of selling the goods produced. Some people, farmers for example, produce to some extent for their own consumption, but the great bulk of goods produced in this country are produced with intent to sell. These are produced because those who are responsible for the production of them expect that people will be willing to buy their products. It is this willingness to buy that we have in mind when we speak of "demand".

Demand has a very important relation to production. It is the demand that decides finally what goods shall be produced and in what quantity. Off hand it might seem that the producers, the employers, decide that. Legally they do, but in the decisions that they arrive at they must be obedient to the wishes of the buyers as indicated in the demand for goods. Those producers who insist on producing goods for which there is no demand at a profitable price soon cease to be producers and their places are taken by men who are more obedient to the dictates of the demanders.

What makes the producer's lot a hard one at times is that he must frequently prepare to meet the dictates of demand before he knows what those dictates are. That is, he must set his production in motion *in anticipation* of the demand. He must decide what to produce, and how much of it to produce on the basis of his judgment of what the demand will be when the goods are ready, and if he overestimates the demand he is liable to have to suffer heavily for his mistake. It is not too much to say that in our day it is the *estimated demand* that controls the character and volume of production.

Demand is not, of course, the only requirement for production. Demand alone does not call forth production like a fairy godmother waving a wand. Machinery, raw materials, labor, etc., must be available and the funds must be on hand with which to secure them. A withdrawal of credit, an inability to secure equipment or labor or materials may bring production to a stop or check its speed. But even if these things could be obtained and there were no demand, there would not long be production for sale. It is in this sense that demand is essential to production, and exercises control over the kinds and quantities of things produced.

Demand may be large or small, good or bad. There is a vast difference between a good demand and *some* demand that barely escapes being no demand at all. The thing that concerns the producer practically is whether the demand is strong or weak, increasing or decreasing. What is meant by a "good" demand? Is it a demand for a large quantity, or a willingness to pay a high price? It is both. The demand can be described intelligently only in terms of both price and quantity. It is necessary to know both of these items in the demand for any commodity before we can say whether it is good or bad, increasing or decreasing.

First, as to price. We must know the price at which people are willing to buy before we know anything of practical importance about their demand. It is not enough to say that people are willing to buy cotton; we must ask at what price they will buy it. Does their willingness to buy mean willingness to buy at ten cents a pound, or will their willingness survive a request for fifty cents a pound for cotton? Does the willingness to buy pig iron assume that pig iron will be offered at fifteen dollars a ton or at forty-five?

We must also know the *quantity that will be taken* at the price suggested in order to judge the strength of the demand. Even though the price be satisfactory to the producers, if the quantity demanded at that price is small the demand is not strong. A total demand for but one-quarter of the capacity of the steel mills in a given year is a poor demand for steel billets even at a price of sixty dollars a ton; just as a demand for the whole capacity is a poor demand if it is conditioned on the very low price of fifteen dollars a ton. A good demand is one which calls for a large quantity at a good price. Both items, quantity demanded and the price at which it is demanded, must be known in order to gage the strength of the demand.

The next characteristic of demand that we have to note is that at any given time there are many different "quantities demanded," and they vary according to the price suggested. There is no one fixed amount demanded regardless of the price. There is one quantity at one suggested price and quite a different quantity at another suggested price. Therefore, in order to describe fully the demand for a particular commodity at a particular time, we must state what the quantity taken would be at each of the possible prices worth considering. The demand can best be represented in a schedule or table showing the several possible prices and the various quantities demanded that correspond with them. For illustration:

Suggested Price	Quantity that Would Be Taken if the Figure Opposite Were the Price
$0.90	1,070,000
.95	1,040,000
1.00	1,000,000
1.05	950,000
1.10	920,000

It will be noted in the above illustration that the amount demanded is greatest at the lowest suggested price (90 cents) and smallest at the highest suggested price ($1.10). In fact at any price suggested the amount is smaller than it is at any lower price. These particular figures are not actual, but made up merely for purposes of illustration. It is generally true, however, of the demand for any commodity: that a higher suggested price is accompanied by a smaller demand in quantity, and a lower suggested price by a demand for a greater quantity. This is another way of saying that you can sell a larger quantity at a lower price, whereas if you ask a higher price you cannot sell such a large quantity, under normal circumstances. *This is a general rule as to demand—that at any given time the amount demanded is larger or smaller accordingly as the price suggested is lower or higher.*

There are times when the lowering of the price of certain goods does not lead to an increase in the amount of those goods demanded. These are exceptional cases. Some times the possible buyers may believe that the price is artificially high and will hold off from buying in the expectation that the price will have to be lowered. If the price is then lowered slightly, they may take the lowering of the price as a proof of their belief that the price cannot be maintained and instead of buying more will be strengthened in their determination not to buy until the price is further reduced. Not until the price has been reduced to what the possible buyers regard as its probable bottom point will the price reductions, under such circumstances, stimulate greater buying. But this is an unusual condition of demand. It is likely to be found only after prices have swung so far upward that a downward movement is generally expected, a condition which has been strikingly illustrated during 1921.

Goods differ, too, as to the degree in which the amount demanded will respond to a change in the price at which the goods are offered. The demand for goods that are necessities, like salt, and goods that are widely consumed as a matter of habit, like common grades of tobacco, does not show wide differences in the amount demanded even with considerable differences in the price asked. Window glass is another example. The amount demanded is affected far more by other factors, as for example, the amount of building. This is determined by such prices as the prices of building materials and the wages of building labor, rather than the price of a single small element like window glass. On the other hand, the demand for certain other classes of goods will show a considerable expansion or contraction in the amount demanded with a small difference in the price asked. Luxuries, as a rule fall into this group. But whether the differences in the amounts demanded are great or small with differences in the prices under consideration, the general rule remains that there is *some* difference.

This characteristic of demand influences in an important way the amount of each commodity produced. Producers have to adjust the volume of their production in accordance with this rule if they are not to "over-produce." The expectation that leads them to set production in motion is that they will be able to sell their goods at a price at least high enough to return them their costs plus a profit that will make it worth while for them to produce. If they produce too much they will not receive that price, but will be compelled to accept a lower price, if they sell at all. This is "overproduction." The producers must decide on the quantity to produce in the knowledge that the greater the quantity produced, the lower will the price have to be if the total output is to be sold.

We have now discussed the nature of demand and the measurement of its strength or weakness *at any given time*. The meaning of changes in demand, the measurement of such changes, and their effects on production will be taken up in the next article.

Carbon and Other Motor Troubles

By I. B. Rich

The time is fast approaching when the motor butcher of the past must give way to the real mechanic, who can and will turn out a dependable job. The real mechanic must study motor conditions as he finds them and correct the builders mistakes, which too often occur. And this means that he must study motor theory, at least to some extent.

One of my friends is an expert on motor repairs, or I should say motor renewal or conditioning. He does not handle ordinary "fixing" jobs, but when a man's motor isn't behaving properly—or needs a real overhauling, he gets the work for miles around.

One of his specialties is pistons and he's an expert on piston trouble diagnosis. The first thing he looks at in a piston is the inside of the head. He does't bother so much about the carbon on the outside, because that is a matter of leakage past the rings. But carbon on the inside is a different story, and it is affected by the heat conducting properties of the piston head.

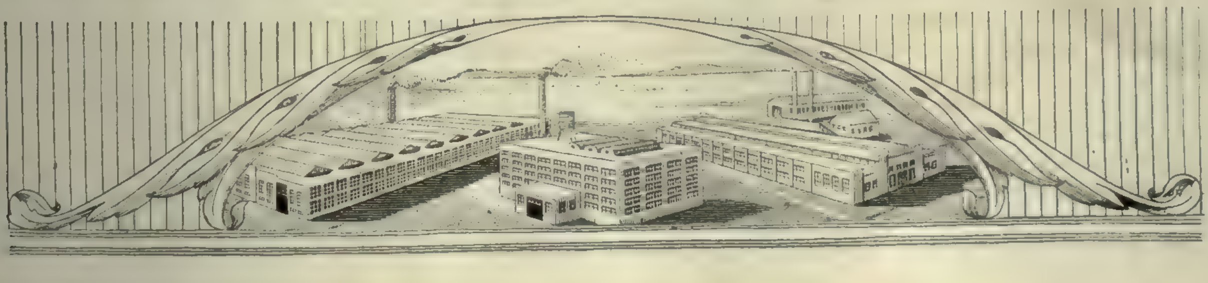
If he finds carbon on the inside of the piston head he makes new pistons, usually with a little thinner head. For when carbon forms rapidly on the inside of the head it gets knocked off by the explosions, falls into the crankcase oil and doesn't improve the bearings a particle. He also examines the bearings and if he finds them a sort of silvery color instead of brightly polished, he knows there is carbon mixed in the cylinder oil and that it can only come from formations inside the piston. By properly proportioning the head of the piston, he eliminates this difficulty.

He also has a piston ring practice all his own. He believes in four narrow rings, above the piston pin. Rings below the pin or in the skirt have no value in his opinion. Light tension rings are used as in Rolls-Royce practice, with say 1½-lb. spring tension as against some rings which run up to 12 pounds. With a cylinder as round as possible, the lighter the pressure the better. Racing cars frequently have but two rings and occasionally only one, as piston ring friction is sometimes as high as thirty-five or forty per cent of total motor friction. But for service, four light rings fill the bill, according to his experience.

In grinding cylinders he uses a wheel which heats the work to some extent so as to get the cylinder block as nearly the working temperature as possible. This gives an approximately round hole under working conditions, whether it is round when cool or not, and is better that way.

He also studies the weight of pistons very carefully and finds that an ounce or so on a piston makes a great difference in the motor at high speeds. So he favors aluminum alloys when a suitable mixture is used. When it comes to aluminum connecting rods, however, he is still from Missouri. The steel rod can be made very light at the piston pin end, which is the end that counts as a reciprocating part. The shaft end, where the weight is, comes into the revolving class.

These are some of the problems for the real automobile mechanic to consider carefully. The "auto fixer" is the descendant of the old livery stable clan and, like his predecessor, bound to go the way of all outgrown individuals and industries.



Handling Materials in an Automobile Plant

Utilizing Elevators and Floor Openings for Carrying Material from One Floor to the Next — Continuous Assembly and Modern Devices for Facilitating Work

BY FRED H. COLVIN
Editor, *American Machinist*

WHEN large quantities of material must pass through a plant each day, the method of handling it economically presents many difficult problems. And as the way in which these problems are solved has much to do with the total cost of the finished products, the methods are worth careful study from a number of different angles.

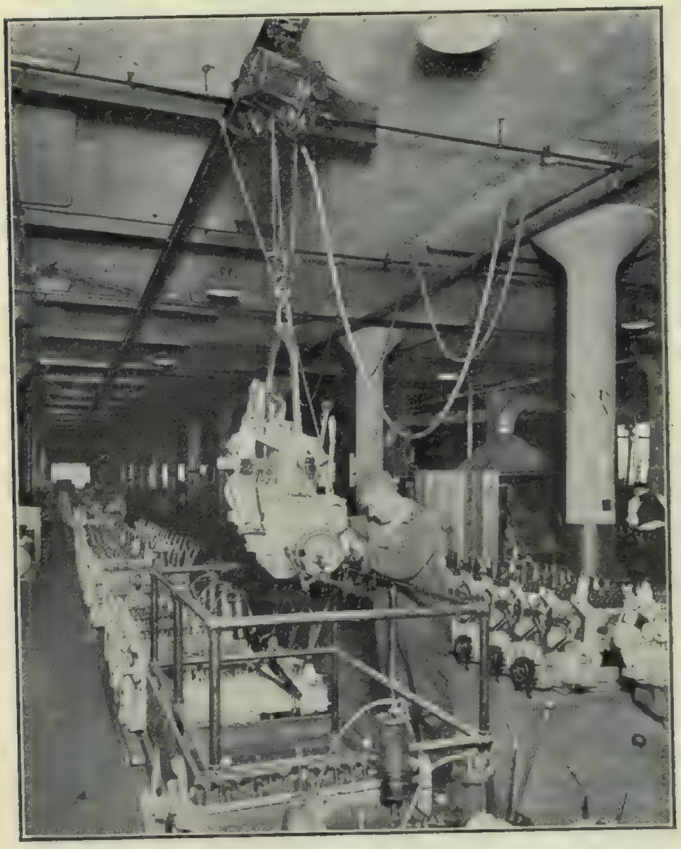


FIG. 1. LOWERING MOTORS TO ASSEMBLY FLOOR

This article shows how these problems have been met in the plant of the Cleveland Automobile Co., Cleveland, Ohio, a new plant which was designed particularly for securing automobile production in an economical manner. Fig. 1 shows one of the handling methods by which a complete motor is lowered from the third floor to the assembly line directly beneath it on the floor below.

Going now to the layout of the various floors, and beginning at the top, we have a diagram in Fig. 2 of the floor layout, each department being plainly designated. Ample aisles are provided to allow rapid and easy trucking. Some of the departments are inclosed by either a wall or woven wire partition, while others are simply separated by aisles. The size of the building is approximately 80 x 800 ft., giving about 64,000 sq.ft. floor area on each floor.

The unpainted sheet-metal parts come up to the large storage space shown and travel to the right, as indicated by the path marked with the arrow head. Those parts which require grinding and polishing are taken care of in that department, while others go straight through to the cleaning room which handles all the parts that pass through the dipping and rubbing room. They then go across the building to the long conveyor on the other side. This conveyor is continuous and passes through dip tanks and three baking ovens so that all enameled parts are automatically taken care of.

Leaving the enameling department, material comes either to the enameled parts storage, or goes direct to the elevator as shown. This layout also indicates where the hood and shell assembly takes place, as well as how pieces from the enameled parts storage are sent to the elevator for assembly on the floors below.

PARTS STORAGE AND SUB-ASSEMBLIES

The other end of the fourth floor is devoted to wheels, wheel rims and tires. Here the wheels are painted and stored to await assembly. The rims leave the rim storage department, cross the aisle into the tire storage where the tires are mounted and inflated in a suitable rack. From here they go to the wheel chute *A*, which guides them to the second floor, where they are needed for the chassis assembly.

Coming down to the third floor, the layout of which is shown in Fig. 3, we have the general storage of all parts along the upper side of the front of the building. The main units which go to make up the completed car are stored by sub-assembly operation at the nearest point of application to assembly line. The front and rear axle assembly, for example, is shown on the opposite side of the building, together with the differential and rear axle housing sub-assembly. Both of these sub-assemblies feed into the rear axle main-assembly track shown in Fig. 4.

This track takes the assembled axles to the opening in the floor at *A*, Fig. 3, where they are lowered through the opening to the second floor at the proper point for attachment to the frame. This arrangement is also shown at *A*, Fig. 4, where an axle assembly is about to be lowered to the floor beneath.

Fig. 4, also gives a good idea of the way in which the axle housing is supported on small trucks or carriages while being assembled. These trucks run on tracks at a convenient height and are very easy to handle in every way. It will also be noted that there is a return track for the trucks between the legs just above the floor, so that when an axle reaches the end of the track and is sent down to the floor below, the truck is simply placed on the lower set of rails and sent back to again take its place in the truck assembly line.

At the other end of the third floor, Fig. 3, are the brazing and welding departments and the crankcase and cylinder head storage. Between them are the crankcase sub-assembly track and the cylinder head sub-assembly. Here also are the crankshaft and connecting rod sub-assembly departments and storage, these two units meeting at *B*, and joining the crankcase sub-assembly at *C*, an overhead air hoist conveyor being used in this department. A little further along is the piston and

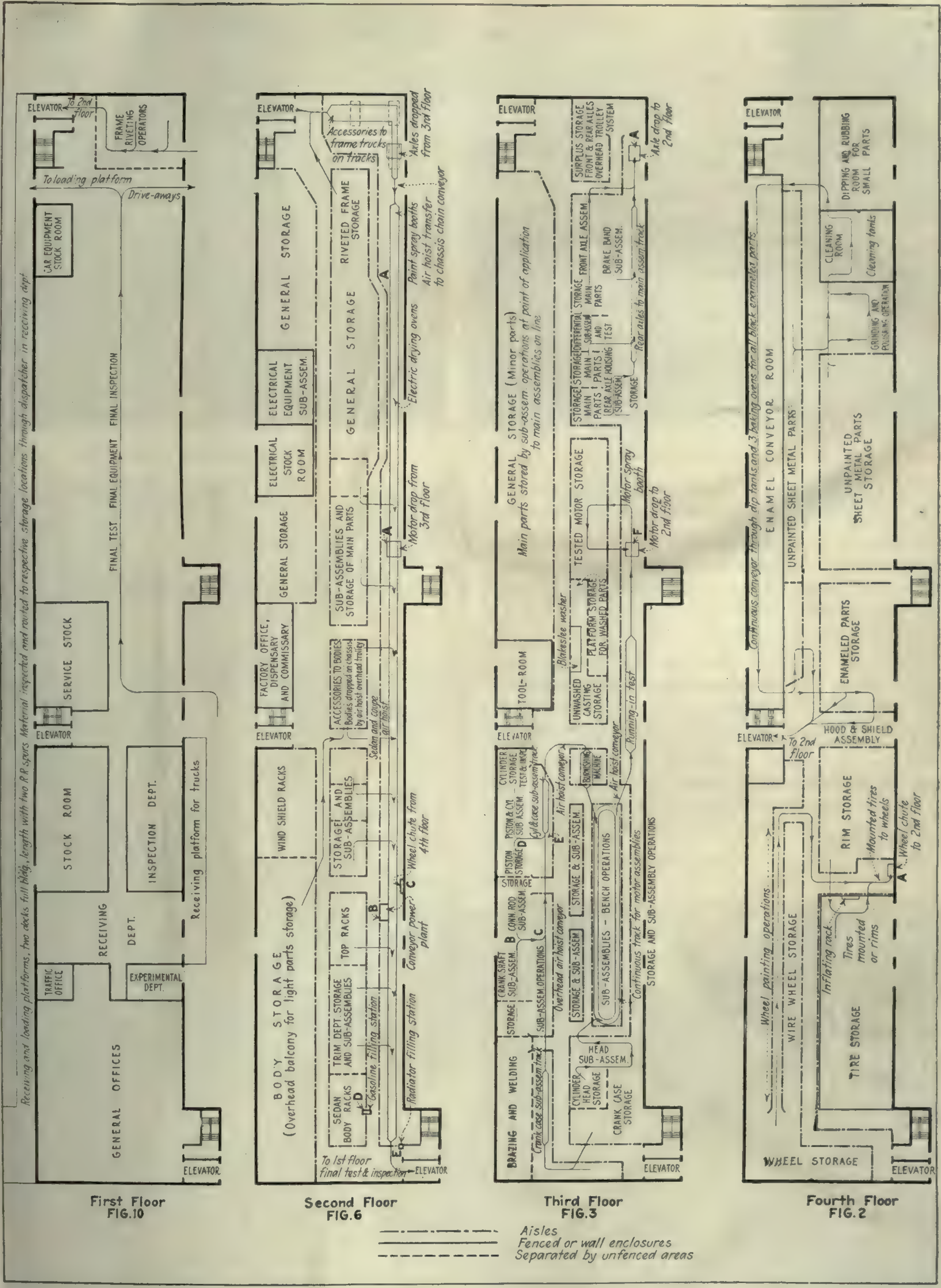

ELEVATOR
To 2nd floor
FRAME RIVETING OPERATORS
To loading platform
Drive-aways
CAR EQUIPMENT STOCK ROOM
FINAL TEST
FINAL EQUIPMENT
FINAL INSPECTION
SERVICE STOCK
STOCK ROOM
INSPECTION DEPT.
Receiving platform for trucks
RECEIVING DEPT.
TRAFFIC OFFICE
EXPERIMENTAL DEPT.
GENERAL OFFICES
Receiving and loading platforms, two docks full bldg. length with two R.R. spurs. Material inspected and routed to respective storage locations through dispatcher in receiving dept.
First Floor
FIG.10
Accessories to frame trucks on tracks
Axles dropped from 3rd floor
GENERAL STORAGE
RIVETED FRAME STORAGE
Paint spray booths
Air hoist transfer to chassis chain conveyor
ELECTRICAL EQUIPMENT SUB-ASSEM.
Electric drying ovens
ELECTRICAL STOCK ROOM
SUB-ASSEMBLIES AND STORAGE OF MAIN PARTS
Motor drop from 3rd floor
FACTORY OFFICE, DISPENSARY AND COMMISSARY
ACCESSORIES TO BODIES
Bodies dropped on chassis by air hoist overhead trolley
Sedan and coupe air hoist
WIND SHIELD RACKS
STORAGE AND SUB-ASSEMBLIES
Wheel chute from 4th floor
BODY STORAGE (Overhead balcony for light parts storage)
TOP RACKS
Conveyor power plant
TRIM DEPT. STORAGE AND SUB-ASSEMBLIES
Gasoline filling station
Radiator filling station
SEDAN BODY RACKS
To 1st floor final test & inspection
A
B
C
D
E
Second Floor
FIG.6
SURPLUS STORAGE FRONT & REAR AXLES OVERHEAD TROLLEY SYSTEM
Axle drop to 2nd floor
GENERAL STORAGE (Minor parts)
Main parts stored by sub-assem operations at point of application to main assemblies on line
FRONT AXLE ASSEM.
BRAKE BAND SUB-ASSEM.
Rear axles to main assem. track
STORAGE MAIN PARTS
STORAGE MAIN PARTS
DIFFERENTIAL SUB-ASSEM AND TEST
REAR AXLE HOUSING SUB-ASSEM.
STORAGE
TESTED MOTOR STORAGE
Motor spray booth
Motor drop to 2nd floor
F
TOOL-ROOM
Blakeslee washer
UNWASHED CASTING STORAGE
PLATFORM STORAGE FOR WASHED PARTS
Running-in test
CYLINDER STORAGE TEST & INSP.
PISTON & CYL. SUB ASSEM.
Cylinder sub-assem track
BURNISHING MACHINE
Air hoist conveyor
Air hoist conveyor
PISTON STORAGE
STORAGE
CONN. ROD SUB-ASSEM.
STORAGE & SUB-ASSEM.
STORAGE & SUB-ASSEM.
SUB-ASSEMBLIES - BENCH OPERATIONS
Continuous track for motor assemblies
STORAGE AND SUB-ASSEMBLY OPERATIONS
CRANK SHAFT SUB-ASSEM.
SUB-ASSEM. OPERATIONS
Overhead air hoist conveyor
STORAGE
Crank case sub-assem. track
HEAD SUB-ASSEM.
CYLINDER HEAD STORAGE
CRANK CASE STORAGE
BRAZING AND WELDING
Third Floor
FIG.3
DIPPING AND RUBBING ROOM FOR SMALL PARTS
CLEANING ROOM
Cleaning tanks
GRINDING AND POLISHING OPERATION
Continuous conveyor through dip tanks and 3 baking ovens for all black enameled parts
ENAMEL CONVEYOR ROOM
UNPAINTED SHEET METAL PARTS
UNPAINTED SHEET METAL PARTS STORAGE
ENAMELED PARTS STORAGE
HOOD & SHIELD ASSEMBLY
To 2nd floor
RIM STORAGE
Mounted tires to wheels
Wheel chute to 2nd floor
Wheel painting operations
WIRE WHEEL STORAGE
Inflating rack
Tires mounted on rims
TIRE STORAGE
WHEEL STORAGE
Fourth Floor
FIG.2
Aisles
Fenced or wall enclosures
Separated by unfenced areas

FIG. 2. LAYOUT OF FOURTH (TOP) FLOOR. FIG. 3. MOTOR AND OTHER ASSEMBLY—THIRD FLOOR. FIG. 6. LAYOUT OF CHASSIS, ASSEMBLY FLOOR. FIG. 10. FINAL INSPECTION FLOOR

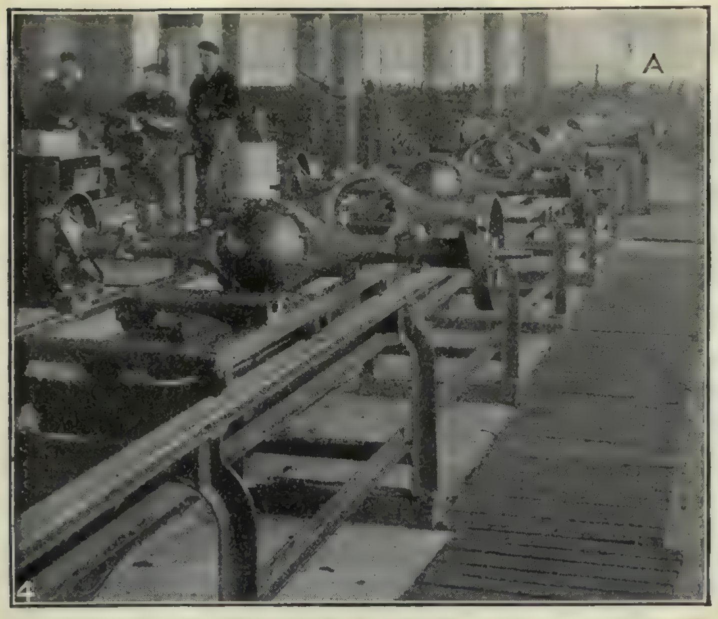


FIG. 4. REAR-AXLE ASSEMBLY LINE

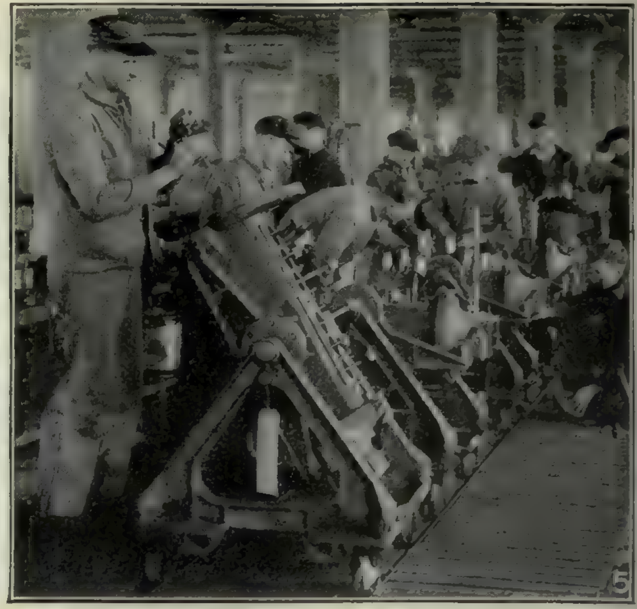


FIG. 5. MOTOR ASSEMBLY STANDS

cylinder storage, where after being tested and inspected these units join at *D*, and together go into the other assembly line at *E*.

An air hoist conveyor also takes the motors from the assembling track, where the cylinders, pistons, crankshafts, connecing rods and similar units are brought together, on to the burnishing machines, which were illustrated in a previous article. After burnishing the bearings, the motors go to the sub-assembly section shown and are there joined by the head sub-assembly. The continuous track, carrying motor assembling stands, is shown in Fig. 5. These stands it will be noted, are swung on substational trunnions and provided with an indexing pin and flange, so that the motor can be locked in any one of six different positions. The stands roll easily on the track which consists of two channels laid on top of the cement floor. Platforms on each side and in the center, bring the top of channels flush with the working platform.

After assembly, the motors go for their running test, after which they are sprayed in a special booth provided for the purpose. The spray removes all oil and leaves the motors clean for final assembly to the chassis. The tested motors either go into storage or direct to the opening in the floor at *F*, through which they are lowered, as shown in Fig. 1.

FIG. 7. STORING WIND SHIELDS AND PARTS

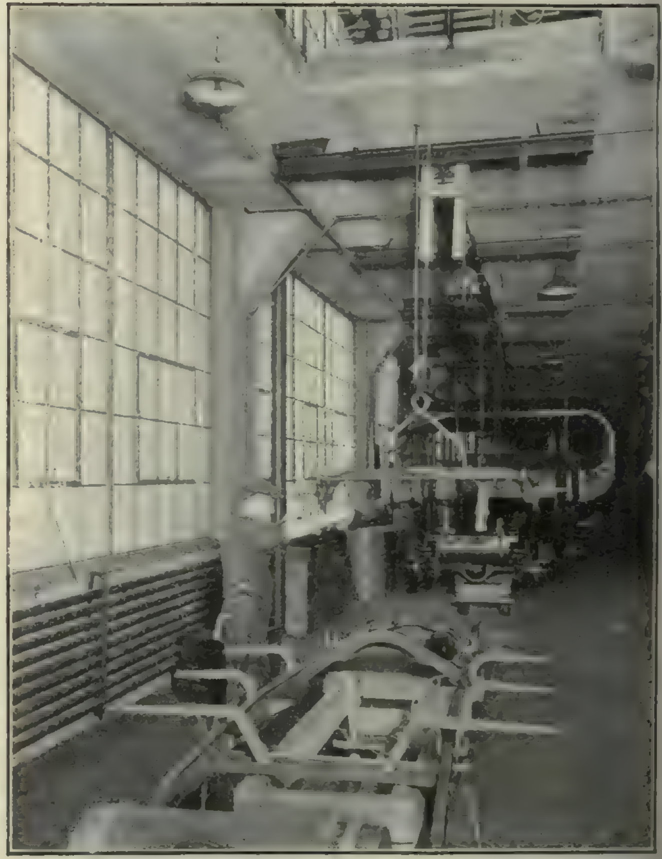


FIG. 8. ASSEMBLING AXLES TO FRAMES

The second floor is shown in Fig. 6. This might almost be called the general storage and assembly floor, as it contains the frame, the electrical equipment, sub-assembly of minor parts, bodies and the many accessories which go to make up a completed car. A good

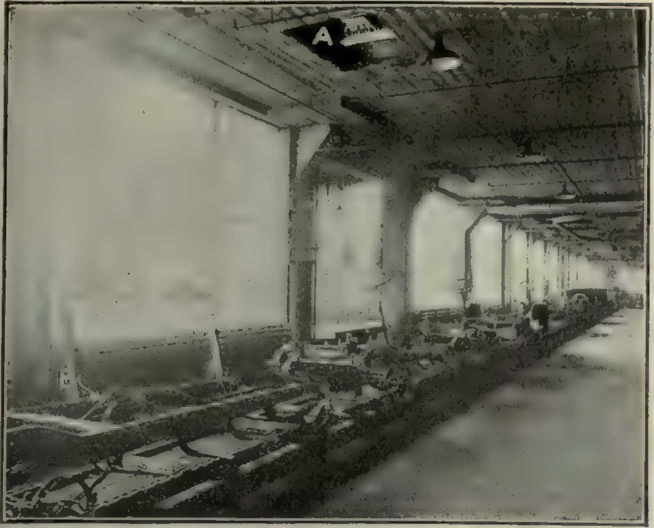


FIG. 9. CONTINUOUS ASSEMBLY TRACK

idea of some of the storage methods may be had from Fig. 7, which shows a stock of radiators and wind shields in the distance. The racks shown provide means for storing the wind shields either horizontally or vertically, and protecting them against damage while in storage. This view also shows an auxiliary storage platform which has been erected for holding light material received in cartons, and occupies considerable space. The body storage department has an overhead balcony for light parts similar to that shown in Fig. 7.

All of these departments feed material into the assembly track, the frames being carried on trucks until the rear axles have been fastened into place. The trucks support the frames as shown in Fig. 8, where a front axle assembly is being lowered into place. This assembly comes down through the opening in the floor above, shown at *A*, in Fig. 3. The rear axles are lowered through the same opening, the frame being moved forward to receive them.

Lowering Motors to Assembly Line

The motors are lowered through the opening *F*, shown in Fig. 3, and as illustrated in Fig. 1. The motors in this way reach the assembly line, the frames having been rolled over by an ingenious handling apparatus by which the air hoist picks them off the truck, allows them to be easily turned over and places them on the continuous assembling track shown in Fig. 9. This view also shows the opening in the floor above at *A*. Here the frame with axles assembled enters the spraying booth for painting and passes through the electric drying oven which sets the paint before reaching the position at *A*, Fig. 6, where the motor is lowered from the upper floor. It will also be noted that the steering gear is put in place at this point. The propeller shaft is shown at *B*, Fig. 9, ready for fastening to the transmission as soon as the motor unit is put into position.

Fig. 9 gives a good idea of the construction of the side wall of the building, the large proportion of lighting space and the small washroom provided at the side. In order to make Figs. 1 and 9 match up satisfactorily, it is necessary to note that Fig. 1 was taken with the camera pointing away from the side wall instead of toward it, as in Fig. 9. The angular top of the side wall column will, however, serve to identify them in both cases.

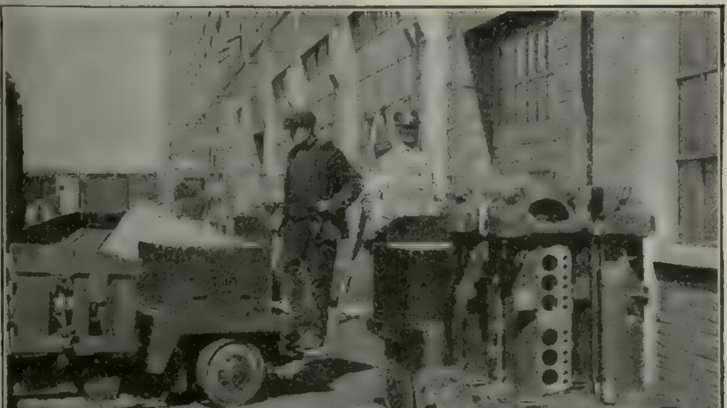
Sub-assembly from the stores on this floor are fed into the line as shown by the arrows in Fig. 6. An air hoist lowers the body on to the frame, body accessories are set in place and windshields, tops, etc., feed in as the frame moves along the assembly track.

Nearing the Finish

The conveyor power plant is shown at *B*, Fig. 6, while the wheel chute *C*, which was first shown in Fig. 2, ends at this floor and delivers the wheels at the proper place for assembly to the chassis. The final trimmings are added as the chassis proceeds, and at the gasoline filling station *D*, the tanks are filled ready for the motor to use in driving to the body floor.

A little further on is the radiator filling station at *E*, from which the completed car swings to the large elevator shown at the left and is lowered to the first floor for final test and inspection.

All material is received on the first floor, the layout being shown in Fig. 10. The two railroad spur tracks with two receiving and loading docks and the method of handling material is shown in Fig. 11. Here two of the electric trucks, each with its load mounted on a platform, are being handled easily and expeditiously. In



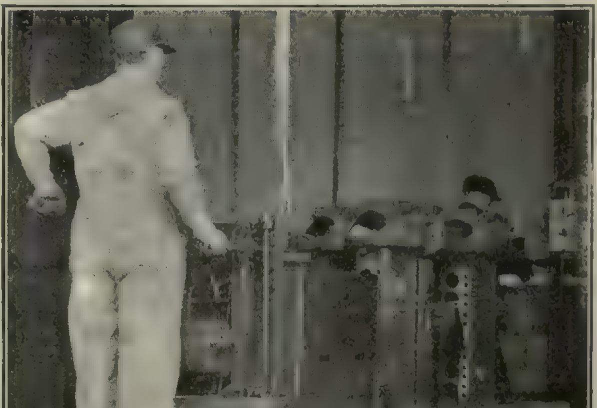


FIG. 11. RAILROAD LOADING PLATFORMS. FIG. 12. USING TRUCKS ON ELEVATORS

one case, cylinder bases are being carried to the elevator to be delivered to the motor department on the third floor. The other truck is handling rear-axle fittings directly into a box car.

After the completed car has been taken down on the elevator at *A*, Fig. 10, it is driven outside to the entrance *B*, where it follows the line marked "Final Test," "Final Equipment" and "Final Inspection." When it reaches the dividing point *C*, it swings either to the right or left, according to the method of delivery.

The back end of this floor is devoted to such frame riveting operations as are necessary, the frames going from here to the elevator which carries them to the second floor to take their place in the line, shown in Fig. 8. The layout as a whole is very complete, the entire plant being designed and arranged to secure maximum production at a minimum cost.

The elevators are large, both as to size and capacity, the load shown in Fig. 12, being run directly on to the elevator and hoisted to the third floor. These methods reduce handling cost to a minimum.

All material received is first inspected by the inspection department representative. When approved, tickets are issued by this department and sent to the dispatcher. The dispatcher marks the tickets with the number or the floor and the bay, thus routing material to its proper location to which it is handled by the electric trucks. All columns throughout the plant are numbered so as to make locations easy for all concerned in routing. The first floor also contains the general offices, the experimental department and the traffic office. It is rather interesting to note the comparatively small space devoted to the office in proportion to the productive space of the plant.

Machining Auto Starter Frames

Special Fixtures for Drilling and Tapping—Devices for Locating and Removing Work—An Unusual C-Clamp—Boring Fixture for Polepieces

By ROBERT MAWSON

THE firm of Gray & Davis, Inc., Boston, Mass., has been manufacturing generators and starting motors for automobiles for a number of years. The machining of the frame, which is used on both units, will be illustrated and described in this article. The frame, Fig. 1, is a drop forging and is shown in the rough at *A*, and finished at *B*.

The forging is first hot washed in a Niagara metal-washing machine to remove the grease and dirt. The first machining operation is done on the Gridley single-spindle automatic shown in Fig. 2. The frame is held in a large collet on the machine while the pole-shoe seat is rough and finish bored. The end is also cut to length, the rear end plate ring-fit is rough bored, while the inside and outside of commutator end and the inside of rear end plate fit, are chamfered at this setting.

The frame is then placed in a No. 4 Warner & Swasey turret lathe as shown in Fig. 3 being located on an expansion arbor. Here the front end is finish turned, the commutator end finish faced, the rear end rough and finish machined, the large hole in front end bored and reamed and the hole slightly chamfered. It will be noticed that the tools employed for machining the ring fit at the rear of the frame and the rounded portion at the forward end are both held in toolholder *A*, so that as the cross-slide is fed forward both these surfaces are machined. The finish-reaming tool for the large hole is shown at *B*. The outside diameter is then machined in the lathe shown in Fig. 4.

An Expanding Chuck

The frame is then placed on the chuck *A*, Fig. 5, being located against the pins *B*. The serrated plungers *C* are forced out against the inside of the frame not only centering it but acting as drivers as well. Two methods of operating the plungers are employed. On the lathe shown air is used, but on the Warner & Swasey lathe the standard lever arrangement furnished with the machine is utilized.

The lever used for operating the air to control the expanding arbor is shown at *A* in Fig. 4. After the frame has been located as described the outside is turned, the limit being 0.006 in. The machined surfaces are inspected with a snap gage by the operator. The frame is then ready for drilling the holes for the screw for fastening the pole-shoes and the commutator end plate. This is done in the jig shown in Fig. 6. The frame is located by a flange which fits over the rear end at *A*, and also by the reamed hole *B*. The open washer *C* is then slid over the screw as shown and the cam-shaped lever *D* is used to force the frame back to the seat and hold it securely.

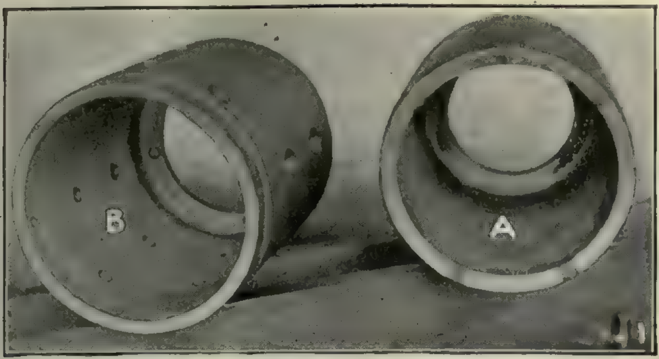
The various positions for the frame during the drilling operation are obtained by means of an index pin *E* operated by the lever. When the index pin has been withdrawn the operator turns the piece to the next position by means of the handwheel *F*. The lever is then released and the plunger locates and holds the frame in the new location.

An Unusual Jig

The frame is next placed in the jig shown in Fig. 7, being located by two pins that fit into pole-shoe holes. The four holes for screws to hold the rear end plate are then drilled.

As the construction of this jig is somewhat unusual it is shown in Fig. 8 with the frame removed. The pins *A* are used for locating the work as previously referred to, the lower end resting on and fitting over the turned lugs *B*. The lever *C* is then drawn down, operating two pinions *D* and *D* which operate racks at the rear of the square sliding plungers *E*. It will be observed that the plungers are integral with the jig cover so that as they are drawn down, the cover plate descends at the same time onto the top of the frame being drilled. The arrangement of the jig insures quick and accurate results, as the operator has an unobstructed view of the inside of the fixture when locating the piece before drawing the cover down into position. The drills are operated by means of a multiple-spindle drill head.

The next operation is drilling the four holes used to attach the nameplate, and the jig used for this work is shown in Fig. 9. The frame is slid into the jig from the front and located by means of the plunger *A*



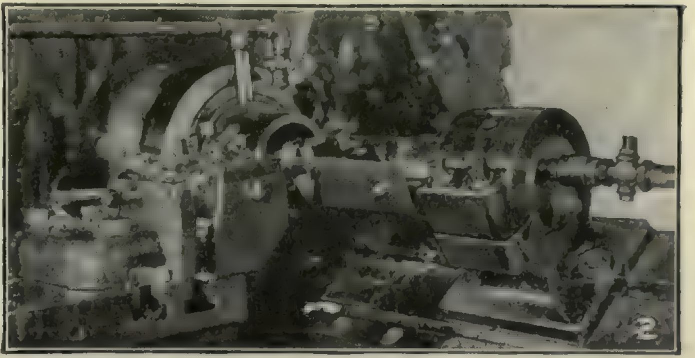
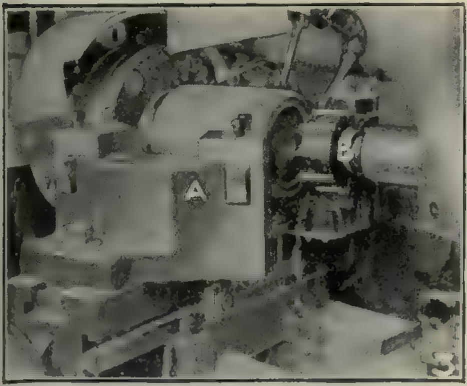
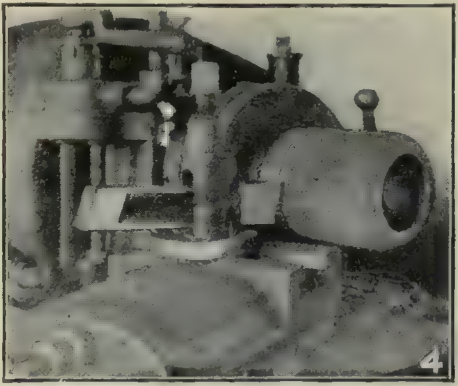


FIG. 1. THE FRAME FINISHED AND ROUGH. FIG. 2. BORING THE FRAME





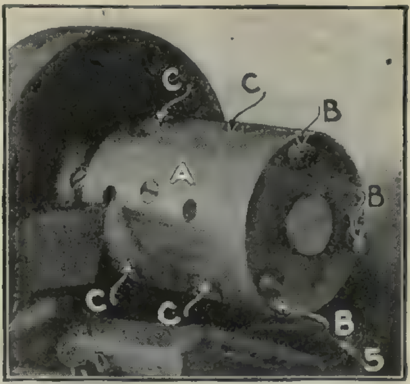
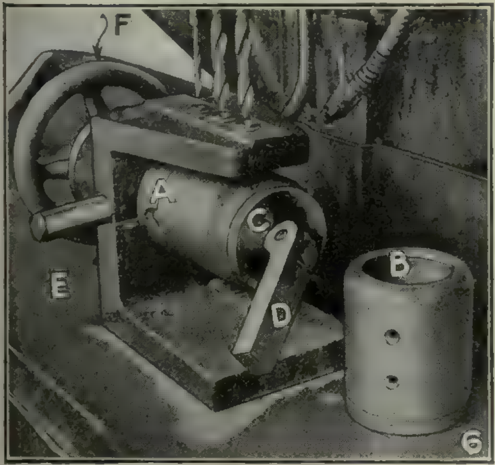
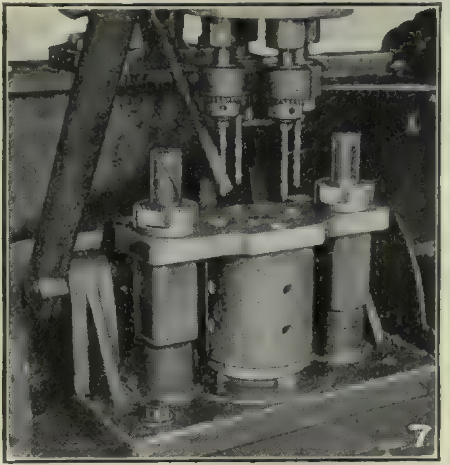


FIG. 3. REAMING THE END. FIG. 4. TURNING THE OUTSIDE. FIG. 5. THE DRIVING MANDREL.





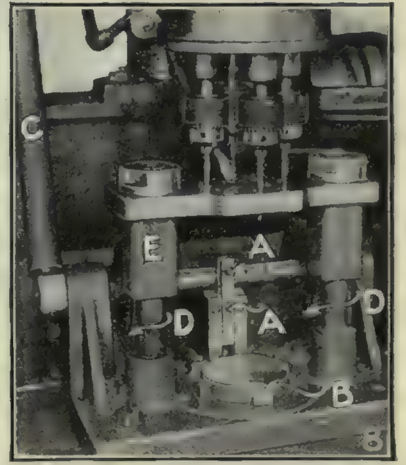
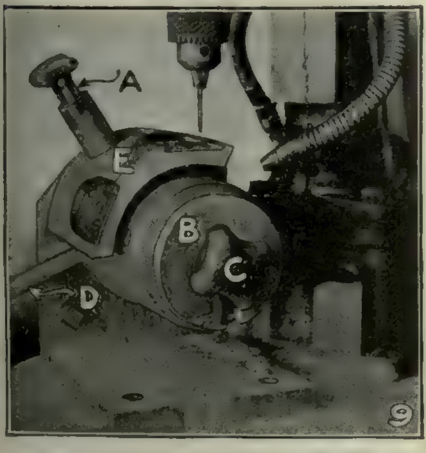
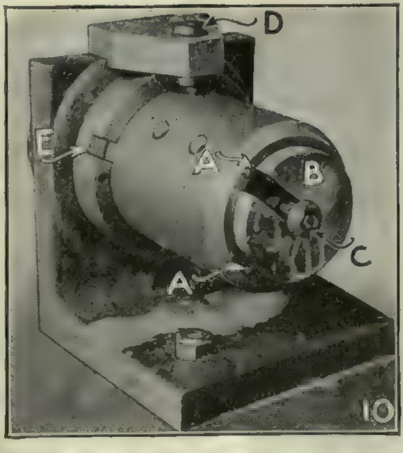


FIG. 6. JIG FOR DRILLING SIDE HOLES. FIG. 7. DRILLING THE END HOLES. FIG. 8. DETAILS OF THE JIG





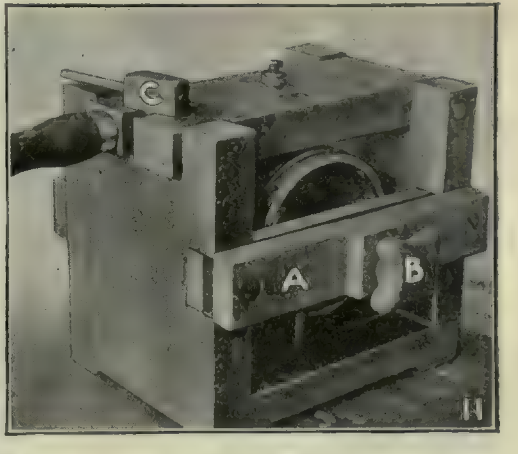


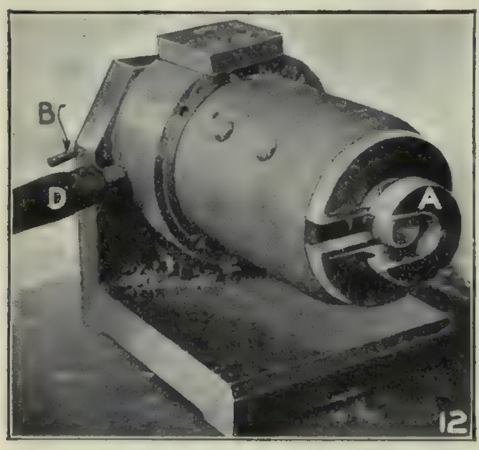
FIG. 9. ANOTHER DRILLING JIG. FIG. 10. JIG WITH "PRY" SLOT FOR REMOVING WORK.
FIG. 11. DRILLING BRACKET FASTENING

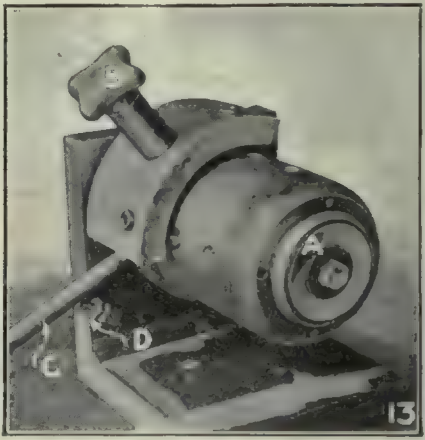
which fits into one of the pole-shoe holes previously drilled.

The open washer *B* is then placed over the screw as shown and the hand nut *C* being tightened holds the frame securely in the jig. After the first two holes are drilled, the jig arbor is turned on a center stud by means of the handle *D* to another located position and two more holes drilled, the drill being guided by bushings in the plate *E*.

The frame is then placed in a mandrel of the jig, Fig. 10, and located by two pins *A* that fit into the end plate holes. The open washer *B* is then placed under the head of the stud *C* which is drawn back by means of a handwheel at the rear of the jig. A hole is then drilled and counterbored, the shank of the combination drill and counterbore being guided by the bushing *D*. It will be noted that the jig is provided with a notch *E*, so that if the work should stick to the mandrel it can be removed easily by using a pointed tool in the notch.

The next operation is drilling two holes for the screws that fasten the bracket to the frame and the jig used for this purpose is illustrated in Fig. 11. The work is again located by two pins which fit into pole-shoe holes, the frame being placed in the jig from the top while the cover is raised. The clamp *A* is then tightened against the piece by the hand nut *B* and the cover dropped down and fastened with the screw *C* operated by the pin placed through its head.





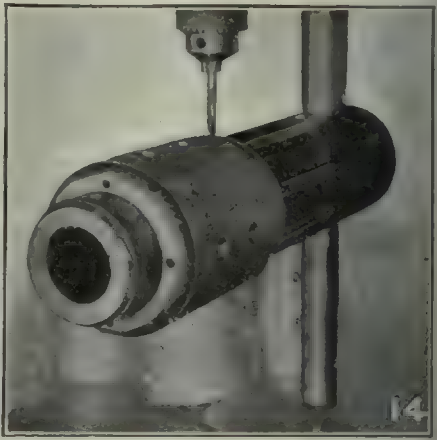


FIG. 12. AN UNUSUAL C-WASHER. FIG. 13. LOCATING SIDE HOLES. FIG. 14. TAPPING SIDE HOLES

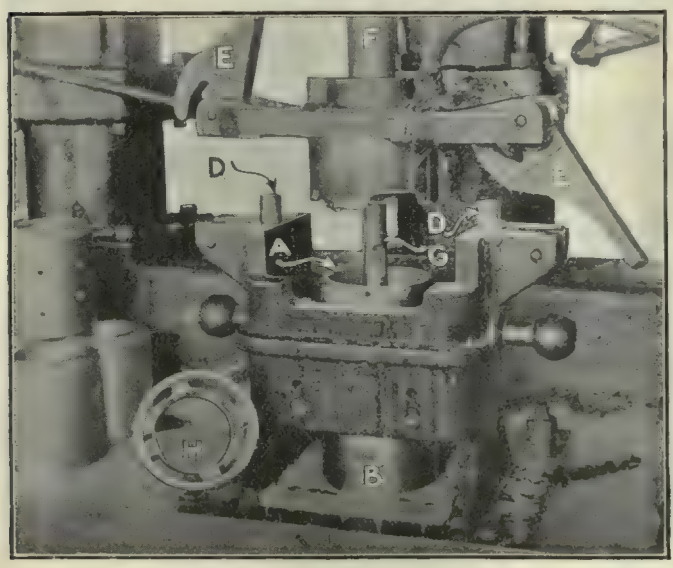


FIG. 15. BORING POLE SHOES

The tool for the next operation, drilling two holes to hold the fuse clips, is shown in Fig. 12. The frame is placed on the jig arbor and located by pins in a manner similar to that in the previous jig. The C-washer *A* is next placed under the binding stud which is drawn back by a nut operated by the pin *B*. The washer is so designed as to afford a good hold for convenience in handling.

The correct positions for the two holes are obtained with a pin that projects from the revolving member of the jig and is brought alternately against stops, one of which is shown under the large flange by the lever *D*.

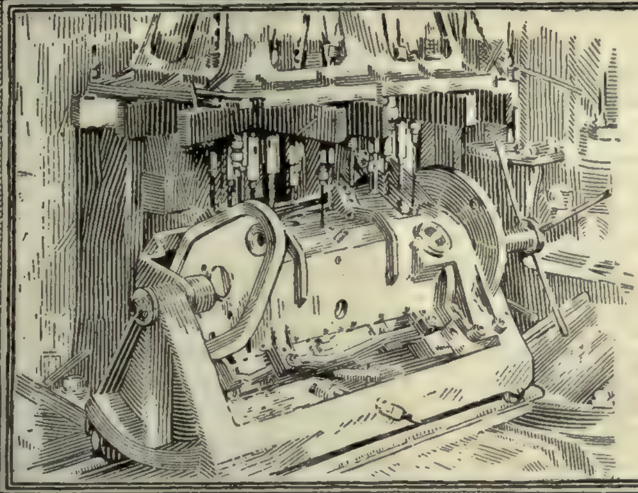
The frame is then drilled for the cut-out cover holes, the jig being shown in Fig. 13. The frame is placed on the mandrel *A* and located by the sliding plunger *B* which fits into the cut-out connection hole. In order to bring the frame to the correct locations for the two holes, it is revolved by the stop pin *C* which alternately strikes against stops, one of which may be seen at *D* the other being behind the frame.

The frame is then burred both inside and out and is ready for the tapping operation as shown in Fig. 14. The frame is held on the mandrel *A* and revolved to the various tapping positions. A series of small tapping machines is set up for this work so that all the holes of one size are tapped on one machine, the frame being then transferred to the next machine where the next size is tapped. By this method the taps need not be changed and better production is obtained. The four holes are tapped in the rear end of the frame by laying it on the opposite face, no special holding arbor being necessary. The frame is now given a rigid inspection and if found correct, transferred to the assembling department where the pole-shoes are placed and fastened in position.

The fixture used in boring the pole-shoes is illustrated in Fig. 15. The frame *A* is located inside the bushing *B* which is made a good sliding fit so that it will center it correctly. The cover is then dropped down, being located by means of the large dowels *D* and held to the fixture base by two hook latches *E* which fit under the pins shown in the ears of the base.

The boring bar *F* is piloted at the top through a long bushing in the cover while the smaller portion *G* is guided by a hole in the locating bushing *B*. The notch shown in front of the bushing *B* is to enable the operator to remove the frame from the fixture if it should stick after being bored.

One of the frames with the pole-shoes bored is shown at *H*.



Tool Engineering

By

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Vise-Jaws and Vise Fixtures—Special and Swivel Jaws—Devices for Insuring Accuracy—Quick Operation—Devices for Equalizing Pressure—Automatic Ejectors

THE use of vises with plain or special jaws oftentimes makes it possible to hold small work advantageously for milling, shaping and drilling operations. Generally speaking vise-jaws are used more often for milling than for other operations. Vises can be adapted and used with special jaws to hold irregularly-shaped work which would be difficult to hold in any other way.

It is unfortunate that tool engineers do not specify the use of vises more frequently, for their advantages are so evident and their adaptability so great that they can be used profitably in many cases which would otherwise require expensive fixtures. The standard type of milling machine vise used for manufacturing in many shops is not adapted for very heavy cutting. It was designed originally for toolroom work to provide a means of holding flat and round stock for light cuts. It is theoretically wrong in principle as the thrust of the cut is taken by the movable jaw instead of by the solid jaw.

Fig. 174 shows a vise of this kind at *A*. Note that the movable jaw *B* is intentionally made long and heavy in order to make it as rigid as possible. In reality, although the vise is not designed for very heavy cutting, good results may be obtained from it and many factories use no other type. The jaw is operated by means of a screw.

The vise shown at *C* is designed especially for manufacturing. This type takes the thrust of the cut on the solid jaw *D*. The movable jaw *E* is a unit with the slide *F* on which the levers *G* and *H* are mounted. By loosening the binding lever *G* and moving both levers along in the slot of slide *F* various openings of the jaws can be easily made according to the capacity of the vise. In operation the cam lever *H* is set until the jaws grip the work firmly, after which the binding lever is tightened. As the latter is slightly eccentric to the cam lever, the locking action is improved and greater leverage obtained. Both of the vises illustrated can be furnished with special and swivel jaws.

In addition to the two types of vises shown there are special forms for toolroom use. The vise principle used is generally like that shown at *A* in Fig. 174, the difference in design being in the method of mounting the vise so that it can be swiveled in either a horizontal or vertical plane. A manufacturing vise operated by compressed air was described in a previous article.

Special vises can be made up for extraordinary conditions if it is found that standard vises cannot be used. If it is impossible to grip the work properly with special jaws in a standard vise, the designer can apply the same principles to his design and make a special vise to suit the conditions. When the capacity of a standard vise is not great enough to take in the work, a special vise can be designed providing the production required warrants the expenditure. Vises that are made up specially are apt to be costly, yet if they are to be used for high production the expense will be saved many times.

DESIGN OF VISE-JAWS

Vise-jaws are apparently very simple from the designers' standpoint, yet their importance is appreciated more as a better understanding of their adaptability and possibilities is gained. A few points of importance are given here in connection with the use of vise-jaws.

(1) Selection of vise. Most factories use several styles and sizes of vises in their production work. Data should be provided regarding the capacities of the various types in order that a selection may be made with discriminating judgment. The predominating factors which influence the selection are: (a) The depth of the jaw: (b) the maximum opening; (c) the length of the jaw.

(2) Depth of the work. As most vise-jaws are made shallow, the depth of the work to be held is an important factor in determining whether a vise can be used for a given operation or not. Within certain limits it is possible to design the jaws for a special piece of work so that they will extend above the jaws of the vise, but when this is done they should be made substantial enough to withstand the thrust of the cut and the pressure of the vise screw without vibration.

(3) Length of the work. The length of vise-jaws varies according to the type and size of machine vise selected and it is often desirable to hold a piece of work that is considerably longer than the jaw. It may also be necessary to provide some means of location beyond the end of the jaws. It should not be decided

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that a piece of work is unsuitable for holding in vise-jaws simply because the work is longer than the jaws.

(4) Vise opening. When vises are screw operated, special jaws should be so designed that very little movement of the screw is necessary to release the work, allowing it to be taken out of the jaws without difficulty. In cases where the work locates on pins in one or the other of the special jaws, it is frequently necessary to provide a filler or clamping plate which can be thrown out of the way when the jaws are released in order to avoid too much movement. This matter will be taken up in detail later in this article.

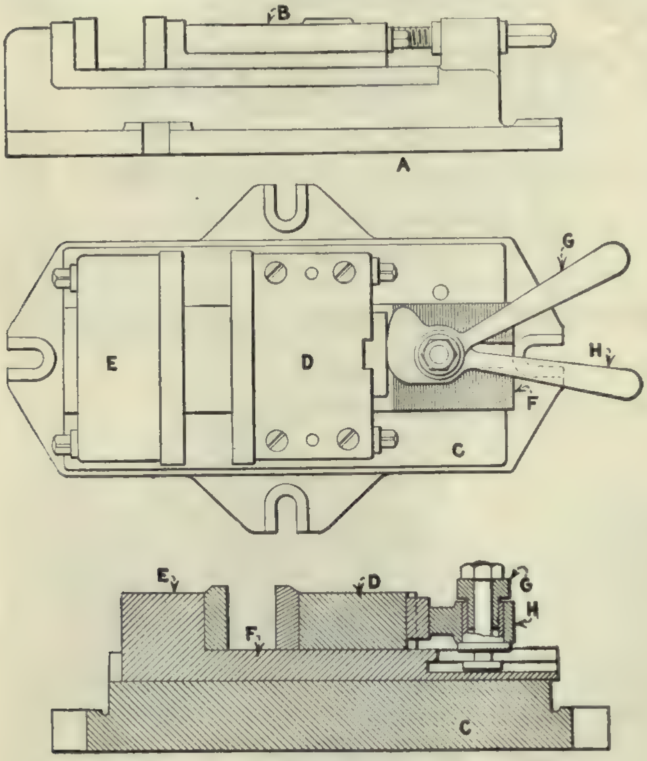


FIG. 174. EXAMPLES OF MILLING AND MANUFACTURING VISES

(5) Formed jaws. Irregular work such as small forgings, castings and other parts which require milling operations are frequently held by means of special jaws which are "formed out" by the toolmaker to fit the contour of the work. When jaws of this kind are designed, a clamping action must be obtained on the work close to the point where the cut is to be made. For example, in a forging having a ball end, the jaw would be formed to hold the ball loosely in order to obtain the location, while the work would be gripped at other points where the cutting action is to take place. There are so many varieties of formed jaws that it has not been deemed essential to take up their design in this article. Each individual case must be treated differently according to the shape of the piece and the general requirements of the work.

General Diagram of Vise-Jaws

Fig. 175 shows a standard type of vise-jaws, such as are usually supplied with a milling machine vise. Attention is called to the fact that the dimensions *A* and *B* are fixed, according to the style and size of the vise used. It is necessary therefore to ascertain these dimensions before proceeding with the design of any special jaws. The dimension *C* is also important as it determines the maximum size of the work that can be properly gripped between the jaws of the vise.

It frequently happens that the work is higher than the height of the jaws, in which case care must be taken to see that the pressure is resisted by designing the jaws so that they will have additional support near the point where the cutting action is applied. An example of this kind is shown at *D* in which it will be noted that the jaws extend considerably above the body of the vise as shown at *E* and *F*. Support is provided by the "heel" at *G* and *H*.

The example at *K* indicates a method used for locating the work *L* on one jaw *M;* the other jaw *N* is cut away as shown at *O* to prevent trouble from an accumulation of chips. The principle used here is applicable to many kinds and shapes of small work, the location always being on one jaw only.

A good method of holding round work is shown at *P*. The work *Q* lies in a "vee" which is slightly undercut at *R* so that the pressure of the jaw *S* tends to draw it down against the surface *T* thus holding it firmly in position. This principle can be used to advantage in holding many kinds of round work.

Assuring Accuracy in Location

When work is to be milled accurately in relation to some previously finished surface it is oftentimes advisable to provide vise-jaws with an accurate means of location. This is particularly desirable when the vises used are old or more or less worn but whether this is the case or not, a very high degree of accuracy can only be obtained by making some provision in the jaws so that they will always register exactly the same. If the tolerances on the work are very close, this point must be kept in mind when designing special jaws.

Fig. 176 shows a very good method of registering vise-jaws accurately. *A* and *B* are the two jaws, one of which is provided with hardened guide pins at *C* and *D* while the other contains bushings *E* and *F*. The pins act as dowels and thus preserve the correct relation of the jaws at all times. In such a case the work might be located on suitable pins at *G*, the positions of these pins being determined by the nature of the work and the general requirements. The length of the dowel pins is determined by the thickness of the work and the method of location. The side view of the jaw gives a clear idea of the relative positions of the screw holes *H* and *K* and the dowel pins mentioned.

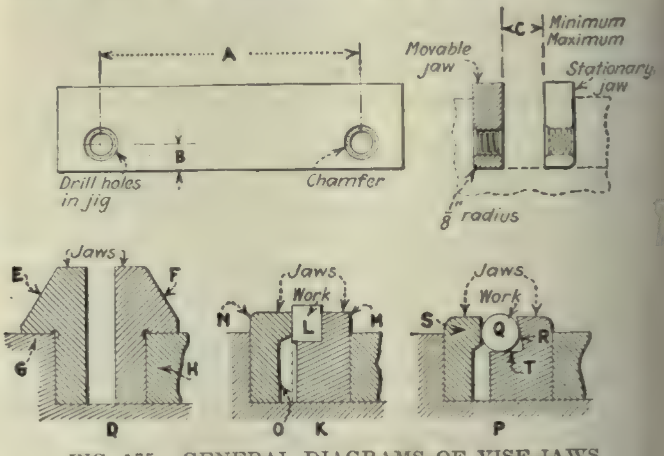


FIG. 175. GENERAL DIAGRAMS OF VISE-JAWS

Two other methods are shown in the same illustration. In one of these the work *M* rests on the shoulder of a special jaw *O* while it is gripped by the other jaw *N*. A support is provided at *P* which acts in a somewhat similar manner to the dowels previously mentioned by preventing the movable jaw from lifting when it is tightened. These jaws would be improved by giving them a shoulder at *Q* and *R* similar to the case shown previously. One objection to this design is that the spaces at *T* and *S* are narrow and therefore they form an excellent place for chips to accumulate and cause trouble in closing the vise.

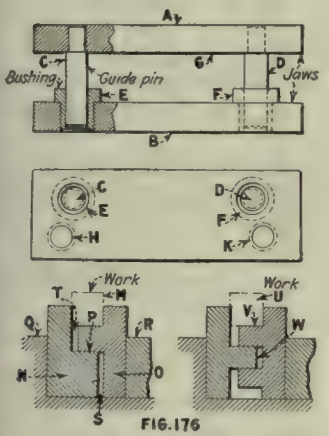


FIG. 176

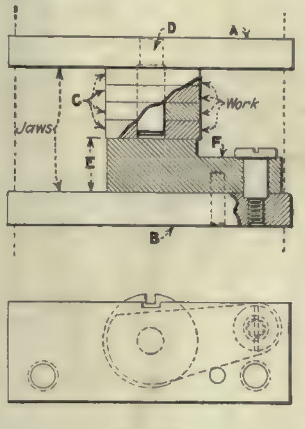


FIG. 177

FIG. 176. ASSURING ACCURACY IN LOCATION

FIG. 177. PROVISION FOR QUICK REMOVAL OF WORK

Another example of an *attempt* to provide an accurate means of location is shown in the jaws holding the work *U* in Fig. 176. In this case the work rests on the shoulder *V* and a tongue is provided at *W* which is intended to prevent the jaw from lifting and thus obtain greater accuracy than would be otherwise possible. The objection to this type is that it is more or less expensive; there are bad pockets for chips and it is generally impractical.

In analyzing the methods of location shown in this illustration it is obvious that the guide pin method is the best on account of its adaptability, simplicity in construction, and the ease with which the jaws can be cleaned. The cost of construction and the accuracy obtained are additional points in its favor.

QUICK REMOVAL OF WORK

When making up a set of vise-jaws it must be remembered that the rapidity with which the vise is operated is dependent to a great extent on the amount of opening necessary to remove and replace the work. When the latter is of such a nature that it must be located on a stud and removed from the stud after the operation, a considerable opening to the jaws may be required. When a cam operated vise is used a certain amount of opening can be made rapidly and this may be serve to take care of many conditions, but when the regular type of milling machine vise is used, every half revolution of the screw means that the operator is obliged to remove his wrench and replace it again. This takes time and is a decided objection if the jaws need to be opened rapidly. In order to obviate this trouble it is customary to provide a filler block to lie between the work and one jaw. By taking out this filler block the work can be removed and replaced readily and not more than a half turn of the screw is required to provide sufficient opening. The filler can be made in the form of a loose piece or it can be pivoted to one jaw so that it can be swung out of the way when not in use.

Fig. 177 shows a pair of jaws at *A* and *B*, the jaw *A* holding four collars *C* by means of the locating block *D*. If no provision were made for rapid removal of the work it would be necessary to open the jaws the distance shown at *E* in order to allow all four collars to be removed at once. To provide against such a contingency, the jaw *B* is provided with a swinging block *F* which acts as a clamp against the work and yet is quickly removable. The designer is advised to make provision of this kind in all cases where similar work is to be handled. Although it is permissible to use a loose piece for the same purpose, it is not nearly as good as a swinging member.

SWIVEL, MULTIPLE AND FLOATING JAWS

When rough work is being held by being gripped on two or more surfaces, it is advisable to provide a swivel jaw in order to hold it properly. Also when several pieces are being held at the same time there is a possibility of slight variations in thickness or diameter of these pieces which makes it necessary to provide some means of distributing and equalizing the pressure.

Fig. 178 shows a piece of work at *A*, being held for a milling operation. The lugs at *B* and *C* are likely to vary somewhat in height, therefore provision must be made for this by means of a swivel jaw as shown at *D*.

An example of a swivel jaw arranged so that it will hold four pieces is shown at *E*. In this case the work consists of four bars *F*, located in the V-block jaw *G*. The other jaw *H* is made in the form of a swivel block having two supplementary swivels at *K* and *L*.

The designer should remember that all of the pressure of the jaws will come upon the pins at *M*, *N* and *O* if made like the illustration. It would be much better practice to make the pins mentioned a loose fit in the swivel and let the pressure come against the radius at the back of each of the blocks. The pins should only act as retainers and not take any pressure.

A supplementary or floating jaw is sometimes used to hold several pieces, as shown at *P*. This method is useful where several pieces are to be milled at one time. The block lies between the two jaws *O* and *R* and is located by means of a pin in an elongated slot shown at *S*. In operation, the work is loaded by removing the floating jaw *P* and placing the piece on it after which it is set in position between the jaws and clamped in place. This method is useful for handling small pieces of work when a number of them are to be located at one time. If there is likely to be a variation in the length of the pieces, the jaw *Q* can be made in swivel form to take care of the variations.

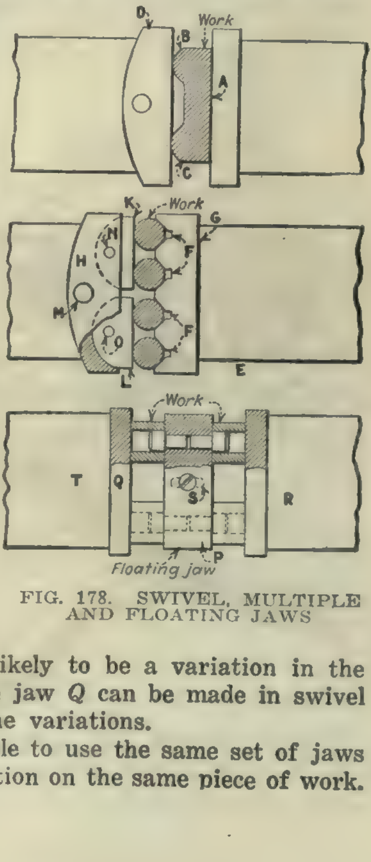


FIG. 178. SWIVEL, MULTIPLE AND FLOATING JAWS

It is sometimes possible to use the same set of jaws for more than one operation on the same piece of work.

and when this can be done without interfering with the production schedule it is obviously an advantage. Occasionally jaws can be provided with two sets of pins or other means of location and cutters can be arranged on the arbor so that both operations can be done at the same time; one piece being finished while the other is being rough-milled. When bar work is to be milled it is often possible to use the same jaws for several operations. An example of this is shown in Fig. 179, in which the work *A* is a bar somewhat longer than the jaws in which it is being held. The bar is located endwise by the stop at *B*, this stop being a part of the extension *C* which is fastened to one jaw. An end view of the jaws is shown at *D* and *E*, where it will be seen that the jaw *E* is slightly undercut to assist in holding the work. The locating bar *C* is fastened to the jaw *E* and acts as a support for the work as indicated.

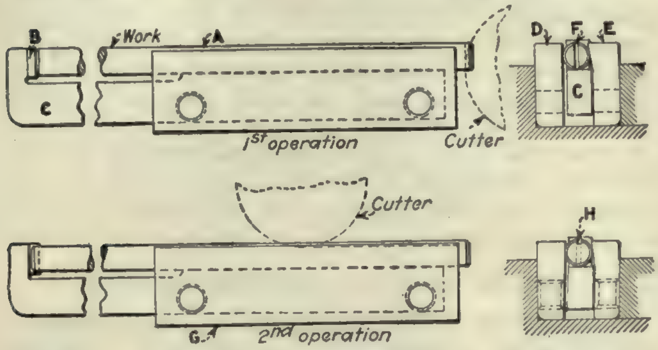


FIG. 179. METHOD OF LOCATING AND HOLDING LONG WORK

The first operation consists in cutting a slot in the end of the bar at *F*. The locater *B* is made so that it will fit this slot, therefore not only can the work be set up for the second operation with the same set of jaws, but the second operation will be properly located in relation to the first. The second operation consists of milling a longitudinal slot in the bar as shown at *H*.

In locating small work in vise-jaws a great deal depends upon the shape of the piece Fig. 180 shows an excellent example of a production job on a small piece of work on which two operations are being performed at the same time. The work *A* is located on pins at *B*, *C* and *D* in the jaw *E* while the slot is cut at *F*. This is the first operation on the work after it has been cut off. In the same set of jaws the piece is held in another position as shown at *G* and located by the milled slot *F*, using locating pins at *H*, *K* and *L*. This operation mills the slots at *M* and *N* and also cuts the work into two pieces by means of the slotting cutter *O*. As it is possible that the work might not be located firmly against the two pins at *B* and *H*, provision is made to insure their contact at these points. By using a pair of flat springs at *P* and *Q* the work will be automatically forced over against the locating pins without particular attention on the part of the operator.

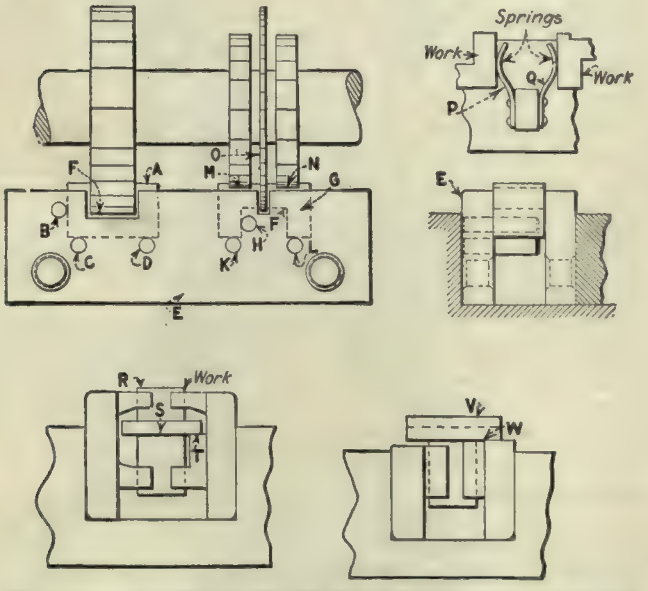


FIG. 180. EXAMPLES SHOWING METHODS OF LOCATION

The work shown at *R* must be located from the shoulder *S*. This brings up a point in design which is frequently neglected when vise-jaws are made and that is the alignment of the jaws. It is always advisable to make the shoulder location on one jaw only as shown at *T*, rather than to attempt to line up two shoulders on opposite jaws. Another example of a shoulder location is shown at *V*, in which case it will also be noted that the location is on one jaw only. There are occasional cases when this rule can be overlooked, for example, when dowel pins are used in the jaws to insure accuracy as shown in Fig. 176. However, it is safer to follow the rule of locating on one jaw only.

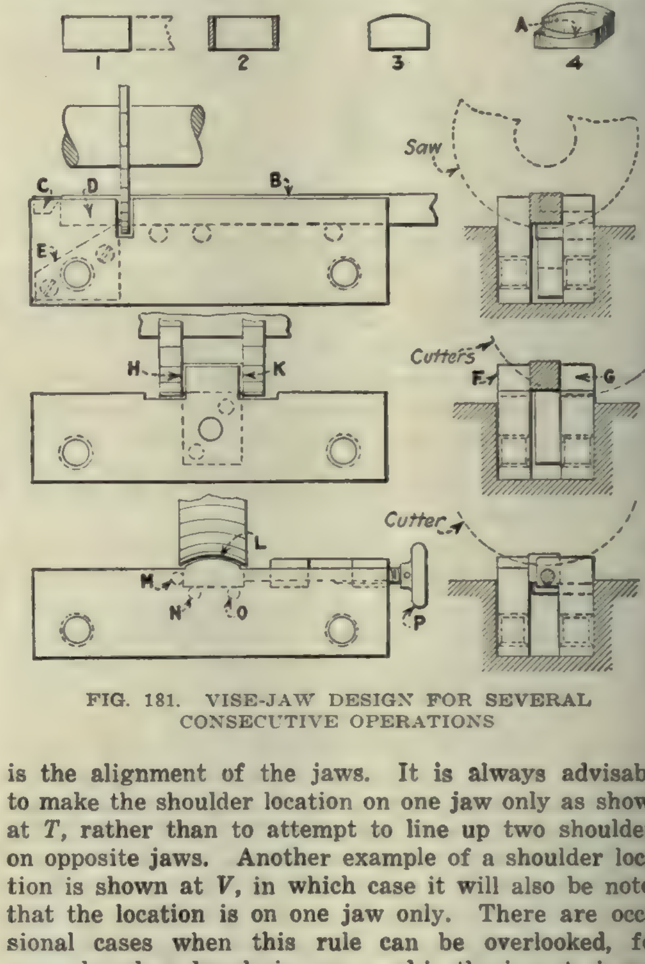


FIG. 181. VISE-JAW DESIGN FOR SEVERAL CONSECUTIVE OPERATIONS

VISE-JAWS DESIGNED FOR SEVERAL CONSECUTIVE OPERATIONS

It is interesting to note the adaptability of vise-jaws for holding small parts which have several consecutive milling operations. An example which illustrates this point is shown in Fig. 181. The consecutive operations are shown on the rectangular block in the illustrations 1, 2, 3, and 4. The work is first cut off from a rectangular bar so that it takes the form 1. The next operation is the forming of the radius shown at 3, and the fourth operation is the profiling of the circular cut shown at 4-*A*. In the first operation the bar *B* is placed in the jaws shown until it strikes the end stop *C*. The jaws are then tightened and the portion *D* is cut off. When the jaws are loosened the piece slides down the inclined plane *E* into a box provided for it and the bar *B* is pushed forward again until it strikes the stop *C*, after which the cutting-off operation is repeated.

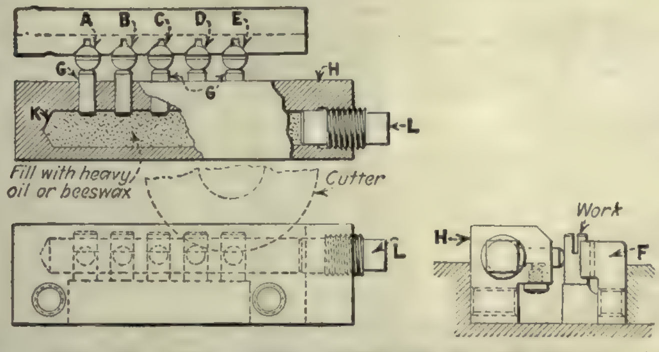
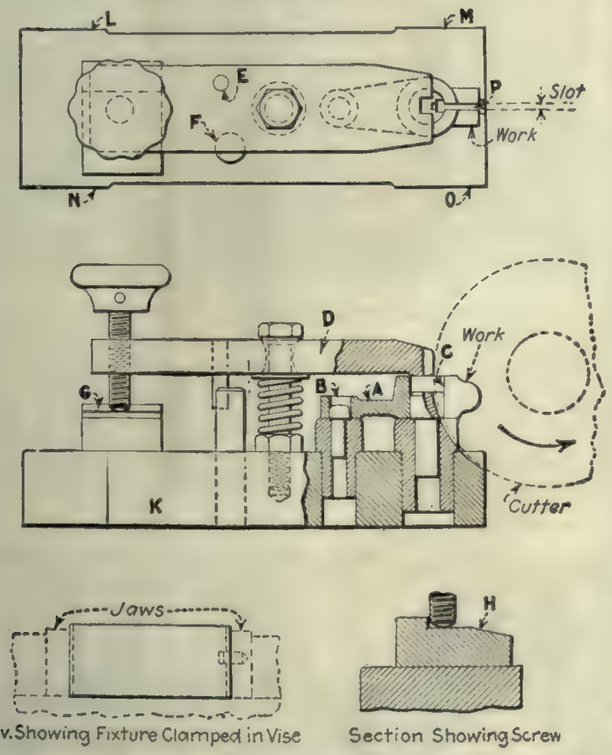


FIG. 182. EQUALIZING PRESSURE BY MEANS OF BEES-WAX JAWS

In the next operation the work is held by means of the jaws *F* and *G* while the straddle milling cut is made at *H* and *K*. This operation machines the piece to length, a suitable allowance having been made for this operation while cutting off the work.

The next operation is the cutting of the radius as shown at *L*. The work is held by suitably formed jaws and is located against the pins *M*, *N* and *O* by means of the thumbscrew *P*, which is so placed that it is outside of the milling machine vise and can therefore be easily manipulated. These three examples have been given to familiarize the designer with the methods used for progressive operations on small parts. Many applications can be made of the principles shown here.



Elev. Showing Fixture Clamped in Vise

Section Showing Screw

FIG. 183. VISE FIXTURE TO HOLD SMALL WORK

There are instances when a number of pieces are to be held at the same time in a set of vise-jaws and yet it is difficult to make sure that all of the pieces are held firmly, due to slight variations in the work. There are also irregular forms which have to be supported at several points while cutting, and which must incorporate some method of equalizing the supports to take care of slight inaccuracies in the work. The principle shown in Fig. 182 can be applied to a variety of conditions, and it has been used successfully for holding work which would be difficult to support by any other known method. In the example shown there are five parts *A*, *B*, *C*, *D* and *E*, located in V-blocks in the jaw *F*. The other jaw is equipped with a series of plungers *G* which are lapped to an accurate sliding fit in the jaw *H*. The chamber *K* in this jaw is filled with bees-wax or heavy grease. When this mass is compressed by means of the screw at *L* the vise pins *G* are forced out until they all come in contact with the work. After the first adjustment has been made by means of the screw the pins will automatically equalize themselves so that a positive contact will be assured on each one. In making up a set of jaws of this sort care must be taken that the various fits for the pins and the screw are carefully made in order to prevent leaks when the pressure is applied.

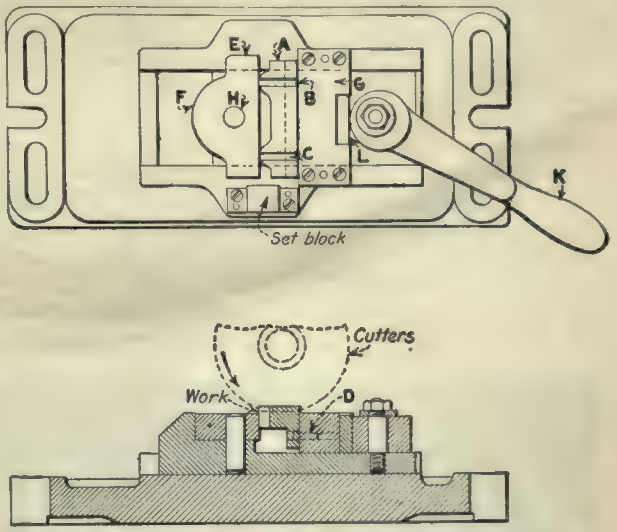


FIG. 184. SPECIAL VISE WITH EQUALIZING JAW

Vise Fixture for Small Work

Occasionally a milling operation has to be performed on a piece of work which is difficult to locate in vise-jaws. When a condition of this kind arises it is sometimes possible to design a vise fixture in which the work can be located and clamped and then the fixture itself placed between the vise-jaws for the milling operation. A case in point is shown at *A* in Fig. 183. This piece of work has previously been drilled and reamed at *B* and *C* and faced on both sides. It is located on two pins in the holes and clamped by means of the strap clamp *D*. This clamp is so arranged that it swings away from the work until the pin *E* strikes the stop pin *F* in the body of the fixture, thus permitting the work to be removed. When the work is clamped the point of the screw *G* rides up on the angular surface of the block *H* and a wedging action takes place which makes the operation very rapid. The fixture *K* locates between the jaws of a standard vise which clamps it at the points *l*, *m*, *n* and *o*. Provision is made at some convenient point so that end location in the vise-jaws will be assured. The operation to be done in this fixture is the cutting of the slot at *P*. Obviously this method of holding is convenient and at the same time the fixture is cheap and can be operated rapidly. Cases are found now and then when a fixture of this kind can be used to advantage.

SPECIAL VISES WITH EQUALIZING JAWS

As a vise of suitable dimensions to handle the work *A* shown in Fig. 184 could not be obtained, a special vise was designed. The work is located by means of two pins at *D* in the solid member of the vise. The work to be done is the cutting of the two slots *B* and *C*.

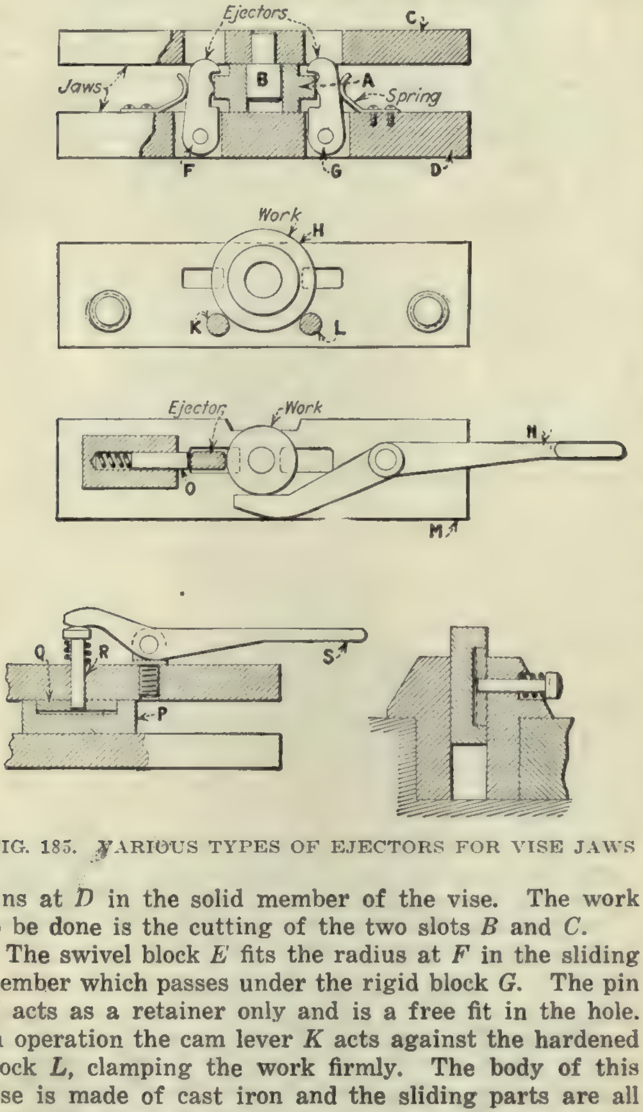


FIG. 185. VARIOUS TYPES OF EJECTORS FOR VISE JAWS

The swivel block *E* fits the radius at *F* in the sliding member which passes under the rigid block *G*. The pin *H* acts as a retainer only and is a free fit in the hole. In operation the cam lever *K* acts against the hardened block *L*, clamping the work firmly. The body of this vise is made of cast iron and the sliding parts are all carefully fitted to insure the necessary accuracy. It will be noted that construction of this vise is such that the cutting action comes against the solid member and not against the movable jaw.

There are occasional cases when special vises can be made up to suit a particular condition but unless the conditions are such that the expense of a special vise is warranted, it is better to use a standard vise.

As a refinement in the design of vise-jaws it is often necessary to provide means for removing the work after the milling operation has been done. Many times the shape and position of the work is such that it can only be removed with difficulty. For cases of this kind ejectors can be provided which will facilitate the operation. Several examples of ejectors are shown in Fig. 185. The work *A* is to be located on the stud *B* in the vise-jaw *C*. As it would be difficult to locate this work easily it is placed on the movable jaw *D* so that it rests on the two pins at *K* and *L*, which locate it approximately. Then, as the jaw is moved up into position the beveled end of the stud *B* enters the hole, thus locating the work correctly. After the work has been done, the ejectors *F* and *G* pull the work away from the stud, making it easy for the operator to remove it. This method precludes the necessity of using a screwdriver to pry the piece off from the stud, which might result in damage to the work or springing the stud out of alignment.

The form of ejector shown at *M* can be used either by itself or in connection with a piece of work like that at *A*. Assuming that this work is the same as the other piece except that it is smaller and thinner, it would be difficult for the workman to get his fingers into position to remove the work. Ejectors similar to those shown at *F* and *G* could be used here to pull the work off from the locating stud, but after it had been removed it would still lie in the jaw in such a position that the workman could not get hold of it easily. By making use of the lever *N*, however, the piece could be raised so that it would be easily accessible.

Attention is called to the construction of the plungers *O* which provide the spring pressure for the ejector. This method is entirely different from the other and it has some advantages, although it is a little more expensive in construction. There is no danger of this type of spring plunger being clogged up with chips or dirt.

The work *P* is located on a button at *Q* and it will be seen that such a piece might be difficult to remove after it had been machined. Using the lever *S* to operate the plunger *R* makes the operation much easier and the work can be removed without difficulty.

In the design of vise-jaws, particularly when small and thin pieces are to be handled, the ejector is an important factor as it assists greatly in cutting down the operating time. In addition to this, the work can be removed readily and without injury and as there is no necessity for hammering or otherwise injuring the fixture, a better product is assured.

Shop Work on Locomotive Cylinder and Valve Parts

Finishing Saddles of Cylinder Castings—Radial Planing Attachment for Saddles—Portable Cylinder Boring Device—Heating Cylinders for Welding—Machining Air Pumps

BY J. V. HUNTER

SOME locomotive shops do not make a practice of finishing the saddles of cylinder castings, they simply mount them in the rough state. Others strike the arc of the boiler shell on the edge of the saddle flange and make some pretense of chipping away by hand any high spots that show up too badly. A more careful practice is followed in the Decatur shops of the Wabash Railway Co., where the arc is laid out and the surface of the casting is planed to a finish with the correct radius. It is claimed that this practice gives better results in mounting and the cylinders are more readily interchanged, giving greater assurance of a good fit when replacements are made.

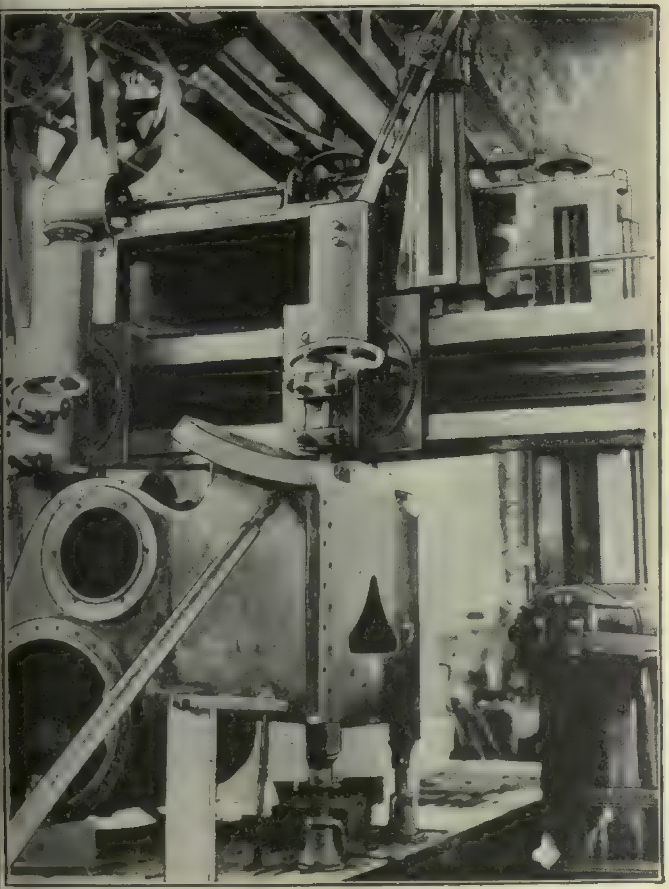


FIG. 1. PLANING A SADDLE TO FIT THE BOILER RADIUS

Planing the saddle is done on the large Niles planer shown in Fig. 1. The casting is levelled into position by heavy jacks and a variety of clamps and braces are used to hold the piece in place. The radius planing attachment, built in the shop, is easy of adjustment and accomplishes the work in an efficient manner. It is shown in greater detail in Fig. 2. The toolhead *A* is standard and no changes have been made in it except to remove the vertical feed-screw from the toolslide, leaving it free to be pulled up or down on the slide, which has been fixed in a vertical position on its saddle.

The cast-iron bracket *B* is bolted on the top of the crossrail, and this together with its related parts provides for the adjustment of the depth of the cut and for swinging the tool at the required radius. The radius yoke *C* has a pivoted bearing on the inside of the toolslide at *D*, and another bearing at the pivot *E*. The first pivot is fixed in position; the second permits adjustment of the length of the yoke, which is accomplished by releasing clamping bolts and then sliding the yoke up or down until the desired length is obtained. The length of the yoke fixes the radius that will be planed, or in other words, the distance between the centers of the two pivots is equal to the radius that will be planed by the tool. Therefore one side of the yoke has been graduated in inches so that the operator can more easily set up the device for planing to the required size.

The pivot *E* is carried on the slide of a saddle that can be moved up or down the bracket *B* by means of the feed-screw *F*, which is hand-operated by a wheel on the end of the crossrail that acts through the shaft *G* and the set of spiral gears *H*. When the yoke is

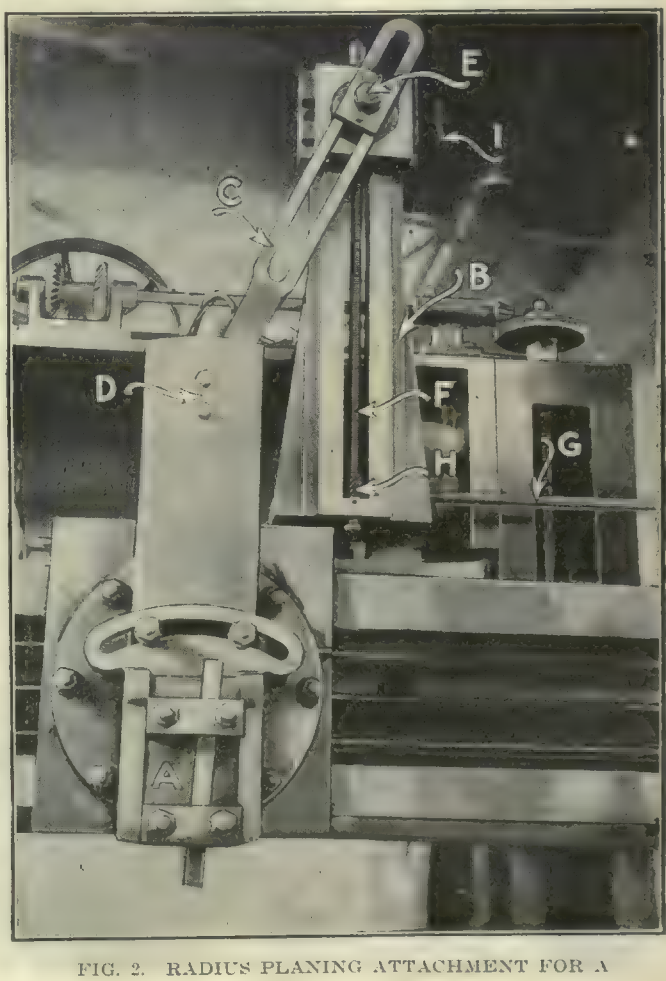
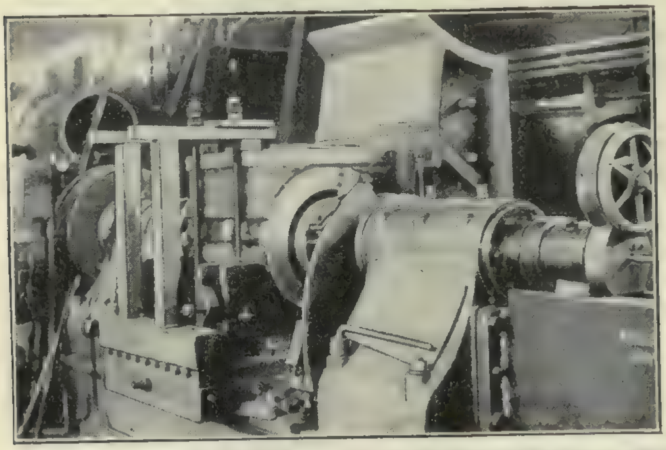


FIG. 2. RADIUS PLANING ATTACHMENT FOR A LARGE PLANER

clamped to the pivot *E* the movement of the pivot up or down on its bracket carries the toolslide with it and thus adjusts the tool for depth of cut. The slide with the pivot *E* can be adjusted horizontally on its saddle by means of a feed screw operated by the handle *I*,



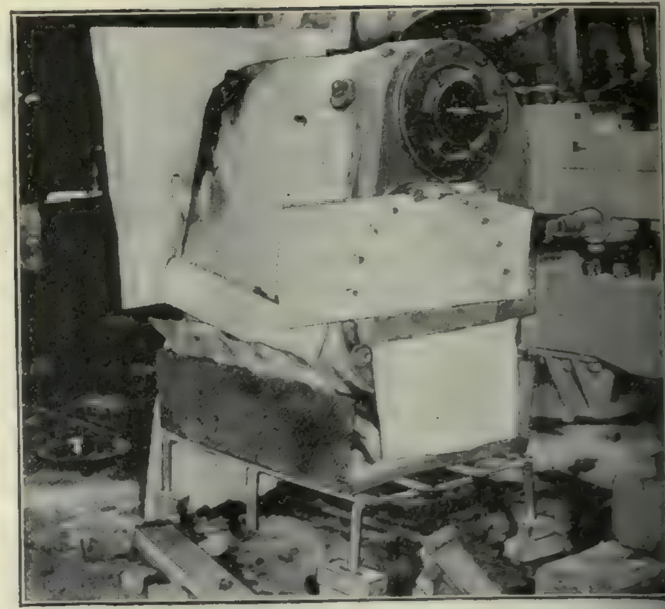
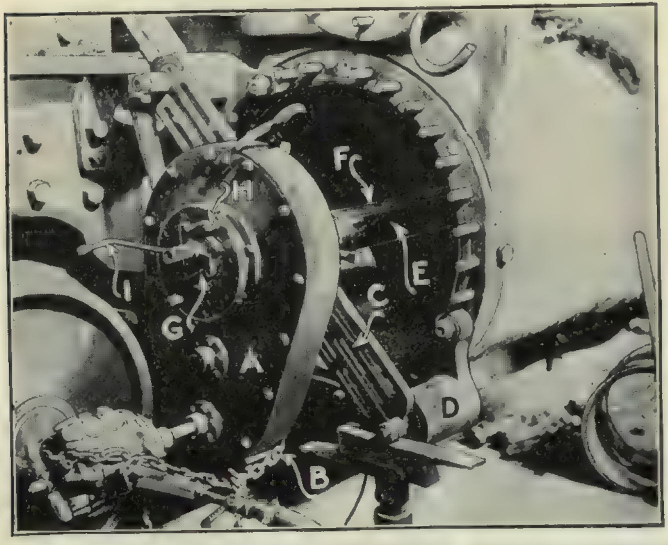


FIG. 3. BORING CYLINDER CASTING ON A NILES HORIZONTAL BORING MILL. FIG. 6. PRE-HEATING CYLINDER BEFORE WELDING CRACKED SECTION



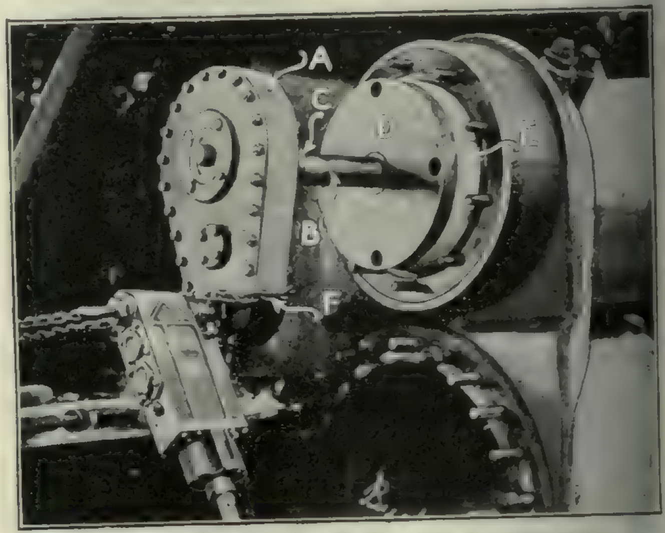
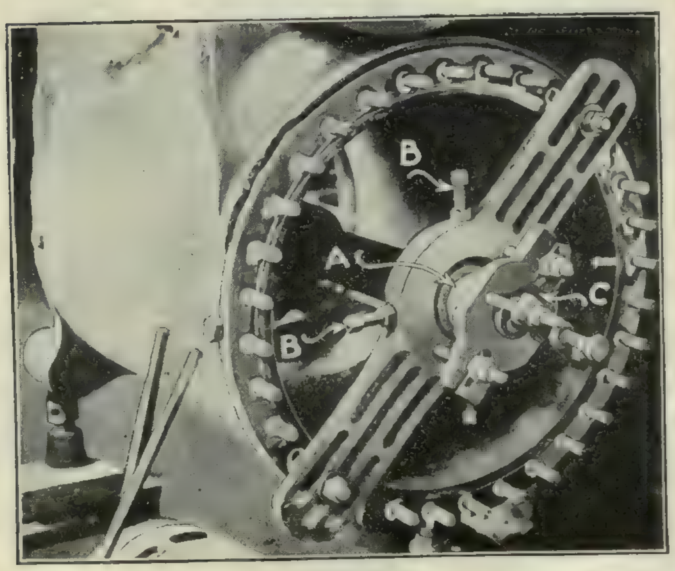


FIG. 4. REBORING CYLINDERS WITHOUT DISMOUNTING FROM LOCOMOTIVE FRAME. FIG. 7. DEVICE FOR FORCING-IN PISTON VALVE BUSHINGS



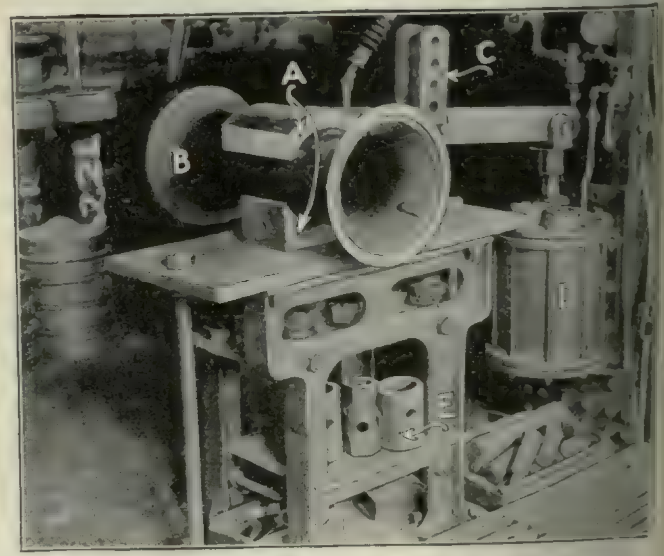


FIG. 5. DEAD END OF CYLINDER BORING BAR. FIG. 9. CLAMPING DEVICE FOR HOLDING PISTON VALVES

thus permitting the pivot to be set so that it will stand plumb over the center plane of the cylinder saddle.

When the attachment has once been set for the proper radius and adjusted for depth of cut, all subsequent movement of the tool is accomplished by feeding the toolhead along the crossrail. In this case the cut progresses from right to left, starting the cut on the vertical center plane of the saddle. As the toolhead moves toward the left the yoke pivots at *E* and swings its outer end upward thus causing it to travel in the arc of the desired circle and the tool at the same time moves upward, thus keeping each successive cut on the same radius.

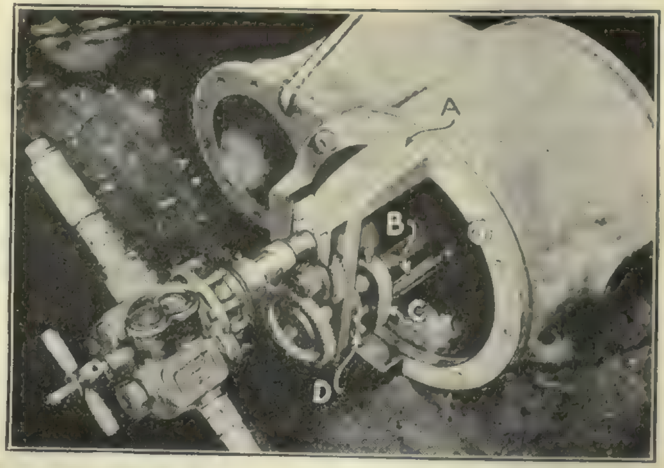


FIG. 10. PORTABLE TOOL FOR RE-BORING AIR PUMP CYLINDERS

BORING NEW CYLINDERS

Boring operations on new cylinder castings are hanlled on the Niles boring mill shown in Fig. 3. The mill is equipped with opposed spindles so that the flanges n both ends can be faced off after the boring operation as been completed. The usual type of cylinder facing ool is used, this being carried in a swinging arm which s provided with a star feed.

Re-boring of worn cylinders is accomplished without emoving the cylinders from the engine frame, by neans of the portable tool shown in Fig. 4. This device vas built in the shop and like many other portable ower-driven tools found in railroad shops, it has a neumatic motor for its power unit. The motor in this ase is connected with a spindle at the lower end of he gear case *A*, and drives the boring bar through a ear reduction. The gear case hangs from the boring ar and is prevented from rotating by the chain *B* that s drawn around some portion of the front truck. The riving end of the boring bar is supported by the lotted bar *C*, bolted to the brackets *D* that are in turn eld by the stud bolts in the end of the cylinder. Centering the boring bar is not accomplished by shifting he bar *C*, but by special adjusting setscrews fixed in a ing in the center of the bar. This form of adjustnent is clearly shown in the view of the dead end of he boring bar, Fig. 5. The oring bar rotates in a earing collar *A* that can be djusted for centering the ar by means of the four etscrews *B*. The clamp *C* bolted to the slotted crossar and carries an adjustble center that serves to ke the thrust of the boring ar and steadies it against d play. A single arm on e boring bar carries the ol and it is fed by means the feed screw *F*, Fig. 4, at lies in a groove along e side of the bar. The edscrew is operated by the ar wheel *G* which comes in ntact with the stationary n *H* at each revolution of e boring bar. The handle is provided for rotating e feed screw by hand hen setting up work or for turning the tool arm to the arting position for taking a second cut. A screw adjustment is provided on the tool arm for setting the tool bit for depth of cut.

Torch welding is frequently done on cylinders without going to the trouble and expense of removing them from the frame. A cylinder prepared for the preheating that must be done for a job of this kind is shown in Fig. 6. The preparatory work consists of arranging a charcoal fire so as to bring the casting slowly to a temperature at which the welding operation can be performed without danger of subsequent damage due to shrinkage cracks when the welded section cools. The asbestos lagging was only removed from the cracked section and from the bottom of the casting, so that it might more readily absorb heat at this point while the upper section of the lagging prevented radiation. All other portions of the cylinder were covered with asbestos sheets so as to retain as much heat as possible. Occasionally a charcoal fire can be built inside the cylinder, but better practice employs the fire basket that may be seen below the cylinder in the illustration. The fire basket was very simply made from a section of smoke box cinder-screen, and a light frame is used

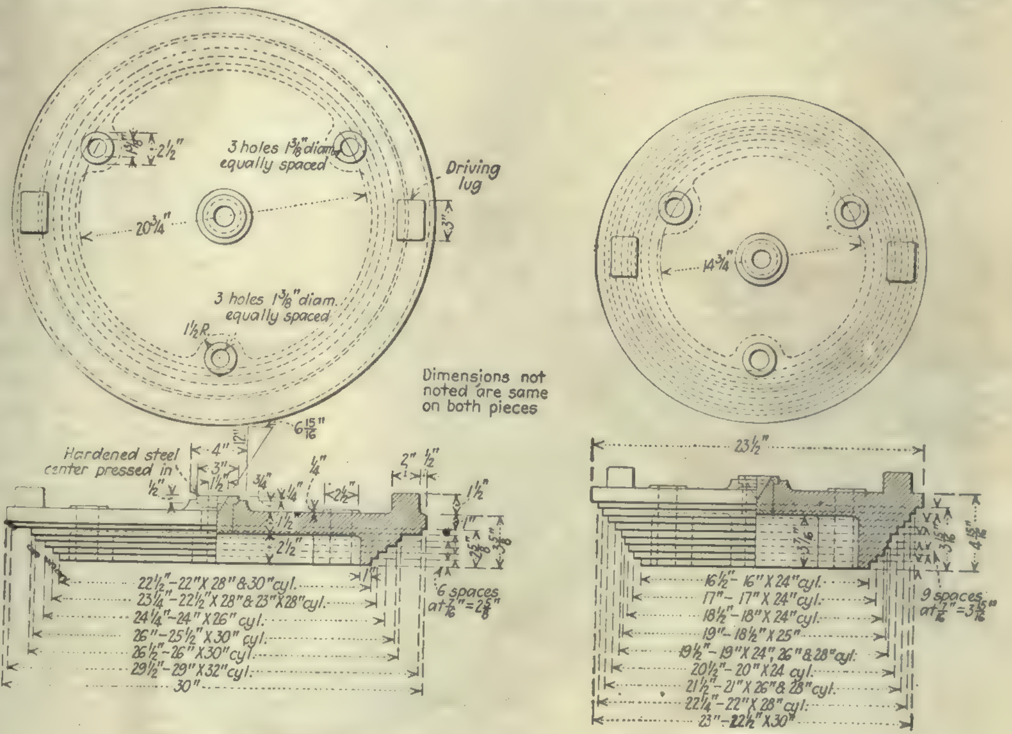


FIG. 8. CENTERS FOR LATHE-TURNING CYLINDER BUSHINGS

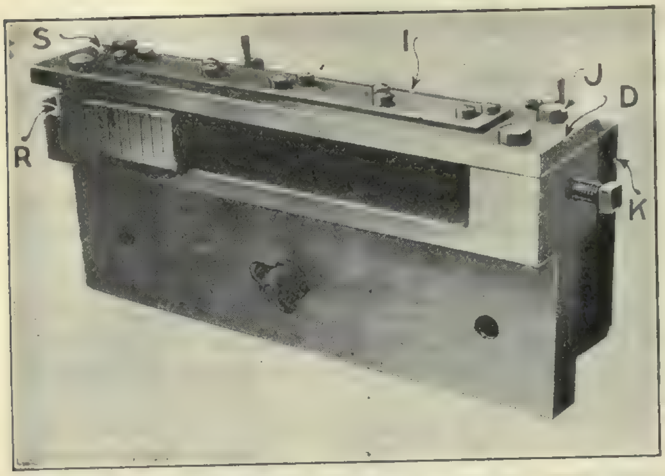
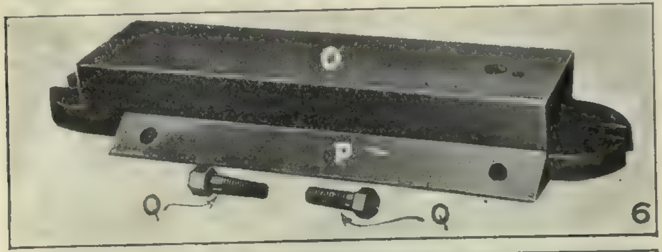


FIG. 4. FIXTURE WITH SOME SPACERS PLACED AND COVER IN PLACE

number of holes were drilled and tapped through it and so located that a setscrew in each of them would bear against the center of the edge of one of the spacer blocks. This would force the other edge of the spacer block against the surface *B* of the fixture and assure its being square in one direction with the surface *A* and the other surface behind it. A setscrew *G* at the end would then clamp all the spacing blocks against the surface *C* and assure that the spacing blocks were square in the other direction with the surface *A* and the one behind it. On trying this out however it was found that as each spacing block was put in and its screw tightened, the screws tightened against the previously located spacing blocks were loosened and the act of tightening had to be gone over several times, and that even then there was no way of equalizing the pressure, as some of the spacer blocks would be quite loosely held while others would be held too tight.

On making this discovery the designer removed the setscrews and drilled the threaded holes out so that they would be an easy fit for a $\frac{3}{8}$ in. steel ball.

The holes were drilled $\frac{23}{64}$ in. in the following manner: The end of a $\frac{23}{64}$-in. drill was flattened leaving about $\frac{1}{64}$ in. of the original point angle at the edge. A piece of hardened steel was then placed on the drilling machine table to act as a stop. The cover *D* was then placed on the hardened piece of steel and the drill run into each hole till it was brought up by its flattened end coming in contact with the face of the hardened steel piece. This left a small internal angular flange which served to retain the ball in the hole.



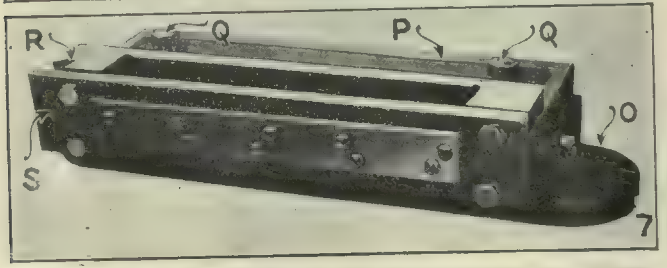


FIG. 6. TABLE OR ADAPTER FOR GRINDING MACHINE. FIG. 7. GRINDING FIXTURE SECURED TO ADAPTER OR TABLE

Into the holes thus made $\frac{3}{8}$-in steel balls were dropped and behind each was placed as stiff a compression spring as we could make to go freely into this small hole. On top of the springs the $\frac{1}{8}$-in. cold-rolled steel plate *I*, Fig. 2, was located and secured with fillister-head screws.

When assembling the spacing blocks in the fixture preparatory to grinding them, the cover *D* was removed as shown in Figs. 1 and 3. The spacing blocks were then placed close together side by side as shown at *H* Fig. 3 with one face against the straightedge *L*.

The depth of the recess between *E* and *F*, Fig. 1, is but a few thousandths greater than the width of the spacers. As the $\frac{3}{8}$-in. balls project about $\frac{1}{8}$ in. through the holes and beyond the inner face of the cover *D* there is available a clamping pressure on each of the spacer blocks equal to the power necessary to compress the spring $\frac{1}{8}$ in. Further this spring pressure is flexible and self adjusting, requires only the tightening of the four capscrews at the ends of the cover *D* and needs no following up to see that all the spacer blocks are uniformly held.

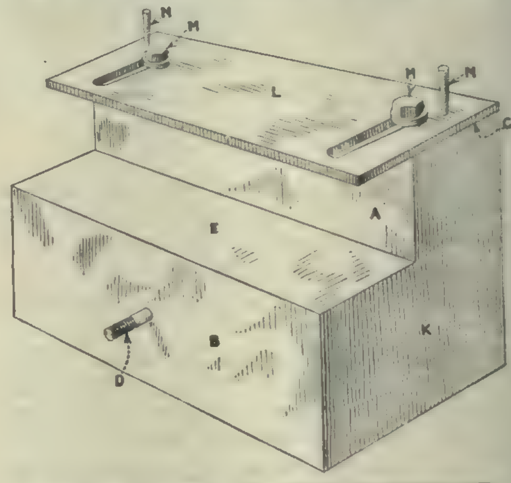


FIG. 5. DETAIL OF SETTING FIXTURE

After all the spacer blocks are placed, the cover is located on top and the four cap screws *J* Fig. 4 ar tightened. As these screws are screwed down eac ball comes in contact with its spacer block and force it against the face *B*, Fig. 1, of the fixture. Owing t the stiffness of the springs the spacer blocks are hel with great firmness against the surface *B*.

After the cover *D* is clamped tight the setscrew *G* i tightened enough to hold the spacer blocks agains shifting under the stresses due to grinding.

Before going further I should explain the settin fixture used in conjunction with the grinding fixtu when setting the spacer blocks ready for grinding.

This setting fixture is also made of cast iron ar is in box form with walls about $\frac{3}{8}$ in. thick so that will not be too heavy to handle. It is shown at *K* Figs. 1, 3 and 4 and in the perspective view Fig. 5.

Referring to Fig. 5 the surface *A* is planed parall to the surface *B*, although no great degree of accura is required on any part of the body of this fixtu The surface *C* is planed approximately square to t face *A* and parallel to the planed surface *E*. A stud is screwed into the center of the face *B* and is us to secure the grinding fixture in place against t

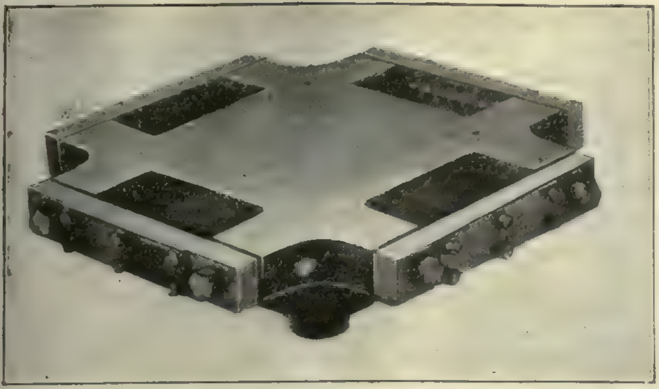


FIG. 8. TOP OF FOUR-SIDED GRINDING FIXTURE

face *B* while the spacer blocks are being assembled, as shown in Figs. 1, 3 and 4.

A straightedge *L* of 3/16-in. steel is located on the surface *C* so that its edge is parallel to the surface *B*, Fig. 5. As the grinding fixture is secured to the surface *B* during the assembling operation this means that the edge of the straightedge *L* is parallel to the surface *A* of the grinding fixture, Figs 1, 3 and 4.

Two capscrews *M* Figs. 1, 3 and 5 are used to hold the straightedge in place but it is located for each size of spacer block by two taper pins *N*, one at each end. These fit in holes through the straightedge and the setting fixture body. Slots are provided in *L* for the capscrews *M* so that they need be only slackened when re-adjustments of the straightedge are being made. Separate taper pin holes are provided through the straightedge *L* and setting fixture body for each size of spacer block to be set in the grinding fixtures.

As previously stated grinding is done on a Pratt & Whitney vertical surface grinding machine. To enable the fixture to be used on this machine the adapter or table *O*, Fig. 6, was made. This table can either be bolted direct to the platen of the machine or it can be held by the magnetic chuck; we have used it both ways.

The grinding fixture is held to the adapter by the two capscrews shown. The top of the table *O* was made about 1½ in. thick so that if necessary a cut can be taken over it each time it is replaced on the grinding machine, thus insuring the flatness and accuracy of its top surface and its parallelism to the path of traverse of the machine table. It will be noted that there is a strip of ⅛-in. cold-rolled flat steel *P* with a hole near each end. This is merely a long double washer which is placed under the two capscrews used to hold the grinding fixture to the table. It is made in this form so that the surfaces around the capscrew holes in the grinding fixture will not be marred as they would be by ordinary washers which would be likely to turn with the capscrews and throw up burrs. These burrs would not only mar the fixture but they would prevent it from seating on the table properly when it is turned over for the second cut thus producing inaccurate work.

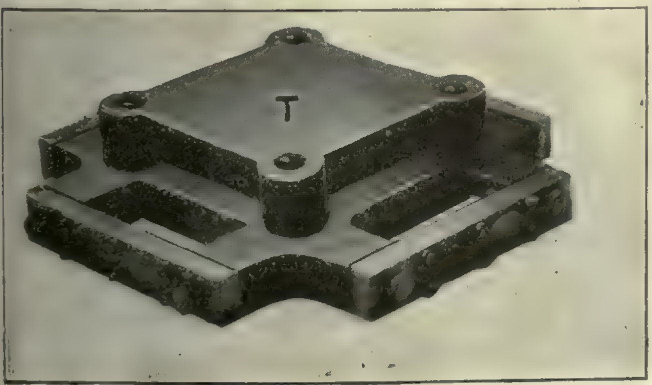


FIG. 9. BOTTOM OF FOUR-SIDED GRINDING FIXTURE SHOWING ADAPTER

After the fixture is secured to the table, as shown in Fig. 7, the top surfaces of the spacer blocks are ground till all of them are cleaned up. The two capscrews *Q* are then released and the fixture turned over and again fastened to the table *O*, in which position the other ends of the spacer blocks are ground to a finish.

As the surface *A*, of the grinding fixture, Figs. 1 and 3, and the one behind it are parallel and as the surface of the table *O* Fig. 6, is parallel to the traverse of the grinding wheel, the surfaces of the ends of the blocks must also be parallel to each other.

It will be noted that a species of V-block has been worked out of the fixtures body as at *R* Figs. 1, 3 and 4. The sides of this V-block *R* are accurately square in both directions to the surface *A* of the fixture. It will also be noticed that there are three holes *S* in the cover *D* above the V-block. These holes are tapped to accommodate three setscrews. The rough blanks for the spacers are cut about 1/16 in. longer than finished size and after they are placed in the fixture the operator takes a grinding gage and sets it in the V-block fastening it with the three setscrews. These grinding gages are made of cold rolled steel. They are ground to length and their ends are coated with sulphate of copper.

The grinding machine operator grinds the first surface of the spacer blocks till the wheel just touches the coppered face of the grinding gage. When he turn the fixture over and grinds the other surface he again brings his wheel down till it just touches the coppered surface of the other end of the grinding gage. In this manner no calipering is necessary and the work is easily brought within the required limits. In this work the limits are for the 5¼-in. size, within 0.002 in. The important matter is to get all the spacer blocks of a lot as nearly the same length as it is possible to grind them. If the grinding is carefully done and the operator takes precautions not to let his wheel "ride" over the surface, a charge of blocks can be easily brought within 0.0005 in. of uniform size.

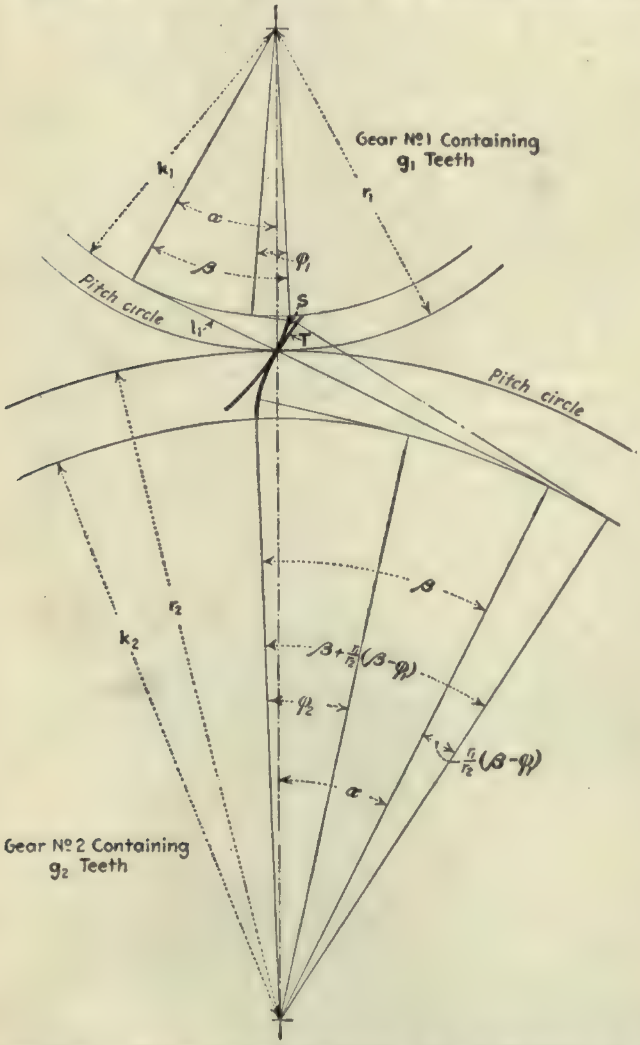
In Fig. 8 is shown another modification of this same principle. In this case the spacer blocks are divided into four groups. Two groups of eight spacer blocks each and two of seven blocks each. Fig. 8 shows the top of the fixture and Fig. 9 the bottom. With this fixture no adapter or table is used, or rather the adapter is, during the first grinding operation, secured direct to the fixture. The table *T*, Fig. 9, is fastened to the fixture by four screws, located in counterbored holes, so that their heads are below the surface. When grinding the operator places the table *T* direct on the magnetic chuck. The top ends of the spacer blocks are then ground and when they are cleaned up the operator removes the fixture from the magnetic chuck, takes out the screws which hold the table to the fixture and, with the table removed, places the fixture back on the magnetic chuck again. This time the previously ground surfaces of the spacer block ends rest directly on the magnetic chuck. If the magnetic chuck is true the work is bound to come parallel.

Two grinding gages are used with this fixture. They are made from blocks which have been spoiled on the fixtures previously used. By laying them on the steam hammer anvil and striking them a blow they can be lengthened sufficiently to make grinding gages of them.

In work of this kind one cannot be too careful to eliminate all the possible causes of trouble. A number of spacers came from the new fixture with their end faces out of parallel. On close examination it was found that they had been slightly bent before they were clamped in the fixture, in some cases only a few thousandths, but when clamped in the fixture they were forced straight. While they were in the fixture their end surfaces were parallel after being ground, but as soon as the clamping screws were released they resumed their original shape which threw the end surfaces out of parallel. This trouble was overcome by surface grinding the sides before placing them in the grinding fixture.

Angles of Approach, Recess and Contact of Involute Gears—Discussion

By J. M. Labberton


Gear No. 1 Containing g_1 Teeth
k_1
r_1
α
β
φ_1
Pitch circle
l_1
S
T
Pitch circle
β
$\beta+\frac{r_1}{r_2}(\beta-\varphi_1)$
φ_2
$\frac{r_1}{r_2}(\beta-\varphi_1)$
α
r_2
k_2
Gear No. 2 Containing g_2 Teeth

In an article by A. B. Cox in the *American Machinist* on page 559, Vol. 54, a method of calculating the angles of approach, recess and contact in involute gears was described. This method required the derivation of a special formula for the involute and was confined to gears having addenda the same for both gear and pinion.

In the following paragraphs is given a method originated by the writer which is simpler and which covers all ratios of addenda. This method has been in use by the Westinghouse Electric and Manufacturing Co. and the R. D. Nuttall Co. for several years.

Referring to the accompanying figures:

Let r_1 and r_2 be the radii of the pitch circles of the gears shown, and

Let α be the pressure angle.

$$l_1 = a_1 = r_1 \sin \alpha.$$

Where k_1 is the radius of the base circle, an involute drawn from this base circle will take the path shown if it is assumed that it must pass through the point where the two pitch circles coincide.

$$\text{But the angle } \beta = \frac{r_1 \sin \alpha}{k_1} = \frac{r_1 \sin \alpha}{r_1 \cos \alpha} = \frac{\sin \alpha}{\cos \alpha}$$

Therefore, angle $\beta = \tan \alpha$; or in other words, the radian value of β is numerically equal to the tangent of the pressure angle.

Consider the angle ϕ_1 and that section of the involute generated by the evolute of the arc of $(\beta - \phi_1)$. This section of the involute makes contact during the angle of approach, and therefore $(\beta - \phi_1)$ is the angle of approach. The arc of ϕ_1 is the evolute of that section of the involute adjacent to the base circle which never makes contact. It is conceivable that ϕ_1 can be zero, but if less than zero there is no involute and interference occurs.

That portion of the involute above the pitch circle is generated by an angle equal to the angle of recess. But this portion of the involute on gear No. 1 mates with that section of the involute of gear No. 2 generated by the angle $(\beta - \phi_2)$. Therefore, the angle of recess of the No. 1 gear is $\frac{r_2}{r_1}(\beta - \phi_2)$.

Study of the figure will disclose that the addenda are:

For gear No. 1, $k_1 \sqrt{\left[\beta + \frac{r_2}{r_1}(\beta - \phi_2)\right]^2 + 1} - r_1$

For gear No. 2, $k_2 \sqrt{\left[\beta + \frac{r_1}{r_2}(\beta - \phi_1)\right]^2 + 1} - r_2$

The angle of contact being the sum of the angles of approach and recess, the angle of contact

$$C_A = \beta - \phi_1 \pm \frac{r_2}{r_1}(\beta - \phi_2).$$

As a summary we have the following formulas:

(1) β (in radians) is numerically equal to the tangent of the pressure angle, or $\beta = \tan \alpha$

(2) Angle of approach of gear No. 1 $= \beta - \phi_1$

(3) Angle of recess of gear No. 1 $= \frac{r_2}{r_1}(\beta - \phi_2)$

(4) Addendum of gear No. 1 =

$$k_1 \sqrt{\left[\beta + \frac{r_2}{r_1}(\beta - \phi_2)\right]^2 + 1} - r_1$$

(5) Addendum of gear No. 2 =

$$k_2 \sqrt{\left[\beta + \frac{r_1}{r_2}(\beta - \phi_1)\right]^2 + 1} - r_2$$

(6) $k_1 = r_1 \cos \alpha$

(7) $k_2 = r_2 \cos \alpha$

Proceed as follows in the solution of a problem: The pressure angle and addenda known substitute in (4) and (5), and solve for ϕ_1 and ϕ_2. Substitute these latter values in (2) and (3) to obtain angles of approach and recess for the No. 1 gear.

Tools for Boring and Turning Locomotive Tires—II

Rough and Finish Turning Tools—Solid Tools and Tools in Holders—Angles of Rake and Clearance Vary Greatly in Different Shops

By FRED H. COLVIN
Editor, *American Machinist*

IT WILL be noted that the numbers in the table in this article do not correspond with those published in the table in Part I, so that in making comparisons, the *names* of the railroads, and not the numbers, should be noted. Form-finishing tools are used in each of these cases and details are given where they differ in construction. The following illustrations show the way in which these tools are made, in most cases.

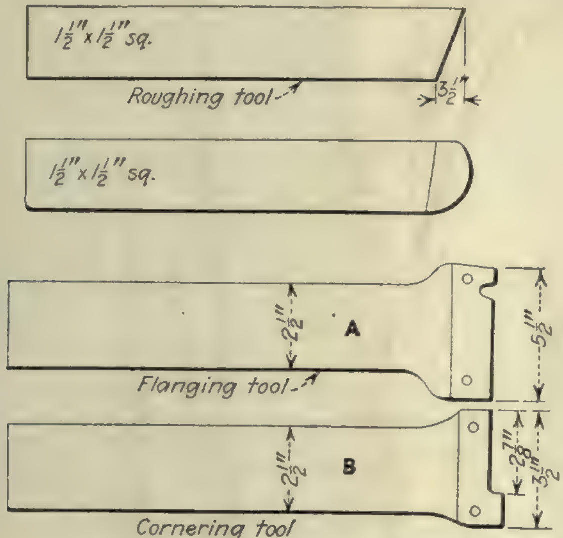


FIG. 10. ATLANTIC COAST LINE

No. 2. Both roughing and finshing tools of the Atlantic Coast Line R.R. are shown in Fig. 10, "rights" and "lefts" are of course necessary in the case of the form tools, though both are not shown. The first tool *A* finishes the flange, while *B* makes the regular bevel and also trims the outer corner. These tools have 1½- to 2½-deg. clearance.

TABLE II. TIRE TURNING DATA

Name of Railroad and Shop	Size of Tool Body in Inches	Top Rake of Tool, Degrees	Clearance at Point, Degrees	Cutting Speed—Feet per Minute: Roughing	Cutting Speed—Feet per Minute: Finishing	Feed per Revolution in Inches, Roughing
Atlanta, Birmingham & Atlantic, Atlanta, Ga.	1½x2½	10	5	10-15	10-15	¼-⅜
Atlantic Coast Line, Wilmington, N. C.	2½x2½	5	3½	17	17	⅜
Atchison, Topeka & Santa Fe, Topeka, Kan.	2 x 3	12	15	16-18	18	⅛
Bessemer & Lake Erie, Greenville, Penn.	1½x 3	2	4	11	11	¼x⅜
Chicago & Alton, Bloomington, Ill.	1½x 3	8	6	16	12	⅛
Chicago & Northwestern, Chicago, Ill.	1½x 3	4 to 6	6 to 8	13	13	⅜
Canadian Pacific, Montreal, Can.	1½x 3	6	[illegible]	15	17	⅜
Chicago, Rock Island & Pacific, Silvis, Ill.	1½x2½	5	5	12	12	5/16
Denver & Rio Grande, Burnham, Colo.	1½x2½	8	6	17	17	⅛
Grand Trunk, Battle Creek, Mich.	1½x 3	5	5	15	15	⅜
Grand Trunk, Montreal, Can.	2 x 3	5	5	13.7	13.7	¼
Hocking Valley, Columbus, Ohio	1½x 2	2 to 3	7	14	14	¼
Lehigh Valley, Bethlehem	2 x 3	7	8	12-20	12-20	¼
Norfolk & Western, Roanoke, Virginia	2 x2½	6	6	16	16	⅜
New York, New Haven & Hartford, Readeville, Mass.	1½x 4	2	7	50	45	½
New York Central, Depew, N. Y.	1½x1½	11	4	14-18	14-18	5/16
New York, Ontario & Western, Middletown, N. Y.	1½x 3	12	6	15	10	5/16
Pennsylvania, Olean, N. Y.	1½x 3	3	5	13¾	12½	⅜
Philadelphia & Reading, Reading, Penn.	1½x 3	2	5	18	12	¼
Wabash, Dacatur, Ill.	1½x 3	2	5	15	17	⅜

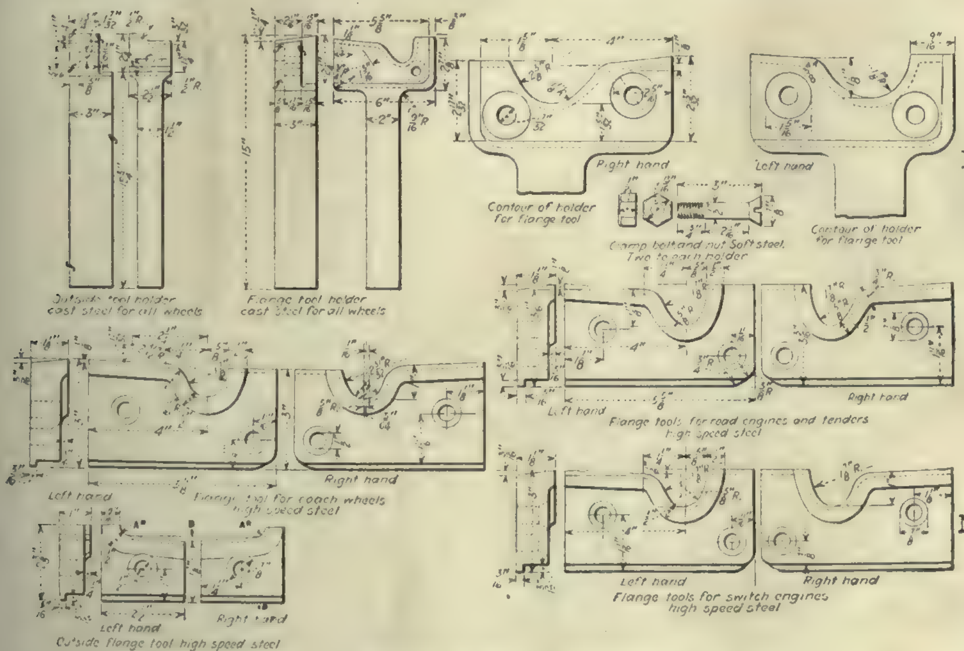

Right hand
Left hand
Contour of holder for flange tool
Contour of holder for flange tool
Clamp bolt and nut Soft steel. Two to each holder
Outside tool holder cast steel for all wheels
Flange tool holder cast steel for all wheels
Left hand
Right hand
Flange tools for road engines and tenders high speed steel
Left hand
Right hand
Flange tool for coach wheels high speed steel
Left hand
Right hand
Outside flange tool high speed steel
Left hand
Right hand
Flange tools for switch engines high speed steel

FIG. 11. ATCHISON, TOPEKA & SANTA FE

No. 3. Full details of the form-cutting tools for the tire treads, and the holders which support them are given in Fig. 11. These tools come from the Atchison, Topeka & Santa Fe Ry. and show the contours for road engines and tenders, for switching engines and for car wheels. As dimensions are similar on both right- and left-hand tools—they are not given in both cases.

No. 4. The contour of the standard form of tire is shown at *A* in Fig. 12. The tools used by the Bessemer & Lake Erie R.R. are also shown, including the roughing tool at *B* which

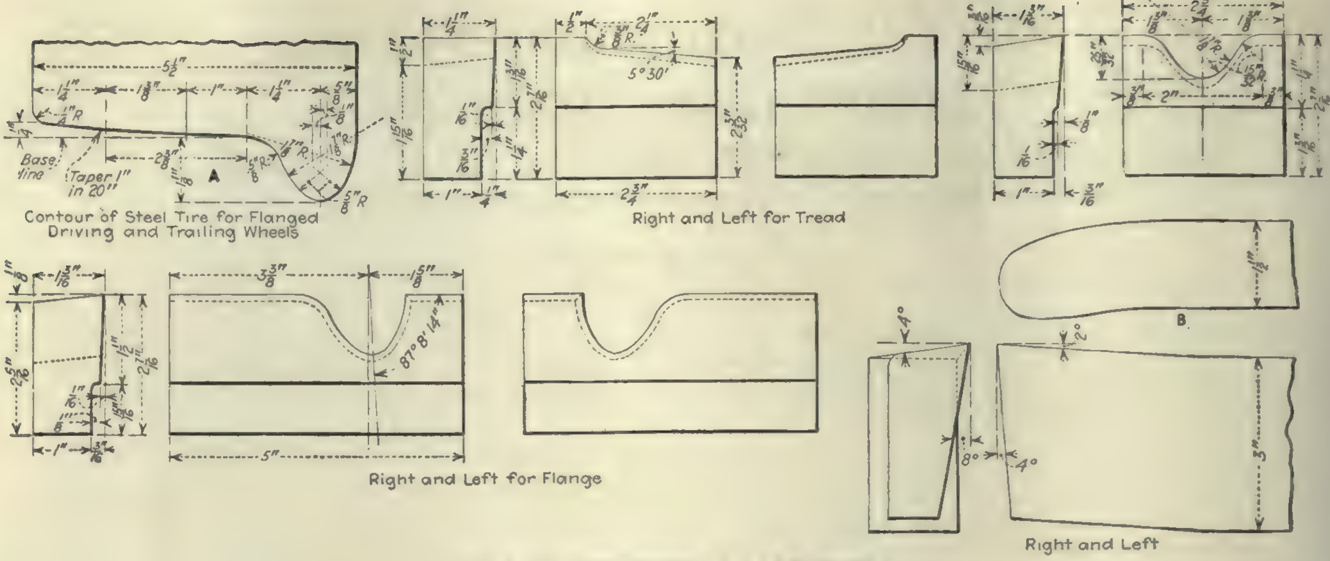

Contour of Steel Tire for Flanged Driving and Trailing Wheels
Base line
Taper 1" in 20"
A
5°30'
Right and Left for Tread
87°8'14"
Right and Left for Flange
B
Right and Left

FIG. 12. BESSEMER & LAKE ERIE

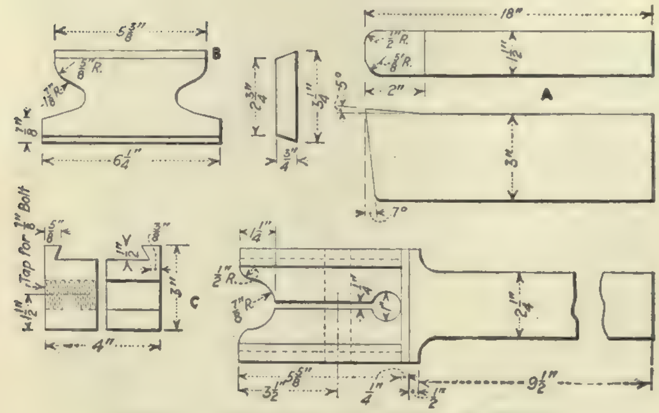


FIG. 13. CHICAGO & NORTHWESTERN

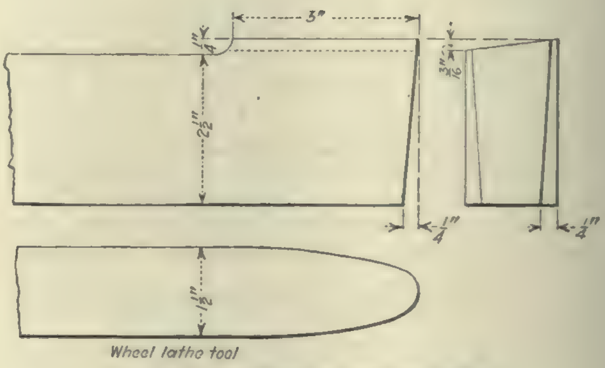


FIG. 16. DENVER & RIO GRANDE

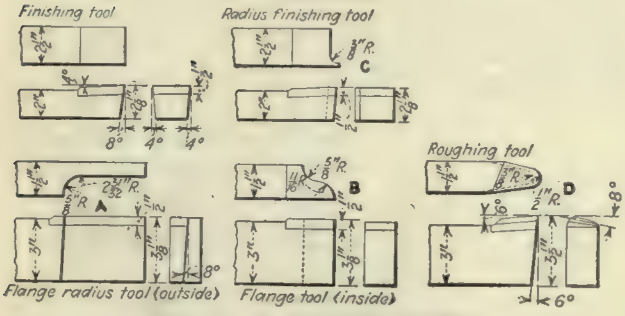


FIG. 14. CANADIAN PACIFIC

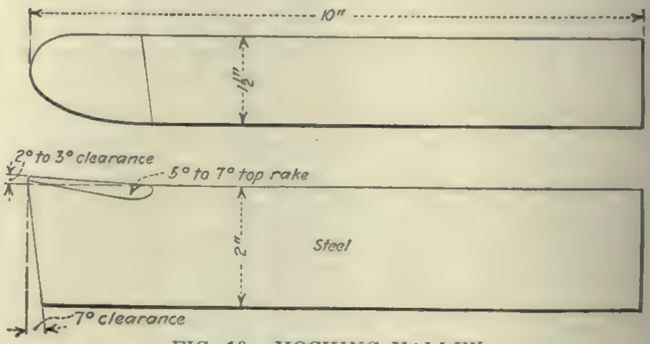


FIG. 18. HOCKING VALLEY

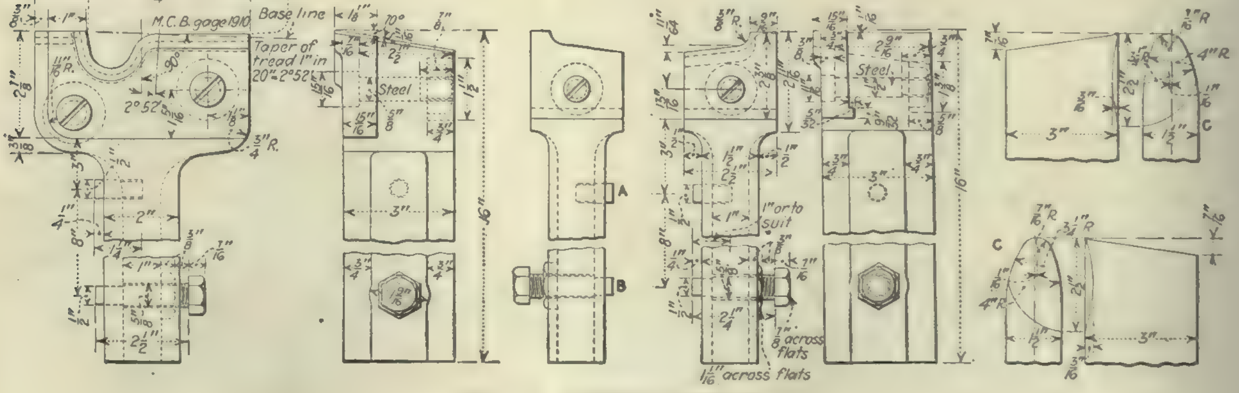


FIG. 19. LEHIGH VALLEY

has a top rake of 2 deg. and a side clearance of 8 deg. on both right- and left-hand tools. The form tools are also shown. These tools have finished a pair of 54-in. tires in 37 min. on a Sellers wheel lathe with turret head tool-holder.

No. 5. The roughing tool of the Chicago & Alton R.R. has a ¾-in. radius. Form finishing tools are used in the usual manner, one covering the flange and half the tread, the other finishing the tread and the corner radius.

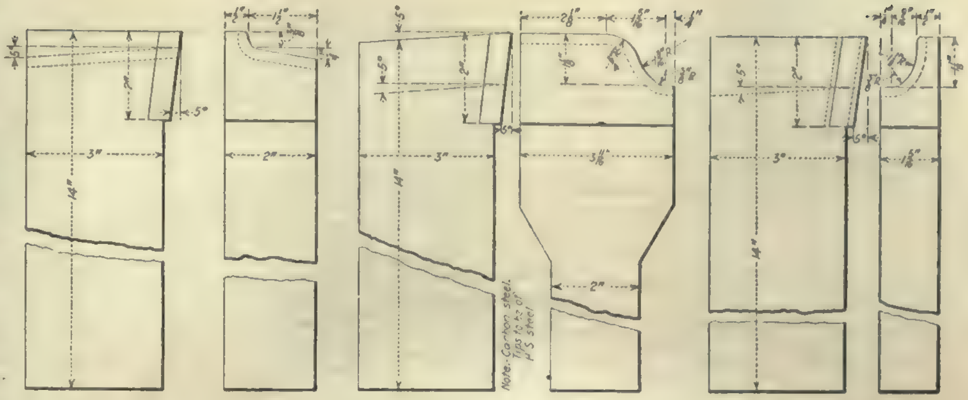


FIG. 17. GRAND TRUNK

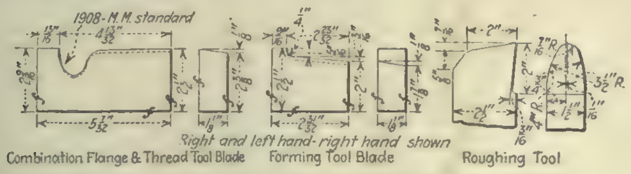

1908-M.M. standard
Combination Flange & Thread Tool Blade
Right and left hand-right hand shown
Forming Tool Blade
Roughing Tool

FIG. 15. CHICAGO, ROCK ISLAND & PACIFIC

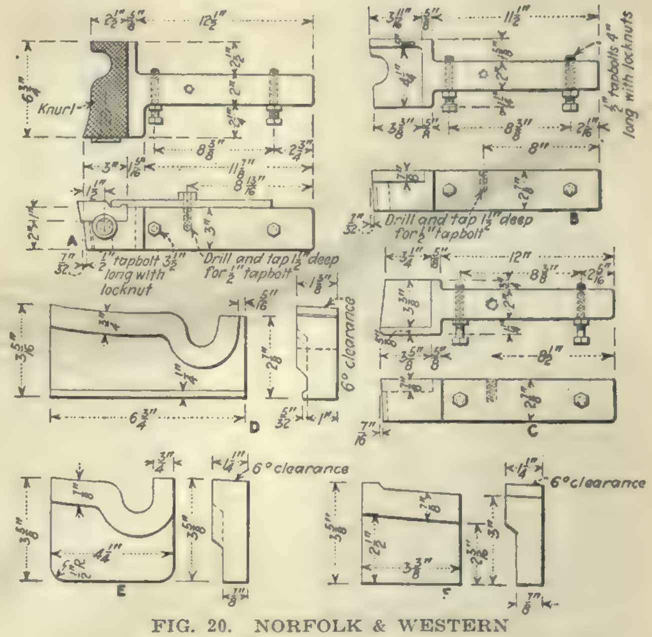

Knurl
A
½" tapbolt 3½" long with locknut
Drill and tap 1½" deep for ½" tapbolt
½" tapbolts 4" long with locknuts
B
Drill and tap 1½" deep for ½" tapbolt
6° clearance
C
D
6° clearance
E
6° clearance
F

FIG. 20. NORFOLK & WESTERN

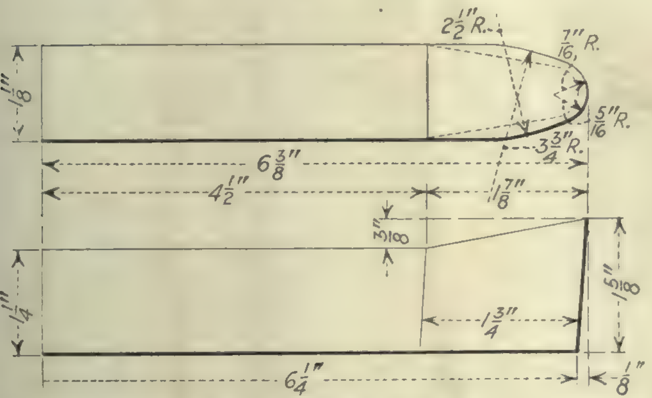


FIG. 22. NEW YORK CENTRAL

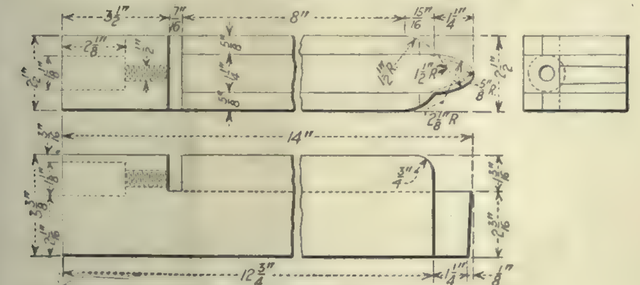


FIG. 23. NEW YORK CENTRAL

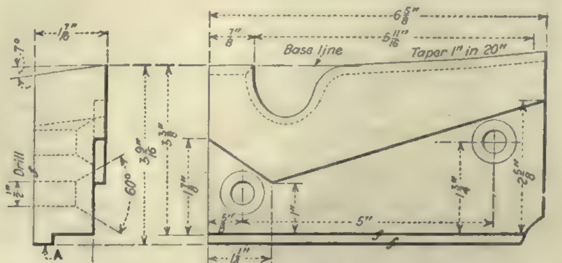


FIG. 21. NEW YORK, NEW HAVEN & HARTFORD

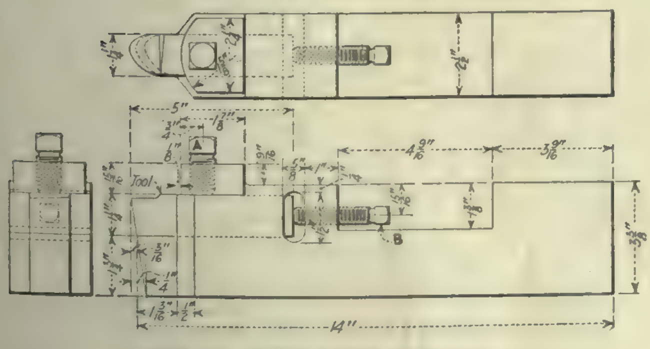
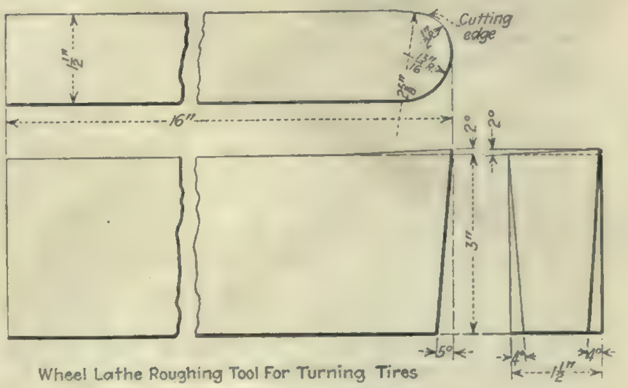


FIG. 24. NEW YORK CENTRAL



Wheel Lathe Roughing Tool For Turning Tires

FIG. 29. WABASH

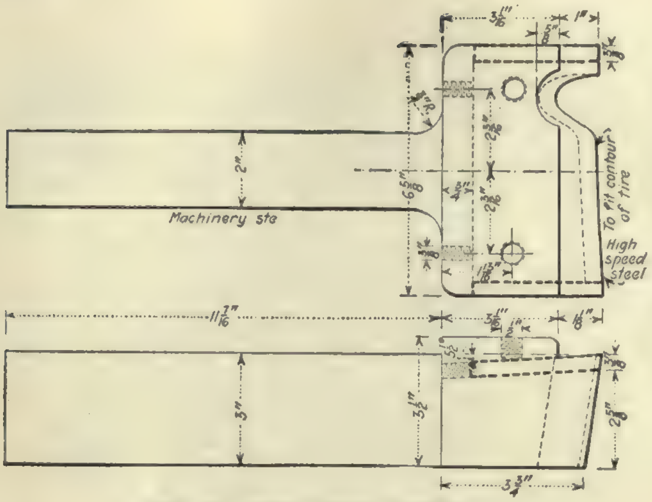


FIG. 25. NEW YORK CENTRAL

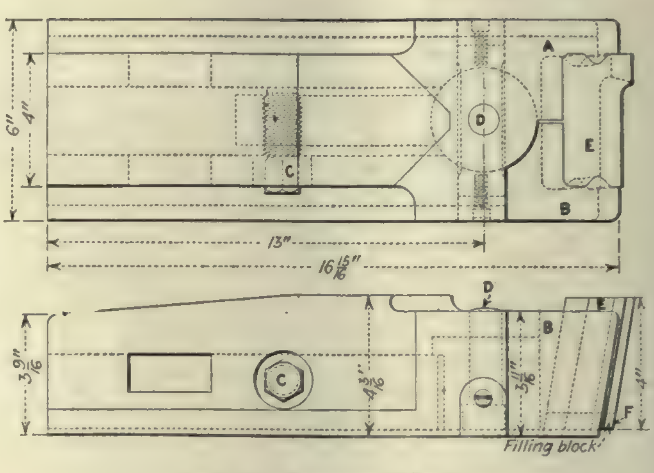


FIG. 27. PENNSYLVANIA

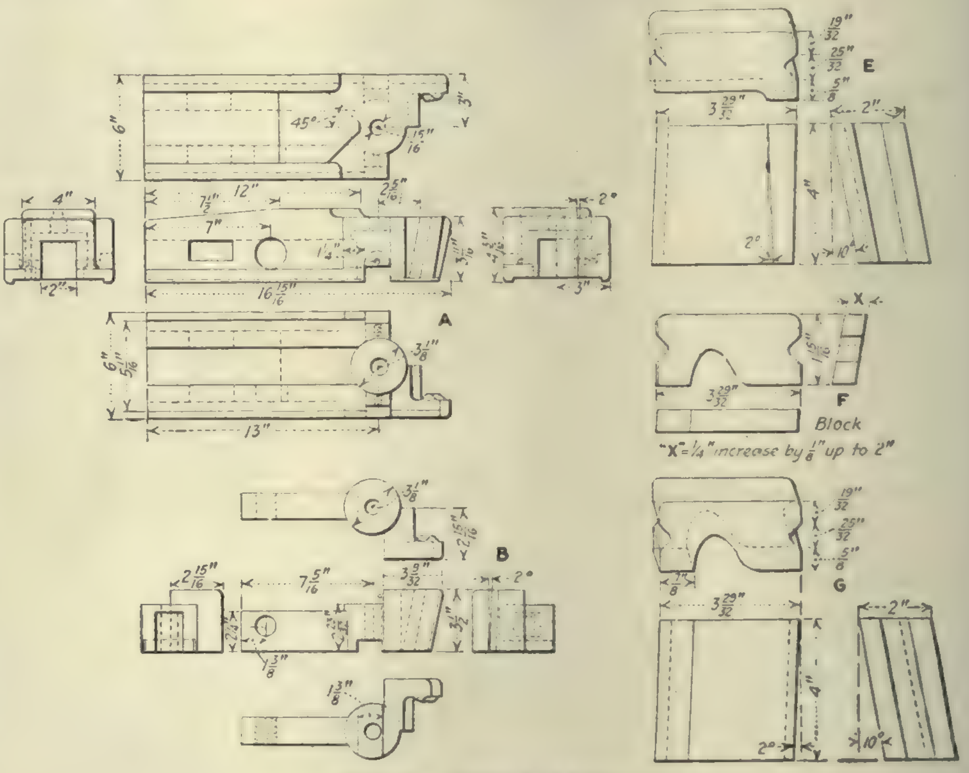


FIG. 26. PENNSYLVANIA

No. 6. Different tools of the Chicago & Northwestern Ry. are shown in Fig. 13. The roughing tool is given in detail at *A*, while the double ended form tool for the flange is shown at *B*. The holder for the latter is shown at *C* with all necessary dimensions.

No. 7. The Canadian Pacific Ry. uses mild steel shanks with high-speed steel welded to the cutting edge, details being shown in Fig. 14. The wheel tread is not formed with one tool, but by successive use of tools *A*, *B* and *C*. This view also shows the roughing tool at *D*.

No. 8. In addition to the top rake and clearance shown in the table, a side rake of 7 deg. is given to the cutting edge of tools used by the Chicago, Rock Island & Pacific Ry. The cutters for finishing and the forming tool outlines are shown in Fig. 15. These cutters slip into a holder which supports them firmly while in the cut.

No. 9. The outline of the rough turning tool of the Denver & Rio Grande R.R. is shown in Fig. 16.

No. 11. The Grand Trunk shops at Montreal use carbon steel shanks with high-speed steel tips welded in place. The dimensions and forms are shown in Fig. 17. The method of use is similar to that of the tools shown in Fig. 14.

No. 12. The rough turning tool used is shown in Fig. 18. Finishing is done with a flat formed tool as is the usual practice of the Hocking Valley Ry.

No. 13. A somewhat different design of form tool is used by the Lehigh Valley R.R. and is shown in Fig. 19. The holder is a steel casting made for both right- and left-hand tools, with a channel or I-section in the shank. The stud *A* and the setscrew or stopscrew *B* make it easy to locate the tool in the holder and to swing it sideways so as to get the right angle. The roughing tool is shown at *C*.

No. 14. There is nothing unusual in the roughing tool of the Norfolk & Western Ry., but the form finishing tool is rather unique in its construction as can be seen in Fig. 20. Three types of holders are provided, the one at *A* being for forming the complete tread, while *B* and *C* form the flange and the bevel respectively. The cutters shown at *D*, *E* and *F*, are of high-speed steel, clamped in place as at *A*. It will be noted that holder at *A* is knurled to help hold the form cutter. Both *B* and *C* however have a raised flange at the side and rear which takes the thrust. A clamp is used on all these tools.

No. 15. Tools for rough turning tires have low-carbon steel bodies with high-speed noses or tips welded in place. The form finishing tool is made with a master milling cutter of proper contour. The cutter is fastened to a holder by two large screws, while the lip *A*, Fig. 21, which fits a groove in the

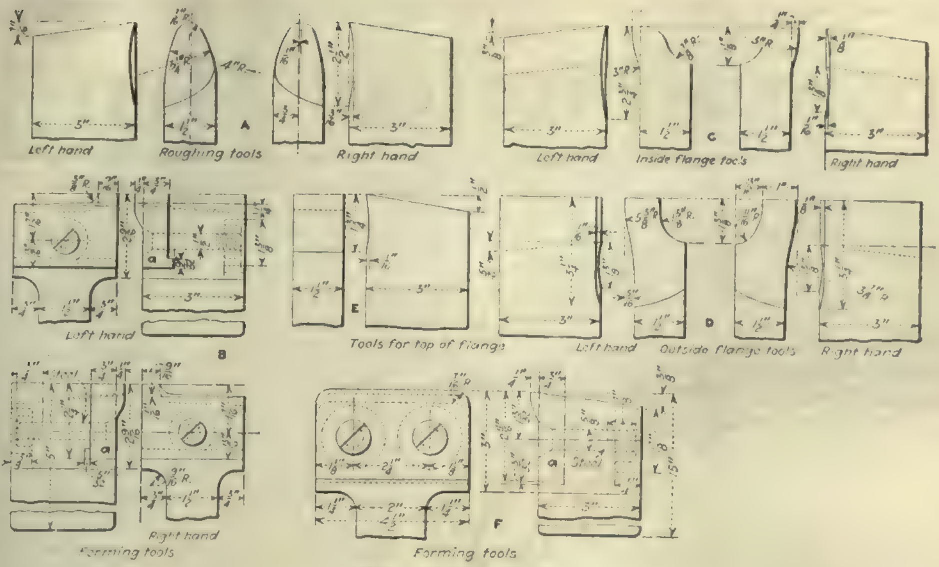


FIG. 28. READING

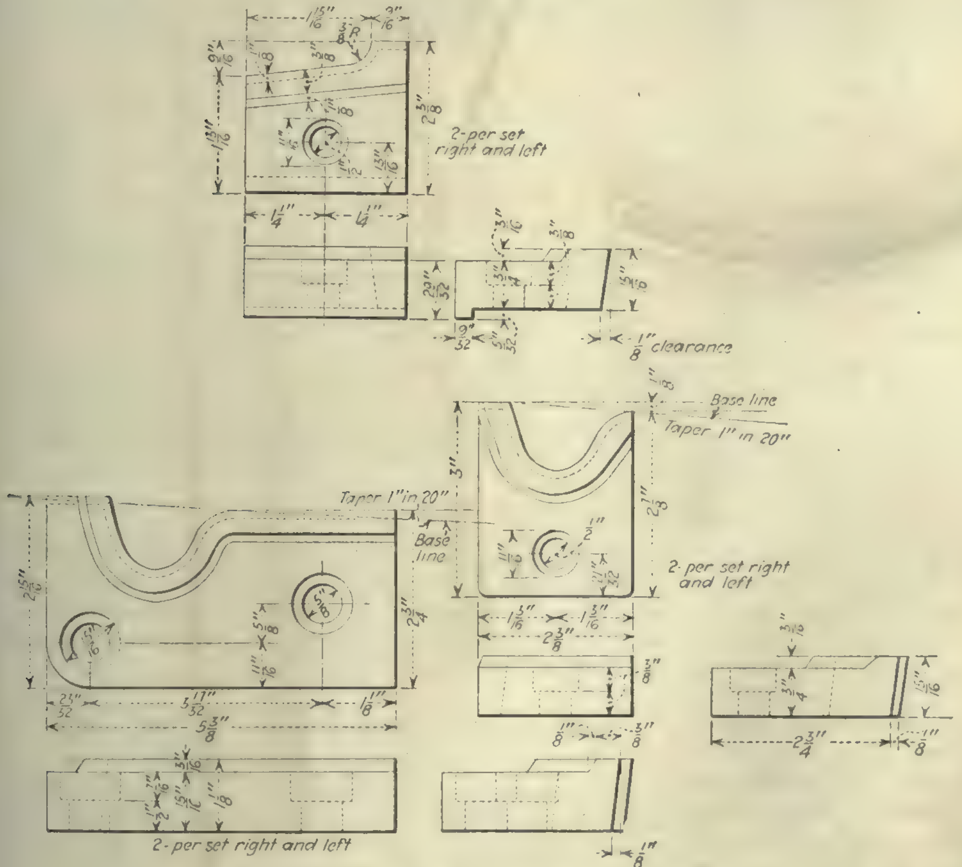


FIG. 30. WABASH

holder, both locates it and prevents any lifting under the heaviest cuts.

No. 16. The New York Central R.R. has several forms of tire turning tools. The solid tool is shown in Fig. 22, while Figs. 23 and 24 show two types of toolholders with inserted blades. The latter has the clamping screw *A* and adjusts the cutter by screw *B*. In Fig. 25 is the holder for the form tool used in finishing. This has a pocket, at a 5½-deg. angle to give top rake, and both adjusting and clamping screws. This makes a substantial holder, but one which would be expensive were it not for the use of electric welding in filling in the sides of the slot as shown by dotted lines. These sides complete the pocket which serves to hold the cutter against side thrust and to locate it with reference to the flange.

No. 18. This forming tool from the Pennsylvania R.R. is quite different from any of the others, as shown in Figs. 26 and 27. The first shows details and the second the assembled tool holder and cutter. This form of holder and cutter is used for both the flange and the outer edge of tire.

The cutter is made on the principle of the straight forming tools used in screw machine work, and is held at the angle which will give the desired clearance. Several views of each part are shown in the details. The body *A* forms the left-hand jaw of the holding mechanism, while *B* is the movable jaw or clamp. The reference letters are the same in both Figs. 26 and 27. Referring to Fig. 27 the body jaw *A* and movable jaw *B* clamp the cutter *E* by means of the screw *C*. The loose jaw swings on the pivot pin *D*. The tool *G* is for finishing the flange.

The cutters are sharpened by grinding on the top or flat surface. In order to keep the cutting edge at the proper height, blocks are made to slip in under the bottom of the cutter as at *F*. There are 15 of these blocks in a set, varying by ⅛ in. from ¼ to 2 inches.

No. 19. The tire turning tool practice of the Philadelphia & Reading R.R. differs considerably from most of the others, as can be seen in Fig. 28. It resembles the C. P. R. and Grand Trunk in some respects. The roughing tools *A* are about as usual, but several tools are used for finishing. The bevel and chamfer are turned with the tools at *B*, the inside of the flange with tools *C*, the outside with *D*, the top of the flange with *E* and the fillets beside the flange with *F*. These tools are made right and left except *F*, and *B* and *F* have high speed cutters. The cutters are shown at *a* in both *B* and *F*.

No. 20. The form of the Wabash Ry. rough turning tool is shown in Fig. 29 and the form finishing tool in Fig. 30. The latter shows three types of tools, one to finish a goodly portion of the tread, while the other shows a separate flange tool and one for the bevel and the rounded corner.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Slide Rule for Speeds, Feeds and Time

By Fred A. Parsons

The slide rule shown was developed by the Kempsmith Manufacturing Co. for the use of their foremen for estimating operation times, especially in milling-machine work, although it is well adapted for either milling, drilling or turning.

The particular point of interest is that it combines standards for cutting speeds with a very quick method of determining the proper r.p.m. of work or cutter to obtain these speeds. By manipulating the rule according to the example printed on the bottom, the feed in inches per minute for any given feed in thousandths per revolution may be read after having determined the required revolutions per minute, and another setting gives the cutting time for any length of feed required.

The cutting speeds printed at the top of the rule represent conservative modern practice for average materials listed, and form a basis or starting point for the foreman or operator. When all conditions are favorable they may often be considerably increased, and sometimes, in case of hard or difficult materials, must be reduced. It will be noted that provision is made for the various tool materials, carbon, high-speed steel and stellite. Stellite drills are not listed as we have none as yet.

The listed speeds bear definite relations or ratios to each other, and as determined by experiment and borne out in practice the ratios run about as follows:

(a) Finishing cuts about 20 per cent faster than roughing; when finishing in one cut use roughing speeds.

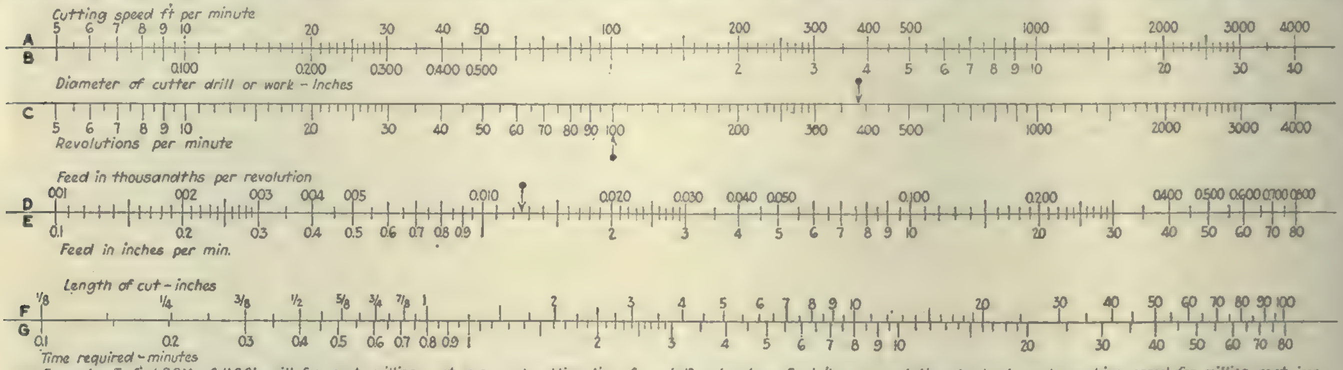
(b) Ratio of relative speeds for carbon, high-speed steel and stellite is about 1–1.5–2¼ respectively.

(c) Ratios of milling, drilling and turning speeds are about 1–0.8 and 1.5 respectively.

Item (c) is determined by various considerations, for instance: simple tools as lathe tools, which are easy to grind and replace, should, for economy, be run much faster than milling cutters which must last considerably longer between grinds to be economical. Slower speeds must also be used for turning tools in automatic machinery, etc., where tools are expensive to reset. Drills must be run slower than milling cutters because the entire cutting is on two points which are difficult to cool by means of fluids and without much metal to carry away the heat.

	MILLING						DRILLING		TURNING					
	R	F	R	F	R	F			R	F	R	F	R	F
Malleable iron	60	75	90	100	135	170	50	70	90	100	130	150	200	240
Cast iron - soft	40	50	60	70	90	110	35	50	60	75	90	110	135	160
Cast steel - clean	30	35	45	55	65	80	25	35	45	55	65	80	100	120
Steel bar - soft to 0306	60	75	90	110	135	170	50	70	90	110	130	160	200	240
	Carbon		H.S.S.T.		Stellite		Carbon	H.S.S.T.	Carbon		H.S.S.T.		Stellite	

	MILLING						DRILLING		TURNING					
	R	F	R	F	[illegible]	F			[illegible]	F	R	F	R	F
Tool steel - well annld	25	35	40	50	55	80	[illegible]	30	35	45	50	65	80	95
Brass - yellow	75	95	110	150	170	200	60	90	110	150	160	220	250	300
Bronze	40	50	60	70	90	100	35	50	60	70	90	100	135	160
Alluminum	460	550	700	9060	1000	1200	350	550	700	900	1000	1300	1500	1800
	Carbon		H.S.S.T.		Stellite		Carbon	H.S.S.T.	Carbon		H.S.S.T.		Stellite	



Example: To find R.P.M. of H.S.St. mill for rough milling cast iron, and cutting time for cut 12 inches long. Feed 1/16 per revolution. In chart read roughing speed for milling cast iron with H.S.S.T. cutters = 60 ft P. min. - set 4 on scale B against 60 on scale A & under arrow read 58 R.P.M. on scale C - Keep slide B set & move scale C until arrows match - under 0.062 on D read feed in inches per min. = 3.6 on scale E. Return all scales central & set 3.6 on scale E under arrow on D - under 12 inches on F read 3.34 minutes time required.
Chart for machine tool work Copyright 1921 by the Kempsmith Manufacturing Co. Kempsmith milling machines.

SLIDE RULE FOR SPEEDS, FEEDS AND TIME

Making Universal Joints Without Jigs

By E. A. Dixie

We recently had four rough universal joints to make for use in a machine. Their making entailed the machining of eight castings similar to the one shown at *A* in Fig. 1, and in detail in Fig. 2.

There was nothing fancy about the job, the requirements being that there should be no jigs and as little machine work as possible. With this in view it was decided to make the fulcrum blocks of 2 in. square cold-rolled steel cut 1⅞ in. long in the hacksawing machine and left just as they came from the saw.

The castings *A* were bored 1 in. as shown in Fig. 2 for the reception of the end of the shaft to which they were to be secured by means of taper pins. At the same operation the end was faced. They then went to the milling department where they were gripped in the milling machine vise and a 2-in. mill was passed between the jaws.

The blocks then went to the laying out table and the centers *B* were laid out with relation to the shaft and the milled inside surfaces of the jaws. The centers were then center punched and the rest of the work was up to the drilling machine.

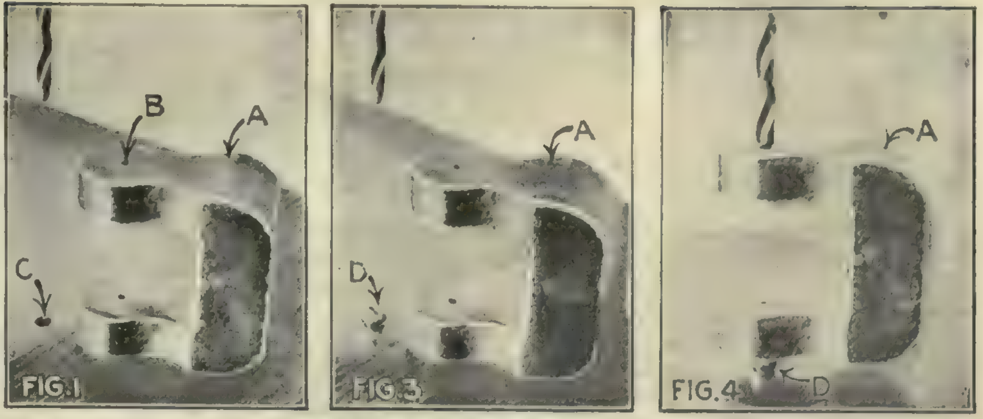


FIG. 1. YOKE AND HOLE IN MACHINE TABLE. FIG. 3. HOW BALL WAS USED. FIG. 4. YOKE CENTERED ON BALL READY FOR ENLARGING SMALL HOLE PREVIOUSLY DRILLED

It will be noted that, as usual, some one had run a drill into the drilling machine table at *C*, Fig. 1. This hole *C* was utilized by the machinist to center the bottom of the jaw while he drilled the top. In Fig. 3 it will be noted that a steel ball *D* has been located in the hole *B*, and that in Fig. 4 the center punch mark or drilled hole in the bottom jaw has been located on the top of this steel ball. With the casting positioned in this way a $\frac{3}{16}$-in. drill was run through one jaw, then the yoke was turned over and the drill run through the other. This was followed by a $\frac{17}{32}$-in. drill as $\frac{1}{2}$-in. capscrews were to be used in assembling the joints.

As there was nothing particular about the accuracy of the blocks, the sole requirement being that they should be strong and work freely, one side of each of them was centered, drilled and tapped $\frac{1}{2}$ in. The blocks were then assembled in the yokes and held by a $\frac{1}{2}$ in. capscrew, shown in Fig. 5, which had previously been gripped in a collet chuck and had its head turned to a cone which would fit in the hole in the drilling machine table. With the yokes thus assembled the pointed head of the capscrew was located in the hole in the drilling machine table and with a $\frac{17}{32}$-in. drill passed through the hole in the top of the yoke, the second hole in the block was "spotted." After all the holes were thus spotted the blocks were removed and drilled and tapped in the usual manner.

The square cold-rolled stock from which the blocks were made was about 0.002 in. thinner than the 2-in. milled opening between the yokes. The capscrews were $\frac{1}{32}$ in. smaller in diameter than the clearance holes in the jaws so that the asembled universal joints were quite free. Very little stress came on the $\frac{1}{2}$-in. capscrews finally used to assemble the joints as the square block takes and delivers most of the drive, the capscrews merely keeping the parts from becoming disassembled.

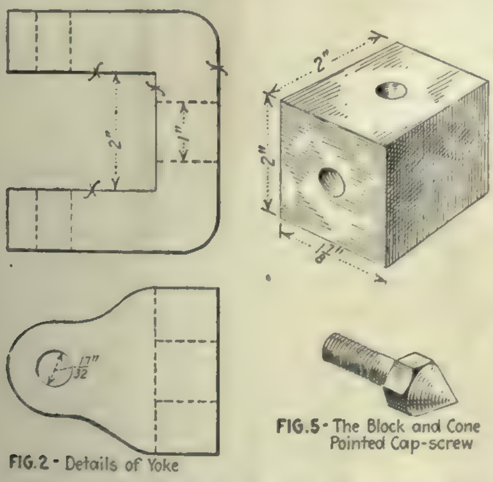


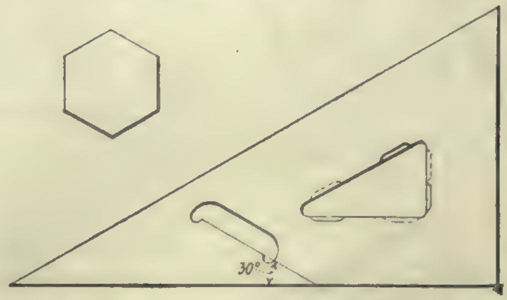
FIG. 2. DETAILS OF YOKE. FIG. 5. BLOCK AND CONE-POINTED CAPSCREW

The use of a steel ball in this manner for centering opposite sides of pieces where holes have to be drilled approximately in line is not as widely known as it should be. Some sensitive drilling machines are provided with male and female centers which can de adjusted vertically. Where such is available there is no need to use the ball but there are many drilling machines which are not so equipped and on them the ball can often be used to advantage.

Triangle for Drawing Bolt Heads

By J. Homewood

The accompanying drawing shows a 30-60-deg. draftsman's triangle that is cut out to give an additional edge to facilitate the drawing of nuts, bolt heads and other similar parts where it is ordinarily necessary to turn the triangle over to complete the figure. This device will be found very convenient for doing small work, such as the hexagon nut head shown, because of the fact that lines slanting 30 deg. in either direction can be drawn without turning over the triangle.



TRIANGLE WITH AN INSIDE EDGE TO AID IN DRAWING NUTS

Position of Diamond in Wheel Truing

By G. G. Little

On page 45 of the *American Machinist*, in the article "Grinding with a Phantom Wheel," the position of the diamond for truing the wheel is in my estimation wrong.

There is but one position in which to place the diamond to insure truing the wheel properly with relation to the movement of the tables of the machine, and that is in a vertical position directly beneath the center of the spindle.

IN THIS ISSUE

THE issue is opened by the first of the McCabe articles on "Economics of Production." There is an introduction by Ernest F. DuBrul, general manager of the National Machine Tool Builders' Association. Our previous announcement stated that there would be ten articles in this series, but it has now been arranged to present everything in seven installments, no one of them longer than two pages. Much of our material for several months has been on economics, directly or indirectly. We recall "Obstacles to Business Revival," by Nathaniel R. Whitney; "The Hard Times—Their Cause and Cure," by Theodore H. Price; "Business Conditions as the Big Banks of the Country See Them" (a weekly article for a long time), and the "Business Barometer" now running each week. They were articles that treated their subjects from an economic viewpoint, but they assumed pre-education in the subject of economics. The McCabe articles, on the other hand, are on the subject of economics itself, treating it in a clear and simple way, yet making it possible for those who wish to do so, to understand the underlying principles of this important science.

Materials handling enters largely into efficient and economic production, particularly in duplicate part work. It is a matter that has too frequently not been given the proper amount of attention. In fact we, ourselves, plead guilty to that charge to some extent. We are going to remedy our deficiency and as a first step are presenting, page 292, an article by Fred H. Colvin on handling materials in an automobile plant. The article shows how elevators and floor openings are used for carrying materials from one floor to the next, describes the continuous assembly arrangement and shows the layout of the plant's four floors. Parts storage and subassemblies also are taken up.

Robert Mawson, page 296, tells how auto-starter frames are machined in the Gray & Davis plant. His article is not hard to read on account of the many illustrations of the special fixtures, devices and clamps that he describes.

There are six pages of the Dowd and Curtis series on tool engineering, beginning with 299, devoted to the design of vise-jaws and vise fixtures and including data on the design of special and swivel jaws for insuring accuracy and quick operation, devices for equalizing pressure, and automatic ejectors.

Equipment and methods in use in the Decatur shops of the Wabash Railroad are described by Hunter in his article on shop work on locomotive cylinder and valve parts, page 305. He tells how saddles of cylinder castings are finished, describes a radial planing attachment for saddles and a portable cylinder boring device, and shows how cylinders are heated for welding.

The article on page 309 by Andrew MacNab explains some novel grinding fixtures. We cannot pick out any particular features to emphasize but assure you that the whole article is of great interest.

The second of Colvin's articles on tools for boring and turning locomotive tires was announced for last week, but lack of space prevented our running it. We managed to crowd it in this week, page 313. The two articles were worked up from the results obtained from inquiries sent to seventeen of the leading American railroads in an effort to secure definite knowledge of present practice in tire boring and turning.

How have selling prices of metals and metal goods compared with the selling prices of other commodities—food, farm products, cloth and clothing, lumber and building materials, etc.? You may feel that they have been very modest, as you remember how much you have been paying for your building materials, your clothing and your food. And you are right. But you need statistics to convince anybody else. If you have a way of presenting your statistics graphically you are still better off. On pages 326 and 327 there is an article, "Fluctuations in Wholesale Prices, 1914-21," which provides a chart that shows the increases and declines of wholesale prices by groups of commodities by months, from early 1914 to late July, 1921, based on an index of 1913 prices equal to 100. There are also shown graphically the price increases and reductions expressed in percentages. We find that not a single industry shows such a consistently low average as that of metals and metal products.

Coming Features

For some time we have been engaged in the preparation of a number of automotive service articles which are to describe the methods, operations and equipment used by several of the largest service stations in the East. The first of these articles will be published within a few weeks. In the meantime they are to be preceded by two articles on cylinder grinding in motor repair shops and one on piston work in motor repairing. The first of the trio will appear next week.

Other articles for the next issue: Organization and Management of the Small Shop (IV); Machining Wrigley Automobile Transmission Gears (III); Incentive or Production Basis of Wage Payment (III); and Economies of Production (II).

EDITORIALS

The Economics of Production

THE present business situation has done much to stimulate thought along economic lines. Not only those at the head of business and manufacturing houses but others all the way down the line are beginning to wonder about the reasons for certain events in the world of trade.

Leaders in all fields of action have emphasized the need for a more thorough understanding of the fundamentals of business or, in other words, the science of economics. We have been keenly aware of the accuracy of their judgment and it is with the earnest hope that we can do something to help the seekers after light that we offer a series of articles under the title, "The Economics of Production."

The articles have been some time in preparation by a professor of economics in one of our large universities, as it was found to be no easy task to reduce so complex a study to the simplest form. The author brings a wide practical and theoretical knowledge to his work and has stated his principles in language that anyone can understand. Don't be frightened away by the word "economics" in the title. A better acquaintance with it will bring confidence and respect.

Let the Buyer Beware

CAVEAT EMPTOR was a timely watch word in old Rome and apparently still is applicable to certain transactions in machine tools. We refer to the practice of a few unscrupulous dealers in second-hand tools who bring an old machine up to date by the simple expedient of adding a digit or two to its serial number. Thus lathe number 168, a veteran of much service, becomes number 1168, a member of a younger and greatly improved series, until the confiding purchaser attempts to buy repair parts for it from its makers.

The automobile "gyp" has been credited with marvelous ingenuity in his many schemes for making an ancient motor car seem what it isn't, but his manipulations seem absurdly complicated when placed beside this simple expedient. Why go to such trouble when bargain hunters are in the market?

The buyer has no one but himself to blame for his gullibility. Were he not so anxious to get something for nothing there would soon be an end to such dealings, as the trickey dealer would starve to death. But unfortunately there are other parties who suffer—the honorable dealers in used tools and the manufacturers. They cannot escape the shadow cast by the crooked dealer although they are not in the least concerned.

The remedy should be a subject for discussion at the meetings of the various trade associations. There is probably no sure cure so long as human nature remains as it is, but it might help in the future to block the serial number at both ends by stars or dashes deeply stamped. This would not prevent the complete removal of the whole serial number but it would make its alteration more difficult. If buyers of machinery would make their purchases of reputable dealers, the problem would require no further attention.

Unwise Taxes on American Traders Resident Abroad

IT IS reported at this writing that a section of the proposed new tax bill outlines a general plan to refrain from taxing American firms doing practically all of their business in foreign countries, except on that portion of their income derived from American resources.

This is probably much too free an interpretation of what those who framed the bill had in mind, and possibly of what the bill actually specifies. It is conceivable that in considering income derived from foreign business the tax experts were attempting to equalize the opportunities of American with those of other traders resident and doing business abroad.

The National Foreign Trade Council makes these statements: "No country, except the United States, taxes its nationals living abroad on income derived from foreign sources. The United States levies income, war profits, and excess profits taxes on its citizens wherever located, and on income derived from all sources."

No one will deny that to properly develop foreign trade America must have American traders living in the foreign trade centers. Isn't it also true that they should be on an equal footing with the nationals of other countries?

Such an argument seems to be enough in itself. But there is a stronger one. The handicapping of American traders with a tax that other nationals do not have to pay will soon put them out of the running and destroy them as a source of income. It is uneconomic.

There's Something Doing

AMONG the glimmers of sunshine which occasionally pierce the gloom come some real rays from three fields, bakers' machinery, paper pulp machinery and cash registers. The first was working overtime, the second about normal and the last almost swamped with orders.

A large dealer who felt pretty blue over the report for May, 1921, had quite a thrill of encouragement when he compared the statement with similar reports for May, 1912, and 1913. The current year was considerably ahead of either. It is difficult to pick the right yard stick for comparing the actual amount of business being done.

Another large dealer reports that releases are being secured on orders which have been held, in some cases for many months. This is particularly true of orders from the automotive field where the manufacturers seem to feel that they must reduce machining costs and be ready for next season's production. Some of these orders are of sufficient size to be interesting, and while the machines have been built for some time, it is an indication of renewed activity and confidence in the future.

Most hopeful of all perhaps, is the report of actual buying of machinery by one mid-western railway. If other railroads will follow suit, buying even a little, builders of heavy machinery can be more cheerful.

Shop Equipment News

Monarch Junior 9- and 11-Inch Engine Lathes

The Monarch Machine Tool Co., Sidney, Ohio, has added to its line of engine lathes a small size, known as the "Junior." It is made in both 9- and 11-in. swing, and in bed lengths from $2\frac{1}{2}$ to 5 ft. It can be furnished in either bench or floor model, as shown in Figs. 1 and 2. As the name of the lathe indicates, it is very much like the larger lathes made by the concern in that it has similar movements and construction.

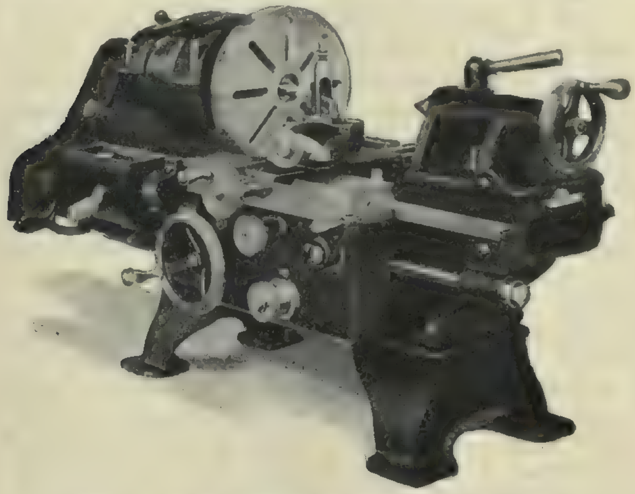


FIG. 1. MONARCH JUNIOR QUICK-CHANGE BENCH LATHE

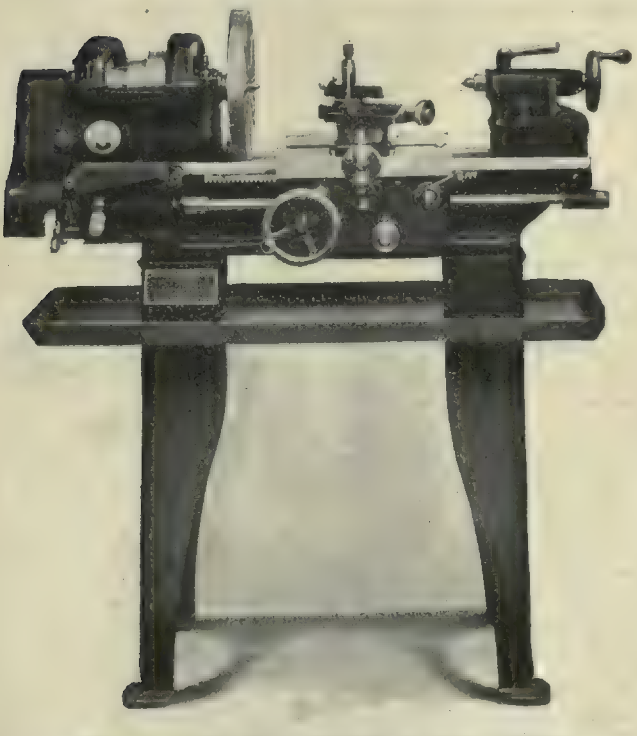


FIG. 2. MONARCH JUNIOR FLOOR LATHE

Specifications: **Swing over bed, $9\frac{1}{2}$ and $11\frac{1}{2}$ in.**; over carriage bridge, $7\frac{3}{4}$ and $9\frac{3}{4}$ in. Hole through spindle, $1\frac{1}{16}$ in.; taper, No. 2 Morse. Spindle bearings: front, $1\frac{9}{16}$ in. diameter by $2\frac{5}{8}$ in.; rear, $1\frac{3}{8}$ x 2 in. Back gear ratio, 5.4 to 1. Range of threads per inch: on quick-change lathe, 4 to 60; on semi-quick-change lathe, 4 to 32. Number of thread and feed changes, 54 and 27. Traverse of tailstock spindle, 3 in. Size of tool, $\frac{1}{2}$ x $\frac{3}{4}$ in. Spindle speeds: number, 6; ranges 27 to 416 r.p.m. Motor required, $\frac{1}{2}$ to $\frac{3}{4}$ hp. Bed lengths, $2\frac{1}{2}$, 3, 4 and 5 ft. Weight: net, 460 to 565 lb.; crated, 510 to 625 lb.

The headstock is of the bowl type in order to give rigidity, and is equipped with three-step cone pulley and single back gears. Phosphor-bronze bushings are used for the spindle. The countershaft has Edgemont friction clutches and ring-oiled bearings. The bed is made of semi-steel and has cross girts, to give strength. The tailstock has a graduated base, can be set over for taper turning, and can be overhung considerably.

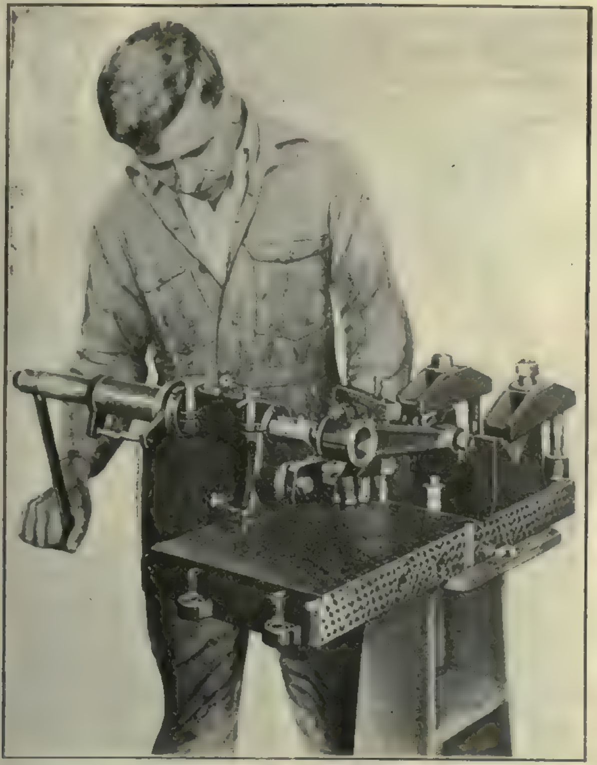
A "Mac-It" screw is employed in the toolpost. Graduated dials are provided on the base and adjustment screws of the compound rest. The carriage is drilled and tapped to receive a taper attachment, chasing dial and chasing stop. Longitudinal and crossfeeds are provided, the apron being so constructed as to prevent the engagement of both simultaneously. The halfnut can be engaged only when both feeds are disengaged.

The machine can be furnished with either full- or semi-quick-change gear box. Fifty-four feeds and threads are obtainable with the former. With the latter three feed changes can be obtained by shifting the change lever and separate change gears can be furnished for cutting any desired thread.

The regular equipment includes countershaft, faceplate, center rest, follow rest, centers and wrenches. Other attachments, such as taper, turret and draw-in and chasing dial and stop can be furnished, no machine work being required to secure them to a machine already in use. An oil pump, settling tank and pan can be furnished. For individual motor drive a countershaft with a belt-tensioning idler can be mounted on the headstock and belted to a constant-speed motor on the back side of the bed.

Weber Connecting-Rod Machine

The machine shown in the accompanying illustration is the Weber connecting-rod machine, which has been placed on the market by the Sawyer-Weber Tool Manufacturing Co., Los Angeles, Cal. The bed of the machine consists of a faceplate on which may be located the clamps, V-blocks, boring tool and other equipment shown in the illustration. It is said that with thi machine an operator can babbitt a connecting-rod bearing, straighten the rod and bore the bearing to size As can be seen, the rod is held by a wristpin throug the small end which is clamped in the V-block. Th rod is held securely in a support, which has two set screws in the top for clamping the rod in position. On specially formed cutter is used for the entire operatio of boring, facing and filleting. There are two tappe holes in the side of the faceplate, into which a clam bolt and the stud which serves as a support for th clamp can be screwed, so that a piston can be clampe to the side of the plate and held there for reaming th crosshole. An arm holding a vertical faceplate can als be attached at these holes which makes it possible t test connecting-rod and piston assemblies for straigh ness. For this operation the wristpin in the small en of the rod is clamped firmly in the two V-blocks and

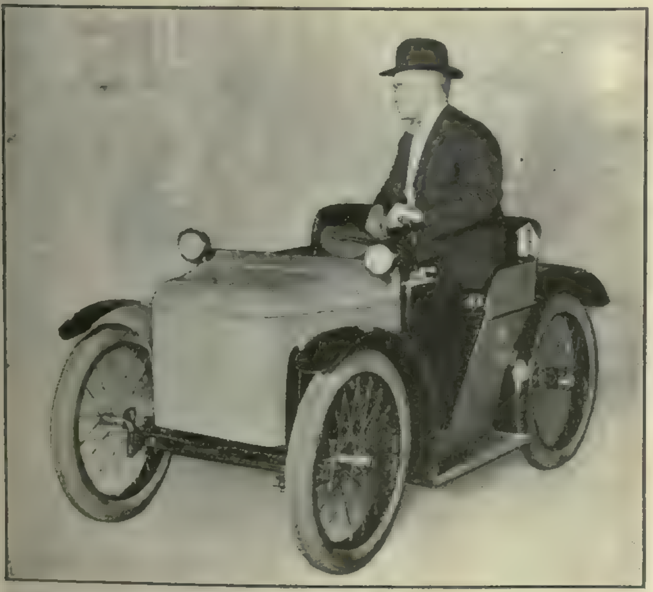


WEBER CONNECTING-ROD MACHINE

combination V and parallel block (which is furnished with the machine) is attached to the piston and tested for alignment with the faceplate.

"Automatic" Electric Shop Car

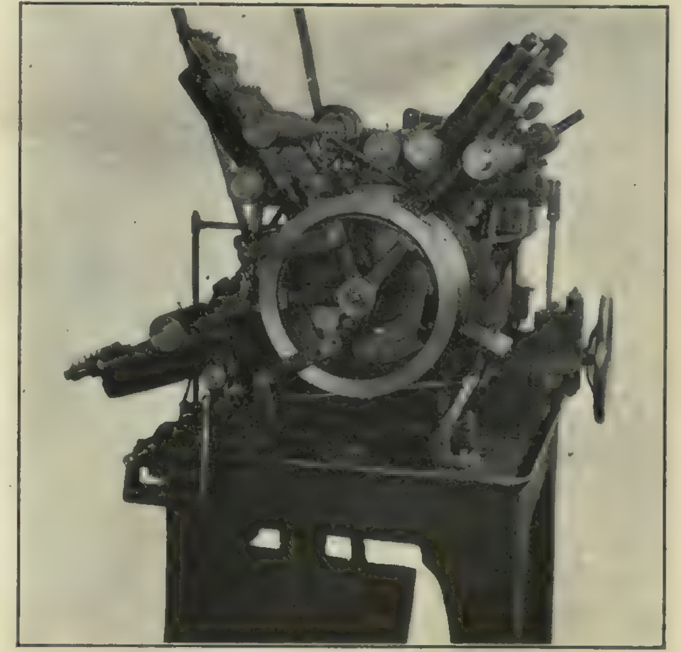
The Automatic Transportation Co., 2933 Main St., Buffalo, N. Y., has developed the automatic electric car shown in the illustration. It is intended to provide quick and convenient inter-shop transportation, and save the time of the busy executive in making inspections and keeping in touch with the various departments of his plant. It can be used for such other purposes as distributing mail and assisting paymasters, timekeepers, watchmen and others in the performance of their duties. The wheelbase of the car is 65 in. and the tread is 35 in. which is calculated to be small enough so that the average factory aisles and doorways will offer no barrier to its progress. The car has a cruising radius of fifty miles on one charge of electricity at a speed of 15 miles per hour, and a load capacity of 500 pounds. It is said that the cost of recharging the batteries is but a few cents per day. A complete charging apparatus is furnished with each car at extra cost.



"AUTOMATIC" ELECTRIC SHOP CAR

Langelier Spoke Nipple Drilling and Tapping Machine

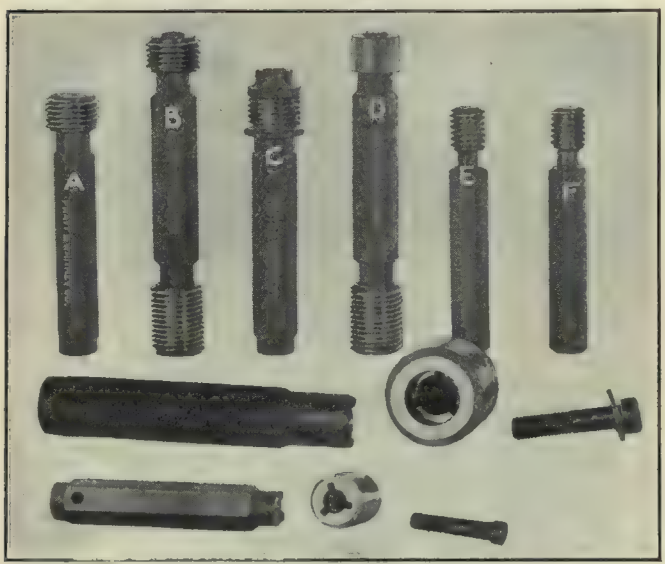
The Langelier Manufacturing Co. of Providence, R. I., has developed a special machine for the rapid drilling and tapping of the spoke-nipples used in the construction of automobile wheels. The nipples are held in lots of five in five different positions on the drum shown in the center of the machine. Corresponding to these five positions are five heads carrying the tools for the different operations. One set of tools centers the nipples, the next set drills them, and so forth. Thus with each movement of the drum, five completed nipples are ejected from the machine. The drill spindles are designed to run about 3,000 r.p.m. Each head is provided with adjustment to compensate for drill wear and grinding. The mechanism which drives the taps includes a reversing clutch fitted with a pneumatic clamping device which drives the taps a few turns into the work, then reverses and partly withdraws them, then sends them forward a turn or two more, and again reverses, continuing this movement, just as a mechanic would manipulate a tap by hand until the thread is run through. The drills are guided by stationary bushings, located close to the surface of the drum, and the bushing holders are fitted with ducts to deliver oil under each bushing directly upon the drill at the point where it enters the work. The machine is almost entirely gear-driven, its high-speed gearing running in oil. The machine is said to deliver 120 finished nipples per minute. It is equipped with automatic stops which suspend its operation if tools are broken or work misplaced.



LANGELIER SPOKE NIPPLE DRILLING AND TAPPING MACHINE

Pratt & Whitney Reversible Thread Plug Gages

The Pratt & Whitney Co., Hartford, Conn., has brought out a line of reversible thread plug gages, made from the same alloy steel blanks as the improved cylindrical plug gages, in all sizes above ½ in. "No Go" and "Go" ends are made interchangeable with the cylindrical plugs and either length can be used according to the customer's preference for long or short threads. The short gages are designed particularly for threads of fine pitch. Rigidity between gage and handle is said to be assured by the use of the tripod support, and the advantage of being able to reverse the gage is obvious. At *A* and *B* in the accompanying photographs are shown the standard type of reversible end gages, single and double end. At *C* is a "Protected Master," so-called from the fact that it is impossible to screw it into a hole and thus destroy its accuracy. It is used as a standard for checking thread plug gages. *D* is a setting plug to be used for setting thread gage templets. The threaded end is made to duplicate the thread in the templet, while the plain end is used for checking the root diameter. *E* and *F* show the non-reversible type of thread plug gage. This style is used for sizes ½ in. and smaller, and for larger sizes where the reversible feature is not desired. The handle is of cold-rolled hexagon steel and the gage end of alloy steel. The two parts are driven together on a slight taper and cannot work loose nor shake.

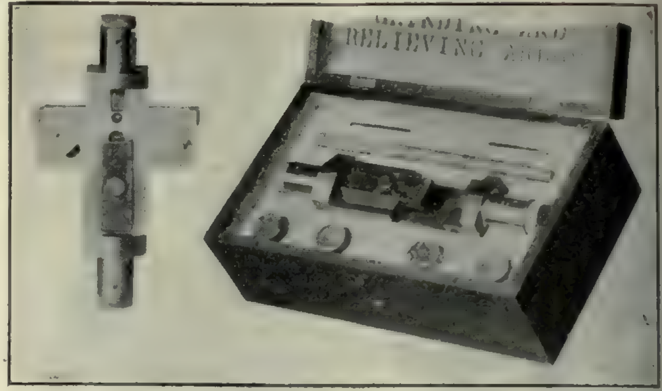


PRATT & WHITNEY REVERSIBLE THREAD PLUG GAGES

Kelly Grinding and Relieving Arbor

The Kelly Reamer Co., 3705 W. 73rd St., Cleveland, Ohio, has recently placed on the market the grinding and relieving arbor shown in the accompanying illustration. This arbor is for use in grinding the cutters of "Kelly" reamers. The center bar of the reamer is placed in the arbor as shown at the left and is located centrally by a lug entering a slot on the bar. The arbor is furnished with hardened end plugs, some of which have center holes in the center while others have them both in and off the center.

The arbor is used in a cylindrical grinding machine between centers, where it is oscillated by hand while the grinding wheel is passed across the face of the cutter. Plugs with offset or eccentric center holes are used for the operation, the result being that the cutter is not only sharpened but relieved as well. After one cutter has been sharpened, the cutter bar is taken out of the arbor and reversed so that the other cutter can be ground.



GRINDING AND RELIEVING ARBOR FOR KELLY REAMERS

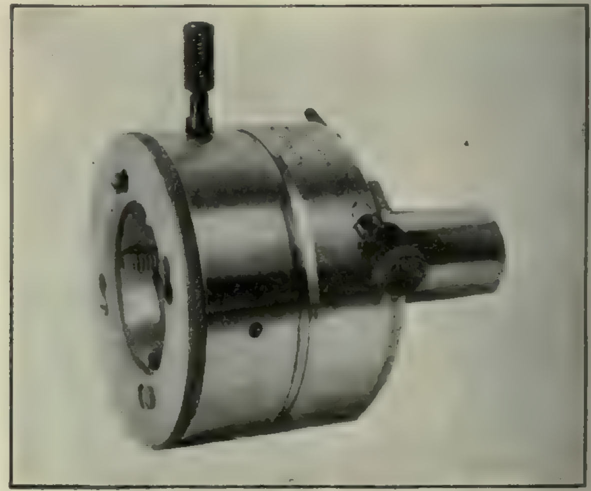
Where cutters are to be ground with a beveled end or lead angle, one end of the arbor should be centrally pivoted while the other end should be pivoted on the extreme offset center.

Alfred Herbert 2½-in. "Coventry" Die Head

The die head shown in the accompanying illustration has been recently brought out by Alfred Herbert, Ltd., Coventry, England, with branch offices at 50 Church St., New York.

The purpose of this die head is to furnish a tool for cutting fine threads that is lighter and cheaper than one of the same nominal size. The action of the die head is the same as the one described in the *American Machinist* April 15, 1920.

Specifications:—Will cut threads on rods from 1¾ to 2½ in. diameter. Will cut threads on pipe from 1½ in. to 2 in., nominal size. Size of die head: Length, 7¼ in.; diameter, 5⅝ in.; diameter of shank, 1¾ in.; length of shank, 3 in. Maximum length threaded using standard shank, 2½ in. Shank is removable, permitting the use of an adapter, allowing the work to pass through it. With this arrangement the length of thread that can be cut is not limited. Weight, 23 pounds.



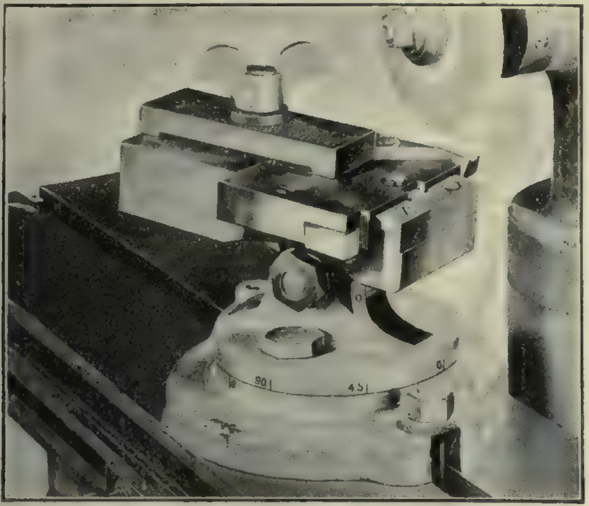
"COVENTRY" 2½-IN. DIE HEAD

Kelly Universal Angle Grinding Fixture

The Kelly Reamer Co., 3705 West 73rd. St., Cleveland, Ohio, has recently placed on the market the universal angle grinding fixture illustrated herewith. The fixture is intended for grinding the nose angles on cutters for "Kelly" reamers, and also for grinding lips in the cutters to give them top rake.

The illustration shows the latter operation, using a formed wheel. For grinding nose angles the fixture is turned approximately 90 deg. in a horizontal plane and a cup wheel used.

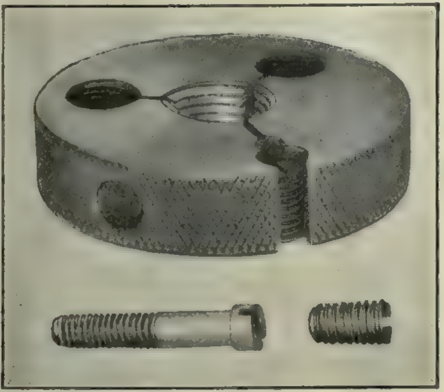
The fixture can be completely revolved in a horizontal plane and set to all necessary vertical angles. As in the use of other grinding fixtures for reamers of this type, when one cutter has been ground, the cutter bar is taken out of the fixture and reversed for grinding the opposite cutter. Provision is made for centrally locating the cutter bar in the fixture.



UNIVERSAL ANGLE FIXTURE FOR GRINDING "KELLY" REAMERS

Pratt & Whitney Thread Templet Gages

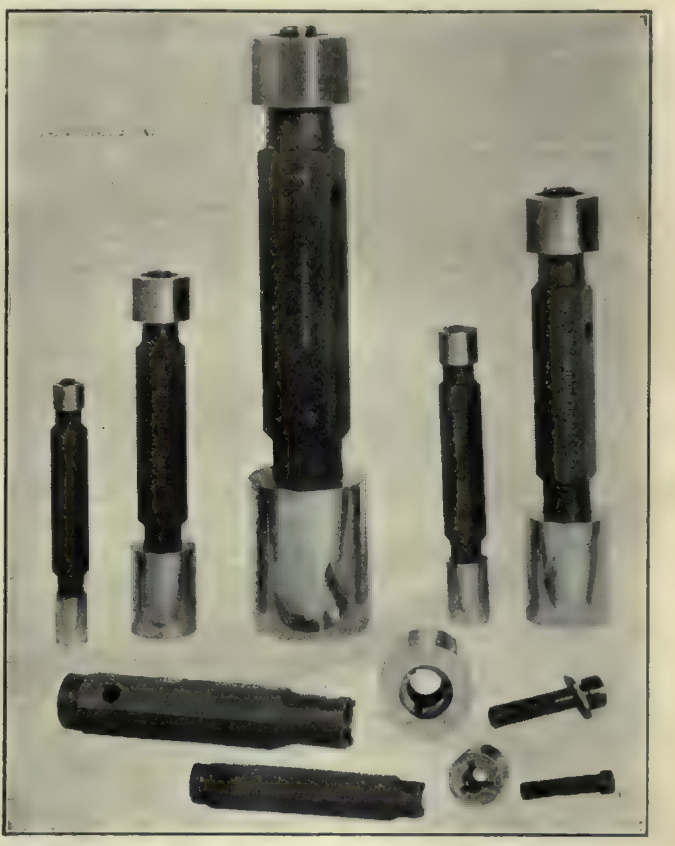
The Pratt & Whitney Co., Hartford, Conn., has brought out a line of thread templet gages that are of the familiar round adjustable type, but are said to have a distinct improvement in the adjustment. The accompanying photograph shows the assembled gage; also the locking and adjusting screws. The latter is a short tapered screw placed parallel to the axis of the gage. One full turn of this screw changes the effective diameter of the gage about 0.001 in., and adjustments finer than 0.0001 in. are easily made. When the locking screw is tightened, the threads of the taper screw form a perfect dowel in both planes. The gages are made in all sizes from $\frac{1}{16}$ in. to 5 in. or larger.



PRATT & WHITNEY THREAD TEMPLET GAGES

Pratt & Whitney Improved Plug Gages

A line of improved standard plug gages has been introduced by the Pratt & Whitney Co., Hartford, Conn. The plugs are machine lapped by a modification of the Hoke process, which is claimed to produce a finely finished surface entirely free from circular grooves. It is said that the gages are perfectly round and of uniform size from end to end, neither the measuring machine, fluid gage nor amplifying gage showing any errors in these respects. The use of a carefully selected alloy steel, together with this exceptionally good finish, seem to justify the belief that these gages will maintain their accuracy an unusually long time. The "Go" ends are held to a very small *plus* tolerance from the marked size, to allow for wear. The "No Go" ends are held to a still smaller *minus* tolerance, as they are subject to little wear and must accept work which is exactly up to the allowable limit.



PRATT & WHITNEY IMPROVED STANDARD PLUG GAGES

A unique and thoroughly efficient method of fastening the ends to the handle is used, which is said to be free from all objectionable features.

The handles are of hexagon stock, giving ample space for marking tool and operation numbers. Three prongs on the handle, of 90-deg. included angle, engage three grooves of 75-deg. included angle in the gage ends. By means of a single screw through the gage, the wedge-like prongs are forced into the grooves, providing a self-centering tripod support. No locking screws, keys or pins are necessary, and the rigidity is said to be practically that of a solid gage. All blanks are well-seasoned before lapping, and the size is marked on the end of the gage instead of on the handle. The range of available sizes is from $\frac{5}{16}$ to 2 in.

Fluctuations in Wholesale Prices, 1914-1921

Prices of Metal Products Well Below the Average Price of All Commodities During 70 Per Cent of that Period

THE statistics of wholesale prices issued by the U. S. Department of Labor and reproduced herewith are particularly interesting to those who value the good name of the metal working industry. We are too apt to have our judgment of a man or an industry swayed by a few glaring acts rather than by a calm survey of the situation as a whole. We have heard so much in some quarters about the enormous increases in prices of metal products that it is well to study these charts with considerable care.

Note that prices were considerably below the average at the beginning of 1914 and remained so until almost the middle of 1915. Then the importance of metal goods in carrying on the war, and the enormous demand from all sources, stampeded the market and were responsible for the sudden increase to 257 in the early part of 1917. This increase was only of short duration, however, and the drop to 174 was even more rapid than the rise. And even the peak was modesty itself as compared with those of lumber and building materials, or with cloth and clothing, and housefurnishing goods.

Using the heavily shaded line as a basis, this being the average of all commodities, those who are in metal working industries might almost assume a holier-than-thou attitude without fear of a come-back. For as can be seen the price line dropped below the average at a time when nearly everything else was climbing skyward at a rapid rate.

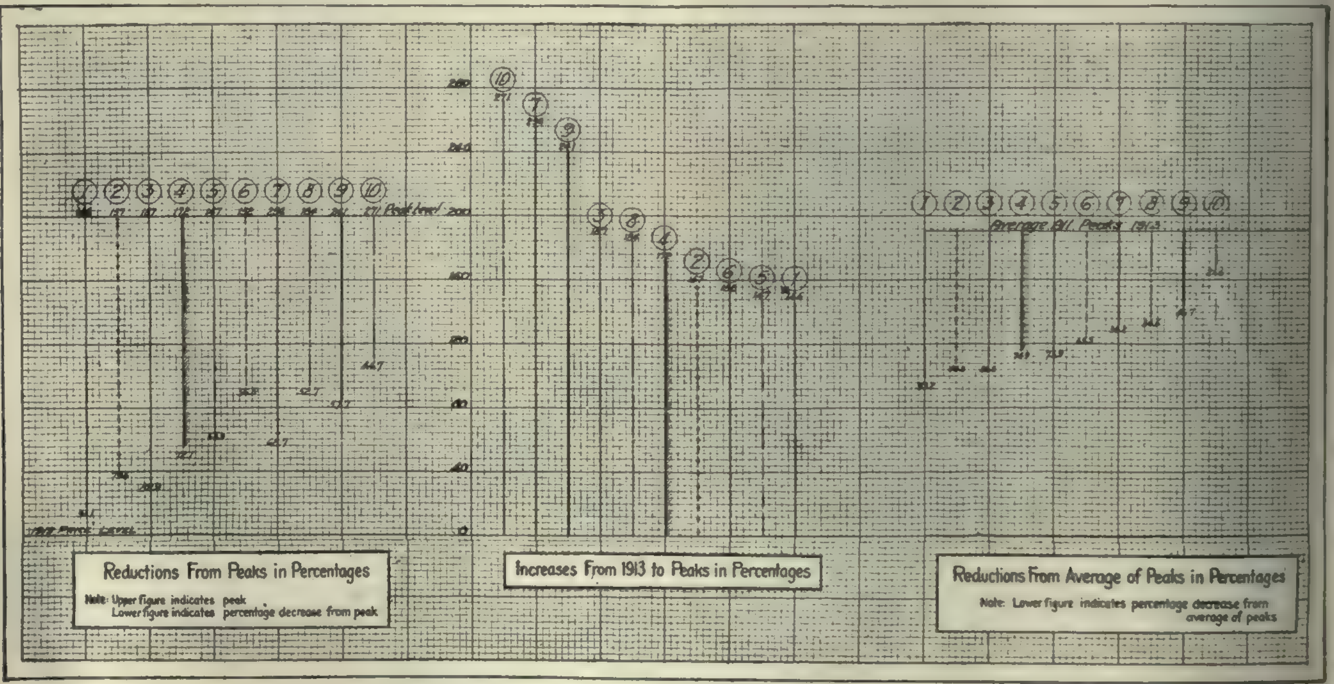
Dropping about 6 points below the average it followed the curve of average prices very closely all through 1918, with the difference becoming larger as the months went by. Starting with 8 points below the average in January, 1918, it was 19 points below in the spring of 1919. And while that was the low point for average prices for considerably over a year, metals and metal products kept dropping until they reached 152 in the early summer of 1919. In the meantime average prices had been soaring steadily once more with the exception of one break in the fall of 1919, and reached their peak of 272 in the early spring of 1920.

Metal products recovered to some extent, getting as high as 194, then breaking and again recovering to 193 in the summer of 1920. Average prices had already begun to fall and after the brief rally, metal products followed suit in such a way as to parallel the average curve, about 20 points below it, all the way down. The report leaves it, in midsummer, 1921, at 134, with only food and farm products lower.

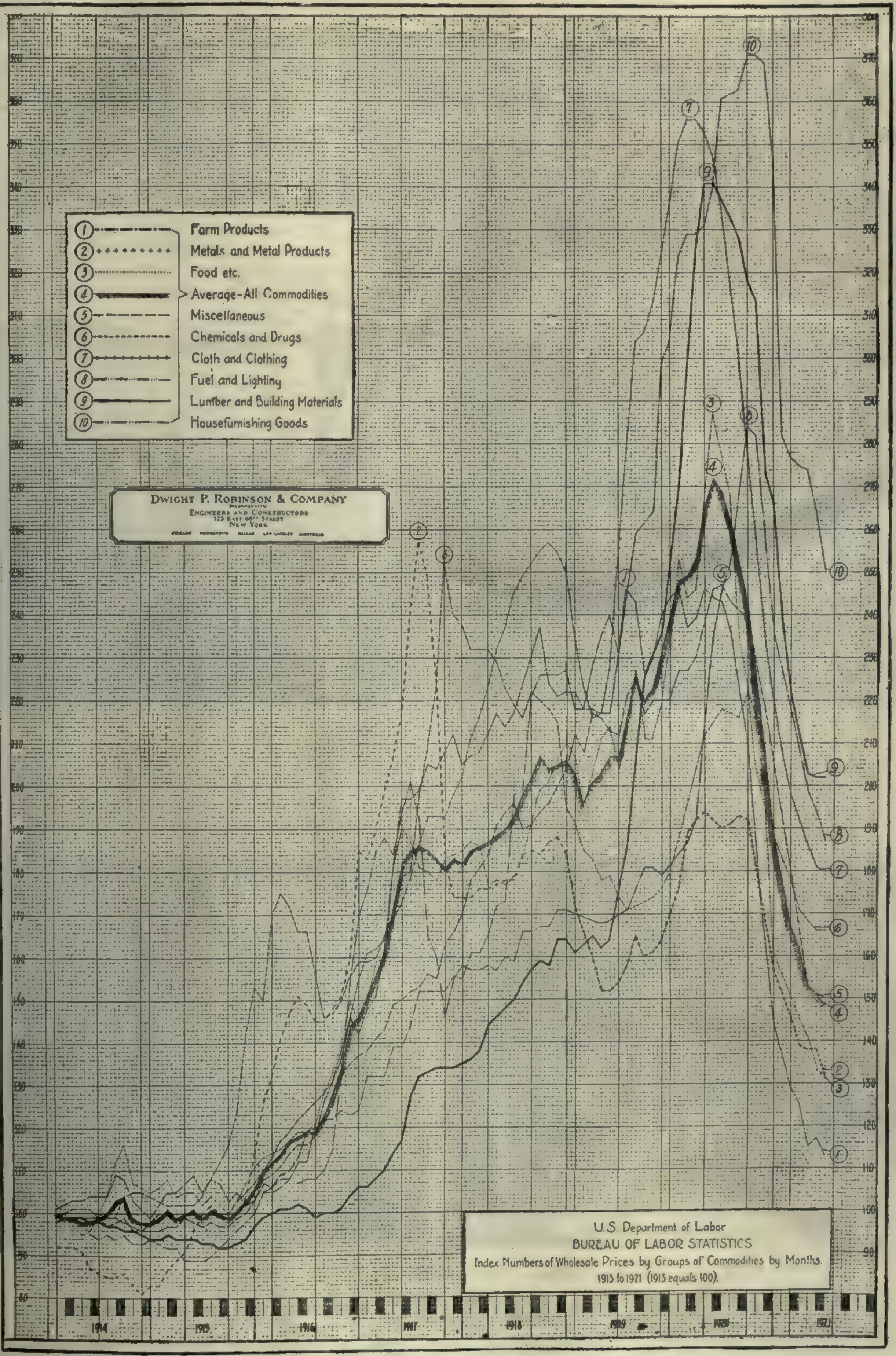
This diagram also shows us that we have rather maligned the farmer in charging him with the high cost of living. It will be seen that he lagged behind even the modest metal working industry and that farm products did not reach their peak until the latter half of 1919, when they touched 246. Other food products kept on, however, up to the 287 mark about a year later.

Not a single industry, however, shows such a consistently low average as metals and metal products. Except for the flurry in 1917, it has been well below the price average, a fact made particularly noticeable by the large area between the metals curve and the curve of average from the beginning of 1918 to the end of 1920, three long, strenuous years.

The manufacturers of housefurnishing goods, of electrical and gas machinery, of cloth and clothing, and a few other industries certainly have no excuse for longer refraining from purchasing the machinery they require for economical production. They can hardly claim to be waiting for lower prices of machines when these are already so far below their own in the index scale.



INCREASES AND REDUCTIONS IN PERCENTAGES



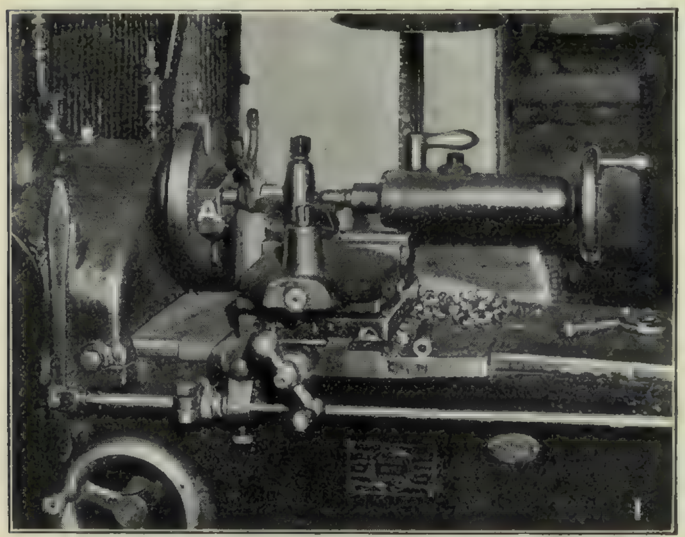
PRICE FLUCTUATIONS OF REPRESENTATIVE COMMODITIES, 1914-1921

Making a Gear Shifter Fork

By FRED H. COLVIN
Editor, *American Machinist*

Although the gear shifter fork is a comparatively small part of a motor-car transmission, there are many interesting operations in its makeup, some of which are illustrated herewith.

The first step is annealing the drop forging, after which the piece is drilled, rough-reamed and faced on both ends. Then comes the turning of the barrel in the engine lathe, as shown in Fig. 1, a mandrel being used for this purpose. The shifter fork has a flattened projection which fits into the box-shaped driver *A*, this being screwed to the faceplate. The work is being done on a Porter-Cable lathe having a feed knockout as shown in front of the carriage. The shape of the projection or wing which drives the fork can be seen in Fig. 2.



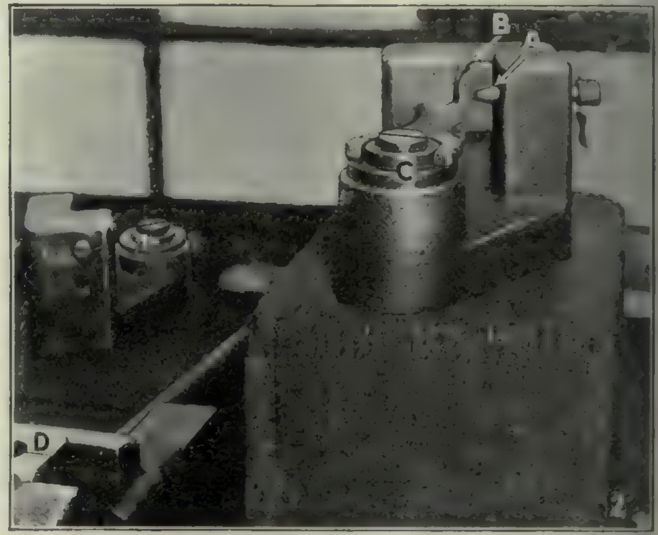
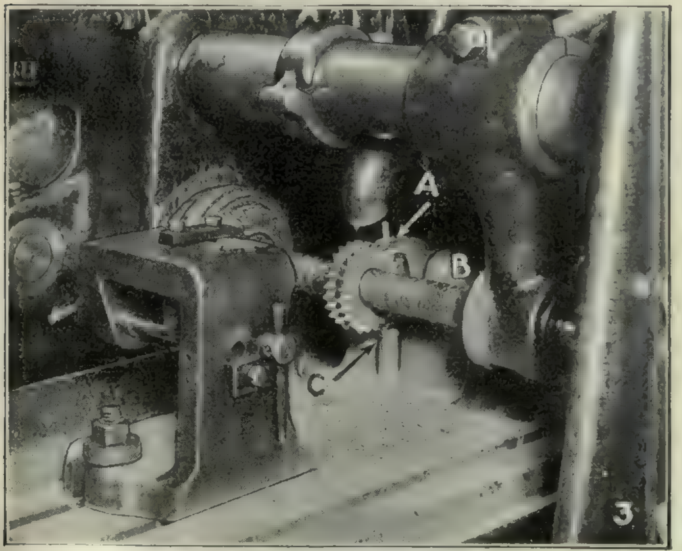


FIG. 1. TURNING THE BARREL. FIG. 2. HAND STRAIGHTENING

The forks are then aligned by striking in a power press, after which the hole is finish-reamed, and the piece hand-straightened if necessary. The gage for this is shown in Fig. 2, the notch on the wing of the fork being located by the hardened pin *A*, while the wing itself is positioned by the pin *B*. The forked ends are tested for squareness on the block *C*. Any correction which may be necessary is made by clamping the barrel of the fork in the special vise jaws *D* and making the necessary correction with a hammer.



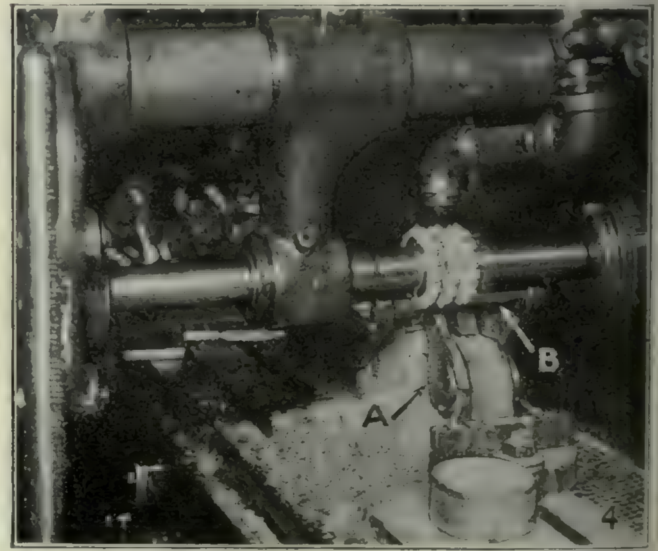


FIG. 3. STRADDLE-MILLING THE FORKS. FIG. 4. MILLING THE THREE SLOTS FOR THE LOCKING PINS

The forks are then straddle-milled as shown in Fig. 3, the fork *A* being clamped in the block *B* and supported by the post *C* against the downward thrust of the milling cutters.

The wing is then straddle-milled, after which the tooth is milled in its correct position, and the three slots for the locking pins milled in the fixture shown in Fig. 4. Here the fork is positioned by having the ends go over the pin *A* while the rod *B* goes through the hole in the barrel and holds it in position, as well as supporting it against the thrust of the milling cutters.

Then the clearance is milled for the other fork, the piece carbonized, heat-treated and drawn to the desired temperature. The scale is then lapped from the hole, the fork straightened and hardened in lead. The fork is then carefully checked up, again straightened if necessary, clearance ground between forks and on the pads completing the operations.

Although this is a small detail it is one which plays an important part in the safe handling of a car.

NEWS SECTION

International Cost Conference Program

The final program of the Second International Cost Conference to be held under the auspices of the National Association of Cost Accountants, at Cleveland, on September 14, 15 and 16, has just been issued. Among the subjects which will be dealt with at the different sessions are: Executive uses of a cost system; the distribution of overhead under abnormal conditions; cost systems as a means of preventing waste; uniform methods and standardized costs.

Most of the railroads have granted reduced fares under the certificate plan for this conference, and it is expected that the largest and most representative gathering of cost men which has ever assembled in this country will meet in Cleveland.

The national headquarters of the association are located in the Bush Terminal Sales Building, 130 West 42d St., New York City.

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Government Investigating Trade Associations

An official statement having to do with the activities of trade associations will be issued the latter part of August. A promise to this effect was made by Commerce Secretary Hoover after a conference on the subject between Mr. Hoover and members of his staff with the Attorney General and members of the Department of Justice staff. Pending the issuance of the statement, Mr. Hoover declines to comment. The Attorney General stated that there are a great number of trade associations which are of much benefit to business and that the activities of the great majority of these organizations are not being questioned. He said the Department of Justice simply is trying to find if there are not some cases in which illegal activities are being carried forward under the guise of trade associations.

The probabilities are that the official statement which is to be issued will not go very far toward illuminating the twilight zone which covers a part of the field of some of the existing associations. Since the Supreme Court of the United States is expected to hand down, during the October term, an opinion in the hardwood lumber case, which may define some of the limits of the fields of the trade associations, it is not probable that any executive department is going to declare any very definite policy before the rendition of that opinion.

The Department of Commerce has ascertained that there are more than 5,800 trade and industrial organizations in the country.

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Urges Publication of Engineering Data

Professor Arthur M. Greene, Jr., new dean of the Princeton College of Engineering and chairman of the research committee of the American Society of Mechanical Engineers, urges the need for research in an address to the engineering profession, through the official journal of the society. He points out that surprising facts, for instance, have been revealed by the report of the committee on elimination of waste in industry, of the American Engineering Council, organized by Herbert Hoover. Mechanical engineers should be willing to give their data to the profession after they have used them for development work, says Professor Greene. "Many data," he says, "are buried where they are doing no work, and their publication would not damage our business and would help the profession."

Brazil to Provide Water Storage for Semi-Arid States

In connection with its plans for the reclamation of its semi-arid States the Brazilian Federal Government has retained Dwight P. Robinson & Co., Inc., of New York, to supervise a large amount of engineering and construction work. This work, which is located in the states of Ceara and Parahyba, will include the construction of five large dams—involving nearly a million cubic yards of concrete—to create storage reservoirs, some of which are to be larger than any artificial reservoirs existing elsewhere.

The work is to be conducted under the direction of the Brazilian Government, and in its ultimate importance and economic value it is comparable to the irrigation work carried on since 1903 by the United States Government.

In these semi-arid states of Brazil there is an average rainfall of about 30 in., which if properly distributed as to time and volume would make, even under the tropical sun, a sufficient supply of moisture to produce moderate crops. The climate, however, consists of a dry season extending from May to December and a rainy season lasting from January to April or thereabouts. Practically all of the rainfall occurs during the rainy-season months when, if the precipitation falls in heavy rains, the soil is saturated, the springs are renewed and the rivers are in flood. In the dry years, however, the rainfall, although aggregating as much as the average year, may be precipitated largely in thin showers which, under a tropical sun, are quickly evaporated, with the result that the soil does not become well moistened and the rivers carry little if any run-off. Severe droughts result which reduce the inhabitants of this section to a condition of starvation. It is to remedy this situation that this reclamation program has been undertaken.

The region to be benefited, lying in latitude 4 to 8° south of the equator, will have climatic possibilities similar to southern Arizona and California or the irrigated section of the west coast of Mexico. The streams which drain the region are of large volume and will furnish ample supply for reservoirs. The products of the country include cotton, sugar, skins, medicinal products, various kinds of palm and other nuts for the production of vegetable oils, citrous fruits and other products of tropical and sub-tropical agriculture.

The work is under the direct control of the Inspectoria de Obras Contra as Seccas, which is a department of the Ministry of Viacao e Obras Publicas. The Inspector General in charge of the work is Dr. Miguel Arrojado Lisboa; Dr. Pires do Rio is the Minister of Viacao e Obras Publicas.

The initiation of active work at the present time is due in large measure to the interest shown by the president, Dr. Epitacio Pessoa, who has given this program for the material betterment of a needy section of his country the same support which Theodore Roosevelt gave the Reclamation Service in the United States.

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Remington Salesmen Convene

Eleven southeastern sales managers of the Remington Arms Co., of New York, held a three-day conference in Atlanta the second week in August, discussing general business conditions and mapping out the sales campaign for the coming year. Similar group meetings are to be held in New Orleans, Dallas, Oklahoma City and Kansas City.

Paris Aeronautic Exposition in November

The Seventh International Aeronautic Exposition will be held at Paris on November 12 to 27, 1921, according to a recent communication from the office of the American consul general at that city. Exhibitors are welcome from any country not having been at war with France. This exposition is not confined to flying machines and motors, but will include sections devoted to aerial navigation companies, motor boats, gliders, machine tools, marine motors, electrical apparatus, spare parts, and industrial materials, relating to the aeronautic industry. Applications of exhibitors for admission must be received by September 1, 1921. Blanks may be procured from the European Division, Bureau of Foreign and Domestic Commerce, or from the bureau's district office, 734 Customhouse, New York, upon reference to file No. 33549a.

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Detroit Police Arrest Tool Steel Robbers

With the arrest of five Detroit men last week the police of that city believe that they have caught some of the members of what they believe to be an organized ring of steel robbers which has been operating in Detroit, Cleveland and Toledo for the last nine or ten months. Tool steel to the value of several hundred thousand dollars has been stolen by members of this ring, the police say.

The detectives say that confessions by two of the prisoners show that the stolen metal was sold by Detroit brokers at much less than the market price. An elaborate system, whereby the crooks even had their confederates tamper with the accounts of the firms from which the steel was stolen, was also discovered.

Stolen steel valued at more than $5,000 was discovered in a yard in Detroit.

The men under arrest include Hyman Kramer, William N. Burroughs, superintendent of the Union Drawn Steel Company's yards at Detroit; Albert Langer, superintendent of the railroad yards at several Detroit plants, and Earl Miller, head of a large Detroit trucking concern. The fifth man, Benjamin Cohen, head of the Cohen-Kunzky Scrap Iron Corporation of Detroit escaped.

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Bureau of Mines to Study Coke Properties

G. St. J. Perrott, associate physical chemist of the United States Bureau of Mines Experiment Station, Pittsburgh, Pa., is to be sent to Birmingham, Ala., to study the physical properties of coke in relation to its production and use in the blast furnace. Blast-furnace operators declare that there is a decided lack of knowledge regarding the physical and chemical properties of coke in producing iron ore. In the stress of wartime they found it necessary to use almost anything in the way of coke material that was offered, and, it is said, they found they could use materials that before seemed impossible. It is believed, therefore, that the investigation proposed offers a very fertile field for the obtaining of very important information. Conditions are very favorable for the conducting of these investigations at the Tuscaloosa Experiment Station of the Bureau of Mines, where there are quite a number of small blast-furnace plants and by-product plants, many of which are ready to carry on investigating work.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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Despite the aloofness of some Americans the drama now being enacted on the world's stage includes all humanity and to be understood it must be seen in its entirety. Interest this week has shifted to Europe. The Irish atmosphere is again cloudy and while there is reason to hope that De Valera may not mean all he says and that the ancient feud may yet be settled, it is plain that the English people will not permit Ireland to secede and it is possible that Great Britain may find herself involved in a long and internecine conflict as a result of her determination to preserve the "United" Kingdom.

That she will succeed in maintaining the solidarity of the British Empire even though she may have to face a struggle so deplorable there can be no doubt, but the pity of it and its possible effect upon her dominions overseas must give pause to the thoughtful observer. In distant India the rumblings of unrest are distinctly audible, in Australia the demand for an Imperial parliament in which the Antipodean commonwealth shall be represented is daily becoming more vocal, and in the relations of Great Britain with several other nations of the Eastern hemisphere lesions are threatened that may severely tax the remedial skill of Lloyd George, who continues to amaze the world by his political dexterity. His latest appeal for a triple alliance between Great Britain, Japan and the United States is probably inspired by a recognition of these involvements and their implications. The wonder is that he can stand the strain. So long as he can maintain himself and his coalition cabinet he will probably be able to compose the situation; but a less tactful and more autocratic leader might find it difficult to deal with.

Realizing the complexities of the outlook, the English markets have been a little less confident in tone during the week and exportable American staples such as cotton and wheat have shown a reactionary tendency.

German Finances

Another and a curious consequence of the parlous conditions that exist in Europe is to be observed in Germany where the Berlin stock exchange suspended operations for two days because it was overwhelmed with buying orders inspired by a desire to exchange the rapidly depreciating paper mark for securities supposed to have a permanent and intrinsic value. As a result of this eagerness to exchange marks for something else they have fluctuated wildly. On Tuesday they declined to 1.06¾, recovering to 1.22 on Thursday.

At a cent apiece $10,000 will buy a million marks worth $240,000 at their par value in gold. Attracted by such long odds a great many fatuous people in this country are taking the gamble and it is not impossible that a large share of the German reparation fund will be raised by the simple expedient of running the Berlin printing presses and selling their paper output. A banker who has studied the facts closely told me that he was disposed to believe that in one form or another Americans now owned one fourth of the outstanding German circulation, which, according to the last statement of the Reichsbank, amounted to 77,300,000,000 marks. This does not include the "Darlehnskassenschein" notes issued by the German treasury which amount to about 15,000,000,000 marks. Against both these issues there is held only 1,091,500,000 marks in gold.

Certainly the ease and promptitude with which Germany is now making the reparation payments agreed upon is surprising and the joke would be on us if it should turn out that she is exchanging 100 paper marks which cost her little or nothing for a dollar in good American money.

But whatever the facts it seems unlikely that Germany can continue to conduct her business with such a preposterously inflated currency and when deflation comes as come it must the demonetization of paper in Germany with the speculative collapse that will inevitably follow may be acutely felt in France and Italy where the circulating medium consists entirely of bank notes that are practically irredeemable.

Elsewhere in Europe the week has brought no striking developments. American relief for famine stricken Russia has been delayed by Soviet insistence upon supervising its administration. This Mr. Hoover has quite properly refused to permit. The Russians thereupon waived their demand and the machinery of food distribution has been finally set in motion. The released American prisoners now coming out of Russia report that the country is politically unconscious and an economic and social wreck. The war between Greece and Turkey is still in progress though our papers hardly mention it and most Americans are unaware of it.

In Mexico the insurgent element is trying to organize another revolution against Obregon, whose revenues have been seriously reduced because the export tax on oil has practically stopped its production. In Cuba the financial crisis is being slowly relieved as sugar is sold, but recovery is slow. Incidentally, raw and refined sugar are about 30 points lower in the American markets.

I have given first place to a review of foreign conditions this week because there is really little that is new to report in regard to affairs at home. Things are slowly but steadily improving here but the speculative spirit is still lacking and the demand is for the necessary rather than the superfluous. If we are, as some believe, sufficiently self contained to be unaffected by the reaction which will attend upon European deflation, we have nothing but our own fears to make us afraid. For a more elaborate exposition of this view I take the liberty of referring to an article entitled "Can We Be Prosperous Without the Aid of Europe?" written by me and published in the *American Magazine* for September.

Briefly, there is some improvement in the demand for iron, steel and copper. Coal is also being more freely bought though the winter's requirements are still very poorly provided for.

Continued impairment in the condition of the cotton crop is reported and the market would have been higher if conditions abroad had been less discouraging. The textile markets are steady and the turnover good. Railway revenues and traffic continue to pick up but railway securities are still sluggish in the stock market as a result of Congressional hesitation in authorizing the War Finance Corporation to advance the five hundred millions that the President and Eugene Meyer are anxious the roads should have, because they believe it would stabilize financial conditions, start the wheels of industry moving and bring about the re-employment of the unemployed.

The unemployment is, however, probably exaggerated. Based on returns from industrial establishments and other organized employers of labor the Department of Labor estimates that 5,735,000 persons were out of work in July, but these figures take no account of the fact that many who were formerly employed in factories and cities are now at work upon the farms.

Although the railroad men defend it, the Interstate Commerce Commission has not enhanced its popularity by refusing to allow Mr. Ford to reduce rates on his railroad because the "rate structure" would thereby be disturbed. People think it strange that it is easy to get rates up and so hard to get them down.

Meantime a demand for lower freight and passenger rates is being heard from all over the country. It is daily becoming louder and unless the railroads and the commission heed it the President and Congress may be forced to act as Election Day comes nearer. Hope deferred maketh the heart sick and while small favors are thankfully received the reduction in taxes promised in the bill now before the House has not been greeted with great hilarity. The public mind has been somewhat indurated by unfulfilled promises of financial relief and most taxpayers are now like the man from Missouri. For them, seeing is believing.

Reserve Ratio Gaining

The most definitely stimulating news of the week is to be found in the statement of the Federal Reserve System. The reserve ratio has advanced from 65 to 65.8 per cent and the supply of gold shows a further gain of $24,300,000. It now stands at $2,600,000,000 as against $1,966,000,000 a year ago. This increase of $634,000,000 is about one and a half times the world's gold production in the same period.

Unless those who frame and control the policy of the Federal Reserve Banks are determined to deny the American people the reduction in the cost of credit to which this abundant gold supply entitles them, we shall have much easier money market soon with the increase of business activity that always follows when enterprise can obtain the capital upon which development depends.

That the well informed are confident that a decline in interest rates is not far off is shown by the gradual advance in Liberty Bonds, the hardening market for other interest bearing obligations and the ease with which new issues can be floated. An advancing bond market has always been the precursor of a broader activity in business and there is every reason to believe that his rule holds good.

With lower interest rates, cheaper railway rates and some real reduction in the tax burden, a return of genuine prosperity would not be long delayed.

	End of Last Week	End of Previous Week	Last Year
Bank Clearings (Bradstreets)			
In thousands	$5,809,905	$5,771,386	$7,574,459
Business failures	376	329	139
Security price, N. Y. Stock Exchange:			
20 Industrials	65.96	66.42	85.31
20 Railroads	72.28	71.30	73.90
40 Bonds	77.62	77.66	73.80
Commodity Prices:			
Wheat, No. 1 spring	$1.59¼	$1.66	$2.80
Corn, No. 2 yellow	.73¼	.77	1.77½
Beef, good dressed steers	15.25	16.25	23.50
Pork, mess, bbl	26.00	24.50	32.50
Sugar, refined	.0615	.0615	.1710
Coffee, Rio No. 7	.07 3/16	.06[illegible]	.08[illegible]
Cotton, middling	.1300	.1325	.3350
Print cloths	.04¾	.04⅝	.12½
Wool, domestic average	.4173	.4173	.....
Silk, No. 1, Sinshiu	5.70	5.75	5.60
Rubber, crude, plan	.14	.14	.32½
Hides, pack. No. 1	.14	.14	.28
Iron, No. 2, Phila	20.[illegible]	19.84	49.50
Steel billets	30.00	30.00	60.00

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Publications Desired by Amsterdam C. of C.

The Netherlands-American Chamber of Commerce at Amsterdam will be pleased to receive books and literature concerning the United States, together with periodicals and artistic advertising posters of American firms, states a recent communication from J. W. Vander Laan, secretary to the American commercial attaché at The Hague. All material should be addressed to E. H Von Baumhauer, secretary of the Netherlands-American Chamber of Commerce, Damrak 83, Amsterdam, the Netherlands.

Resolutions Passed by International Chamber

Among the resolutions adopted at the recent London meeting of the International Chamber of Commerce was one which declared that "government control of or participation in industry and commerce discourages individual initiative and renders trade conditions uncertain and artificial." The resolution further set forth that government control of industry and commerce should be discouraged and private enterprise encouraged in all lines of industry and commerce.

This resolution, with seven others, was introduced in the sessions of the production group, and was adopted by the whole congress. The other group sessions—Distribution, Transportation and Communication, Finance, and Devasted Areas—also contributed resolutions for the congress to act upon. In all, twenty-nine resolutions were approved by the congress, all of which have been made public by the American section of the International Chamber.

Means of effecting economies as well as increasing production were discussed at the production group sessions. This was true especially of fuel, the production group declaring that "in addition to the measures taken to increase the production of fuel it seems no less necessary to make every effort to make the best use of the coal at our disposal."

The congress recommended that in countries which have not yet an organization studying the question of the economy of fuel, such an organization be created for this purpose; and that the International Chamber get into touch with the different national organizations with a view to co-ordinating and diffusing the results of their work.

Economy in raw material also was urged in a resolution which pointed out that "the conservation of some of the world's natural resources is of paramount importance to the welfare of the world for the reason of the rapidly diminishing supply." It was urged that the International Chamber take immediate steps to encourage research work and investigations in every possible way to lessen the waste in the production and utilization of raw materials, and to make available the results of such researches and investigations.

In accord with the view of the American delegation, the production group went on record in favor of standardization, holding that "standardization is of paramount interest from the standpoint of international commercial relations." The resolution adopted on this subject urged that in countries where there does not yet exist a standardization organization, such an organization be created for the purpose of studying this subject.

It was recommended by the congress that within the International Chamber there be created industrial sections which will enable qualified representatives of each category of industrial or business men to get into touch with each other and discuss questions of international interest; that the International Chamber get into touch with already existing permanent international federations or bureaus, such as construction, motor industry, cotton, production of books, in order to co-ordinate the result of their work.

The abolition of export taxes on raw materials was advocated. The resolution on this subject made plain the fact that every tax on export of raw materials must necessarily increase the cost of production and thereby hinder economic development and prevent economic restoration. It also stressed the point that "it is desirable to put a stop to, as far as possible, the rivalries between nations in their search for raw materials, to stamp out the cause of economic conflicts which may threaten peace, and to do away with the natural inequality arising from the fact that the riches of the world are unequally spread over its surface and to assure the rapid restoration of the world's commerce."

The resolution suggested that the following raw materials be free from an export tax: Untanned hides, skins and furs, wool in bulk or wool skins, raw horsehair, etc., silk in cocoon, raw silk, floss silk or silk in bulk, raw materials for fertilizers, gum in a raw state, Indian rubber, gutta percha, unprepared timber, raw cork, raw cotton, flax, hemp, jute and other vegetable fibers in a raw state, ores and mineral products, natural metals, precious metals (gold, platinum, silver, etc.), mercury, filings and waste of metals, stone and earth employed in construction and different industries, etc., coal, mineral oils, and oleaginous grains and fruits not used as food, in their imported state.

Another resolution urged that the International Chamber appoint a permanent committee to undertake a world survey of the construction industry and provide a necessary staff for carrying on such work.

This survey would proceed along the lines of collecting and collating and discriminating the vast amount of valuable data which is available and which is at present in the possession of such agencies as the British Societies of Engineering Standards, the Royal Institute of British Architects, the French Ministry of Commerce, the Office de Batiment in Paris, the International Biographical Institute of Brussels, the Advisory Committee of the Federation of Labor, the National Federation of Construction Industries of the United States, the Associated General Contractors of America and a number of similar agencies operating in different countries.

The question of statistics was brought before the congress in a resolution which stated that increased and cheaper production is essential in the re-establishment of the economic balance of the world, and will follow a sustained normal demand as soon as this can be arrived at. The resolution urged that steps be taken to bring about as soon as possible the creation of an international bureau of statistics which will make promptly available exact and readily comparable data of paramount significance of the commerce of the world.

Specifications on Pumps and Motors for South Africa

Blueprints and specifications covering the contract for the supply and erection at Vereeniging, Transvaal Province, South Africa, of two vertical and two horizontal spindle centrifugal pumps and motors, with all accessories, and one 10-ton traveling crane have been received by the Bureau of Foreign and Domestic Commerce from Consul Fred D. Fisher, of Johannesburg. This material is for use in connection with the Vaal River scheme. The specifications may be examined by interested persons at the bureau's New York office, 734 Customhouse, or will be made available at any other district or co-operative office upon request. Refer to file No. 33 592

Steel Prices Advanced

Indication that prices for iron and steel have reached the lowest point compatible with present costs of production was seen in the reported action of the Inland Steel Co. in raising the price, in spite of a lack of demand, for a certain grade of iron on the ground that any lower price results in a loss to the company. The company is said to have the only foundry furnace now in operation in Chicago district, is reported to have advanced price of foundry iron from $18.50 to $20 a ton. This situation is in harmony with statements of the Federal Reserve Board and other responsible agencies that wholesale prices generally have reached the lowest levels that can be maintained under present conditions. As one Federal Reserve official puts it: "The cycle of deflation is about completed."

Mexico Buys Baldwin Locomotives on Credit

Samuel M. Vauclain, president of the Baldwin Locomotive Works, Philadelphia, Pa., who has returned from Mexico City, where he conferred with President Obregon, announced he has arranged for a credit of $2,500,000 to that government for the purchase of locomotives and had given the Mexican government the privilege of an additional credit of $2,500,000. Under the first credit Mexico ordered 45 locomotives and 20 under a separate condition of payment.

Low Iron Production in South

The lowest record for pig iron production in Alabama for many years was made during July, when only 66,573 tons were reported. This was produced with five furnaces in operation. The June report was 93,224 tons, produced with eight furnaces in operation, and this was the previous low record in many years. There was no product at all in Georgia and Tennessee during July, for there were no stacks operating in those states at all, the five in Alabama being the only ones in the iron-producing states of the South.

August started off with two blast furnaces operating in Alabama, on foundry iron, and four on basic with the probability that there will be at least two more furnaces running before the end of the month because of the steady improvement the past few weeks in conditions in the metal trades industries.

Bureau of Standards on Fuel Economy of Automobile Engines

Since internal combustion engines were first used to drive motor cars, designers have sought to increase the power output per unit of piston displacement and to increase the reliability of the engine. Great progress has been made along these lines, but today it is necessary for the engine to be not only powerful and reliable, but also economical in its fuel consumption. This demand is of recent origin, and knowledge as to the degree in which fuel consumption is influenced by factors of engine performance is meager.

In the early days of the automobile, a favorite topic for discussion was the influence of spent gases which were allowed to remain in the clearance space at the end of the exhaust stroke. This dilution of the fresh charge was considered to have a bad effect, as is evidenced by the number of scavenging devices which were developed. Most of these devices have been discarded and new methods are being suggested for adding exhaust gas to the induction system, thus increasing the amount of inert gas in the cylinder.

The engineers' attitude seems to have changed from open hostility to toleration, and finally to admiration. The first change is easily explained. Increased power was desired and thorough scavenging made this possible by permitting the introduction of a larger charge. The gain in power, however, failed to justify the cost and complication, and hence the devices were abandoned.

In adding exhaust gas to the induction system a higher thermal efficiency has been the goal. Some investigators have found that increasing the amount of inert gas in the charge tends to prevent fuel knock, and hence enables a high compression ratio to be employed. Since thermal efficiency depends upon the expansion ratio, which in the conventional engine equals the compression ratio, it should be higher with a higher compression ratio. Full throttle tests apparently show such to be the case, and from these results it has been concluded that the addition of exhaust gas will be even more beneficial at part throttle. It is assumed that under such conditions a decrease of power is of no consequence and that the heat of the exhaust may be of considerable aid in vaporizing the fuel. Since in service the automobile engine is operated at part throttle most of the time, it is under this condition that economy of fuel consumption is most important. Therefore, the Bureau has given considerable attention to the effect of admitting exhaust gas under such circumstances.

Nearly all investigators have noted that under light loads the engine will not fire mixtures having as high a rate of air to fuel as that which gives the best economy at higher loads. This is probably because the inert gas with partially opened throttle forms so large a proportion of the total charge. The compression pressure is, of course, also too low, and many experimenters have ascribed the poor efficiency to this cause. To prove that the proportion of the exhaust gas is the predominant influence, an engine partly throttled was operated with the leanest air-fuel ratio with which it would fire regularly. The engine was again operated with a sufficient amount of exhaust gas admitted with the charge to reduce the engine power to the same value as had been obtained in the first test by throttling. Although the pressures in the latter case were considerably higher than before, not nearly as high an air-fuel ratio could be fired and lower thermal efficiency was the result.

It seems fair to conclude, therefore, that the dilution of the charge by the spent gases remaining in the clearance volume makes it impossible at low throttles to employ those air-fuel ratios which, if they could be fired, would yield the maximum efficiency. If the exhaust gas that is present during normal operation forms a barrier to the use of high-efficiency mixtures, then surely the designer ought to avoid any devices for adding still more dead gas to the charge.

Greater Output of Steel in Czechoslovakia

Large allotments of coal permitted a greater output of steel in Czechoslovakia during 1920. Consul C. S. Winans reports a production of 972,976 tons, an increase of 186,954 tons, or 23.8 per cent over the previous year. However, this aggregate is slightly below the total for 1918 and very much below the quantity (1,610,079 tons) produced in 1917.

Business Conditions as the Big Banks of the Country See Them

National City Bank of Chicago Notes Change in Spirit of Business World—Railroads Improved—Credit Problems

There has been some betterment in trade conditions, but the changes from a month ago have been relatively unimportant so far as actual transactions are concerned. But there has been a pronounced improvement in sentiment which accounts for much in a time like this after the whole world has been in a turmoil and various foreign currencies show little gold value. The better feeling has come about through the strong leadership at Washington reflected in a well formulated plan to assist crippled industries and finance the cotton growers, cattle raisers and other hard-pressed borrowers over the producing season. It may be doubted whether any administration move for several years has excited more genuine public support than the emphatic stand taken by President Harding against the enactment of the soldiers bonus law. The clear-cut statement of the reasons for opposing huge payments at a time when the Treasury was experiencing serious difficulty in making both ends meet and when the nation was suffering from burdensome taxation, as well as the confirmatory data given out by the Secretary of the Treasury, were as refreshing as it was unusual. Every student of government finance will endorse the President's attitude for the fact is that the industry, brain-power, and painstaking service in this and other countries is being just about taxed to death. It is also true that any bonus system which committed the government to enormous additional outlays of this kind would react most unfavorably upon the beneficiaries and lead to renewed inflation with ultimately greater disorder and social unrest. This is not a question of politics at all, but cold mathematics which every man, woman and child who will pay this year about $60 each for the expense of running the Federal government will understand if they do a little thinking on their own account.

Price Changes

Readjustment of commodity prices is still underway, but it is evident that the movement in some industries has nearly run its course. The situation in the steel trade is very interesting and suggests that profitable business is so scarce as to make it easy for large buyers to obtain concessions. The average price of eight leading steel products on July 19th was $51.61 as compared with $85.03 at the peak level of last August and $35.80 in August, 1913. This means that prevailing prices are about 44 per cent above the pre-war level and that the industry has made considerable progress in returning to a normal level. Better buying is expected as soon as the government pays over to the railroads the $400,000.000 or $500.000.000 under the agreement to settle various claims growing out of government operation of the transportation industry. Final adjustment of these claims will be of great service also in enabling the roads to wipe out long standing indebtedness and to make heavy purchases of supplies. It is evident, therefore, that the release of these buying orders will cause a revival in industries which for some time past have had relatively little to do.

The Railroads

The outlook for the railroads is distinctly better than it was, for with the 12 per cent wage reductions and lower prices for various supplies production costs will be much less burdensome in the future. Furthermore, the carriers are entering the season in increased earnings through crop moving operations which always mean valuable traffic for many lines. While the total operating revenues in May decreased nearly $13,000,000, operating expenses fell off almost $49,000,000. With these and other changes the roads reported a favorable May balance of $37,080,653 compared with a deficit in May, 1920, of $5,429,769. This is highly reassuring as was also the showing made during the first five months of 1921 when net operating income amounted to $90,382,121 as compared with $26,400,100 for the same months last year. The roads are now in a position to benefit from wage reductions which only became effective last month and from the readjustment of working schedules from the costly war-time basis. Recognition of these changes accounts in part for the quiet buying of railroad securities by large and small investors which has been a prominent factor during the past month.

Limiting Armaments

The coming international conference to discuss the limitation of armament outlays marks a sensible effort to get the great nations to capitalize the remarkable opportunities for such co-operation created by the war. In some respects, therefore, the meeting will be the most important gathering of the kind called for a generation and while no one can tell just what will come out of it, the probability is that far-reaching reforms will be achieved. There never was a more favorable opportunity to stage a conference of this kind, for the world is war weary in a manner and to a degree never seen before. Should it be possible to get the leading nations to limit armaments, there is no doubt but that the resultant savings would be of great value in helping to restore industry to a normal working basis again. This development together with the settlement of the British coal strike and efforts to reach an amicable agreement in Ireland have given new courage to people who have been disheartened by the continuance of enormous disbursements for destructive purposes. There are other indications that the foreign situation is more composed than it was and that consistent progress is being made in various quarters.

Lower Costs

Production costs are being gradually reduced, although the downward trend in some industries is still slow. But all groups of producers as well as all classes of merchants are realizing the need of reducing prices and deflating production costs. This movement is going on all the time, for buyers are resentful of high prices and will not stand for them. There is gradually developing a better co-operation between capital and labor in this country and abroad, and it is to be hoped this will go further—for the waste caused by strikes and lockouts in times like these is about as distressing as anything can be, in a period when official estimates indicate that 5,000,000 people are unemployed.

Credit Situation

As a consequence of continued liquidation in the security markets many long-standing loans have been paid off and the total indebtedness represented by "frozen loans" has been reduced. This has further strengthened the position of the banks, although much remains to be done before conditions become really normal, because the demoralization of the foreign exchanges and the difficulty of securing payment for goods shipped abroad have created exceptional credit burdens. This situation will work out all right in time, for the accounts are being carefully handled and business in this country is getting better. The American banking reserve, however, is exposed not alone to extraordinary demands in financing trade recovery at home, but in a large measure to the much greater requirements of foreign countries whose industrial revival is necessary to sustain our foreign trade. One must, therefore, take a world view of money market requirements in order to judge the credit problem in its proper light. Although possessing the largest gold reserve in the world and showing a marvelous increase in the reserve ratio, we are by no means sufficient unto ourselves as a nation, or in a position to ignore the urgent needs of those countries which are willing to become our best customers. In this regard the money market problem assumes international proportions and must be judged with reference to the extraordinary responsibilities which the United States of 1921 has to consider in helping the world to restore its industrial organism. The American people are living and trading more sensibly than they did a year ago, and while there are many serious problems yet to solve, the outlook today is very much brighter than it was six months ago, or even three months ago.

Trade With Germany Resuming Along Pre-War Lines—Survey of National City Bank of New York

Germany's requirements as to the United States products are apparently unchanged. Details of the 1921 trade of the United States with Germany, just received, show that her habits of reliance upon the United States for manufacturing materials and certain staple articles of food continue as before the war. Total exports from the United States to Germany in the fiscal year just ended—the year ending June 30, 1921—exceed in value those of the pre-war high record year, 1914, the total for the fiscal year 1921 standing at $381,772,000 against $344,794,000 in the fiscal year 1914.

The principal articles forming this big total of our 1921 exports to Germany are practically the same as those prior to the war. They consist chiefly of raw cotton, copper, wheat, meats, and mineral oils in the various forms, though the list of foodstuffs now includes condensed milk, not formerly sent to Germany, while naval stores, cottonseed meal, and tobacco which were sent her formerly are not enumerated by the Department of Commerce among the articles sent to that country in 1921.

Raw cotton is the biggest single article, measured by values, of the 1921 exports to Germany, totaling $104,000,000 out of a grand total of $381,772 000 of all articles exported to that country. In fact, the quantity of cotton sent to Germany in the fiscal year just ended is greater than to any other country in the world except the United Kingdom, and totals 576,000,000 pounds against 210,000,000 in 1920, but is far less than in the year immediately preceding the war when it totaled 1,442,000,000 pounds with a valuation in that year of $182,000,000 against the $104,000 000 in the year just ended. Wheat is the next largest item in the exports to Germany, amounting to $72,000,000 in value in the year just ended (including flour in terms of wheat), as against $4,000,000 last year and less than $11,000,000 in 1914. Lard comes next in the value of the 1921 exports to that country, $41,355,000 against $15,230,000 one year ago and $16,573,000 in 1914. The quantity of copper exported to Germany in 1921 was greater than to any other country of the world, 136,000,000 pounds, valued at $20,283,000 against 112,000,000 pounds to France and 91,000,000 to the United Kingdom. Her food demands upon us are greater than in 1914, the 1921 figures showing bacon $16,000,000 against nothing in the year prior to the war, and condensed milk $6,367,000 as against nothing in the pre-war year. Other articles include canned meats, oleo oil, cottonseed oil and paraffin.

For mineral oils in its various forms, the demand is even greater than prior to the war, especially in lubricating oils of which the total sent to Germany in 1921 amounted to $12,000,000 against $3,000 000 in the year before the war, and of illuminating oil, gasoline and naphthas, the total in 1921 is slightly greater than that of 1920. Of cottonseed oil the value in 1921 exports to that country is a little over $1.000.000 as against one-half million dollars in 1914.

One especially interesting point, adds the bank's statement, in this quick return of Germany to her former trade habits with us is that the growth in our exports to that country has continued up to the very last month, while to practically all other countries exports show a big decline in the closing months of the year under consideration. The total exports to Germany in June, 1921, were in round terms $31,000,000 against $20,000,000 in June of last year, an increase of over 50 per cent, while to Europe as a whole the June exports are 40 per cent below those of the same month of last year.

In our imports from Germany, adds the bank's statement, the tendency to return to pre-war conditions has been less strongly marked, the total imports from Germany in the fiscal year just ended having been but $91,000,000 as against $190,000,000 in 1914 while for the very latest month, June, the total, $7,000,000, is slightly less than in June of last year when it stood at 8½ million dollars.

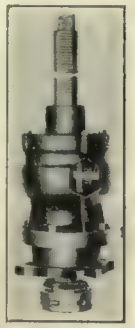
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Boring Tool, (Re-), Cylinder, Van Dresser

International Purchasing and Engineering Co., 2631 Woodward Ave., Detroit, Mich.

"American Machinist," May 26, 1921.

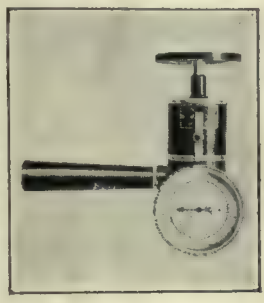


The device consists essentially of a cutter or reamer, a driving and a feeding mechanism for it, a housing, and a base which can be fastened directly to the top of the cylinder to be machined. The size of the reamer is adjustable. The high-speed steel blades are ground helically, and can be adjusted in unison from the lower end of the reamer head without removing the head from the feed bar. The base of the housing is said to be adaptable to any motor. The device may be operated by hand or run by a drill press. The motor cylinders on many cars may be rebored with the motor in place in the chassis. The device is made in seven sizes, to bore cylinders from 2¾ to 4½ in. in diameter, each size being adaptable to cylinders varying in size ⅝ to ¾ of an inch.

Cutmeter, O-Z

O. Zernickow, 15 Park Row, New York, N. Y.

"American Machinist," May 26, 1921.

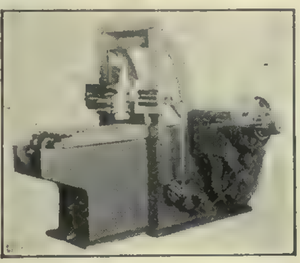


The device is intended for determining the cutting speed of machine tools of all types. It may also be used for such purposes as ascertaining the speed of rolls in paper mills and the linear speeds of belts and ropes. When in operation, the device is held by means of the handle, and the small wheel is placed in contact with the moving part, the surface speed being shown directly on the dial. The meter operates on the governor principle, and it is said that its accuracy is not affected by changes of temperature, by moisture or by the presence of magnetic fields. A damping mechanism is incorporated, so as to prevent vibration of the indicating hand. By means of the three separate ranges, the device may be used to indicate revolutions per minute from 30 to 1,200, and speeds in feet per minute from 20 to 800.

Planer, Crank, 24 x 24 x 24-Inch

Woodward & Powell Planer Co., 97 Webster St., Worcester, Mass.

"American Machinist," June 2, 1921.

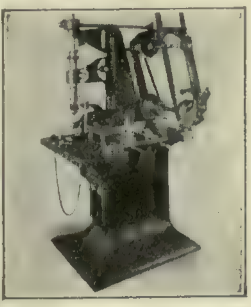


The machine combines the rigidity of the planer with the ability of the shaper to plane to a line and to operate with short, rapid strokes. It is said to be especially adapted to forge shop and railroad shop work. Any length of stroke up to 24½ in. can be taken over any portion of the table. The adjustment can be made while the table is in motion, if desired. The machine can also be furnished with a stroke of 28½ inches. The feeds for cross, vertical, and angular travel are operated by hand or automatically by power, and take place on the return stroke. The planer can be operated by belt on a single pulley connected to a four-speed gear box, as shown; or it can be geared to a motor mounted on top of the gear box. Approximate weight, 8,000 lb.

Drilling Machine, Duplicating, Powers

Sterling Tool and Machine Works, Inc., 205 West 19th St., New York, N. Y.

"American Machinist," June 2, 1921.

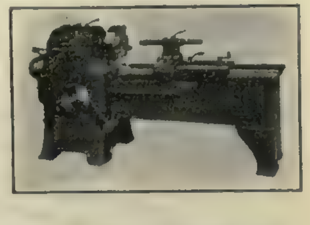


Although adaptable to ordinary drilling, the machine is intended chiefly for the performance of drilling work either requiring the duplication of a part already made, or done directly from a templet or drawing. The rectangular table can be adjusted vertically on dovetail ways. The head or column carrying the spindle can be moved both longitudinally and transversely by means of ball cranks. The spindle is fed by hand and is provided with an adjustable stop. At the right is an arm mounted on the column and holding in two bearings the vertical pilot bar. The master plate is clamped on the table under the pilot, and the work to be drilled under the spindle. By positioning the pilot bar in the holes of the master plate in turn, and moving the table and the spindle, the holes in the work can be made to duplicate those in the master.

Oil-Grooving Machine, Internal, No. 2

Fischer Machine Co., 310 North 11th St., Philadelphia, Pa.

"American Machinist," May 26, 1921.

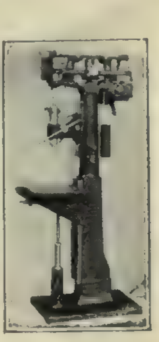


The machine is intended for the grooving of the internal surfaces of bearings up to 15 in. in diameter and 15 in. in length. It is said to combine the standard features of construction of engine lathes and crank shapers. The bearing in which the oil grooves are to be cut is mounted on a revolving chuck or faceplate, and the boring bar is carried by a block mounted on a reciprocating slide. By different combinations of movements of the tool and work, oil grooves of various types can be produced. The machine is driven by cone pulleys from a countershaft, and it is started by engaging a friction clutch on the drive shaft. In order to cut grooves that are symmetrical, a means of compensating for the errors resulting from the angularity of the connecting rod which transmits the reciprocating motion to the carriage is provided. The machine is equipped with a relieving and taper attachment, to provide for cutting oil grooves in tapered bearings.

Drilling Machine, "Hy-Speed"

Cincinnati Hy-Speed Machine Co., Cincinnati, Ohio.

"American Machinist," May 26, 1921.

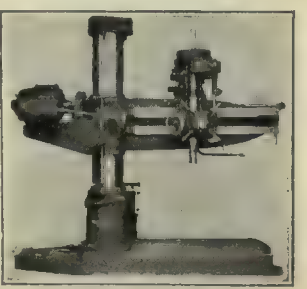


Among the features of the machine are the single-pulley, overhead drive and the dry-plate clutch operating in connection with the internally clamping, air-cooled brake. By means of a single handle directly in front of the operator, the machine can be instantly started and stopped. The spindle speeds are controlled by a handle on the side of the column. An automatic power feed and an automatic tapping attachment can be arranged on any spindle. Unit construction is embodied in the machine.. The narrow-faced idler pulley is carried directly on the belt shifters and, moving intermittently with the shifters, helps lead the belt from one step to another. The machine is built in various types for either floor or bench use, with a single speed if desired, or with a belted motor drive, an automatic power feed, or an automatic tapping attachment.

Drilling Machine, Radial, Motor-on-Arm Drive

Dreses Machine Tool Co., 227 West McMicken Ave., Cincinnati, Ohio.

"American Machinist," June 2, 1921.

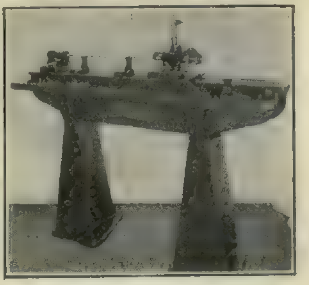


The driving arrangement shown in the illustration has recently been put on the machines made by this concern. The motor, shown fitted to a 5-ft. radial drilling machine, drives the drill and also raises the arm. It is mounted on an extension of the arm, so as to partially balance it; and it is placed on a sub-base, so that different makes of motor can be fitted without a change of the arm. The driving mechanism is very simple. The pinion on the motor meshes directly with a large gear on the horizontal back shaft of the arm. The controller is placed in front of the motor, and the controlling handwheel is brought within easy reach of the operator.

Measuring Machine, Changes in

Pratt & Whitney Co., Hartford, Conn.

"American Machinist," June 2, 1921.



The changed design of pedestal for the 36- and 48- in. machines, retains the rigidity of the older form in a much lighter construction, besides furnishing support to the hardwood shelf in front of the machine. The measuring head is fitted with a clamping arm moved by a tangent screw in the adjustment block, so that when the graduation on the dial is brought almost to line, the clamping screw may be tightened, binding the arm to the dial, and the final adjustment made by means of the tangent screw. An adjustably mounted vernier has been added, and also a permanently mounted glass for the dial reading and vernier. Improvements have also been made in the microscope by means of which the readings from the longitudinal scale are obtained.

Clip, paste on 3 x 5-in. cards and file as desired

Borah's Ideas on Economy and Disarmament

While Germany, defeated and disarmed, is paying thirty-three billions in reparations for the World War, the United States will pay a greater sum for armament, at her present rate, Senator William E. Borah declares in the current number of *The Nation's Business.* Senator Borah cites that fact as a threat of Germany's economic supremacy, unless other nations curb their enormous expenditures for military parade on land and sea.

"Despite her military defeat, Germany, by reason of the short-sighted and blundering policies of the allied and associated powers, may yet secure economic dominance of Europe," Senator Borah says. "Defeat has resulted in Germany's being deprived of her army and her navy. The burden of armaments has been forced from the backs of the German people. They may now devote their energies and their talents to agriculture, to industry, to the arts, to the things which constitute the real wealth and strength of a people. Their genius will find expression not in arms or on the military field, but in improved machinery and coöperative industry. Every ounce of effort which they put forth will be along lines which produce something, which add wealth to the community, which make for contentment and prosperity to the people, which insure greater physical prowess and a higher brain power.

"On the other hand, the allied and associated powers are carrying a vast burden because of their great armies and navies. These burdens are being increased upon a stupendous scale. Hundreds of thousands of their people are to be engaged in lines which produce nothing, add no wealth to the community, make not for health, growth and happiness, but for display, parade and possibly for destruction and death. The German people are compelled to preserve their energies for things which count. The allied and associated powers are burying their people under intolerable taxes, discouraging industry, sterilizing human energy, and breeding discontent through their everlasting plans for increased armaments.

"It is true that Germany has a vast debt upon her for reparation. But this debt is no larger—and perhaps not so large—than our own expenditures as they will be created from year to year for armaments.

"Let us take the figures: Germany is expected to pay an annuity of $500,000,000 plus 26 per cent of the actual value of her exports. As matters now stand the German foreign trade would make this export charge amount to about $260,000,000, which would make her annual payment about $760,000,000. We will assume, however, that her exports will increase, so that at the end of forty years it is estimated that Germany will have paid $33,000,000,000. Look at our expenditures for our military and naval establishments. We expended for military and naval purposes from June 30, 1920, to June 30, 1921, $825,337,939. The Army and Navy bills just passed will incur an expenditure of not less than $830,000,000—perhaps more. This would equal in forty years a little over $33,000,000,000. So we shall pay for our Army and our Navy at the present rate an amount equal to the vast reparation bill which has been assessed against Germany.

"France has an army of 800,000 men. The exact cost of maintaining this great army I do not know, but one can imagine how stupendous it is. The British army and navy combined call for an expenditure much larger than our own. Thus while Germany has her billions of reparation the allied and associated powers are spending their billions for their armies and navies—we alone expending as much for our Army and Navy as the entire reparation claims against Germany.

"The business men of this country must realize, more keenly perhaps than anyone else just now, what these armament expenditures and the taxes thereby imposed mean to business of the future. There is little encouragement for men of business capacity to plan and strive for success when they realize, as they must, that their profits are to be taken for taxes, and that those taxes, when collected, are to be expended, not for things which make for wealth and development, but for sheer waste and sterility. We shall not enjoy that resiliency and revival in business which we are entitled to experience in this country until taxes are brought within reason. And taxes cannot be reduced until expenditures are brought within reason. And public expenditures cannot be reduced until outlays for armaments are brought within reason.

"All that is being done and said just now about reducing the expenses of the Government in other departments and along other lines will amount to very little so far as lifting the burden of the taxpayer is concerned, unless we also cut most savagely the expenditures for armaments, for there is where the vast sum of money goes.

"Neither can we wait, nor need we wait, until all questions about which nations may hold differing views are settled before we begin to limit our armament expenditures. There are now three nations in absolute dominance of the seas—the United States, Great Britain and Japan. These three nations are the only nations which are building vast navies. They are now actually engaged in a naval race. They are building navies with mad speed and piling taxes upon the people at a rate and to an amount never before dreamed of in time of peace and seldom in time of war. To say that these building programs shall go forward, that these taxes shall continue to be increased, and the burdens under which the people are breaking shall be augmented until all international questions about which nations and peoples may hold different views are settled, is to say that there is to be no disarmament.

"Disarmament should not be postponed, or subordinated, or made incident to the settling and adjusting of all international questions. It should be made the controlling, dominating question. It is the most vital problem in the world today. Unless disarmament is effectuated, there is no possible relief from the economic conditions under which we are now suffering. And any plan, or any program, which makes the question of disarmament a subordinate, or incidental proposition, rather than the main and controlling proposition, will result in the future, as it has in the past, in no relief to the taxpayers and no relief from war.

"There are many obstacles to overcome before we can achieve disarmament, or any pronounced limitation of armaments. I do not underestimate the difficulty of overcoming these obstacles. But the obstacle which seems to me the greatest, the obstacle which seems to me the most difficult to master, is one which we will not admit exists, and that is the reliance which we have come to have on force as the only power left on earth with which to govern men.

"I understand fully that there may be circumstances in which an appeal to force is not only necessary but righteous. But to deify force, to make it the dominating factor, to have it ever present, to sit at conference with your finger pointing back over your shoulder to your armies and navies, to intrude into every settlement, and to announce to the world that it is your ultimate reliance, is barbaric—and it is none the less barbaric when it is practiced by professedly Christian nations.

"For myself, I refuse to concede that force is the only power left, or that it should be the dominating and controlling power. It cannot be possible. Reason and justice must still have their place in the affairs of the world, and if leaders and statesmen are strong enough to place their reliance upon them, they will go far. I venture to declare, in the face of professional militarists, that no nation can long defy the public opinion of the civilized world—and especially no government can long defy the public opinion of their own people. And if this conference is conducted as an appeal to the public opinion of the world and to the public opinions of the peoples of the respective countries, it will accomplish far more than if it is conducted under the constant threat of dominating armaments."

EXPORTS OF METAL-WORKING MACHINERY, AS REPORTED BY THE DEPARTMENT OF COMMERCE FOR JUNE, 1921, AND THE FIGURES FOR JUNE, 1920, AS FINALLY REVISED, ARE AS FOLLOWS:

	June, 1920	June, 1921
Metal-working machinery:		
Lathes	$846 583	$131,140
Other machine tools	1,127,297	267,344
Sharpening and grinding machines	395,903	60,499
All other	1,164,940	1,029,230
Total Metal-working machinery	3,534,723	1,488,213
Exported to:		
Belgium	114,881	9,066
France	409,799	161,900
Italy	93,427	8,995
Norway	10,746	2,752
Spain	60,615	7,593
Sweden	68,512	150
United Kingdom	909,168	132,388
Canada	634,333	69,330
Mexico	37,532	74,352
Cuba	40,704	39,597
Brazil	19,955	35,910
Chile	7,402	2,266
China	42,744	59,499
British India	165,884	115,519
Japan	506,074	599,419
Australia	103,450	23,739
Other countries	309,497	145,738

Imports of machine tools were in greater number in June, 1921, than they were in June, 1920, but the value was very much less in June of this year. There were 194 machine tools, valued at $12,204 imported in June, 1921. This compares with 53 machine tools valued at $85,296 imported in June, 1920.

Business Items

The Beacon Visible Pump Co., Louisville, Ky., has been incorporated with a capitalization of $200,000 by J. J. Kasper and A. H. Van Dyke.

The American Washing Machine Co., Muskogee, Okla., has been incorporated with a capital stock of $25,000 by W. F. Bickford, J. M. Sims and E. V. Vernor.

The Sash Weight Foundry Co., Sand Springs, Okla., has been incorporated with a capitalization of $10,000. L. C. Hinds, A. C. Spitznagel and E. M. Tyler are the incorporators.

The Owen Thomas Engine Co., Cleveland, Ohio, has been incorporated with $25,000 capital by George W. Phypers, Murray Smith, L. F. Chapman and others.

The Rochester Automatic Tool Corporation, Rochester, N. Y., has been incorporated with a capital stock of $100,000. Directors include H. F. Stablebrodt, J. J. Appel and M. J. Landau.

The General Motors Products Corp., Philadelphia, Pa., has been incorporated at $1,000,000 by F. R. Hansell, J. Vernon Pimm and E. M. McFarland.

The Baker Ice Machine Co., Fort Worth Tex., has been incorporated with a capitalization of $25,000 by H. M. Coleman, O. H. Hammer and O. J. Hocher.

The Utah Fuel & Iron Co., Carson City, Utah, has been incorporated at $2,500,000 to develop coal and iron ore lands.

The Automatic Control & Signal Corporation Chicago, Ill., has been incorporated with $500,000 capital stock, by H. B. Bourdette, A. J. Brookins, R. L. Laird.

The Lake Tool Co., Sour Lake, Tex., has been incorporated with $15,000 capital stock by M. L. and M. F. Yount and R. M. Stafford.

The Fitch Vending Machine Co., Buchanan, Va., has been incorporated with $15,000 capital stock, by J. F. Fitch, A. B. Land and O. E. Obenshaim. The company will lease a plant and is reported in the market for some equipment.

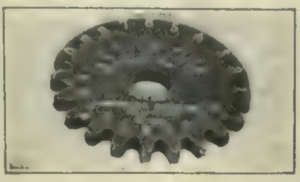
The Victor Piston Ring Co., Baltimore, Md., has been incorporated with $500,000 capital stock, by Jackson Brandt, J. E. Butler and others.

The Great West Farm Machines, Ltd., Milverton, Ontario, Canada, has been incorporated to manufacture farm imple-

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Stamp, Figure, Steel, "All-in-One"
Marburg Brothers, Inc., 90 West St., New York, N. Y.
"American Machinist," June 2, 1921.

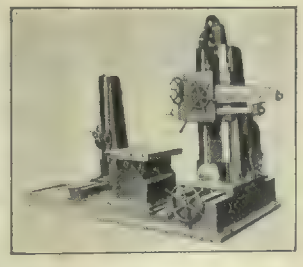


These steel figures, or numbering sets, are for stamping figures on metals. The device contains all ten steel figures on the periphery of a steel disk, the figures being hand cut. It is said to be easy to align the figures properly on the work being stamped, because of the fact that they are held on a disk. The proper figure may be easily selected without looking at the cut figure itself, because of the fact that the figures are stamped on the side of the disk, both next to and opposite the cut figures. It is claimed that, besides enabling the operator to do better stamping work, much time may be saved by the use of the device.

Threading Machine, Single-Spindle, "H & G," Model SS
Eastern Machine Screw Corporation, New Haven, Conn.
"American Machinist," June 9, 1921.

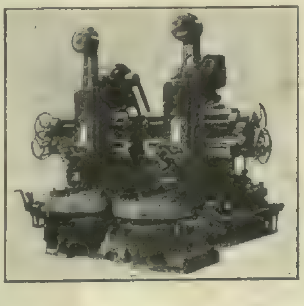
The opening and closing of the dies is automatic and the point at which the action occurs may be adjusted to suit the work. Two styles of work carrier can be provided, one with side-opening jaws, and the other with spring collets for holding the work. Either style is operated by one lever, a single movement of which is all that is required to grip the work and to advance it to the dies. The machine has a capacity for threads up to 1¼ in. in diameter by 9¾ in. long. The gear ratios are 2:1 and ½:1. The bed and pan are cast in one piece and adapted to use on a bench. The machine occupies a space of 14 x 36 in., and when mounted upon the pedestal for floor use the height to the center line of the spindle is 38½ in. The machine is regularly equipped with a countershaft and one die-head. Any H & G die-head from ¼ up to 1¼ in. may be used.

Drilling and Boring Machine, Horizontal, No. 3
Jones Machine Tool Works, Philadelphia, Pa.
"American Machinist," June 9, 1921.



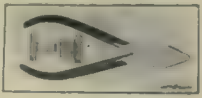
The machine is made in either the standard or the portable type, in which latter case the base for the table is omitted. It is driven by a 3½-hp., variable-speed motor with six geared speed changes, located in the base of the column and flood lubricated, the range of spindle speeds being from 20 to 700 r.p.m. The spindle has a traverse of 20 in. The spindle thrust is carried by large ball bearings. The saddle, which is counterbalanced, has a vertical traverse of 30 in., the horizontal traverse of the column being also 30 in. When the machine is intended for drilling only, the extension of the base, the outer support column and the runway for supporting the boring bar are omitted. The weight of the boring machine is 12,500 lb., and of the drilling machine 9,500 lb.

Boring and Turning Mill, Duplex
Webster & Bennett, Coventry, England.
"American Machinist," June 9, 1921.



The turret-heads and tables can be run at different speeds, as they operate independently. The machine is made in two sizes, 20-in. and 42-in., the latter being shown. It is driven by means of single pulleys fitted with friction clutches, so arranged that the speed change gears cannot be changed or shifted until the clutches have been released. Positive horizontal, vertical, and angular feeds are provided, and are reversible and interlocking. Rapid power traverse in all directions is instantly available. Any pressure beyond that intended causes the safety clutch to slip and so prevents damage to the feed mechanism. The turret is balanced by compensating springs instead of weights and chains.

Plier, Bushed Joint
Lindquist Engineering Works, Portland, Conn.
"American Machinist," June 2, 1921.



In this plier the joint is somewhat different from the usual construction. Instead of using a single rivet to hold the two parts of the plier together, the rivet passes through a shouldered bushing. One jaw is counterbored to receive the head of the bushing, which is just long enough to reach the bottom of the counterbore in the other jaw. A flat-head rivet passes through the bushing, taking its bearing upon the end of the bushing instead of upon the jaw, so that no matter how tightly the rivet is drawn it cannot bind the jaws and cause them to stick. The method of construction is shown in the sketch.

Threading Machine, Double-Spindle, "H & G," Model DS.
Eastern Machine Screw Corporation, New Haven, Conn.
"American Machinist," June 9, 1921.

The opening and closing of the dies is automatic and the point at which the action occurs may be adjusted to suit the work. Two styles of work carried can be provided, one with side-opening jaws, and the other with spring collets for holding the work. Either style is operated by one lever, a single movement of which is all that is required to grip the work and to advance it to the dies. The machine has two spindles, with five gear ratios ranging from 1:1 to 9:1, and will take the H & G die-heads from $\frac{3}{16}$ to 1½ in. in size. It is made only to stand on the floor, occupying a space of 29⅜ x 45½ in., and standing 38 in. from the floor to the center line of the spindles.

Graduating and Marking Machine
Noble and Westbrook Manufacturing Co., Hartford, Conn.
"American Machinist," June 9, 1921.

Either hand or power-driven machines can be furnished. On the power-driven machine, the placing of pieces of work in the machine and removing them when the operation has been performed are the only duties required of the operator. With the hand machine, one turn of the handle completes a piece of work. Provision is made for holding the work in the proper relation to the graduating die and the depth of the marking is controlled by means of a treadle. Parts of various diameters can be graduated by changing the position of the intermediate gear located on the adjustable section. The graduating and numbering are completed in one operation. Full equipment for the machines, including the engraved marking dies, can be furnished.

Lathe, Crankpin, Tosi
Franco Tosi Società Anonima, Legnano, Italy.
"American Machinist," June 9, 1921.

The machine is intended for turning the crank bearings on large multi-throw crankshafts, such as those used in stationary and marine engines. The tools are held by a big hollow mandrel that revolves around the piece to be turned. The main parts of the machine form two separate rigid sets, the fixed one composed of the bench and the mandrel head, and the other composed of the slide, the two supports to hold the shaft to be turned and the shaft itself. The latter set travels longitudinally across the first set on the bed. In order to center the piece which is to be turned, the head can be moved transversely by hand and afterward secured in the position required. There is a continuous circulation of oil between the head and the mandrel, keeping the bearing surfaces cool and lubricated. All levers and gear handwheels are in a central position, within easy reach of the workman.

Clip, paste on 3 x 5-in. cards and file as desired

ments, machinery, tools, etc., with $300,000, by Henry C. Mohr, John Boshart, Enos Nafziger and others.

Alfred Herbert, Ltd., a corporation created under the laws of the United Kingdom, has been granted license to carry on business in Toronto, Canada, as manufacturer and dealer in machinery, tools, boilers, iron, steel and metal products, with $100,000 capital stock and has appointed James C. Blair of Toronto as its representative.

The DeVassie, Beedle & Duffy Automotive Grinding Co., Pittsburgh, Pa., has been incorporated with $10,000 capital stock, by H. M. DeVassie, Ingram, Pa., William B. Duffey, E. T. Beedle, Canonsburg, Pa.

The Miller-West Co., Dayton, Ohio, organized with a capital stock of $20,000 formed for manufacture and jobbing of automobile accessories, has been incorporated. Dr. George W. Miller is president and P. E. West, connected with the Dayton and Troy Automobile Company, is secretary and general manager.

The Criterion Automotive Products Co., Dayton, Ohio, with a capital stock of $75,000 has been incorporated and will take over and enlarge the business of the Criterion Tool and Engineering Co.

Shenango Valley, Pa., iron and steel industries report increased operation. Two important mills that have been shut down for some time reopened with about 3,000 men at work. Four other mills enlarged their working forces.

The Harrisburg Corporation, of Harrisburg, Pa., has acquired a half interest in the plant of the Henry Millar & Henry Co., West York, N. J., manufacturer of gasoline engines and tractors. The business will be enlarged. The Harrisburg Corporation, which has a capital of $1,500,000, controls the Harrisburg Foundry and Machine Co.

The Dayton Irrigation Co., Dayton, Ohio, has been incorporated with $100,000 capital stock for the manufacture of lawn sprinklers, garden sprinklers, etc. John H. Keyes is president, and E. P. Christ, secretary and treasurer.

The Atlas Elevator Device Corporation, Brooklyn, N. Y., has been incorporated with $100,000 capital stock, by E. Weigele, W. H. Dinspel, E. R. Gippert and others.

The U. S. High Speed Steel and Tool Corporation, Green Island, N. Y., has increased its capital stock from 150,000 shares to 200,000 shares.

The Harvard Engineering and Development Co., Cleveland, Ohio, has been incorporated with $25,000 capital stock, by H. P. Hartrath, Joseph S. Krajewski and others.

The American Pli-Nipper Co., Washington, D. C., has been incorporated with $500,000 capital stock to manufacture nippers, etc., by Henry G. Wernimont and others.

The United Iron Works, Kansas City, Mo., has increased its capital stock from $2,500,000 to $3,085,600.

The Waugh Foundry and Machine Works, Williamson, W. Va., has been organized by C. S. Waugh, J. R. Hill and others.

Announcement is made at Hamilton by the International Harvester Co. of Canada, Ltd., that the Chatham works of the company are being made ready to take over the manufacture of motor trucks. Chatham was selected by the company because it was the home of the wagon and sleigh factory of the company.

Lebanon capitalists have purchased from the Bearings Company, of Lancaster, Pa., the Rivetless Chain and Engineering Co., at Avon. The company has a capital of $100,000. The purchasers are Samuel L. Light, Harry H. Light, William H. Worrilow and Thomas S. Quinn.

The Garvin Machine Co., of New York City, announces the resignation of its sales manager, Frank A. Powers, and the appointment of Lyman M. Waite, formerly with the National Acme Co., and recently with the Springfield Automatic Screw Machine Corporation, of Fitchburg, Mass., to succeed him.

Sidney Thompson, president of the Defiance Screw Machine Products Co., has taken over the Napoleon Tool and Machine Co., of Defiance, Ohio and has increased the capitalization to $50,000. The new company will be known as the Napoleon Products Co., and will manufacture auto parts.

Announcement of the incorporation of the Sponsel Universal Joints Company, Washington, D. C., composed of local bankers and business men, with a capital of $4,000,000 under the laws of Delaware, was made last week. Two universal joint patents are owned by the new company, covering the invention of Charles W. Sponsel, consulting engineer. One of the patents is designed for automobile purposes, and the other for general machinery uses. Plans are now being completed for the financing and production of joints by the incorporators. Local offices have been established in the Albee building.

The Allegheny Steel Tank Car Co., Warren, Pa., is going into liquidation and another company, the Conewango Car Co., is being organized to conduct the business.

The Yale & Towne Manufacturing Co., Stamford, Conn., it is reported has installed an electric heated furnace, of two-ton capacity, whereby it will be enabled to make steel and malleable iron castings. Four heats a day may be poured from the furnace, making a total capacity of eight tons a day. The company also is installing a new annealing plant which will contain an arched tunnel through which electric trucks may pass.

The Cincinnati office of the Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has been moved from the Gwynne Building, to the Dixie Terminal Building. A. R. Maujer, formerly of the sales-engineering force of the Pittsburgh office is now in charge of the Cincinnati office.

Pamphlets Received

Airplanes and Safety: The Travelers Insurance Co. of Hartford, Conn. An interesting and instructive booklet on airplane development, presenting an elementary account of the construction and operation of airplanes, and discussing some of the means by which flying may be made a safer mode of travel and transportation.

Handy Wiring Tables and Illumination Data. Issued by the Geo. Cutter Works of the Westinghouse Electric & Mfg. Company, South Bend, Ind. This booklet contains a considerable amount of data which should be of interest to anyone connected with the problems of wiring and lighting offices, factories, etc. Tables of foot candle intensities recommended for different classes of service, are included in this booklet and an interesting discussion of lighting installations is made. Several new devices manufactured by the Westinghouse Company are also shown.

Application of Oil Circuit Breakers. A new publication issued by the Westinghouse Electric & Mfg. Company, East Pittsburgh, known as Special Publication 1643. This includes a complete discussion of the application of circuit breakers, together with an outline of the characteristics of several types of Westinghouse oil circuit breakers.

The Use of Powdered Fuel Under Steam Boilers. A forty-one page pamphlet comprising the address made by Harlow D. Savage, of the Combustion Engineering Corporation, of New York, to the American Iron and Steel Institute. Mr. Savage's address goes into detail regarding the different types of equipment, the actual results obtained up to the present, and is in a sense the story of powdered coal progress. The methods of operation now in use in various plants are described and illustrated with both line drawings and photographs. The results of tests are also given, the authenticity of which are assured by the fact that the tests were run under the direction of the U. S. Government Bureau of Mines.

Radioactivity — New conceptions of the constitution of matter: Research narratives No. 13, published by Engineering Foundation, 29 West 39th St., New York City. A most interesting pamphlet relating the progression of scientific experienment which resulted in the discovery of the X-ray, and later polonium and radium.

Development of Scandinavia - American Trade Relations: One of the foreign commerce series published by the National City Bank of New York; written by F. C. Schwedtman. A lengthy but very interesting discussion of the Scandinavian people, taking up their habits, industries, agriculture and foreign trade.

Personals

Alexander Gabay, formerly tool and efficiency engineer for the Western States Machine Co., Salt Lake City, Utah, has been appointed production manager and assistant superintendent of the Baird Lock Co., Chicago, Ill.

Guy Vaughan has been appointed general manager of the Standard Steel and Roller Bearing Co., of Philadelphia, Pa.

Walter King, formerly connected with the Berger & Carter Co., of San Francisco, Cal., has accepted a position with the Axelson Machine Co. of Los Angeles, Cal., as manager of the lathe department.

J. A. Henry has been appointed western district manager for the Warren Iron and Steel Co., Warren, Ohio. His headquarters will be in Chicago.

Arthur R. Markel, secretary of the Columbus McKinnon Chain Co., Columbus, Ohio, has been made assistant to the president of the company. Don S. Brisbin, formerly assistant sales manager of the McKinnon Industries, Ltd., St. Catharines, Ont., Canada, has been transferred to Columbus as director of sales.

Charles J. Hunter, vice-president and treasurer of the Wheeling Steel and Iron Co., Wheeling, W. Va., has been elected president of the company, succeeding John Duncan who resigned. Mr. Duncan is now actively associated with the Illinois Co. of St. Louis, owner of coal, coke, iron and railroad properties in southern Illinois.

R. H. Scott, vice-president and general manager of the Reo Motor Car Co., Lansing, Mich., has been re-elected president of the Novo Engine Co. also of Lansing.

E. H. Cory, mechanical engineer of Cleveland, Ohio, has taken charge of the Harrisburg Corporation, Harrisburg, Pa., builders of tractors.

E. C. Walton Jr., has succeeded H. F. Vanderburg as purchasing agent of the Cincinnati Ball Crank Co., Oakley, Cincinnati, Ohio. He will also act in his former capacity of employment agent.

Obituary

Jack H. Lewis, of Atlanta, southeastern manager for the Dixon Crucible Co., of New Jersey, died at his home in Atlanta, Aug. 8, from a pistol wound inflicted by himself. A verdict to this effect was returned by a coroner's jury following an inquest. The death of Mr. Lewis followed a long illness which resulted finally in a nervous breakdown. He had been southeastern manager for the Dixon company for some years and was well known in the South.

Forthcoming Meetings

The second International Cost Conference will be held at Cleveland, Ohio, on Sept. 14, 15 and 16, under the auspices of the National Association of Cost Accountants.

The third annual convention and exhibition of the American Society for Steel Treating will be held in the Manufacturers Building, State Fair Grounds, Indianapolis, Ind., during the week of September 19 to 24 inclusive.

The annual congress of the National Safety Council will be held at Boston, Mass., during the week of September 26. C. W. Price, 168 North Michigan Ave., Chicago, Ill., is general manager.

A joint meeting of the American Society of Mechanical Engineers, the Society of Automotive Engineers and the Army Ordnance Association will be held at Aberdeen, Md., Friday, October 7.

The American Gear Manufacturers Association will hold its semi-annual meeting at Rochester, N. Y., October 13, 14 and 15. F. D. Hamlin, 4401 Germantown Ave., Philadelphia, Pa. is secretary.

The National Machine Tool Builders' Association will hold its fall meeting at the Hotel Astor, New York City, October 18, 19 and 20.

NEW *and* ENLARGED SHOPS

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

N. J., Ampere—The Lock Joint Pipe Co.—one 48 in. 10 gage squaring shear; and 1 small shear for cutting rods.

N. Y., Buffalo—The Day Machinery Co., Exchange and Ellicott Sts., dealers in machine tools—

Open back inclinable and straight side geared presses.

Vertical boring and turning mill from 84 in. to 100 in. swing.

Speedy belted sensitive radial drill press 3 ft. to 4 ft.

Two slip roll forming machines to form a cylinder 5 in. dia., 54 in. to 60 in. long, 14, 16, or 18 gauge, with double friction clutch for reversing.

Power bending brake, 90 in. wide for $\frac{3}{16}$ in. plates.

Power bending roll, Pyramid type, about 98 in. between housings, for $\frac{5}{16}$ in. plate Rolls should be about 7 in. dia.

Single or double punch and shear with capacity to punch $\frac{3}{4}$ in. through $\frac{1}{2}$ in. About 48 in. throat.

Double automatic seaming machine for 16 gauge material, double housing type preferred.

Pa., Philadelphia—Drake Eng. Co., 23 North 10th St., A. Drake, Purch. Agt.—small air compressor, Becker vertical miller, 4 spindle drill, gear cutter and cold saw.

Pa., Philadelphia—G. Miller, 1035 Mt. Vernon St., tool maker and machinist—one 11 ft. engine lathe.

Ga., Tifton—Tifton Handle Mfg. Co., W. E. Chandler, Mgr.—automatic lathe and sander.

Ill., St. Charles—N. Lehr—one speed lathe.

Mich., Detroit—The Universal Gear Wks., Palmer Blvd. and Six Mile Rd., L. G. Berling, Secy.—tools for making and finishing gears.

Mich., Detroit—The Wilton Tool & Mfg. Co., 2121 Grand River Ave., H. Wilton, Pres.—machine tool equipment for the manufacture of special tool steel and finished steel parts for automobiles.

O., Cleveland—The Simmons Mfg. Co., 3405 Perkins Ave.—spot welder (used).

Wis., Milwaukee—The Economy Sheet Metal Wks., 105 5th St., W. Ehmke, Purch. Agt.—one 20 in. and 28 in. roofing folders, and 32 in. square shears.

Wis., Oconomewoc—E. Otto, mill work—hollow chisel mortiser mitre machine.

Mo., Kansas City—The Dennison Engine Co., 200 North Park Ave.—machine shop equipment, including planers, shapers, turret lathe, boring mill, lathe, also shaft straightening machine.

Kan., Pittsburg—The Pittsburg Boiler & Machine Co.—McCabe pneumatic flanging machine for flanging boiler plates.

Ont., Simcoe—C. Blackburn, Colborne St.—tools and machinery for garage, auto repair shop and plant for the manufacture of auto tops.

Ont., Windsor—The Canadian Plant Eng. Co., H. Johnstone, Mgr.—metal working machinery for the manufacture of soot blowers and power equipment.

Md., Baltimore—Hampden Laundry & Ice Mfg. Co., 3648 Hickory Ave., J. H. McFaul, Jr., Secy.—complete laundry and ice manufacturing machinery and complete refrigerating equipment.

N. J., Clayton—The Clayton Automobile Exchange—1 oxy-acetylene cutting torch, power emery grinder, air compressor and tank.

N. J., Woodstown—The South Jersey Farmers Exchange—grinding machinery for fertilizer plant.

N. Y., Buffalo—A. G. Sherman, 235 Highland Ave.—coal conveyor, about 50 ft.

N. Y., Syracuse—The Bd. of Contract & Supply, City Hall, will open bids Aug. 29 for woodworking machinery for the Edward Smith Junior High School, on Lancaster Ave.

Fla., West Palm Beach—Kelsite Stone Products Co., 210 Seward Bldg., H. G. Mitchell, Pres.—machinery for the manufacture of blocks, bricks, roofing tile, wall tile, and similar products.

Ky., Middlesboro—Middlesboro Creamery Co., M. H. Thompson, Purch. Agt.—machinery for use in 40 ton ice plant. Interested in both raw and distilled water plants.

N. C., Garland—Carter & Carter—machinery for the manufacture of brooms.

Tenn., Memphis—Shelby County Training & Industrial School, 225 Madison Ave., L. S. Akers, Secy.—complete laundry equipment.

Ill., Chicago—Bunge Bros. Coal Co., West Lake and North Paulina Sts.—complete equipment for blacksmith and wagon shop.

Ill., Rockford—The Bd. Educ., c/o E. E. Lewis, Supt., will open bids Aug. 26 for manual training equipment, including wood turning lathe and woodworking machinery.

Wis., Green Bay—The Amer. Lumber & Mfg. Co., St. Paul St.—additional wood working machinery.

Wis., Jefferson—C. A. Baumann—belt driven machinery for the manufacture of condensed milk at plant in Lake Mills.

Wis., Milwaukee—The Sonnenberg Sausage Co., 92 Michigan St.—ice machine and refrigerating equipment.

Mo., Monett—E. L. Jerome—machinery for ice cream factory.

Ont., Tillsonburg—R. Myrick—machinery and equipment, both steam driven and electrically operated, for making butter.

Ont., Woodstock—Warren & Son—$40,000 worth of machinery and equipment for the manufacture of organs.

Metal Working Shops

NEW ENGLAND STATES

Conn., Hartford—The City Health & Charity Dept. will soon award the contract for the construction of a 2 story, 43 x 63 ft. laundry and central heaing plant, etc., on Holcomb St. Estimated cost, $80,000. Whiton & McMahon, 36 Pearl St., Archts. Noted Feb. 17.

Conn., New Haven—W. E. Malley, 305 St. Ronan St., will soon award the contract for the construction of a 1 story, 60 x 140 ft. garage, etc., on George St., Brown & Van Beren, 185 Church St., Archts.

Conn., Wallingford—H. L. Judd Co., 42 South Cherry St, manufacturer of hardware, is having plans prepared for the construction of an addition to its factory. Estimated cost, $100,000. Lockwood, Greene & Co., 101 Park Ave., New York City, Archts. and Engrs.

Mass., Springfield—The Noyes-Buick Co., 758 Main St., will build a 1 story, 100 x 185 ft. garage, etc., on Main St. Estimated cost, $125,000. Private plans.

Mass., Springfield—W. Sacks, 131 Main St., has awarded the contract for the construction of a 1 story, 100 x 100 ft. garage, etc., on Worthington St.

Mass., Worcester—The Worcester Electric Light Co., 11 Foster St., has awarded the contract for the construction of a 2 story machine shop, on Webster St. Estimated cost, $35,000.

R. I., Providence—Monks & Johnson, Archts., 99 Chauncy St., Boston, Mass., are receiving bids for the construction of a 1 story factory for the manufacture of emblems on the block bounded by Highland Ave., North Main, 3rd and 4th Sts., for Williams & Anderson Co., 33 Broad St. Estimated cost, $60,000.

R. I., Woonsocket—The Shambow Shuttle Co., 583 Main St., has awarded the contract for the construction of a 3 story, 84 x 158 ft. plant on North Main St., for the manufacture of shuttles. Estimated cost, $125,000.

MIDDLE ATLANTIC STATES

N. J., Bridgeton—J. Toye Co., 353 Bank St., has had plans prepared for the construction of a 1 story, 40 x 80 ft. foundry. Estimated cost, $12,000.

N. J., Camden—The Bd. Educ., City Hall, will receive bids until Aug. 22, for the construction of a printing shop for the Junior High School, on Newton Ave.

N. Y., New York—The Fordham Plaza Auto Co., Inc., 1856 Bath Ave., Brooklyn, is having plans prepared for the construction of a 3 story, 100 x 160 ft. garage on Wester Ave. near 189th St., here. Estimated cost, $150,000. C. Clark, 441 Tremont Ave., Archt. and Engr.

N. Y., Syracuse—The Meldrum-Gabrielson Corp., Industrial Bldg., has awarded the contract for the construction of a 1 and 2 story, 60 x 160 ft. factory on West Fayette St., for the manufacture of milling machines. Estimated cost, $75,000.

SOUTHERN STATES

Fla., Oldsmar—The Oldsmar Tractor Co. plans to build an addition to plant which will be used as a foundry. H. J. Keller, Mgr.

MIDDLE WEST STATES

Ill., Chicago—H. T. McFarlane, 532 South Canal St., has awarded the contract for the construction of a 6 story, 115 x 116 ft. factory, on Green and Van Buren Sts. for the manufacture of auto bodies. Estimated cost, $400,000.

Ill., Chicago—The Niagara Radiator & Boiler Co., North Tonawanda, N. Y., is having plans prepared and will soon receive bids for the construction of a 1 story, 140 x 175 ft. foundry, on 63d and Woodlawn Sts., here. Estimated cost, $100,000. E. C. Andrews, Pres. Private plans.

THE WEEKLY PRICE GUIDE

This Week's Market

Steel prices in New York warehouses remain unchanged. The general tone of the warehouse business is optimistic, despite the very light demand for finished steel at the mills. The official Pittsburgh schedule of $1.75 for bars and $1.85 for plates and shapes continues. Mill shipments, New York, of shapes and plates are quoted at $2.18 to $2.23; bars at $2.13. Pig iron, Birmingham No. 2 foundry, is quoted at $20 as against $19, f.o.b. furnace.

New York quotes tin at 26c. as against 26⅝c. per lb., and a reduction of ½c. per lb. on zinc sheets in casks. Prices in Chicago are the same as those in New York on copper and brass sheets, brass rods and tubing and copper bars. Long terne plate has dropped from $7.70 to $6.75 and Swedish iron has advanced from 17½c. to 18½c. per lb. Cleveland reports decreases of 1c. per lb. in copper wire and tubing, 2c. per lb. in brass tubing and ½c. per lb. in brass rods.

Linseed oil has dropped from 84c. to 80c. per gal. (5 bbl. lots) in Chicago.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	†$24.50
Northern Basic	21.52
Southern Ohio No. 2	22.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	†30.26
BIRMINGHAM	
No. 2 Foundry	*20.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75	†21.76
Virginia No. 2	†28.74
Basic	†20.26
Grey Forge	†22.26
CHICAGO	
No. 2 Foundry local	*20.00
No. 2 Foundry, Southern, sil 2.25@2.75	†26.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	21.96
Basic	19.96
Bessemer	21.96

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$2.88	$2.74	$2.88
Soft steel bars	2.78	2.64	2.70
Soft steel bar shapes	2.78	2.64	2.70
Soft steel bands	3.43	....	
Tank plates	2.88	2.74	2.88

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh (refined)	$2.50
Warehouse, New York, delivered	2.78
Warehouse, Cleveland	3.52
Warehouse, Chicago	2.78

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
Blue Annealed				
No. 10	3.10	3.53	3.25	3.53
No. 12	3.15	3.58	3.30	3.58
No. 14	3.20	3.63	3.35	3.63
No. 16	3.30	3.73	3.45	3.73
Black				
Nos. 17 and 21	3.75	4.05	3.80	4.45
Nos. 22 and 24	3.85	4.10	3.85	4.50
No. 25 and 26	3.90	4.15	3.90	4.55
No. 28	4.00	4.25	4.00	4.65
Galvanized				
No. 10 and 11	4.00	4.25	4.00	4.95
No. 12 to 14	4.10	4.35	4.10	5.05
Nos. 17 and 21	4.40	4.65	4.40	5.35
Nos. 22 and 24	4.55	4.80	4.55	5.50
No. 26	4.70	4.95	4.70	5.55
No. 28	5.00	5.25	5.00	5.65

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb.	$4.23	$4.23	$4.00
Flats, squares and hexagons, per 100 lb.	4.73	4.73	4.50

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	55@60%
Cleveland	55%
Chicago	50%

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 3/32, 8½c. per lb.; ⅛, 7.15; 5/32 to ¼, 6.75. Swedish iron in Chicago sells for 18½c per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel	5.00	6.50	8.25
Spring steel (light)	8.00	6.50	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.03
Hoop steel	3.88	3.29	3.48
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	4.85	3.09	5.23

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of July 7, 1921:

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
BUTT WELD					
1 to 3	64½	52	¾ to 1½	39½	24½
LAP WELD					
2	56½	[illegible]	2	34½	20½
2½ to 6	60½	[illegible]	2½ to 4	37½	24½
7 to 12	57½	44	4½ to 6	37½	24½
13 and 14	45	37	7 to 12	35½	22½
15	42½	32			
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	62½	51	1 to 1½	39½	25½
2 to 3	63½	52			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	54½	43	2	35½	22½
2½ to 4	58½	47	2½ to 4	38½	26½
4½ to 6	57½	46	4½ to 6	37½	25½
7 to 8	53½	40	7 to 8	30½	18½
9 to 12	48½	35	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	12¾@13
Tin in 5-ton lots	26.00
Lead	4.75
Zinc	5.00
ST. LOUIS	
Lead	4.35
Zinc	4.60

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	20.00	20¾@21	20.00
Copper wire (carload lots)	15.50	15.50	14.00
Brass sheets	15.75	18.00	15.75
Brass pipe	18.50	20.00	18.50
Solder (half and half) (case lots)	17.75	20.25	17.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	13.75
Cleveland	15.50
Chicago	13.75

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel

Ingots and shot	41
Electrolytic	44

Monel Metal

Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold drawn rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots 10.00

	Warehouse	
	In Casks	Broken Lots
New York	11.00	12.00
Cleveland	11.15	11.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	5.25
Chicago	6.00
Cleveland	6.00

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	9.50	9.50	$9.50
Copper, heavy, and wire	9.00	9.00	9.00
Copper, light, and bottoms	7.00	7.00	7.00
Lead, heavy	3.25	3.50	3.00
Lead, tea	2.00	2.50	2.00
Brass, heavy	5.00	5.00	7.25
Brass, light	4.00	4.00	4.25
No. 1 yellow brass turnings	4.50	4.00	4.50
Zinc	2.50	2.50	2.50

ALUMINUM—The following prices f. o. b. shipping point in cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	25.00	25.00@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	18.50
Chicago	18.50
Cleveland	22.00

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	35.50	35.00
Commercial	30.00	13.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

This market is very soft, and our quotations for the present are useful only as a guide.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	2.00	$2.25	3.00
Hot pressed hexagon	2.00	2.25	3.00
Cold punched hexagon	1.50	2.25	3.00
Cold punched square	1.50	2.25	3.00

Semi-finished nuts, 9/16 and smaller, sell at the following discounts from list price:

	Current
New York	75%
Chicago	50%
Cleveland	80%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	50%	60–10%	60%
1⅛ and 1¼ in. by 3 in. up to 12 in	40%	50–5%	55%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York...... $3.00 Cleveland...... $4.50 Chicago....... $4.50

For cast-iron washers, ¾ and larger, the base price per 100 lb. is as follows:

New York...... $4.25 Cleveland...... $3.75 Chicago....... $4.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	50%	60%	55%
Larger and longer up to 1 in. by 30 in	45%	50–10%	50–5%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40–10%	10%
Chicago	50%	50%
New York	50–10%	25–10%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel 7/16 and smaller	50–10%	60–10%	60–10%
Tinned	50–10%	60–10%	45%

Structural, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:

New York...$4.40 Cleveland...$3.90 Chicago....$3.68 **Pittsburgh**..$2.65

Boiler, same sizes:

New York...$4.50 Cleveland...$4.00 Chicago....$3.78 **Pittsburgh**..$2.75

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	19.00	23.00	20.00
Brass	18.50	20.00	18.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in., inclusive in rounds, and ½-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $6.75 per 100 lb. In Cleveland—$5.50 per 100 lb.; New York price is $7.25.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	7.50@10.00	8.50@11.00	12.00
Colored mixed	5.50@ 9.00	6.50@10.00	10.00

WIPING CLOTHS—Jobbers' price

	13½x13½	13½x20½
Cleveland, per 1,000	$55.00	$65.00
Chicago, per lb	.11½	.11½

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.00
Chicago	2.65

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	2.75

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$2.90@ $3.00
Prompt foundry	$4.00@ 4.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.78	$0.83	$0.80
5-gal. cans	.81*	.98	1.00

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	12.25	13.75	12.25
25 and 50-lb. kegs	12.50	14.00	12.50
12½-lb. keg	12.75	14.25	12.75
5-lb. cans	15.25	16.75	15.25
1-lb. cans	17.25	18.75	17.25

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount Business is good in white lead.

Ill., Chicago—The Seventh St. Building Corp., c/o W. Jordan, 110 South Dearborn St., has awarded the contract for the construction of a 1 story, 112 x 165 ft. garage at 704-12 South Wabash Ave. Estimated cost, $60,000.

Ill., Chicago—B. H. Stephens, Archt., 37 West Van Buren St., is receiving bids for the construction of a 1 story, 208 x 230 ft. factory on Lake and Albany Aves., for the manufacture of ball bearings, for the G. A. Ball Bearing Co., 3051 West Lake St. Estimated cost, $65,000.

Ill., Chicago—W. G. Uffendell, Archt., 39 South State St., will receive bids until about Sept. 15 for the construction of a 3 story, 75 x 200 ft. garage at 4616 Winthrop St., for the Sheridan-Wilson Garage Co., 64 West Randolph St. Estimated cost, $150,000.

Ill., Chicago—The Yellow Cab Co., 57 East 21st St., will soon award the contract for the construction of a 1 story, 140 x 250 ft. garage. Estimated cost, $100,000. J. Hertz, W. C. Bennett, c/o owner, Archt.

O., Cleveland—The Bryant Auto Co., 3191 West 25th St., has awarded the contract for the construction of a 3 story, 80 x 180 ft. garage on West 25th St. near Clark Ave. Estimated cost, $150,000. Noted July 28.

O., Cleveland—The Creney Co., 14453 Euclid Ave., has awarded the contract for the construction of a 2 story garage on Euclid and Eastham Aves. Estimated cost, $50,000.

O., Cleveland—S. Glazer, 603 Republic Bldg., plans to build a 1 story, 65 x 140 ft. garage on Euclid Ave. near East 105th St. Estimated cost, $60,000. E. A. Curtis, Republic Bldg., Archt.

O., Cleveland — The International Steel Tie Co., 16702 Waterloo Rd., plans to build a 1 story, 40 x 120 ft. factory, on Waterloo Rd. Estimated cost, $40,000. W. C. Mahon, Secy. Private plans.

O., Cleveland—M. L. and I. G. Kohn, 722 Natl. City Bldg., plan to build a 3 story, 100 x 140 ft. garage on Carnegie Ave. and East 36th St. Estimated cost, $100,000. Private plans.

O., Cleveland—Koller Bros., 724 Prospect Ave., manufacturers of plumbing supplies, are receiving bids for the construction of a 1 story, 50 x 106 ft. garage, at 703 Huron Rd. Estimated cost, $50,000. J. L. Cameron, 10406 Euclid Ave., Archt.

O., Columbus—The Union Boiler Wks., 57 South Center St., is having plans prepared for the construction of a 1 story boiler factory on Goodall St. Estimated cost, $8,500. Private plans. Noted Aug. 11.

O., Shaker Heights — The Moreland Development Co., c/o O. P. Van Swearingen, Marshall Bldg., Cleveland, is having plans prepared for the construction of a 4 story garage and commercial building, on Shaker Blvd. and Market St., here. Estimated cost, $250,000. A. W. Harris, Schofield Bldg., Cleveland, Archt.

Wis., Milwaukee—The Milwaukee-Western Fuel Co., 120 Wisconsin St., will soon award the contract for the construction of a 1 and 2 story, 136 x 140 ft. garage, on South Pierce and Clinton Sts. Estimated cost, between $90,000 and $100,000. Klug & Smith, 69 Wisconsin St., Archts. and Engrs.

WEST OF THE MISSISSIPPI

Minn., Minneapolis—The Pence Auto Co., 8th St. and Hennepin Ave., has awarded the contract for the construction of a 1 story, 100 x 220 ft. factory, at 2401 Bway. Estimated cost, $65,000. H. E. Pence, Pres.

Mo., Joplin—Nuhels Wire & Sheet Metal Co. plans to build a 50 x 200 ft. factory at 513 East 5th St.

Mo., St. Louis—The Standard Stamping Co., c/o G. Wiegand, 2000 North Bway., will soon award the contract for the construction of a 1 story, 107 x 132 ft. enameling plant on Bway. and Madison St. Estimated cost, $50,000. Klipstein & Rathman, Chemical Bldg., Archts.

Tex., College Station — The State has awarded the contract for the construction of an engineering shop and 2 agricultural buildings, at the A. & M. College, here. Estimated cost, $400,000.

WESTERN STATES

Cal., Burbank — The Amer. Aluminum Products Co., c/o R. D. King, Archt., 519 Van Nuys Bldg., is having plans prepared for the construction of seven 1 story factories, covering 60,000 sq.ft. of floor space. Estimated cost, $150,000.

Cal., Los Angeles—The Angelus Sanitary Machine Co., San Fernando Bldg., has awarded the contract for the construction of a 1 story 90 x 160 ft. can factory. Estimated cost, $35,000.

CANADA

Ont., Windsor—The Canadian Planet Eng. Co. plans to build and equip a plant for the manufacture of soot blowers and power equipment. Estimated cost, $75,000. H. Johnstone, Mgr.

In July

we published the names, addresses and requirements of 133 concerns in the market for

Machine Tools and Machinery

This service is both expensive and difficult to maintain, but we *have reason* to believe that it is of value to the readers of the *American Machinist*, and is appreciated by them.

These leads are not easy to obtain, even by our carefully instructed field force. Our men are instructed to verify beyond doubt every item of information reported for publication in these columns. We use no newspaper clippings, no hearsay, no rumors; only the machine-tool and machinery requirements given us by the concerns first hand, or sent in by our regular correspondents.

If you are in the market, or if any of your friends are in need of new equipment, take advantage of our

Machine-Tool and Machinery Exchange

General Manufacturing

NEW ENGLAND STATES

Conn., Hartford—Buck & Sheldon, Inc., Archts. and Engrs., 60 Prospect St., are receiving bids for remodeling plant on Pearl and South Ann Sts., for K. B. Noble Co., 249 Pearl St., manufacturers of contractors' equipment and machinery. Estimated cost, between $25,000 and $30,000.

Conn., Hartford—The United States Envelope Co., Cypress St., Springfield, Mass., has awarded the contract for alterations to factory, on Pearl St Estimated cost, between $50,000 and $60,000.

Me., Dexter—D. Whiting & Sons, Charlestown, Mass., have awarded the contract for rebuilding their creamery on Grove St., which was recently destroyed by fire. Estimated cost, $25,000. Noted June 23.

Mass., Malden (Boston P. O.)—The Revere Knitting Mills have awarded the contract for the construction of a 2 story, [illegible] x 100 ft. factory on Eastern Ave. Estimated cost, $50,000.

MIDDLE ATLANTIC STATES

N. J., Woodstown — The South Jersey Farmers Exchange will build a 1 story, 80 x 200 ft. fertilizing plant and warehouse along railroad tracks. Estimated cost, $50,000.

Pa., Appollo—McCrery San-Collapsible Barrel Co. has awarded the contract for the construction of a 1 story, 50 x 160 ft. factory. Estimated cost, $40,000.

Pa., Phila.—The Brighton Worsted Co., Tioga and D. Sts., is receiving bids for the construction of a 3 story, 32 x 55 ft. factory. Estimated cost, $70,000. Private plans. Noted Aug. 11.

Pa., Sunbury—The Butter Krust Baking Co., c/o B. Apple, has had plans prepared for the construction of a 2 story, 70 x 130 ft. bakery at 249 Eckman St. Estimated cost, $150,000. W. H. Leed, 32 South 16th St., Phila., Archt.

SOUTHERN STATES

Fla., Lakeland — The Federal Ice Co., Blue Island Ave., has awarded the contract for the construction of a 2 story, 100 x 350 ft. ice plant, including 3 storage rooms, with 300 ton capacity. Estimated cost, between $250,000 and $300,000.

MIDDLE WEST STATES

Ill., Chicago—Schmidt, Garden & Martin, Archts., 104 South Michigan Ave., are receiving bids for the construction of a 4 story, 54 x 72 ft. sausage factory at 1743 Larrabee St., for Hetzel & Co., 739 Larrabee St. Estimated cost, $85,000.

Ill., Lawrenceville — The Lawrenceville Cooperage Co. has awarded the contract for the construction of a 1 story, 40 x 100 ft. factory. Estimated cost, $50,000.

O., Cleveland—The Ohio Provision Co., 6201 Walworth Ave., has awarded the contract for the construction of a 2 story, 45 x 101 ft. factory. Estimated cost, $40,000.

O., Columbus—The Columbus Show Case Co., 423 North Grant Ave., has awarded the contract for the construction of a 1, 2 and 3 story, 52 x 84 ft. addition to factory. Estimated cost, $40,000.

Wis., Milwaukee—The Best Block Co., 1228 Humboldt Ave., will soon award the contract for the construction of a 1 story, 50 x 60 ft. factory, (1st unit), on North Pierce and Keefe Aves. Estimated cost, $40,000. J. Menge, 296 West Water St., Archt.

WEST OF THE MISSISSIPPI

Kan., Pittsburg — Tabler Bros. have awarded the contract for the construction of a cold storage plant. Estimated cost, $150,000.

CANADA

Ont., Windsor—The Essex Provision Co., Ltd., 1120 McDougall St., will soon award the contract for the construction of a 2 story, 125 x 400 ft. cold storage plant on McDougal St. Estimated cost, $600,000. Colthurst, Trace & Nichols, 16 Sandwich St., W., Archts.

Ont., Galt—The Galt Amateur Athletic Assn. is having plans prepared for the construction of a 1 story, 130 x 240 ft. artificial ice rink on Shade St. Estimated cost, $150,000. F. C. Bodley, Commercial Chambers, Brantford, Archt.

American Machinist

Volume 55 NEW YORK, SEPTEMBER 1, 1921 Number 9

Making an Optical Flat

The Kind of Glass and How It Is Cut Up—Grinding and Polishing—Testing Surfaces for Flatness

By RUSSELL W. PORTER, M.S.
Jones & Lamson Machine Co.

OPTICALLY flat disks of glass are coming into more general use in the machine shop for the purpose of checking up the wear on gage blocks, comparing standards, testing flat surfaces such as micrometer anvils, gaging the diameter of steel balls, etc. These glass flats should have surfaces more perfect than the work they are designed to check, and should be flat to a small fraction of a wave length of light (about 1/50,000 in.). The use of these flats was fully described in the *American Machinist* of Sept. 30 and Oct. 7, 1920. It is the purpose of this article to describe how glass flats are made.

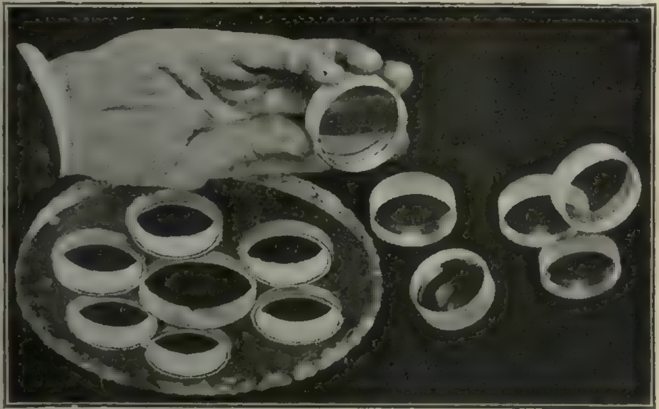


FIG. 1. HOW SMALL GLASS FLATS ARE BLOCKED UP AND POLISHED AS ONE LARGE DISK

The working of glass is entirely different from that of steel. Throughout the processes of grinding, polishing and "figuring," great care has to be taken as to optical cleanliness, temperature, and pressure. The methods are simple but laborious. Much patience is needed. The tests for flat surfaces are extremely sensitive and delicate; departures from a true plane of considerably less than a millionth of an inch can be detected. It is probably true that the number of opticians in this country capable of producing large optical planes, flat to a millionth of an inch, may be counted on the fingers of one hand. This country sorely needed such men during the war, when thousands of planes and plane parallels were required by the army and navy for telescopic sights, periscopes, range finders, sextants, etc.

Pure optical glass is not required for glass flats. As refraction and dispersion do not function in their use, some non-homogeneity and strain are allowable. Commercial polished plate glass answers every purpose. The disks should have a thickness not less than one-fifth their diameters. They are cut from rectangular slabs of the plate by a thin tube of iron or brass held in the spindle of a sensitive drill press, water and abrasive being added as the cutter works slowly down through the slab, leaving a true circular disk. The glass is now ready for fine grinding.

The method from now on is a lapping process. The glass is ground as fine as possible with washed abrasives. As plate glass is already quite flat, only the finer grades of abrasive are required. The glass is then transferred to a bed of pitch checkered into squares by grooves, or covered with holes, to allow free access of water and rouge (peroxide of iron), and the surface brought to a complete polish. This requires about 10 hours. The disk may then be said to be one quarter finished; the remainder of the work is spent in making the surface *flat*, or in "figuring." During this period the glass is frequently tested by methods about to be described, and slowly brought to a true plane.

KNOWING WHEN GLASS IS FLAT

It may seem strange, but optical flats are much harder to produce (as well as more expensive) than curved surfaces such as lenses or telescopic mirrors. As Uncle John Brashear once remarked when asked if flats were hard to produce. "Oh no, it's nothing to make a glass flat; the trouble is in knowing *when* it's flat." He meant by this that the surface is continually changing from a convex to a concave surface of revolution, passing through the plane.

The machinery necessary for working the glass is exceedingly simple. The work is placed upon a vertical spindle and slowly revolved. The grinding tool or pitch lap is moved back and forth over the glass by means of a crank whose stroke or length of throw may be altered at will. The laps are not held rigidly to the crankarm, but by a loose joint and left free to conform to the surface of the glass. Some machines provide for a slow rotation of the lap in a direction opposite to that of the

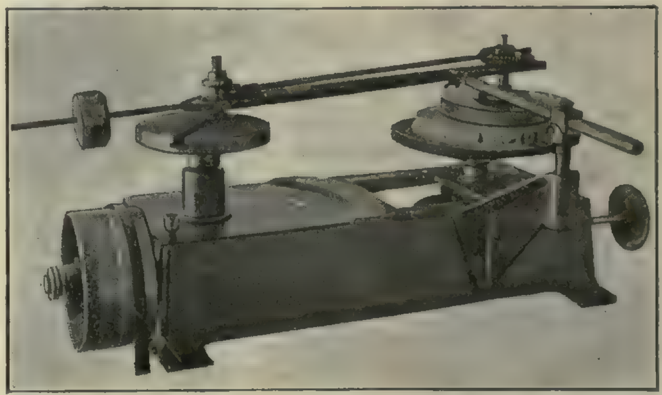


FIG. 2. A GLASS GRINDING AND POLISHING MACHINE

work. For medium-size work there are somewhat less than sixty complete strokes per minute. For small work several disks are polished at once. They are set into a large glass disk, as shown in Fig. 1, in which holes slightly larger than the small flat have been bored.

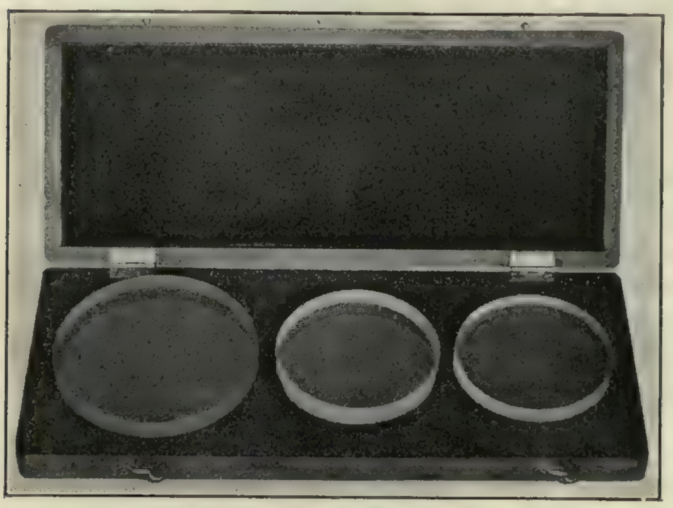


FIG. 3. A SET OF OPTICAL FLATS

They are bedded in plaster of paris and the work "figured" as one flat. This method prevents grinding down the edges of the small flats.

Nevertheless all the thought in machine design tending to produce optically perfect surfaces falls far short of the end. A machine will bring the glass to about 1/100,000 in. of the true surface, but the last "figuring" must be by manual labor. The writer has incorporated in the machine illustrated in Fig. 2 all the possible motions needed in working glass surfaces; straight, elliptical, circular strokes, strokes eccentric to the center of the work, variable length of stroke, and work and lap revolving in opposite directions. But the most effective work has been accomplished with the simple straight stroke, and altering the surface of the lap. And he is prone to admit that local correction is best done by hand.

USE CAST-IRON LAPS

Before proceeding with the testing it may be well to state that the glass is fine ground on cast-iron laps which are kept as flat as possible. These laps are often much larger than the work, hence considerable skill is required to distribute the wear over them evenly from center to edge. Most mechanics know that three surfaces rubbed together alternately will eventually become flat, no matter what shape they had at first. For quantity production iron laps are to be preferred. The glass is thus made sufficiently flat, so that the pitch lap will take care of the remainder of the operations.

There are three independent methods of testing a plane polished surface. The simplest but by no means most rigorous, is to lay the glass on a standard plane and observe the interference bands where the two surfaces are in near contact. The shape of the bands is an indication of the character of the surface. If straight, the glass is flat; if curved, the glass is concave or convex, depending on whether the bands move in toward the center or out from it as the eye is lowered.

This method does very well for small work. Its weak point, however, lies in the fact that the assumed standard may *not* be flat at the time of comparison. A sudden change of a few degrees may spring it convex. If the work is cooler than the standard, then on contact the upper face of the standard will be cooler than the lower, and it will go concave. Three optical flats belonging to the Jones & Lamson Machine Co., Springfield, Vermont, are in a case shown in Fig. 3. They are from 4 to 5 in. in diameter. They stand the test of laying No. 1 on No. 2, No. 2 on No. 3, and No. 3 on No. 1, without showing departure of the fringes from straight lines of more than ⅕ of a band or about 1/500,000 in. This method of applying three surfaces together is absolute, requiring no assumed standard for comparison.

Far more exact is the knife-edge test at the center of curvature of a concave spherical mirror.

By reference to the diagram, Fig. 4, an artificial star or point of light at *A* is made by perforating a tin chimney opposite the flame of an oil lamp. Being near the center of curvature of the mirror, all rays from this point will go out to the mirror as radii of the sphere and be reflected to a point at *B*. If now the eye is placed in the position indicated, the mirror will appear uniformly illuminated like a full moon. And if a sharp edged opaque object like a knife blade be moved slowly across the reflected rays where they cross at *B*, the mirror will darken uniformly and become black and, although concave, it will have the appearance of perfect flatness—manifestly an optical illusion. The point *B* is in fact an image of the pinhole on the lamp. It may be magnified and studied by means of an eyepiece.

USING THE KNIFE-EDGE TEST

Now, if the glass to be tested is interposed between the mirror and the eye, as in Fig. 5, the mirror is seen by reflection in the glass flat. If the glass *is* flat, the mirror will have the appearance of flatness when the knife edge is moved across the point *B*, exactly as in Fig. 4. If it is concave or convex, a so-called "knife-edge shadow" will appear on the glass that will tell the experienced optician all he desires to know as to its surface.

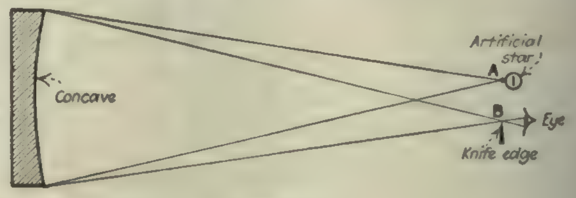


FIG. 4

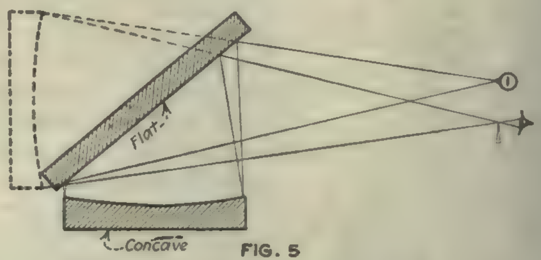


FIG. 5

FIG. 4. TESTING A CONCAVE SPHERICAL SURFACE BY MEANS OF KNIFE-EDGE SHADOWS. FIG. 5. TESTING A FLAT SURFACE BY THE SAME METHOD

He modifies his lap, length of stroke, pressure, hardness of the pitch—whatever change he estimates will improve the surface—and polishes a few moments. Another test. And so on. He finds himself forever near the illusive true plane but shifting from one surface of revolution to another. It may be spherical, paraboloidal, ellipsoidal, or hyperboloidal. He must wait some time after each polishing for the glass to regain a uniform temperature, for the heat of friction has made it convex. The manner in which these curious knife-edge shadows are interpreted is beyond the scope of this article. Suffice it to say that errors of much less than a millionth of an inch show up glaringly.

THE WATER TEST

A third and absolutely rigorous test for flatness is the Rayleigh or "water" test, so-called. The glass is immersed in a pan of water resting on a substantial foundation, with one or two millimeters of water covering the glass surface. The glass is leveled until parallel to the water surface when interference takes place between the water and water-glass surfaces and bands are seen traversing the glass, much as in the first method of testing described. Here our standard is the water surface. To be exact it partakes of the curvature of the earth, but this may be disregarded except for large work. The supports must be very rigid, with total absence of vibrations or air movement. The test is so sensitive, the conditions in fact must be so perfect, that unless for exceptional work the method is not to be recommended. I think it was Lord Rutherford who said the test was all right, but the earth had to be stopped from revolving while the experiment was being conducted.

The manufacture of plane parallels, where opposite faces of a block of glass must be not only flat but parallel—such as sextant mirrors, pentagon prisms of artillery range finders, plates of echelon interferometers—involves many ingenious processes, but must be deferred for another article.

Choosing Foremen and Executives from the Ranks

BY JOHN MARK MAY

That there can be no hard and fast rule that will apply at all times to the selection of candidates for foremen and executives is accepted quite generally. There seems to be in the minds of many who have such selections to make that there are peculiar conditions affecting their cases that are not common to other organizations.

Some think that the duties of workmen and their executive demand abilities differing to such an extent that it is questionable whether a workman, while performing his regular duties, can acquire the necessary knowledge to fit him for an executive position. Others think that a man who has worked in the ranks can never as successfully supervise those who have been his fellow-workmen as can one coming from outside and not so well-known, or perhaps unknown, to the men he is to supervise.

Still others think that no man can be a successful executive until he has had more or less actual executive experience; which means that when a man is raised from the ranks to an executive position he must be tolerated for some time at least, and in the meantime the business will suffer, also that it is preferable to secure a man from outside who has at least been through the probationary stage.

Then there are those who believe that it is for the best interests of all concerned to make promotions from the organization, and that make it a rule that is observed in all but very exceptional cases.

One of the burdens of the manufacturers, especially in recent times, has been the high cost of labor turnover, and there seems to be considerable uncertainty yet about permanent relief in this matter.

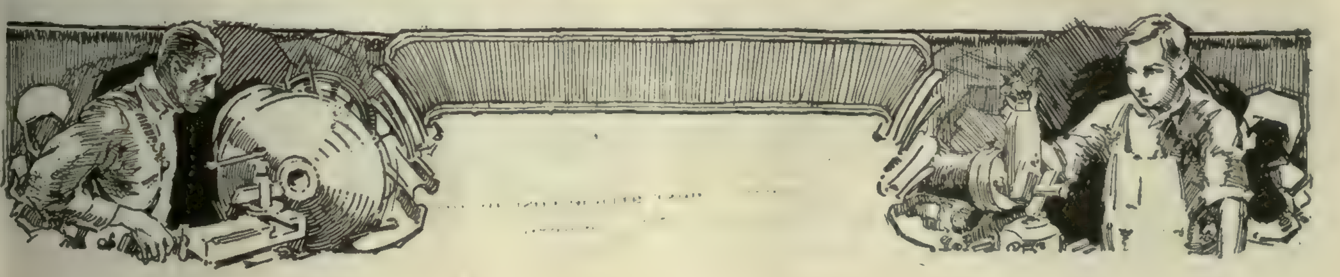
While wages and working conditions are the two greatest factors in keeping men contented, sentiment always has and always will be a factor worthy of consideration. Many men who are good citizens, intelligent and capable workmen, will remain with an organization, even when they could do better elsewhere, because of home ties, friendships, social privileges, property rights, and many other things that make up their surroundings. Some of these are favorable material for executive positions. Is it fair and is it profitable to withhold the opportunity from these men?

This is not the only class that constitutes favorable material; but this class is spoken of particularly because of the fact that they are among those who will not leave their present employers and therefore, would not, except in rare instances, receive promotions to executive positions.

Without exception the impression is given by employers that length of service counts for much, but if the executive positions are given mostly to someone outside the organization it is likely to foster a feeling of discontent that tends to break down the morale of the organization and cost the employer more than it would to bear the expense of educating favorable prospects.

I would rather speak of the early days of the new executive as educational days than as referred to at first as a time during which he was tolerated; believing it to be more nearly correct. All men have to be educated and it would seem that every organization should take a part in it. It looks like a confession on the part of those who are unwilling to shoulder this burden that they are unable or unwilling to make conditions such that men can develop the best that is in them; and surely the places where such conditions do not obtain are not the places that the best men can be expected to seek.

Not only when other things are equal do I believe the present employee should be given a chance at executive work, but even when the odds are somewhat against him. For the reason given above I believe he should have first consideration and that when all factors are worked out to a logical conclusion the plan would be to the best interests of both the employer and the employee.



The Economics of Production

II. CHANGES IN DEMAND

By Prof. D. A. McCabe, Ph. D.

IN THE first article we discussed the nature of demand and the items by which we measure its strength or weakness at any given time. We turn now to changes in demand, to increases and decreases from one time to another in the willingness to buy. Just as we measure the strength of the demand at any one time in terms of both price and quantity, so we shall see that changes in demand are expressed and gaged in the same terms—price and quantity.

An increase in demand means not only that the quantity demanded at the old price has increased, but that the price that can be obtained for the old quantity has increased. A decrease in demand means both that the quantity demanded at the old price has decreased, and that the price that the old quantity can command has decreased. The old correspondence between certain prices and certain quantities has been broken. New quantities demanded now correspond with the old schedule of suggested prices and new prices are now paired off with old quantities.

A change in the demand means a change in the demand schedule—a change in those quantities demanded that corresponds with certain prices which might be charged. It means first, of all, for practical purposes, *a change in the amount demanded at the old price.* If, for example, 100,000 wrenches of a certain type were sold last year at $1, and the number that could be sold at that price this year is greater or less, there has been a change in the demand. If less than 100,000 can now be sold at $1, there has been a decrease in the demand since last year. If more than 100,000 would be taken at the old price, the demand has increased.

A change in the price that can be got for the old quantity is also present in practically every change in demand. When the amount demanded at the old price changes, the price that can be obtained for the old quantity also changes, almost as a matter of course. If only 96,000 of the wrenches can now be sold at the old price of $1, how much will 100,000 wrenches sell for? Obviously they will command less than $1. On the other hand, if the public asks for 107,000 wrenches at $1, it can be expected that if only 100,000 wrenches are offered, the public is willing to pay more than $1.

Thus, *an increase in demand means not only that the quantity demanded at the old price has increased but that the price that can be obtained for the old quantity has increased. A decrease in demand means both that the quantity demanded at the old price has decreased and that the price that the old quantity can command has decreased.* The old correspondence between certain prices and certain quantities has been broken. New quantities demanded now correspond with the old schedule of suggested prices and new prices are now paired off with old quantities, as the table illustrates:

Suggested Price	Old Quantities Demanded	Increased Demand	Decreased Demand
$1.05	96,000	100,000	90,000
1.00	100,000	107,000	96,000
.95	107,000	105,000	100,000

These figures are of course made up simply for purposes of illustration.

How do such changes in demand affect production? They affect it by indicating to the producers that an increase or decrease in the production of that particular commodity is wanted. If a larger number of units, say 107,000, can now be sold at the old price of $1 than could be sold before at that price, obviously there is the same incentive now to produce 107,000 that there was before to produce 100,000. But more than that, if a higher price than $1, say $1.05, is bid for the old quantity of 100,000, the producers are also led on by the lure of the increased profit on each wrench to produce more wrenches.

If, to take the opposite case, the amount demanded at $1 falls to 96,000, the incentive to produce more than 96,000 wrenches is gone. If 100,000 are produced they will have to be sold at 95 cents. Of course more than 96,000 may be produced, in the hope of a rise in price later, and to avoid loss in some other direction, but there is no greater incentive offered now to produce more than 96,000 than there was last year to produce more than 100,000. Thus the demand, using the price offered for the old quantity and the quantity demanded at the old price as its indicators, gives its instructions to the producers.

The "Equilibrium of Demand and Supply"

It is not urged here that changes in demand are the only things that change the volume of production. That may be changed also because of changes in costs. Costs of production affect the quantity produced very materially. The point is that the producers aim to produce that quantity that will give them a price which covers costs of production and a profit. What the price is that will cover costs depends upon the costs. What the *quantity* is that can be sold *at that price* is a matter of demand. The quantity has to be so adjusted that it will strike a price on the demand schedule that at least covers the costs of production. That is essentially what is meant by the expression "the equilibrium of demand and supply" in connection with production.

The place of demand and of changes in demand in the determination of what is to be produced and how much of it, has now been considered. Demand is not the only thing affecting production but it is an essentia thing. The other things have to be adjusted to it. The relation of costs of production to price and so to the quantity produced has also been touched upon. In the next article cost of production and its bearing on price and the quantity produced will be considered at greater length.

Machining the Wrigley Automobile Transmission Gear

III. Machining Operations on the Gear Frame and Axle Parts—Assembling the Gear Frame—Methods of Checking Up the Different Parts

By I. WILLIAM CHUBB
Editor, European Edition, *American Machinist*

THE center case, Fig. 18, is a steel casting in which the first operation is to bore and ream the torque-tube hole: Bore, ream, and face for the gear-frame register and seating, and bore and face for the axle-case cover. Owing to the length of the operation, two machines are employed for this. The body is gripped in an ordinary chuck by the smaller end and a standard bar is put up at the open end, the tubular portion of the job entering the hollow spindle of the machine. The second operation is that of rough-boring, finish-boring, and reaming and facing one axle-sleeve hole (see Fig. 19). The job is located on the large register previously bored, and two machines are in fact employed, one each for the two axle-sleeve holes. The first hole bored is picked up by a plunger in order to line up for the second hole, the location for the first bore being by a taper plug entered into the cored hole.

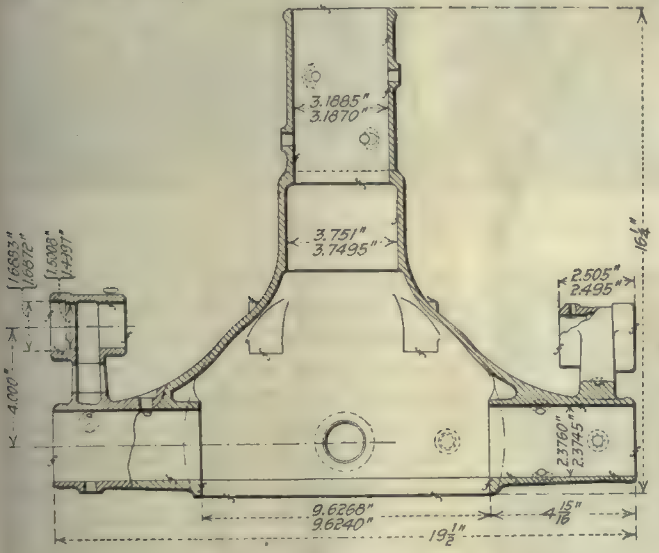


FIG. 18. CENTER CASE

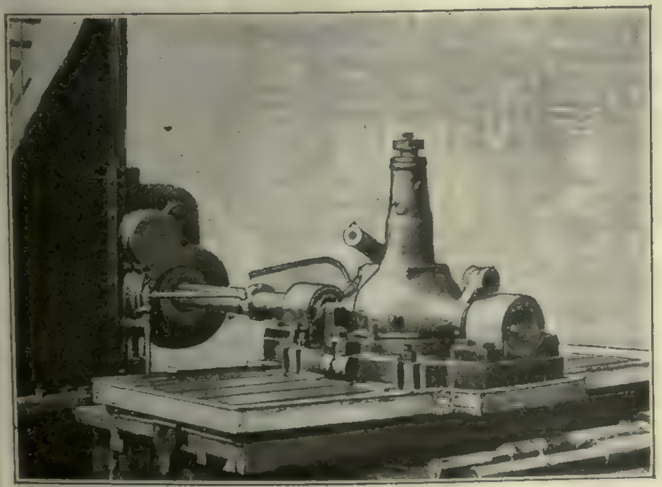


FIG. 19. BORING AXLE SLEEVE HOLES

The fourth operation, Fig. 20, also in a horizontal boring machine, is to drill, bore and countersink each outrigger arm. As these are off center it is necessary to employ an eccentric fixture which throws the case out and thus brings the arms on the center line. Two machines are employed for right and left hand.

Next, under an Asquith radial, two tapping holes are drilled in the outrigger arms, and the center-case arm bushes are fitted and spun over. No special fixture is employed, the phosphor-bronze bushes being driven in with a register bung and spinning tool with revolving rollers employed to rivet the metal over. Up to this point nothing has been done with the end of the torque-tube hole. A facing head is used with a running bush to prevent scoring, and the job, clamped to the table of the machine, is cleaned up to length. Then, under another Asquith radial drill, the four gear-frame bolt holes are drilled and reamed. A plug takes the larger bore and the drill jig, Fig. 21, is located off the top bore, the jig dropping on seatings and being located sideways by a plug which fits a square slot, the plug being placed through the axle-sleeve arms.

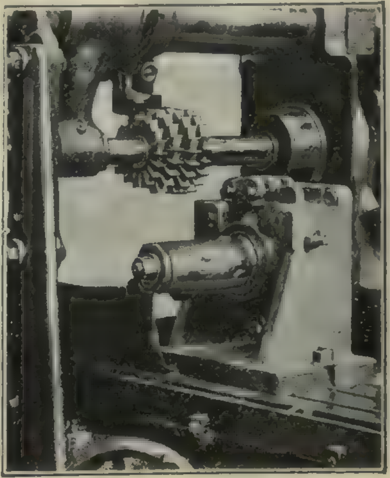
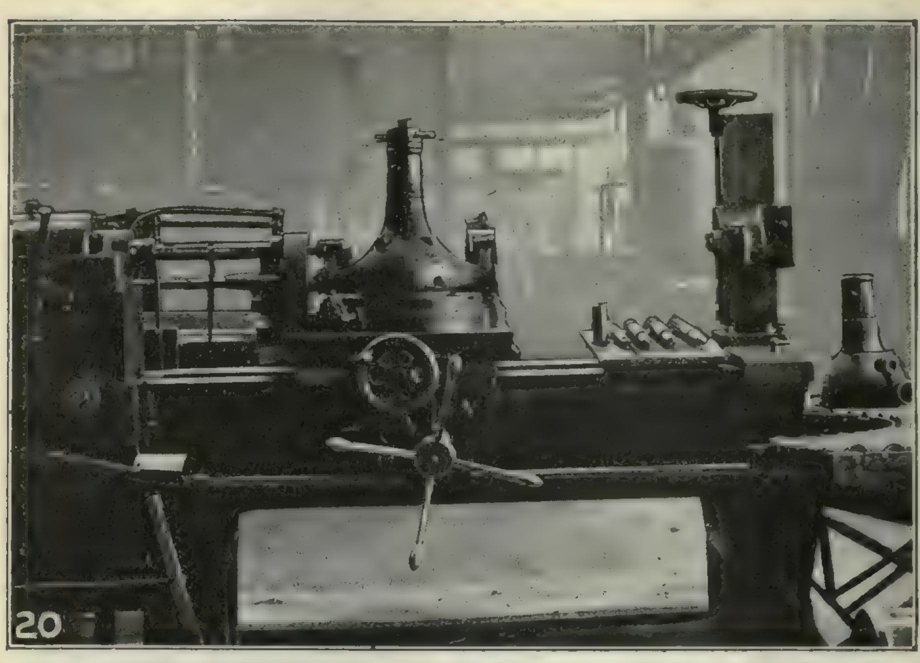


FIG. 25. GANG MILLING FULCRUM PIN BOSSES

The final operation, also under an Asquith radial, is to bore, face and tap the drain hole, drill, face and tap the breather hole, and face the back of the gear-frame bolt bosses. The job is put on an angle plate and located off the large bore. For the breather hole the job turns on a spigot, and for the spot-facing process the case is dropped on the table and the facing bar brought down, with a gage to check the height of the facing from the base.

The brake bracket, Fig. 22, is in two forms, for off and near sides respectively, both being steel castings. First, in a No. 9 Herbert lathe, the bracket is rough-bored, the 100-mm. ball-race diameter is bored, and the job is screwed for the hub bearing cap. It is gripped by the shank in a bell chuck (Fig. 23), with a cone-shape location at the inner end to take the small end of the job and three screws at the front to nip the bosses. The diameters are worked off the turret of the lathe and the facing off the square post on the cross-slide.

In the second operation the case is finish-bored and



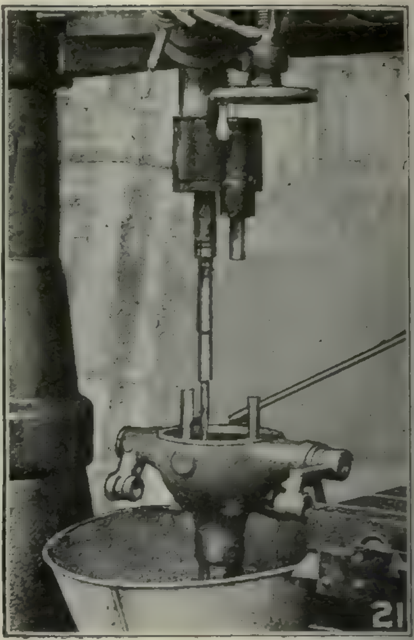


FIG. 20. BORING OUT TRIGGER ARMS (SHOWING ROLLER CONVEYOR). FIG. 21. DRILL FOR GEAR FRAME BOLTS

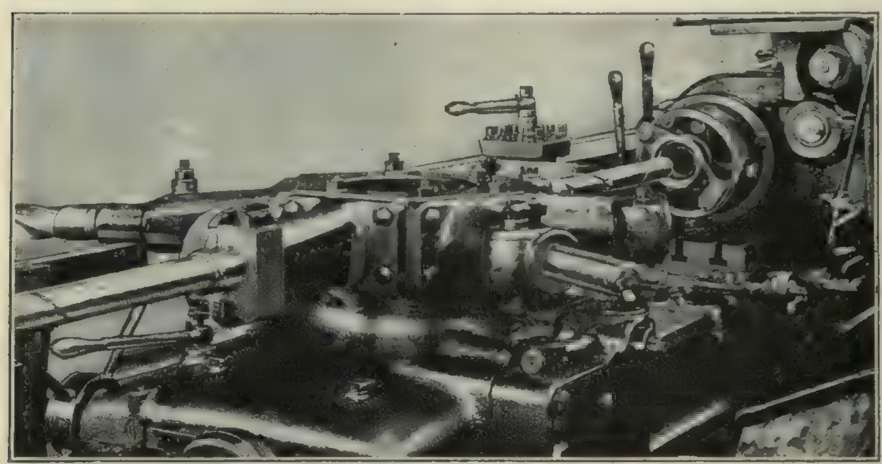


FIG. 23. BORING AND SCREWING BRAKE BRACKET IN BELL CHUCK

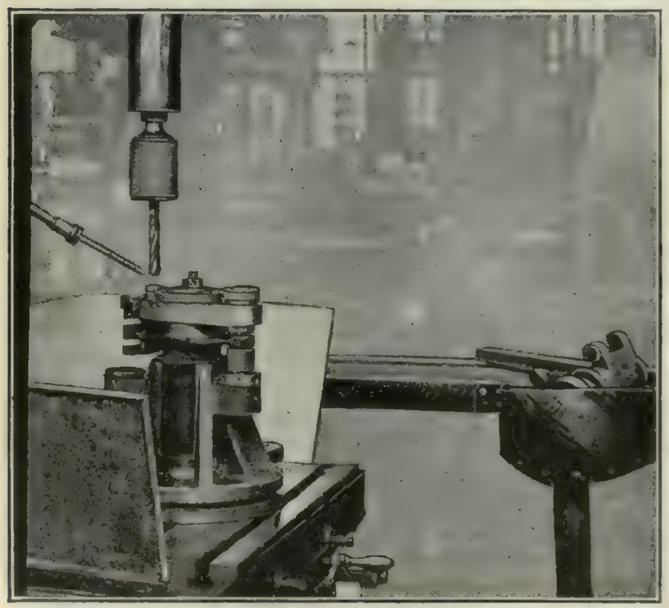


FIG. 24. DRILLING CAM AND FULCRUM HOLES IN BRAKE BRACKET (ALSO SHOWING CONVEYOR POCKET AND BAFFLE)

reamed, faced to length and the dust-cover register turned. The 100-mm. bore is used to locate on a plug on a circular plate with special straps to grip the job. The job, being a steel casting, carries a certain amount of sand, so that, as before, the boring bar has a deep helical groove in order that the sand, together with the chips, etc., may be removed with a heavy flow of oil. Next, under a drilling machine (Fig. 24), the 1⅛-in. cam hole is drilled and reamed and the fulcrum pin holes are drilled. A swiveling indexing fixture is used, eccentric because the center distances of holes are not the same. The job is located on a seating with a central plug and the top jig plate registers in the 100-mm. ball race, the position of the holes sideways being obtained by contour.

Three sub-operations form the fourth operation, all done on horizontal milling machines. In the first (see Fig. 25), for milling fulcrum-pin bosses, the job is threaded on a plug through the sleeve hole and brought against the face by a central horizontal bolt, being located in a rotary direction by a peg in the cam hole. The pressure of milling is taken by a crank lever. A gang of cutters is employed, the position of the cutters being determined by a peg in the fixture which locates the central cutters. The gang consists of two ordinary side and face cutters and two interlocking cutters to maintain distances where brake shoes fit.

Milling for the Spring Shackles

The second sub-operation is milling for the spring shackles. A central horizontal locating stud is used, turned away in several places to correspond with the positions of the cutters, thus forming a setting device. The brackets are right or left hand, according to the position of the shackle boss. A movable locating stud is placed at the top of the fixture and is wound over to the two positions according to the position of the

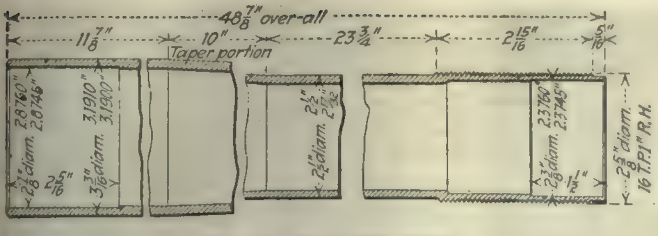

48 7/8" over-all
11 7/8"
10"
Taper portion
23 3/4"
2 15/16"
5/16"
2 7/8" diam. 2.8760" 2.8745"
3 3/16" diam. 3.1910" 3.1900"
2 5/16"
2 1/2" diam. 2 1/2" 2 9/32"
2 3/8" diam. 2.3760" 2.3745"
1 1/2"
2 5/8" diam. 16 T.P.I." R.H.

FIG. 26. TORQUE TUBE

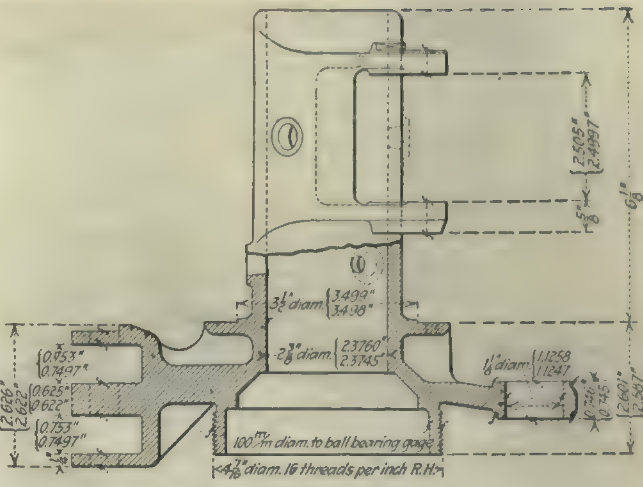

2.505" 2.4997"
5/8"
6 5/8"
3 1/2" diam. 3.499" 3.498"
2 3/8" diam. 2.3760" 2.3745"
1 1/8" diam. 1.1258 1.1247
0.753" 0.7497"
0.625" 0.622"
0.753" 0.7497"
2.626" 2.622"
.745" .743"
2.601" 2.597"
100 m/m diam. to ball bearing gage
4 7/16" diam. 16 threads per inch R.H.

FIG. 22. BRAKE BRACKET

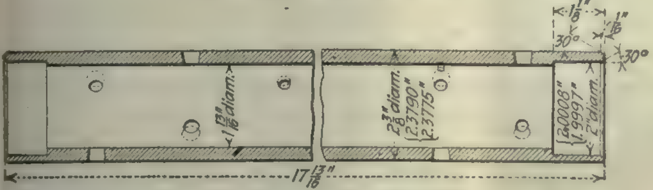


FIG. 27. AXLE SLEEVE

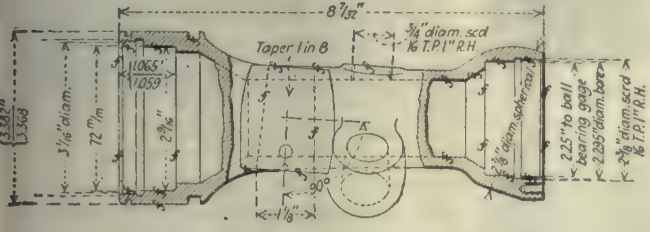


FIG. 30. STUB AXLE SLEEVE

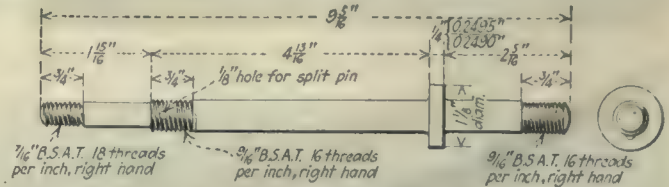

9 5/8"
1 15/16"
4 13/16"
1/4"
0.2495" 0.2490"
2 5/8"
3/4"
3/4"
3/4"
1/8" hole for split pin
1 1/8" diam.
7/16" B.S.A.T. 18 threads per inch, right hand
9/16" B.S.A.T. 16 threads per inch, right hand
9/16" B.S.A.T. 16 threads per inch, right hand

FIG. 37. GEAR FRAME BOLT

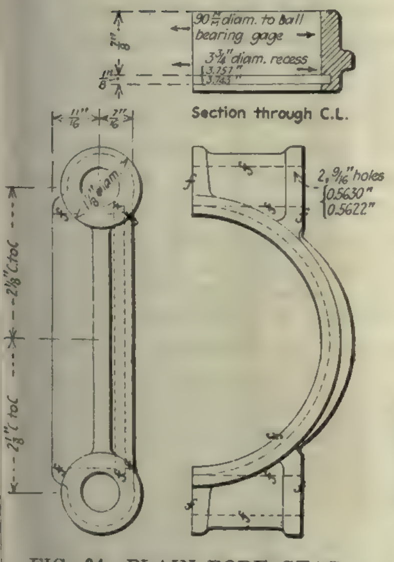

90 m/m diam. to ball bearing gage
3 3/4" diam. recess 3.757" 3.743"
7/8"
11/16"
Section through C.L.
11/16"
7/8"
2, 9/16" holes 0.5630" 0.5622"
2 1/8" C. to C.
2 1/8" C. to C.

FIG. 34. PLAIN BORE GEAR FRAME CAP

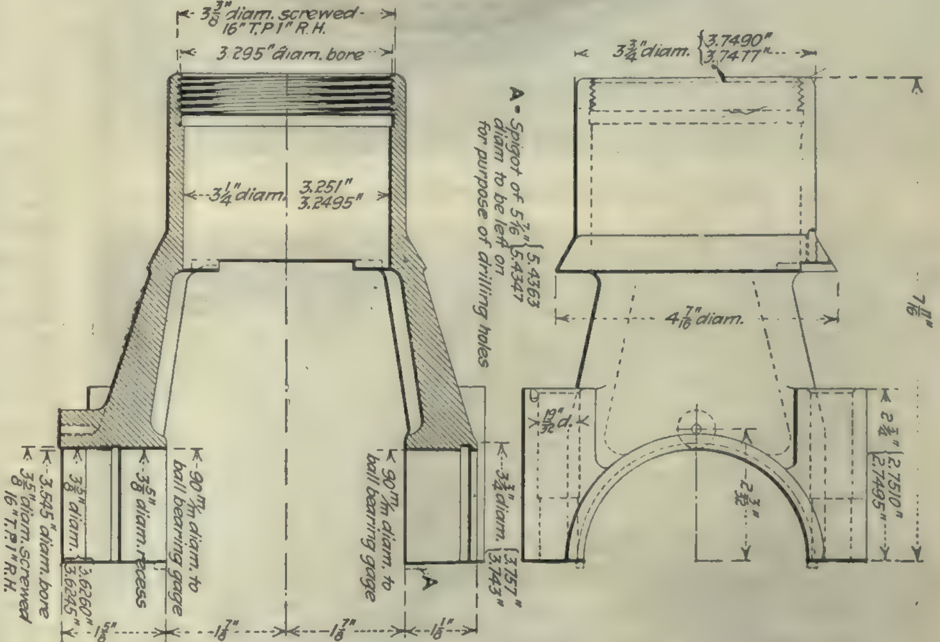

3 3/8" diam. screwed 16" T.P.I." R.H.
3.295" diam. bore
3 1/4" diam. 3.251" 3.2495"
A - Spigot of 5 7/16" diam to be left on for purpose of drilling holes 5.4363 5.4347
3 3/4" diam. 3.7490" 3.7477"
4 7/16" diam.
7 11/16"
3.545" diam. bore 3 5/8" diam. screwed 16" T.P.I." R.H.
3 5/8" diam. 3.6260" 3.6245"
3 5/8" diam. recess
90 m/m diam. to ball bearing gage
90 m/m diam. to ball bearing gage
3 3/4" diam. 3.757" 3.743"
A
1 5/8"
1 7/8"
1 7/8"
1 1/8"
13/32" d.
2 3/4"
2 3/4" 2.7510" 2.7495"

FIG. 32. GEAR FRAME

hackle boss. The fixture has an outer support for aking the pressure of the cut. Then, for milling the am lug, the job is placed on a horizontal plug, located ccording to the casting, with a cutter-setting gage on he fixture. A pillar drill is used for the next operaion, namely, drilling and reaming the spring-shackle in holes, drilling a ½-in. clearance hole through the hackle lugs, and facing the cam hole. In the jig the ob is dropped on its face and held by a vertical central olt, being located for either hand by a plug at each ide. In order to drill the ½-in. hole a drill jig registers n the hole just produced. The facing is really a bossng operation, with an ordinary bar and cutter. The nal operation is done in a two-spindle drill. The jig locates on the dust-cover register and has to be cut away to clear the arms on the casting. The holes are drilled as far as possible, then the jig is turned round, the plug put in second position and the remaining holes are drilled.

MACHINING THE TORQUE TUBE AND ASSEMBLY BRACKETS

The torque tube, Fig. 26, is threaded in an ordinary lathe and runs on large ball bearing cone centers. It is then ground to fit its housing, becoming subsequently a sub-assembly. The axle sleeves, Fig. 27, are partbored and turned at the ends in a center lathe and then taken to a Norton machine for grinding on the diameter, a cone mandrel in the bore driving. Then

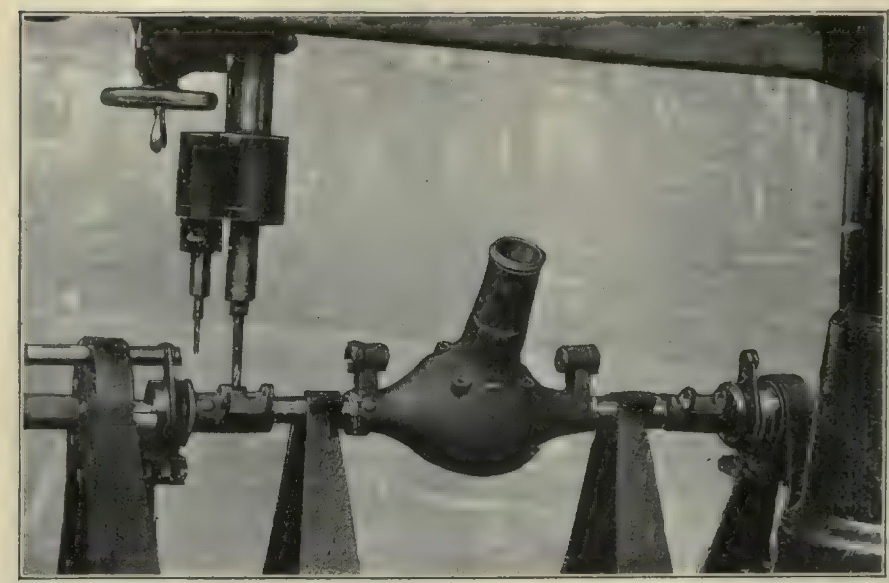


FIG. 28. DRILLING BRAKE BRACKET AND CENTER CASE

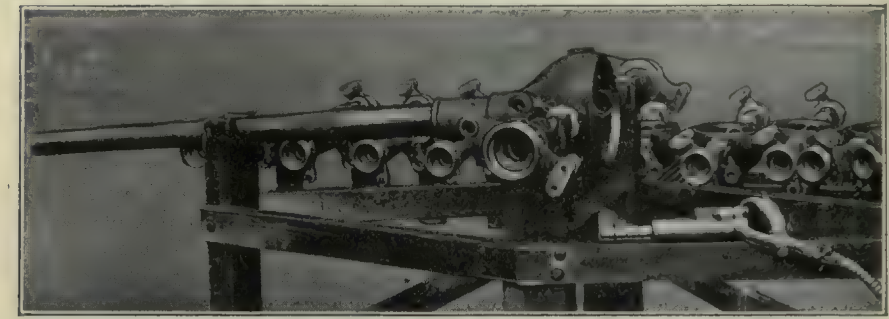


FIG. 29. CRADLE HOLDING SUB-ASSEMBLY FOR RIVETING

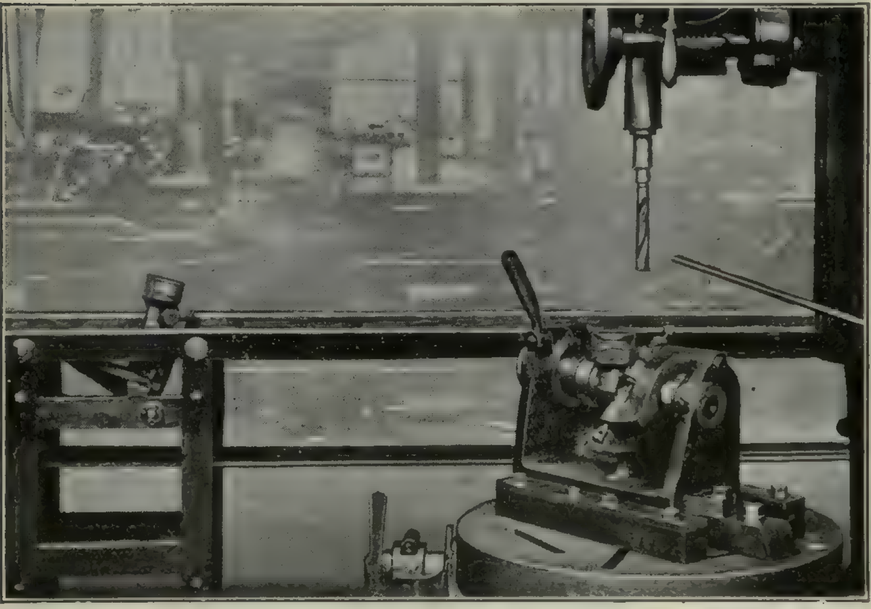


FIG. 31. DRILLING AND REAMING TAPER HOLES FOR SWIVEL PIN

in a hydraulic press the right- and left-hand brake brackets are forced on the sleeves and the sleeves in turn pressed home into the center case. The job is then mounted in a cradle (see Fig. 28) and a number of rivet holes are drilled, the brackets, etc., being finally pinned in place, and two holes drilled and tapped in the outrigger brackets for lubricators The job then goes to the press to have the torque tube forced in, then taken to the radial drill under which the torque tube is dropped on V-blocks in order that rivet holes may be drilled, when it passes to the cradle (Fig. 29) and all rivets are driven in with a pneumatic hammer to complete the back axle.

The stub-axle sleeve (Fig. 30) is in two slightly different forms, that is, right- and left-handed. For the first operation, rough-boring and rough-turning the large end, the job is held in a shaped three-jaw Coventry chuck and set by a running center in the capstan of a Herbert lathe, a twist drill being sent up for the bore, and the end rough-turned by a tool on the cross-slide. It is then held in the fixture in a Warner & Swasey lathe and finish-turned and ringed on the outer diameter, bored and reamed for the ball race and screwed internally, standard reamers and circular chasers being employed. The rings turned outside are for holding oil-retaining wipers for providing an oil seal. Then, gripped in a three-jaw chuck having soft jaws turned to size, the job is bored and screwed at the small end complete on another Warner & Swasey machine, and taken to a horizontal miller for facing the boss of the large taper hole, a piece having been left on owing to the fact that the job is a stamping. The job is held on a horizontal arbor between centers in brushes while the metal is removed. Then in an upright drill the large taper hole is drilled, reamed and the end faced. It is located off the large and small ball-race diameters in a fixture (Fig. 31) which is set off 3 deg. in order that the front wheels may have the required rake for the road. In a similar fixture, locating by the large and small diameters, the job is pulled round to a stop in order to drill, ream, face and tap a small taper hole for the steering arm. Then, using a standard angle plate, a ¾-in. hole is drilled and tapped for lubricating purposes in the top of the sleeve, the position of the hole being set by eye to the stamping. Finally a series of small holes is drilled to allow the oil to get through to the steering arms, this being part of the self-oiling system, and the outer hole being subsequently plugged. The job is held by the taper hole from a central stud with a drilling plate over the top located by stops for the two hands. Similar jigs are used for drilling the holes in large and small bosses. A peg hole is drilled in the end of the small boss, by contour. The details are then taken to a bench where they pass through the usual manual operations, such as burring, that are necessary to make a smooth job.

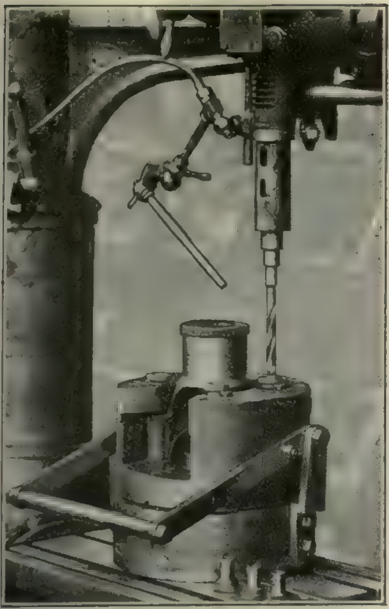


FIG. 33. DRILLING BOLT HOLES IN GEAR FRAME

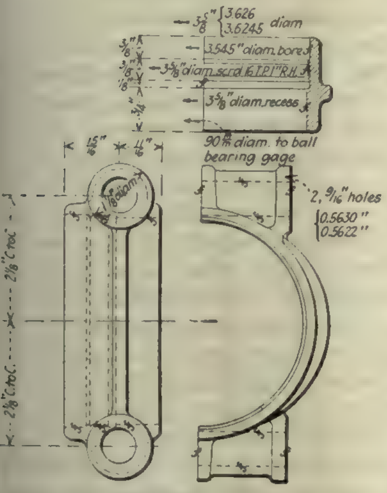


FIG. 35. THRUST GEAR FRAME CAP

The gear frame, Fig. 32, is a steel casting. Held on the diameter, the stamping is taken to a Gisholt lathe and the hole is roughed out by a drill and the end faced, leaving a small spigot (locating pin) which is afterward removed. The backs of the lugs are also faced. No special equipment is employed here. In another Gisholt lathe the job is bolted by straps to a locating plate turned to suit the spigot and itself bolted to the faceplate. The location plate contains a pilot bush for finish-boring and reaming the large hole. Before this, by means of a central bolt passing through the spindle of the lathe, the outside of the main boss is roughed. A Herbert lathe is then used in much the same way for finishing the piece internally and finish-turning the diameter and chamfering and radiusing the end, a combination gage being employed to insure concentricity between bore and screw thread. Next in the horizontal miller the seating is faced inside the main boss for the locating plate for the housing for the bevel pinion; and similarly for bevel-wheel clearance, side and face cutters being used and the job being registered by the four projecting bosses on an angle plate.

For the next operation a special turnover jig, illustrated in Fig. 33, is used for drilling the four holes for the gear-frame bolts. These hold the caps in the gear frame and the gear frame to the center case. The piece is registered again by the four projections with the addition of a central plug. The job is drilled from each side so that the jib has to turn over, and finally the frame is reamed from one side only. The four register points being filed off, the gear frame passes to a sensitive drill which drills holes for snugs, etc., and for locking-plate hole at the side. In this fixture the gear frame is dropped on a central bolt, the jig plate locating in one of the four holes for the locking plate, and a plate ring located on the two $\frac{9}{16}$-in. holes, with four bushes, is for drilling snug holes for the gear-frame bolts, to prevent them turning round.

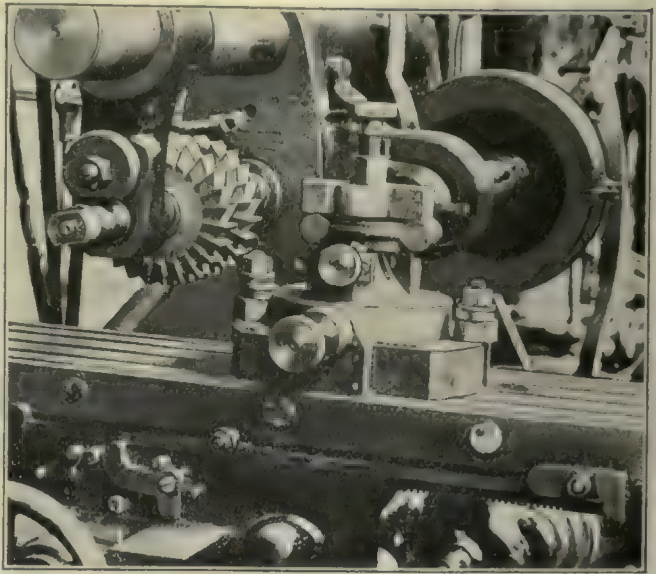


FIG. 36. MILLING TWO CAPS IN INDEXING FIXTURE

The gear-frame caps, Fig. 34 and 35, are steel castings. First placed under a horizontal miller, the piece is put into an indexing fixture, Fig. 36, which locates inside the contour and is secured by the outside contour. The whole is held down by a central bolt and strap and sideways by a spring-operated clamp. A cut is taken across the bosses at one side by a pair of straddle mills, and then the job is indexed round for the other side, to provide cap seatings and nut seatings. Two bolt holes are next drilled under a radial drill and the piece then goes to sub-assembly.

The gear-frame bolt, Fig. 37, is an ordinary turning job done in the Jones & Lamson lathe; passing to a Herbert capstan lathe the bolts are secured in a three-jaw self-centering drawback collet and threaded with a standard Coventry dieholder, subsequently being drilled for snug (dowel-pin) hole and for a split cotter hole, the snug being afterward fitted.

Assembling the Gear Frame

The parts of the gear frame, having been assembled and the burrs removed, are finally bolted together. The gear-frame bolts have to couple up four pieces, namely, the gear frame, the gear-frame caps, the center case and the center-case cover. No clearance is allowed in the holes; consequently all the jigs and testing fixtures must be accurate. One testing fixture checks the holes in the gear frame for center distances and concentricity of body. It takes the form of a central housing to locate the body and four studs on which to drop the gear frame. The fixture can also be used

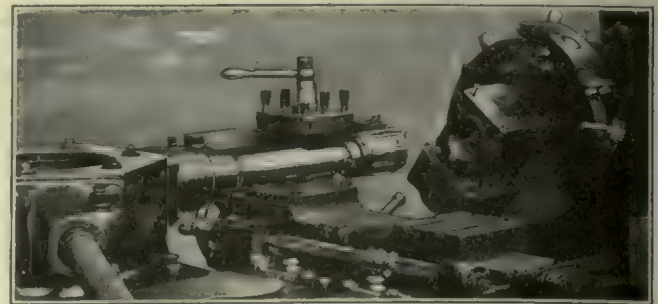


FIG. 38. BORING AND SCREWING GEAR FRAME FOR DIFFERENTIAL HOUSING

for checking the caps for center distances. Another fixture corresponding to the center case has four bushes into which the job can be dropped by the four bolts, thus testing their centers and concentricity again.

After sub-assembling, the piece is put into a fixture, Fig. 38, which has a housing containing on one side four locating bushes which line up the bores for the differential housing and the bearings for the bevel gear. The heads of the bushes also give correct center height to insure the job coming down to the shoulders of the gear-frame bolts. A cap plate screws into the internal thread cut on the bevel pinion housing end to draw the job down to the seating. Also at the top a plate forms a strap over the ends of the bolts and a central pressure screw keeps the job rigid while the holes are being bored and screwed. The fixture is also used as a jig and is balanced to insure round holes. Rough- and finish-boring bars and sizing reamers for the bearing journal are employed, all in the turret of the Herbert lathe, the cross-slide carrying a recessing tool for clearance and a circular chaser for threading. The part then goes to the finished stores for assembly.

Organization and Management of the Small Shop

IV—Financing the Company—Co-operating With the Investor—Necessity of Proper Organization — Advantages and Disadvantages of Partnerships and Corporations

BY E. W. LEACH

I AM sorry it is not possible for you to know me personally so that you could not fail to appreciate the sincerity with which I advise you to exercise every possible caution and discretion in seeking the capital for your business.

I do not wish to arouse in you a suspicion of the integrity of men with money. But capital is a peculiar commodity, earned only through hard work and parted with only under pressure or under promise of multiplication through investment. It possesses real potential energy, the power to do things; but it is possible of strange manipulations, and can easily be the basis of misunderstandings which can seriously interfere with the progress of a business organization. You have a product for which you know there is a market. Don't say to yourself, "Now if I can only get hold of so much money I'll be taken care of in nice shape," and then blindly accept the first offer of that sum without proper consideration of the individual who offers it and the terms on which it can be obtained.

In a tractor or an auto truck we sacrifice speed to obtain power; in a racing car it's just the opposite case. You can't have a maximum of both characteristics. The moment you go out to seek capital for the development of your business you must sacrifice a part of something, and that something is your ownership of your own product and its future. There is only one reason why men will invest money in a business venture, and that is because they see the possibility of making more money. If you could equip your shop and market your product without outside assistance you would receive all of the profits which might accumulate. But "one-man businesses" are rapidly becoming extinct. The desirability of going ahead on such a basis is something you can easily determine yourself. We'll assume that you have *some* money. Establishing a business and putting it on a profitable operating basis is at best a real job for a real man, and it usually requires at least twice the length of time that was anticipated.

If you attempt to finance your business alone your investment will be small, your production will be small, your sales will be small, and your profits will be small. And besides, it is not likely that you have ability to supervise all the phases of the management of your business. If you have conceived and developed your product you are an inventor, you are mechanically inclined. It is probable you have been in that atmosphere throughout your whole business experience. It is not to be expected, therefore, that your ability to design machines will be no greater than your ability to plan sales campaigns or evolve methods for financing the business. I am working, of course, on the theory that no one knows it all.

This is an age of specialists. If you are proficient in inventing and designing you will find sufficient opportunity for unlimited individual accomplishment in developing your line of goods and managing their production. It will be much better that someone else assume the responsibility of the financial control of the business so that your mind can be more free for the problems with which you are especially fitted to deal. If you could invest a thousand dollars of your savings in starting your business, think what more you could do and what better results you could obtain if you had ten thousand dollars. You would then be able to have better equipment and hire more men. You could run the work through in larger quantities and cut down on your costs. You could advertise your goods more pretentiously and with printed matter that would really tipify the quality of your product. All of those things would be conducive to quicker returns, and that's what you are after.

But if you ask someone else to invest ten thousand dollars in your business you will have to sacrifice a part of the profits when they are realized. So the question you must ask yourself will be such a one as this: "If I try to make a go of this by myself it will probably be a few years before I am making any money. I can get outside parties to invest ten thousand dollars. That will give us a bigger start and get us on our feet sooner. And even though I must divide the profits which we will make, isn't it likely that I will be better off in actual progress and in dollars and cents by following the course which seems to promise most in the development of my idea?"

SEEKING OUTSIDE CAPITAL

In seeking outside capital there is one viewpoint from which there are two possible ways in which you and your prospective associates can arrive at the basis on which your company will be formed. One way is for you to arrange a plan of organization, carry it into reality, and then invite individuals to buy an interest in your company as already formed. That method, I believe, has too much of the "take it or leave it" appearance.

Unless you are more fortunate than the average individual you will not be able to find men who will be satisfied with every detail of your suggested plan. And if you have gone so far with your own personal ideas that the plan has no flexibility and does not permit remolding you may find it extremely difficult to raise the money you desire.

I have in mind a friend who wished to organize a factory for a certain kind of work. He figured he should have $20,000 in cash to carry out his plans. He and two friends incorporated for $50,000, issued $30,000 worth of stock certificates to themselves, and then went into the open market to find persons who would subscribe to the remaining $20,000 in stock. It proved to be one of those frequent things which just naturally "can't be done." The thought back of their plan was, of course, that in that way they would surely retain control of the company. That is all very desirable, but I do not believe any man or any group of men in this broad land of ours would ever put $20,000 into a business and receive 40 per cent of the stock against which 60 per cent of the stock had been issued to other parties and the books debited with such indefinite items as services, etc.

In this particular case it was impossible to sell any appreciable amount of the balance of the stock, and the incorporators had simply expended a lot of money foolishly and to no purpose. The second and much wiser way is to go to your prospective investor with a suggestive plan which can be revised in detail or in general substance until it is acceptable to all concerned. And of course this leads us to a consideration of the types of organization which you can use. Almost any textbook on organization has a chapter or two on the advantages and disadvantages of partnerships and corporations, so I shall only devote a few paragraphs to a very brief and informal discussion of the difference between those two forms, trying to bring out that difference without using the usual, stereotyped methods.

THE PARTNERSHIP PLAN

A partnership is composed of two or more persons, any one of whom can be held liable for all the obligations of the company. I am not offering that as a definition of the term, but as an explanation of one important point that an investor will consider when putting money into such a business—his liability.

You, too, must consider that point seriously. To illustrate, supposing you get ten thousand dollars and enter into a partnership agreement. The business prospers and grows, and with the increased volume of production it becomes correspondingly necessary that your accounts payable increase until they may be several times the amount of the capital originally invested in the company.

If, some beautiful summer day, your partner should suddenly conceive the idea of drawing all the money out of the bank and sailing for the South Sea Isles, or if he should die, or if your plant should be destroyed by fire and your partner should not have cash to cover the loss—in any of those events you could be held personally responsible for full payment of all the obligations of the company. Any bills which had been contracted or any notes which had been signed as by the company (either with or without your knowledge) would fall to you for payment. Your home or any property which you might own personally could be taken to satisfy the claims against the company. And your partners, of course, must consider the possibility of finding themselves in the same predicament through any wrong action on your part or through causes beyond the control of anyone.

That, I believe, is the most important fact to prevent you from raising any material sum of money with such a plan of organization in view. Then, too, a partnership does not permit readily any expansion, for it is not so easy to raise more money which may later be necessary. A corporation can borrow money at the bank as an obligation of the corporation; but if you have not contributed to the original cash investment in your partnership and you suggest borrowing at the bank, your partners will not be apt to enthuse over that plan, for such a loan would bind each one of them individually and would be in substance the same as their own personal obligation.

FORMING A CORPORATION

If your product shows possibility of forming the basis of a steadily growing business, it will be well worth your while to plan to incorporate. A friend of mine who lives in a small country town is interested in a business which originated as a partnership and was later incorporated. He told the cashier in his local bank that they planned to go through that procedure, and the banker replied, "Well, that may be all right, but it means an awful lot of red tape, doesn't it?" One would think that even a small town banker would have a more intimate knowledge of corporate organization, but his reply is typical of a great many persons who have never gone through the experience.

There is no special "red tape" about the process of incorporating a business that should scare you out of investigating the probability of that being the most desirable course.

Whether you wish to interest some one person who can also devote his entire time to the business, or whether you merely plan to raise money from any number of persons who will put up the money as a pure investment, there is a permanency and a definiteness about incorporation which cannot help but react favorably to your advantage when you express to those persons your willingness or your intention to use that as your form of organization. To incorporate you draw up a charter, or "articles of incorporation" as it is sometimes called, and submit it to the Secretary of State in that state under whose laws you are incorporating. When your charter has been O.K.'d or "granted" by that officer you hold the first meeting of the stockholders, at which the stock is subscribed and issued and the officers and directors of the corporation for the first year are elected.

STATE LAWS AND CORPORATIONS

Different states have widely varying laws in regard to corporations, so that in some states it is much easier to incorporate than in others. By that I mean that certain provisions could be included in your charter under one set of laws which would be entirely impossible according to the laws of some other state. Any Secretary of State will send you a pamphlet of the laws of his state governing corporations, and this booklet will probably contain useful suggestions about incorporating. One thing you should learn is whether your state imposes a tax on "foreign corporations," that is, a tax on corporations operating in that state whose charters were granted by another state. If there is such a tax in your state it may offset any slight advantage you might gain by filing your charter in a foreign state.

Then, too, there is a very significant disadvantage in selecting the "easiest state" in which to incorporate. If you do that your prospective investors may say to themselves, "Well, there must be something shady about that fellow's proposition; probably he couldn't get by our own laws." I know that if I lived in New Jersey and were asked to invest money in an Arizona corporation whose main office and factory were located right in Camden I should want to study the laws of those two states and learn the real reason for such an action before I parted with any very large sum of money.

But there is always an opposite extreme, and in this case rather than find the easiest set of laws and take out your charter under them it may be to your advantage to prove the soundness of your proposition by finding the most *stringent* set of laws and incorporating in that state where it is known to be extremely difficult for any but an unquestionably legitimate business to be approved.

I happen to be so fortunate as to number among my friends a gentleman who is president of an oil company capitalized at $50,000,000. In order to overcome the usual skepticism of "oil schemes" he organized under the laws of the State of Illinois, where I understand they are particularly conservative in the provisions of their charters. In his case, however, the number of stockholders was very large, whereas in small shops (and that's what you and I are interested in) that is seldom intended. If you have any sentimentality in your make-up you will want your charter obtained in your own home state unless there is a very decided advantage in going elsewhere.

SELECTING YOUR ASSOCIATES

You will not merely be interested in getting a certain amount of money; you will want to obtain that money from one or at least a very few individuals, and so you will be interested not only in their checkbooks, but in their character, their reputation, their business experience; in fact, in what more than mere money they can contribute to the prestige and progress of your business. It will be money well spent for you to employ an attorney to assist you in the details of incorporating. Not one of these attorneys who advertises "I will incorporate your business, give you a minute book, a seal, and a book of steel engraved certificates all for one hundred dollars." Go to a reputable firm who will give individual attention to your individual problems. The amount of stock, whether it will be all common or part common and part preferred, what per cent dividends the preferred stock shall carry, and a hundred other details are matters on which your attorneys will advise you. In deciding on the amount of capitalization you will want to consider how much capital you plan to raise at the outset, what probable future expansion there will be to finance, and what size you can reasonably expect your business eventually to assume.

In providing for both common and preferred stock you must understand the differences between the two kinds. Only holders of common stock vote at the stockholders' meetings and have a voice in the management of the company. Preferred stock invariably carries a definite dividend, such as 7 or 8 per cent. That dividend is guaranteed. If it is not declared one year because there has been no profit made most charters provide that it be made up the next year. If the company has made a profit, holders of preferred stock must be paid first. If any of the profit remains after this has been done, all of that profit is paid out as a dividend on the common stock. I do know of one local company whose preferred stock guarantees 8 per cent and then shares equally with the common stock after the common has received 8 per cent. This makes the preferred stock the better and surer investment from a pure dollars and cents viewpoint, but of course purchasers of preferred stock are denied a voice in the management or a place on the board of directors. It is only in such rare cases as this that you might be able to sell any preferred stock at all at the start, because people can get 7 or 8 per cent on their money in any number of safe, established concerns, whereas your company will be quite speculative from an investment standpoint for two or three years.

The dividend arrangement I explained just above is a very good way to provide for some of your employees. Preferred stock does not usually satisfy employees even though it may be given them outright. The reaction is: "Thunder, I'll get that 7 per cent anyway, there's no chance for it to be any more, why should I work any harder?" But with the possibility of increased dividends through harder work, the reaction will be quite different, and yet there will be none of the embarrassing unpleasantnesses which often make it impossible to consider common stock for any employees, even the foremen or superintendent.

Holders of stock in a corporation are only liable for the par value of the stock they hold, so the one objection to a partnership is eliminated by that fact. The corporation is, from a legal standpoint, a definite individual or "entity," having an existence entirely separate from its members, and having rights and responsibilities in law that do not affect its members as individuals at all. Even though you may plan to raise only $5,000 from a single individual you will find it a wise practice to incorporate for "enough." While that sum may take care of your immediate needs you cannot tell what expansion you may wish to undertake five or ten years from now; and if you provide for that in your original charter you will save yourself considerable expense and the inconvenience incidental to putting through an "amendment."

In giving you these few bits of information and suggestion I have wanted to guard you against some of the costly mistakes which I have made in my own personal experience. I have not tried in this chapter to duplicate the details you will read in some of the books on corporation management and accounting because I have felt that you could get a better and more usable grasp of the "meat and potatoes" of the subject if I permitted myself to be rather informal in discussing it.

The first time I entered business for myself three of us formed a partnership—one man contributing $5,000 in cash. We had thought that amount was entirely sufficient to put us on a sound, safe basis. But we did not take into account the continually increasing cost of materials and labor at that time. We did not anticipate the steel strike which made cold rolled steel more scarce than the proverbial "hen's teeth." We did not know that the first week after we turned our $400 worth of patterns over to a jobbing foundry, that foundry was going to burn down to the ground. There were lots of things we did not know at first. So it was not six months later that we needed another $5,000. We did not have that amount ourselves; we could not borrow that much at our bank; so we had to enlarge the personnel of our company. We incorporated at that time for $200,000 despite the fact that our total cash investment was only $10,000. The stock was evenly divided into common and preferred (the preferred has not yet been touched), and I shall always believe that our capitalization was not at all disproportionate to our cash investment.

THE BASIS OF SMOOTH PROGRESS

In associating yourself in business with other men align yourself with men you know you can trust, *and then trust them.* No progress, no success can grow out of lack of confidence or lack of co-operation. Whether it be money or inventions or services or ability, all of you have some very tangible investment in your business and a very vital concern for its growth and development. There will come times when disagreements will creep up—no two men with keen minds could be expected never to disagree. And so there will be times when you will have to compromise even though you prefer not to do so. But it is at such times that you must let yourself and your desires be secondary to the ideal which urges you on and makes your effort worth while. Your partners may offer suggestions about design or production which will appear to you as absolutely ridiculous. And yet you may propose plans for the management of their part of the business which will be equally impracticable. But two minds are better than one. So in taking others into your organization select those who can fit into a gap which you cannot pretend to fill.

My last thought is a sales suggestion, a thought for you to use in selling your proposition to your partners. Don't play up the possibilities of your business in glowing terms for which you may later be called to account. Don't put in any camouflage or "hocus-pocus." Business men want information—straight, cold-blooded, truthful, reasonable facts from which they can judge the wisdom of the proposed investment. Lay your plans and your problems before them. Put all the cards on the table, if I may use that expression; for if you do not conceal any detail, ever so slight, or if you do not give the possibility of a misunderstanding or a misinterpretation you need have no fear of facing the time when your partners can say, "That wasn't the way we understood it when we put our money into this company."

Strength of Pipes as Columns

BY JOHN S. WATTS

The chart which accompanies this article, will be found to save considerable time and labor in calculating the size of pipe necessary to support a given load as a column of a given length. For relatively small loads the standard pipe furnishes an economical and easily made column, and also for long reach rods, such as are sometimes necessary to transmit the push from a hand lever, the pipe section is an ideal one.

All column formulas vary the safe stress with the ratio of length to radius of gyration, which involves a process of trial calculations as it is necessary to assume a diameter of column, to know this ratio, and if this diameter proves too light or too heavy, to try another diameter and so on.

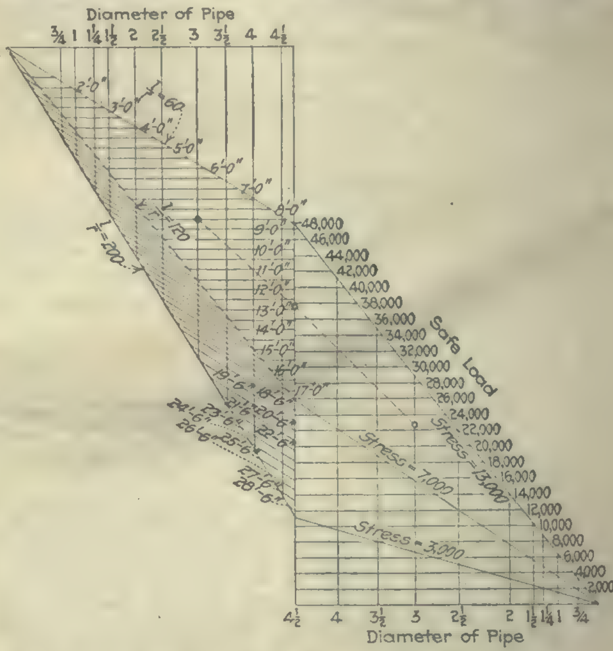
The formula upon which this chart is based is that used by the American Bridge Co., in which the stress allowed for ratios up to 120 is found by the formula

$$f = 19{,}000 - 100\,\frac{l}{r}$$

with a maximum stress of 13,000. The stresses for ratios between 120 and 200, are found by deducting 500 for each increase of ten in the rotio above 120, from the stress allowed for the rate of 120, which is 7,000.

A ratio higher than 120 should not be used except for temporary work, or for a column which is fully loaded only occasionally.

To illustrate the use of the chart, we will determine the safe load on a column made of a 3-in. pipe, 8 ft. 6 in. long. From the upper left-hand corner of the chart, we draw a line through the intersection of the horizontal line for the 8 ft. 6 in. length, with the vertical line for the 3-in. pipe, and produce it to intersect the central vertical line. From the intersection so found, we draw another line to the lower right-hand corner of the chart, and where this line intersects the vertical line for the 3-in. pipe, we read off the safe load on the horizontal lines as being about 22,800 lb. These diagonal lines are marked on the chart to make the explanation more clear. We see at a glance that the ratio $\frac{l}{r}$, is well below the limit of 120.



In practice it is more likely that we will be required to determine the size of pipe of a given length, required to carry a given load, and I will illustrate next the method of solving this problem. My reason for using the above example first being merely that the explanation would be more easily understood, by taking that problem first.

Taking then, the same figures, we are required to determine the size of pipe required to carry a load of 22,800 lb. as a column 8 ft. 6 in. long. Taking a thread stretched from corner to corner of the chart, we draw a pin against this thread, and travel it up or down the central vertical line until the thread intersects a diameter vertical at the given load, in the right-hand triangle, and the same diameter at the given length, in the left-hand triangle.

Cylinder Grinding in Motor Repair Shops

Practical Suggestions for the Service Station Man—The Cost of Work in Various Localities—Cylinder, Piston and Crankshaft Work

SPECIAL CORRESPONDENCE

IN THESE days when motors are being repaired rather than discarded it behooves the repair man to know how to secure the best results at a reasonable cost. Cylinder wear is undoubtedly the most costly from the standpoint of economy and there is little question as to grinding being the best way of restoring a worn cylinder to its original accuracy, or even of improving it. Pistons, piston pins and crankshafts also require attention.

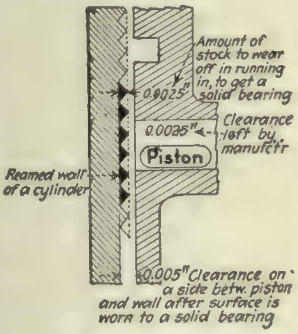

Amount of stock to wear off in running in, to get a solid bearing
0.0025"
Clearance left by manufc'tr
0.0025"
Piston
Reamed wall of a cylinder
0.005" Clearance on a side betw. piston and wall after surface is worn to a solid bearing

FIG. 1. EFFECT OF ROUGH CYLINDERS

The following suggestions have been collected from the wide experience of the Heald Machine Co., of Worcester, Mass., in regard to cylinder regrinding work and will, we are sure, be very helpful to real motor repairmen everywhere.

One of the most accurate and convincing ways of showing the advantages of grinding over either boring or reaming automobile cylinders, is by the grinding machine itself.

Take a block which has been finished by boring or reaming and set it up on an angle iron on a cylinder-grinding machine. Carefully line it up, and then let the wheel run in and out with just enough feed to spark. The result will be surprising. Not only will the reamer marks show up plainly, but it will also distinctly show high and low surfaces.

Decidedly bright spots will indicate a hard place in the iron which the reamer jumped over. This test also proves definitely whether the hole is at right-angles with the base or not; for if it is not, the wheel will grind on opposite sides at the ends.

Note definitely how the reamer marks are brought out when the porous-like surface is ground away. This demonstrates that a reamed hole will wear much quicker than a ground hole. In withdrawing reamers scratches from 0.002 to 0.003 in. deep are sometimes left by the reamer blades.

When the piston and rings are assembled in the cylinder they will rest on the minute hills of metal as exaggerated in Fig. 1. About half the bearing surface is thus lost, due to the depression of metal between each two hills. A full bearing surface is not realized until from 0.002 to 0.005 in. of metal has been removed by the piston and rings. This causes a very rapid wearing of the cylinder wall until it is worn to solid metal. The extra amount worn off causes a large percentage of gas and oil leak past the rings.

For instance, the amount of clearance allowed by the manufacturer between the cylinder wall and the piston in this particular case is 0.005 in. In order to get down to a solid bearing, another 0.005 in. of wear is necessary, making a total of 0.010 in. clearance between the piston and the cylinder wall. A few thousand miles of use, and this block will begin to cause trouble.

The space between the wall of the cylinder and the rings, which has been definitely determined, soon enlarges so much that there is a noticeable loss of power and leakage of oil. This is one of the reasons why cylinders that are not originally ground require to be reground and fitted with new pistons and rings much sooner than those that have been finished by grinding.

Too many repairmen are still advising new rings when an owner is confronted with motor troubles. They believe it is a cure, but it is only temporary, since in most cases the carbon has been cleaned out, valves ground and motor generally tuned up. It therefore seems to have overcome the ailment. It is not lasting, however, for no matter how expensive or complicated rings are used (with or without compression guaranteed), a round ring will not fit an egg-shaped hole; and if the motor has been run that is what you will have.

Thousands of strokes of the rings up and down the cylinder, aided by road dust and other abrasives sucked into the cylinders with the mixture, will gradually wear down the cylinder wall. This wear is greater on the two sides at right-angles with the crankshaft. It is due to the pressure of the piston against one side of the cylinder wall on the compression stroke, and on the opposite side of the cylinder wall on the power stroke. No ring will fit such a shaped hole, so there is bound to be a chance for gas escaping and a long time for the rings to wear in, if they ever do so. Therefore, as the cylinders are only worn the length of the ring travel, it leaves the lower and upper ends smaller. To put a ring the proper oversize in the worn part through the smaller hole is impossible. The only cure for a worn cylinder, and it takes but a few thousandths to show appreciative loss of power, is to have the cylinders reground and fitted with new pistons and rings. Fig. 2, which has been somewhat exaggerated, shows the wear in a cylinder which may have been made by various causes. Note how the gaps in the rings are spread, allowing for gas to pass through or around the rings.

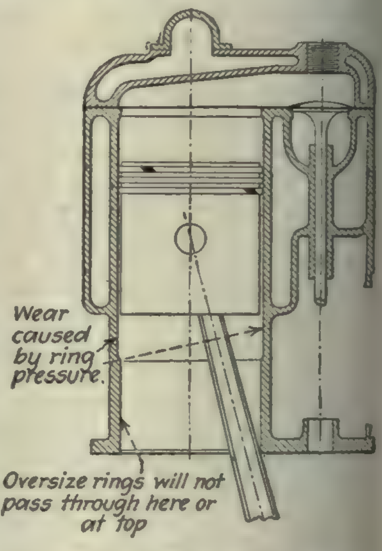

Wear caused by ring pressure.
Oversize rings will not pass through here or at top

FIG. 2. HOW A CYLINDER WEARS

New rings in such a worn cylinder would do no good, unless of the correct size to fill this hole. This is impossible, since rings of the proper size would not pass through the space either at the top or bottom of the cylinder. It will require grinding to take out sufficient stock to allow proper oversize pistons and rings to be inserted.

When the statement is made that a reground cylinder which has been fitted with new pistons and rings is better than it was originally, few people can understand why. It is a well-known fact that castings change shape after they are cast. This is due to strains and stresses caused by the heavier walls of metal cooling last and shrinking away from the already cooled lighter walls.

These strains can be relieved if the castings are seasoned for a long time, or by heat-treating processes. Castings that are immediately machined and put to work in a car, change their shape more or less, due to the heating and cooling of the motor that acts as a heat-treating operation. Therefore, a motor which has been run several hundred miles is thoroughly seasoned and is in ideal condition to be reground and fitted up. Once having been relieved of all the strains and stresses, the castings will retain their shape continuously after grinding, if properly machined.

Cars that do not run right, that use excessive amounts of gas or oil, lack power, or smoke excessively, need overhauling. A disagreeable piston slap is a sure sign of worn cylinders. This is usually heard on hills or when the engine is laboring hard.

After it is taken down, it can best be determined whether the cylinders need to be reground or not. If found scored, out of round, or with excessive clearance between the piston rings and cylinders they certainly need regrinding. All cars that have been run two or three years should be pulled down, have the cylinders reground and fitted with new pistons and rings. Makes of cars where the cylinders were not originally ground are subject to regrinding sooner than those with originally ground cylinders.

If the cylinders have been welded for any purpose, such as a score or a crack, they must be reground. Welding distorts and changes the shape in addition to leaving excess metal. Only by being reground can they be brought back to true, round, smooth holes.

With commercial cars or tractors, the same reasons for regrinding hold true as with pleasure cars, except the regrinding should be at least once a year. They are usually worked constantly to their full capacity and are required to perform tasks which require every ounce of power. Reground cylinders will save money for the owner on all commercial motors. Tractors in particular, are subject to excessive wear, due to the conditions under which they must work and the dust and dirt working into the engine.

While there are a number of convenient dial gages for measuring cylinder bores, it has been found that, in regrinding shops, ordinary inside micrometers are the best for all-around use.

In manufacturing plants where the size of bore runs the same, dial gages are far superior and faster. Where one is jumping from one size hole to another, as happens in the ordinary regrinding shop, nothing that we know of will take the place and give the speed and accuracy of standard inside micrometers.

All holes in the same block should be ground as nearly to the same size as possible. This was not always done by the first companies to take up regrinding. Many times, when the differences were slight, the pistons got mixed in the assembling, and the wrong piston would be used; then trouble developed. Keeping all cylinder bores in a given block the same diameter makes a more perfectly balanced motor and in case of repairs it is easier to refurnish them from the records kept by the regrinding company.

Occasionally the shifting of the cores, when molding the cylinders, leaves a thin wall. In regrinding such cylinders if the wheel should break through the man doing the work cannot be held responsible for this misfortune. Furthermore, should there be a deep score and the owner wishes it ground out instead of filled, he must assume all the responsibility for later trouble.

It would be better business for all regrinding concerns to refuse to touch such jobs, if, in their opinion there is a doubt as to what the strength of the wall will be after grinding.

(*Continued in next week's issue.*)

Aligning Shafting by a Steel Wire

BY W. F. SCHAPHORST

The article "Aligning Shafting by a Steel Wire" by Henry J. E. Reid on page 790, Vol. 54, of *American Machinist* is interesting. It strikes me that the wire method is very good for horizontal adjustment, but for vertical adjustment I call it too cumbersome for general adoption. I do not question its accuracy but it appears that much time is required to rig up the apparatus in the first place, weights of known quantity must be obtained, the distance between supports must be absolutely accurate and each end must be given the same exact elevation.

For horizontal adjustment only, a similar wire arrangement will serve the same purpose just as accurately without the refinements of exact weight, exact heights, and exact distance between supports. Then, to adjust the alignment vertically use an ordinary rubber hose with a gage glass inserted into each end. When the hose is filled with water the level will always be the same at each end and it becomes a simple matter to move the end fixed to a post to the other end along the lineshaft and make accurate vertical adjustments. In this way accurate alignment may be made both vertically and horizontally without any mathematical computations whetever and without tables and charts.

In checking up the table of sags on page 791 I get a result only one-half as great. Possibly it is because the tension in the wire is only 60 lb. instead of 120.

In checking the statement "2×60 is the force applied to each end of the wire," I have used the formula given in "Marks Mechanical Engineers' Pocketbook," page 756, which is:

$$S = \frac{WL^2}{8T}$$

where

W = wt. of 1 ft. of wire
T = tension in the wire
L = the span in feet
S = the sag of the wire at the center in feet.

Applying this formula to the figures given by Mr. Reid, we have

$W = 0.0009$
$L = 320$ ft.
$T = 2 \times 60 = 120.$

Substituting in the formula, we get

$$S = \frac{0.0009 \times 320 \times 320}{8 \times 120} = 0.096 \text{ ft.} = 1.152 \text{ in.}$$

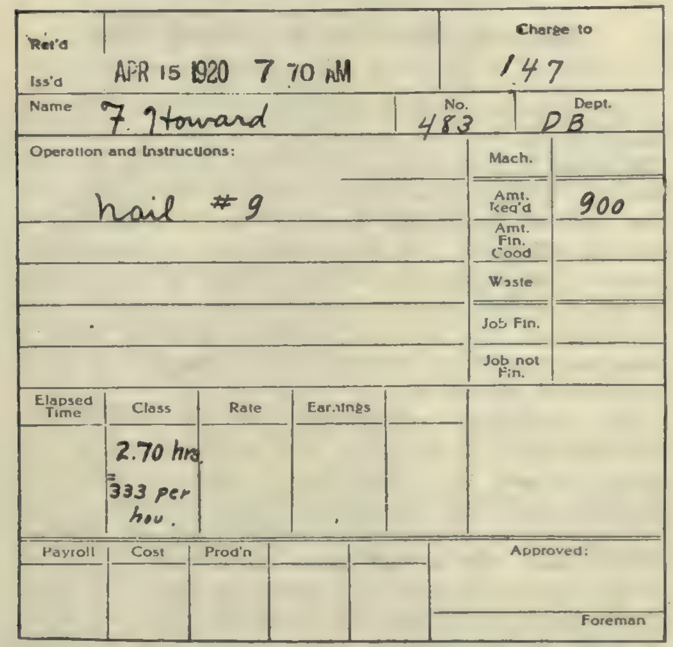
This is the sag in the middle where $L = 160$ ft. and which, according to Mr. Green's table, is 2.303 in. Since 2.303 is just twice as great as 1.152 it is my belief that the weight used by Mr. Reid is 50 lb. instead of 2×60 pounds.

Incentive or Production Basis of Wage Payment

III. Assignment and Recording of Production—Co-operation with the Workman—Fitting the System to the Conditions—Securing Co-operation of Executives

By HENRY H. FARQUHAR

MAXIMUM results in production can come only when the workmen themselves are thoroughly behind the plans, and they cannot be thoroughly and intelligently behind anything of which they are not completely and fully informed. It follows, therefore, that as regards the part they are asked to play, there must be a perfect definiteness and a policy of laying all the cards on the table at all times. Translated into action in assigning and following up work, this means simply that we determine what each man should do, that we tell him in advance what is expected and that we provide means for measuring what was done against what should have been done. Each of these requirements is discussed in more detail below:



Rec'd

Iss'd APR 15 1920 7 70 AM

Charge to 147

Name 7. Howard No. 483 Dept. DB

Operation and Instructions: nail #9

Mach.

Amt. Req'd 900

Amt. Fin. Good

Waste

Job Fin.

Job not Fin.

Elapsed Time	Class	Rate	Earnings	
	2.70 hrs. = 333 per hou.			

Payroll	Cost	Prod'n			Approved:
					Foreman

FIG. 2. JOB TICKET USED FOR PLANNING, FOR TRANSMITTING INSTRUCTIONS TO THE OPERATOR, AND FINALLY AS A RECORD OF PERFORMANCE AND COST

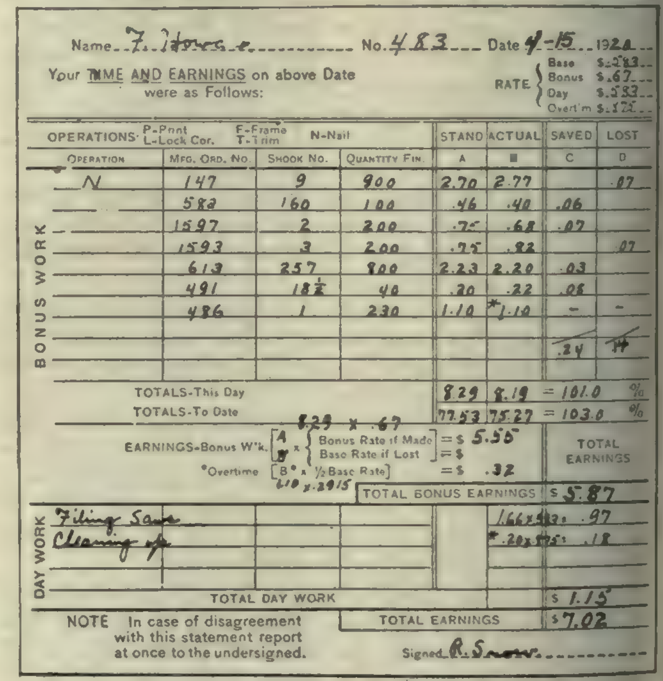
(14) *Each man should, so far as possible, have a clearly defined amount of work scheduled ahead of him.*

This, of course, is not possible in all cases, yet if sufficient investigation of miscellaneous work be made it is surprising how much of it can be put on a definite schedule. I know of one factory where the work of the janitors has been so thoroughly investigated and standardized that they may not only follow a logical procedure in their work but also receive a bonus for performing it in an agreed-upon time. The work of a maintenance department is about as miscellaneous as that found anywhere, yet in another large mill the activities of this department have been carefully planned for years, and today through the use of elementary time studies gathered during the past two years, on practically all repair and construction jobs which come up a standard time is set and a bonus paid, with the result that breakdowns have been almost eliminated, production doubled, wages increased and costs decreased. In still more difficult cases I have offered a reward to good advantage, not for accomplishing a specified amount of work in an agreed-upon time, but for performing to the satisfaction of everyone served all duties which were assigned. The next class of duties difficult to measure and therefore difficult to reward in exact proportion to accomplishment is creative work, but this together with administrative work may be and often is rewarded, not on the basis of time at all but on the basis of results.

The measurement of work is an extremely important part of the manager's job, and the subject is worthy of much more discussion than can be given here. I trust that the foregoing examples may serve as food for thought for those who have possibly considered strictly repetitive work as the only kind susceptible to measurement sufficiently accurate for some form of incentive payment.

(15) *Each man must be informed in advance what he has to accomplish to earn additional reward, and he must be able to measure currently his performance against this standard.*

The principle of letting a man know what is expected of him under given circumstances is no more than his due, but more than this it is imperative, if he is not to be left to work in the dark. It also adds interest to what otherwise might be monotonous work, and gives him the opportunity to protest in advance if he considers allowances unreasonable. Fig. 2 shows a job



Name 7. Howe No. 483 Date 4-15 1920

Your TIME AND EARNINGS on above Date were as Follows:

RATE Base $.283 Bonus $.67 Day $.583 Overt'm $.875

OPERATIONS: P-Print L-Lock Cor. F-Frame T-Trim N-Nail

	Operation	Mfg. Ord. No.	Shook No.	Quantity Fin.	Stand A	Actual ■	Saved C	Lost D
BONUS WORK	N	147	9	900	2.70	2.77		.07
		582	160	100	.46	.40	.06	
		1597	2	200	.75	.68	.07	
		1593	3	200	.75	.82		.07
		613	257	800	2.23	2.20	.03	
		491	18½	40	.20	.22	.08	
		486	1	230	1.10	*1.10	-	-
							.24	.14
	TOTALS-This Day				8.29	8.19	= 101.0 %	
	TOTALS-To Date				77.53	75.27	= 103.0 %	

EARNINGS-Bonus W'k. [A / B x {Bonus Rate if Made / Base Rate if Lost] = $ 5.55 = $ (8.29 x .67)

Overtime [B x ½ Base Rate] = $ .32 (1.10 x .2915)

TOTAL EARNINGS

TOTAL BONUS EARNINGS $ 5.87

DAY WORK		
Filing Saw	1.66x.583=	.97
Cleaning up	*.20x.875=	.18
TOTAL DAY WORK		$ 1.15

TOTAL EARNINGS $ 7.02

NOTE In case of disagreement with this statement report at once to the undersigned.

Signed R. Snow

FIG. 3. EARNINGS SLIP GIVEN EACH DAY TO EACH OPERATOR. THIS IS A SUMMARY OF JOB TICKETS ILLUSTRATED IN FIG. 2

ticket which is used first in planning, then for transmitting orders and instructions to the operative, and finally as a permanent record of performance.

To make this advance notification effective, each man must be able to check his own performance currently (as he works) just so far as is practicable. The entry f the number of pieces per hour on this job ticket Fig. 2) illustrates this important point. If the workan is to respond to the standard it must be translated to terms which he readily understands. Thus, to m the significant figure is the *rate per hour*, so that addition to saying that these 900 pieces should be ocessed in 2.70 hr. we also say that the *rate* for this b is 333 *pieces per hour.* This he readily compares ith his usual speed on such work.

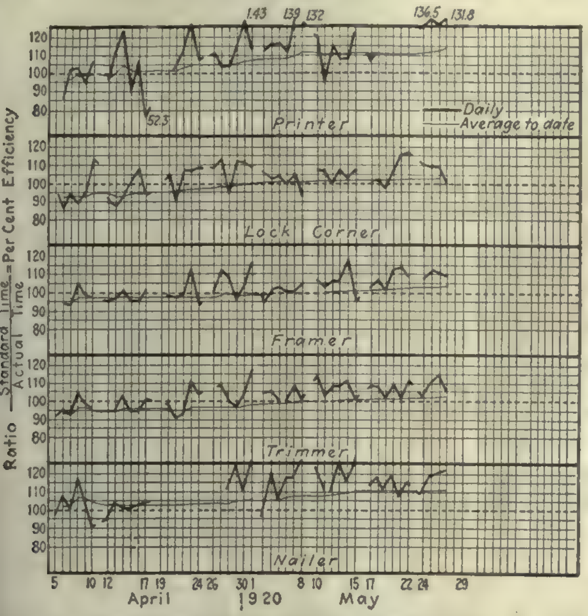


FIG. 4. PERFORMANCE CHART DISPLAYED IN THE DEPARTMENT. THIS IS POSTED FROM EARNINGS SLIPS

To follow up the practice suggested in the last two ragraphs, each workman should be notified by the anagement, preferably daily, as to his performance as own on their records. This, besides helping to susin his interest, will enable him to bring any disepancies daily to the attention of the management d avoid a peak load of complaints and adjustments llowing pay day. Fig. 3 illustrates one method of tifying each workman exactly how he stands each y, this being a summary of job tickets as shown in g. 2.

Importance of Record-Keeping

Lest so much attention be given to looking ahead on of the matters covered in the preceding discussion at we forget that it is usually imperative to be able o to look back, another most important provision is cessary.

(16) *The operation and results of the method must be supported by adequate records.*

Without these suspicion and trouble is almost sure result. Such records, illustrated in part by the job ket, are for the purpose of enabling both men and nagement to verify the accuracy of all figures when inevitable questions and complaints arise; of furhing individual man-records with all that these ve in settling questions of a man's fitness for given rk and of relative earning power and ability of the various men; and of preventing the tendency (through showing up each man's own individual story) to blame others and shift responsibility. They also of course serve many other uses in connection with the administration of work and accurate cost finding.

Period Over Which Performance Is Determined

A task and bonus method of payment was recently thrown out of a factory because the individual job was used for figuring earnings instead of a longer period (say a day) which should have been used. In this case certain uncontrollable delays entered into the men's work, and in making allowance for these in the standard times the *average* delay was used in all cases. This was all right when the average job came along, was entirely agreeable to the men when less than the the average delay occurred, but anything but satisfactory when more than this time was required. On jobs of this last class, the men lost bonus even though they worked just as hard and as faithfully as they did on any of the others. Naturally at such times they pawed the air, and a perfectly good system of pay was discredited in both the management's and the men's eyes because they did not see what the matter was. A rule never to be forgotten is:

(17) *The period over which performance is figured should be as short as possible but never so short as to be unfair to the workman.*

Where uncontrollable elements such as breaks occur in processing a product which we finished but did not originally manufacture, since the time allowance for our operatives must ordinarily be based on the average break, either sufficient time must be included in the performance period so that extraordinary delays will be brought down by the lesser ones to the average figure, or later adjustments must in fairness be made.

Eliminating Detail

The same thing holds true where for any reason, such as considerations of expense, the time studies are not complete or final in every particular. Thus, in one case of making boxes, it seemed impracticable and unnecessary to get detailed times on every single one of the hundreds of different types and sizes of boxes made. Instead, all boxes were classified as best we could into small, medium, and large, on the basis of cubic capacity; then accurate times were obtained on several sample boxes in each of these classes. The capacity basis is probably the best but not a perfect measure of the difficulty of handling a box, and there were numerous contrary boxes which refused to fall into line at the proper point on the resulting curve. These exceptions as they were discovered were each made a separate class from the general run, but how many such "exceptions" there might be which we had not happened to time no one could say. It was necessary, therefore, rather than be forced to make constant annoying adjustments, to take this fact into consideration in developing the method of pay for this special case. The answer was simply to make the day's work (consisting of several different jobs on several different kinds of box) the basis of figuring performance instead of the individual job, in the expectation that over this period the high and low times would compensate each other. This, after the men understood it, seemed to be perfectly satisfactory and resulted in few cases of lost bonus (see chart, Fig. 4).

Fig. 3 is a reproduction of an earnings slip showing how this worked out in practice from a summary of individual job tickets issued during the day. Here this man lost the first job by 0.07 hours, made the next two by 0.06 and 0.07 respectively, lost the fourth by 0.07 and so on, but earned a bonus on all these jobs because the sum of the times he saved during the day exceeded the sum of the times he lost—in other words he was given 8.29 standard hours work to do, which he did in 8.19 hours, entitling him to bonus rate on his day's work as a whole.

LENGTH OF BONUS PERIOD

In another plant on a different kind of work the same general scheme is used except that even a longer period, in this case a week, is used. I understand that some engineers recommend that a month be used (although with a different method of payment), but this seems a little long even for incomplete standardization and inadequate time study. The objection here is the same as one of the many objections often cited to profit sharing in that it is difficult to sustain the interest of the men over so long a period, and a consideration of when and why "efficiency" pay was not earned becomes too much of a post mortem.

One other angle to this question of the proper length of period may be indicated before passing on. Regardless of how long a time is used as a basis of determining reward earned, there is still the question of the proper duration of each job assigned. All that can be said here is again to choose the middle road—a series of short jobs during the day becomes a nuisance to both the men and the timekeepers, while too long a job also has its disadvantages. With investigation and rearrangement of processes it is often possible to build up short jobs or break down long ones into operations of a half day's duration or thereabouts, which seems to be about the happy mean.

In the last analysis the success or failure of any internal plan of management rests very largely upon the foreman. If he is behind the plan and wants it to go it goes, and if he is against it it likewise goes—out. It is therefore most important that his co-operation be secured, and that his intimate familiarity with all details of the work be taken advantage of in setting standards and in devising and operating the incentive method. No matter how carefully thought out beforehand, there will almost surely be irregularities and weak places in the plan which no one on the one hand can use to more telling effect in damning the whole scheme if he so desires, or on the other hand straighten out so satisfactorily as the foreman. This helping over the rough places throws a considerable burden upon him which should receive recognition, and a satisfactory manner in which to recognize it is expressed in the following recommendation:

(18) *The foreman should receive an additional reward according to the total efficiency of his department.*

It must be emphasized at the outset that where this practice is contemplated final authority in passing upon quality of work must be detached from the foreman. This is good practice in any event, since the man who is primarily responsible for *quantity* of work should not ordinarily be expected to exercise an impartial judgment as to quality of that work; but certainly where volume of output is one of the factors in adjusting the foreman's pay he should not be put to the temptation of swelling quantity at the expense of quality. Let him fight this matter out in doubtful cases with one not under his jurisdiction who is interested solely in the accuracy of what is produced, not in the quantity turned out.

Such a reward to the foreman may be based either on output, on workman's earnings, or on cost—that is, he may be given in addition to his regular salary a rate per piece or per ton for example, on total production; or he may be given a definite proportion of earnings; or or he may be rewarded according to the amount by which a predetermined cost is lowered. Where the second basis is used (that of earnings) when the operatives under him are working on piece rate, the reward should begin only after a predetermined amount which may be readily reached has been earned so that low production will not add anything to his pay envelope; and the same provision should hold with any method other than piece work where the task element is similarly weak; with task and bonus payment, however, where earnings are predicated on predetermined high production, he may be given a percentage directly on amount of earnings (including bonus) above the regular day's pay. The objection to the last method enumerated (that of cost) arises through the fact that, as pointed out previously, cost is subject to fluctuation through so many factors over which the foreman has no control. Which of these bases is chosen is largely incidental, however, as long as it is practicable and furnishes definite incentive to continuous high production.

I wish to put a ring around this topic by reverting back to the first paragraph to emphasize the importance of relieving the foreman of final responsibility for inspection in all cases where his earnings are dependent on volume of work turned out.

THE METHOD OF PAY

Up to this point the whole discussion has dealt with the prerequisites to production reward, and it would seem that the least important topic—that of the method itself—had been reserved for the last. If thereby emphasis can be laid on its relative *un*importance, its place in this paper is justified.

From one standpoint, however, and that a negative one, the details of the method to be adopted are most important. By this I mean that it is imperative not to choose a *wrong* method under particular circumstances lest the possible benefits of the various features enumerated be neutralized. Judgment must be exercised not so much as between the various good methods available, as between the good and the bad, for with any given set of conditions there are usually many bad and several good ways which might be used. Some guides in making this choice are indicated in the closing discussion.

(19) *The method of pay must be easy for the workman to understand and to calculate.*

As has been emphasized, maximum response cannot reasonably be expected of the workmen unless they thoroughly understand what it is all about and just what part they are asked to play. A strictly logical basis of reward may fail and has failed in practice because the workmen could not follow the logic nor figure the results. Just as the standard must be expressed in terms which he can understand (see topic 2), so the method of determining his pay when he reaches or fails to reach the goal must be intelligible to him. This of course is not possible in every case with illiterate or uneducated workmen, but it is extremely desirable in all cases, and the more uneducated the men the simpler must be the scheme.

FEATURES OF VARIOUS SYSTEMS

Among the better known incentive methods (leaving out of account the non-incentive day rate which is at once the simplest and, as ordinarily used, least effective method), the straight piece rate and the Taylor differential rate are readily understood by almost any worker. When we come to the premium methods—Halsey, Rowan, Barth, and so on—the calculation is somewhat laborious but may be made by the average workman without difficulty. In the same class falls the Gantt task and bonus as ordinarily used; but with the almost innumerable combinations of these, with the Emerson "efficiency" method and with other sliding scale or inclined plane types the complexity increases beyond the ability of the average workman to grasp, and to this extent they lose practically any theoretical advantage they may possess. This disadvantage is only to a slight extent overcome through slide rules or other means by which workmen may, with some difficulty, figure their earnings, and such paraphernalia does not overcome the objection that with most of such schemes the workman cannot check his performance as he works. It follows, of course, that in accordance with topic No. 16 the records must be in such shape that they are readily available for checking the figures finally arrived at by the men; they must be asked to take nothing for granted.

ONE NECESSARY FEATURE

Against the various advantages and disadvantages of these plans from this standpoint must be put those affecting the feelings and productivity of the operatives. There are two sides to every question, and while some methods appeal to the workers themselves more than other plans do, the welfare of everybody, including the workmen, must be considered from the standpoint of high production and low costs. Without making an attempt to give reasons in detail for my personal preference in the matter, I will state finally what I consider a most important rule:

(20) *The method of pay should embody the "task" idea.*

This, I realize, is a debatable point, particularly during dull times when the workman sees goods piling up to such an extent as to neutralize any incentive appeal to high production. One illustration of why I feel as I do may be given. The output of an operative on a job where his own speed practically determined the amount produced was originally 100 pieces per day. He was paid a piece price of $0.03. A production of at least 145 was desired and the workman was asked to produce this amount. This request being without effect, the piece price offered was increased to $0.0315, but the output remained stationary. The task was then brought into play. The man was told that up to 145 pieces he would get $0.03 as before, and that from 146 to 180 he would get $0.0315 for all pieces produced. He immediately brought his production up to 157 per day, which gave him a rate of $0.0315—or the same rate that had failed to tempt him while under straight piece work. No changes whatever were made in the administration of his work. Later another man on the same job under the same conditions of work but with the new differential rates raised the output to 214 per day and held it there for a number of years. This fact in itself is sufficiently striking, yet at the end of this time the task element was more strongly emphasized by putting this work on Gantt task and bonus, whereupon the same man jumped his output within a few weeks to 246 pieces per day, a small proportion of this last increase being due to slight modifications in the routing of work. Starting with 100 pieces, therefore, the task was responsible in this rather exceptional case for an increase in production of over 140 per cent. Similar stories of increases in production are common in passing from day work to one of the incentive methods, but I know of no more striking instance of the value of the incentive methods which embody task work to a high degree (such as the Taylor differential and the Gantt task and bonus) over those which do not.

THE TASK IDEA

There seems to be something irresistible about task work when the task is properly set. It seems to push a man up from below and pull at him from above as nothing else does. This is well illustrated by the chart, Fig. 4, which shows a running record of five men making boxes under the method of payment described in topic (17). This is a photostat copy of a chart kept before the men and regularly posted from the earnings slips shown in Fig. 2. It will be noticed that the framer resisted the pull for nearly eight weeks after the bonus method was put into effect, but with the more and more frequent earning of the extra money, coupled with the example of the other men, his performance finally rose and remained above 100 per cent. This represented an increase in production of something like 15 per cent over what had formerly been considered excellent performance.

One final caution in deciding what form the task is to take: In a sense almost any incentive method of pay may be said to incorporate the task feature, yet in many methods (such as the inclined plane type of payment) it is embodied to such a slight extent as to be practically non-effective. There should not be too many "steps" in the reward—a fairly high standard should be set and the men required to reach this standard before additional payment is made. This standard may be expressed in any one of a number of ways, but the feeling of satisfaction in having attained it must not come too soon or too easily if we are to guard against the tendency to settle back on what laurels we have won. Only through a rigid standard are two great benefits of task work as regards the men themselves to be realized: that of assisting in ascertaining the fitness of a given man for a given kind of work, and that of distinguishing between good, and poor or lazy, men. These should not share equally in the reward, as they may if the standard be too low, but each according to his individual merit.

A FINAL WORD OF WARNING

I cannot close this paper without adding what perhaps does not strictly belong here: A word of warning to those who contemplate initiating a bonus or other plan of production payment. It is not sufficient that the various features which have been discussed be carefully provided for, for they may come to naught through a false start in putting the plans into effect. I speak from bitter experience in attempting to start several operatives on a new plan all at once, in spite of many warnings not to do so. No matter how carefully thought out one's plans may be, there are always some loose ends which are bound to make trouble in geometrical ratio to the number of men one attempts to deal with in such matters at one time. Under the best conditions the management must be prepared to suffer a good deal of agony during the development of new methods, and so if possible the start should be made with one man who has been carefully selected for the purpose, and followed up with one at a time similarly selected. If the plan will not work with one, it will most assuredly not work with more than one, while on the other hand if one or two be thoroughly sold, there will ordinarily be little trouble in getting it across to the rest. The results of months of expensive standardization and planning—those essentials of high production which I have so constantly emphasized—have on more than one occasion been wiped out through failure to follow the procedure indicated. With success at the start pressure will be brought to bear soon enough by the men for the extension of the work, and for maximum speed in the long run the surest way is to make haste exceedingly slowly in the beginning.

Stabilizing a Business by Proper Accounting

By J. Bainter

"WHY think of war in time of peace?". The reason is, as demonstrated to us not so long ago, that we may be prepared.

The same line of reasoning applies to industry and business with relation to good and bad times. Without wishing to cast aspersions or to make an unkind statement, we feel constrained to say that many business enterprises are at this time suffering because they failed to consider in a golden period the troublesome days that the future might bring.

True, at present practically all industry has felt a slump; but the attitude of the personnels of different concerns toward present conditions vary greatly. The biggest men and the most farsighted men, as a class, are philosophical about matters. They were not surprised by a big falling off in business, because they fully expected it. The concerns that had wide-visioned men to pilot them through the past few years are, as a rule, not now in dangerous positions financially, for the reason that a full knowledge of the various phases of a problem goes far toward providing a solution.

Now, getting to the point, it seems not amiss to mention something about the conducting of business enterprises, at a time when the logic of the argument has been borne out and has, therefore, considerable weight. Since every business organization realizes that there will come to it bad times, as well as the prosperous periods for which it was organized, some means should be adopted to utilize the earnings of one period to carry the losses of another. In this way, stability can be given to an enterprise.

To accomplish this purpose, many cost accountants favor the establishment of burden reserves, or sinking funds of a special type. The idea is based on the knowledge of the average burden for, say, ten years past, this moving average being considered as "normal."

The burden charges per unit of product depend directly upon the amount of production, other things being equal. That is, the general overhead expense, including the cost of such items as administration, office maintenance, insurance, taxes and depreciations, that must be borne per unit of product is greater when production is low. That is our condition at present.

Not long ago, however, when business was good, the burden rate was small—a condition which the future will again bring. Now, the desirable thing is to stabilize a business by making the low rate offset the high rate of another time. There are several methods of doing this, but the burden-reserve method already mentioned is probably the most sound. The details of it are, of course, left to the accountants of each individual plant, but the principle is the charging or crediting to the burden reserve each month the over-absorbed or under-absorbed burden. It is well to add that the success of the plan depends somewhat upon the proper choice of the normal burden rate, which must be determined by the use of the cost data gathered over a period of years.

The few firms actually using the system have been well repaid for it now. As for the others employing cost systems, if in 1915, each had established a reserve to which was credited over-earned burden, they would have something to meet the high burden rate of today. Now, however, it is necessary to start on the wrong side of the account. But, when the cycle has been completed, the account should be balanced and we should be ready to meet the next depression with a smile.

Tungsten

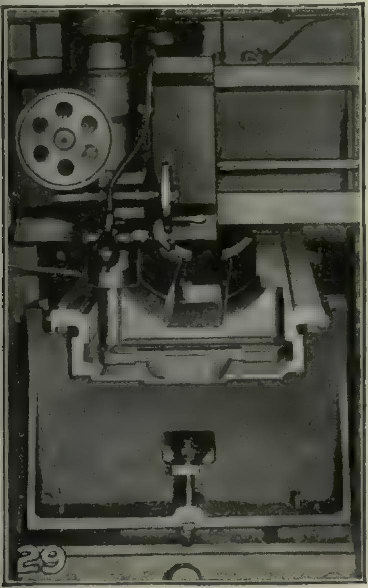
Tungsten, which has come to be known as one of the most valuable of the metallic elements yet discovered, is obtained largely from an ore known as wolframite, found both in Korea and in the United States. It is extracted from the ore in the form of a powder, which is formed into ingots by hydraulic pressure instead of by fusion, as is the case with practically all other metals. The melting point of tungsten is about 3,350 deg. C., which is higher than for any other known metal, and when tungsten cools, instead of being softer as is the case with other metals, it is just as brittle as it was previous to the heating. A process of mashing the grains of metal so as to make it ductile while cold was finally evolved, with the result that it is now drawn into filament for incandescent lamps, doubling the efficiency of the lamps and providing a whiter and better light than any lamp before known. The tungsten filament has a remarkable tensile strength—about 600,000 lb. per square inch for wire 0.001 in. in diameter.

Manufacturing With Special Machines vs. Standard Equipment

IV. Portable Devices for Plain and Thread Milling—An Angular Drilling Fixture—A Special Machine for Milling Sinuous Oil Grooves

BY COL. F. JENKS* AND M. H. CHRISTOPHERSON†

OPERATION 31, Fig. 29, shows finish milling the breech end, the bevels underneath the forward gunlock and on top of the rail. Ten Otis type-11 and two type-12 vertical milling machines were used on this operation. The peripheral cutting speed was generally 50 ft. per minute. The time on the first of 120 sleighs was 120 hr. each. On the next lot of 160 sleighs the average time was 60½ hr. Average time on ten sleighs with experienced men was 48½ hr. which could readily have been maintained. The time on this operation at the Arsenal was 56.83 hr. Cutting compound was used on the cutters. Operation 32-A was similar and consisted in milling the underside of forward gunlock taper by raising the rear setting fixture plate to compensate for the angle. Average machining time, 1¾ hr. Operations 32-A and 40 were combined in a single operation at the Arsenal and the time given as 6.31 hours.



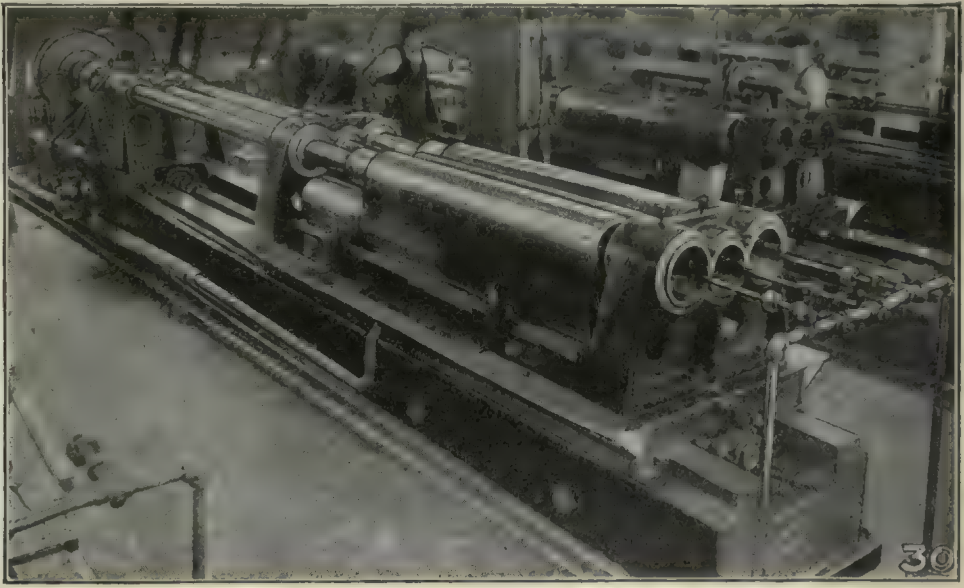


FIG. 29. USING AN UNUSUAL MILLING CUTTER. FIG. 30. REAMING THE CYLINDERS

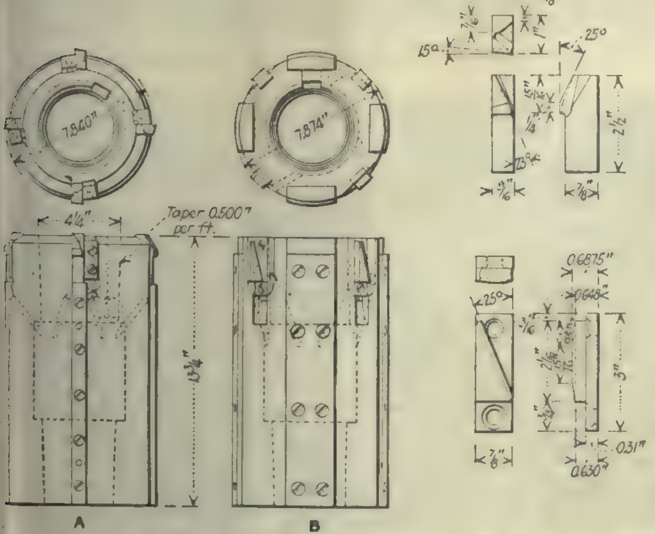


FIG. 31. DETAILS OF BORING HEAD AND REAMER

Finish-milling the breech end for the locking wedges and the several points which held the gun in place was probably the most important and difficult work to perform on the sleigh as it was impossible to protect against possible errors by any mechanical means, except by preparing the most suitable cutters and gages. Otherwise the workmen themselves had to be depended on and the great variation in the time was due principally to the need for training men to the extreme accuracy in workmanship which this particular part of sleigh required.

OPERATION 33

Finish-boring and reaming the three cylinders is shown in Fig. 30. Eight Otis type-9 triple bar boring mills were used in this operation. Revolution of boring bars, 5¼ per minute; peripheral speed of recoil cylinder reaming tools, 11 ft. per minute; peripheral speed of recuperator cylinder reaming tools, 9½ ft. per minute; table feed, 7½ in. per hour; average time on setting sleigh and finish-boring and reaming the three cylinders, 18¾ hr.; average low time on 10 sleighs, 16 hr. The time on this operation at the Arsenal was 20.11 hours.

A constant stream of cutting oil, mixture 10 parts mineral seal oil, four parts pale paraffin oil, one part

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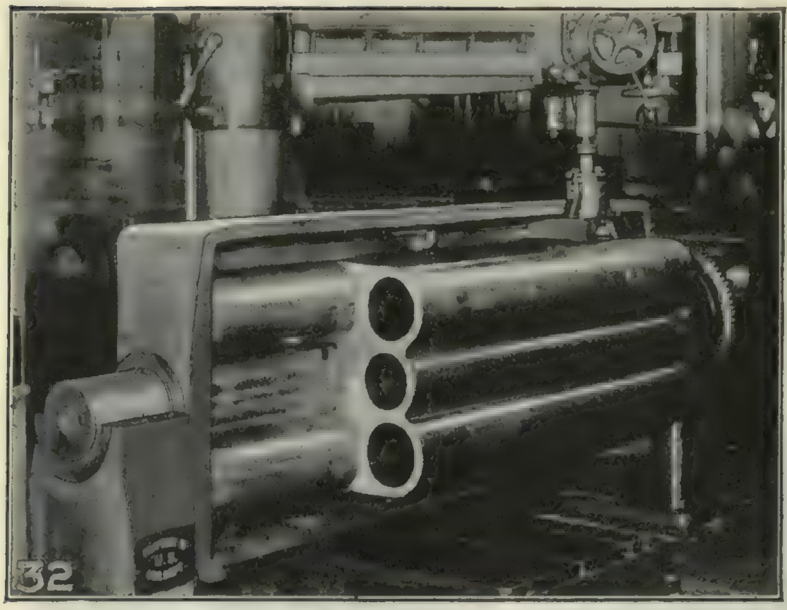
*Chief of Artillery Division, Ordnance Department, U. S. A.
†General Works Manager, Otis Elevator Co.



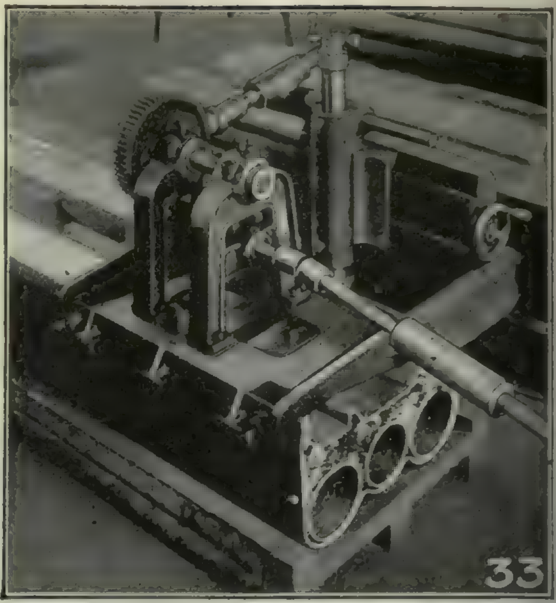


FIG. 32. TRUNNION FIXTURE FOR CROSS DRILLING. FIG. 33. A PORTABLE MILLING FIXTURE

lard oil concentrate was forced through the boring bar and heads directly into the path of the cutting tools. The finish boring heads *A* in Fig. 31, increased the diameter of the recoil cylinders from 7⅜ to 7.840 in. The boring heads were made of cast iron with semi-steel wearing strips that were readjusted by means of shims underneath and turned to correct diameter after each use. The cutters were ground to shape and the angle of the cutting tool fixed to insure the most reliable cutting edge that could be accurately maintained throughout the bore. After completing the finish boring cut the heads were replaced by the three finish-reaming cast-iron heads, *B* in Fig. 31, in which reaming cutters were inserted. After being inserted in the head the cutters were ground true with the bore in the head and each cutter was finally lapped by hand to a smooth cutting edge.

The heads were fitted with wearing strips of hard maple which were kept constantly in an oil bath and just previous to being used were turned to 0.002 in. larger diameter than the reamer. Each reaming cutter enlarged the cylinders approximately 0.030 in. Carbon steel was used in the finish-boring and reaming tools.

After a thorough study of boring mill design it was decided to make these triple bar machines with self-centering couplings between the driving mechanism and boring bars to prevent vibration. The triple stand at the driving end of the table was equipped with ground bushings in which the boring bars revolved.

The sleigh was set in place on hardened steel setting fixtures bolted and doweled to the table after being carefully located to insure the cylinders being bored parallel to the slide liner seats. When setting the sleigh, the table was drawn back so the taper ends of the boring bars extended through the triple stand at the end of the table; the boring heads were then put on the taper ends of the bars and the end nuts drawn up. Hardened and ground bushings were inserted in each bore of the triple stand and formed true and close fitting sleeves over the boring head wearing strips. The machine was then started, the triple stand with its sleeves guiding the heads in a direct line with the boring bars. The wearing strips on entering the finished bore directly behind the cutting tools, avoided sagging of the boring bars and prevented gouging by the cutting tools. Finally when the boring heads had completed their cuts and the same procedure with the reaming cuts had been accomplished, the sleigh was readily removed without interference of the boring bars.

OPERATION 34

Counterboring both ends of the recoil and recuperator cylinders preparatory to milling the internal threads in Operation 39. Two Otis type-9 boring mills with special boring heads fitted on the taper end of each bar were used. Average time on setting the sleigh and in machining the counterbore, 4¼ hr. Operations 34 and 39 were combined as a single operation at the Arsenal and the time given as 31.00 hours.

OPERATIONS 35 AND 35-A

These operations consisted of drilling a number of small holes from each side of the sleigh into the breech pocket, preparatory to chipping out a rectangular section for slotter-tool clearance and for drains from the locking wedge pocket; also drilling and tapping both sides of the sleigh for locking wedge screws and filler plugs which are shown in Fig. 32. Four 5-ft. radial drilling machines were used. Average time on 280

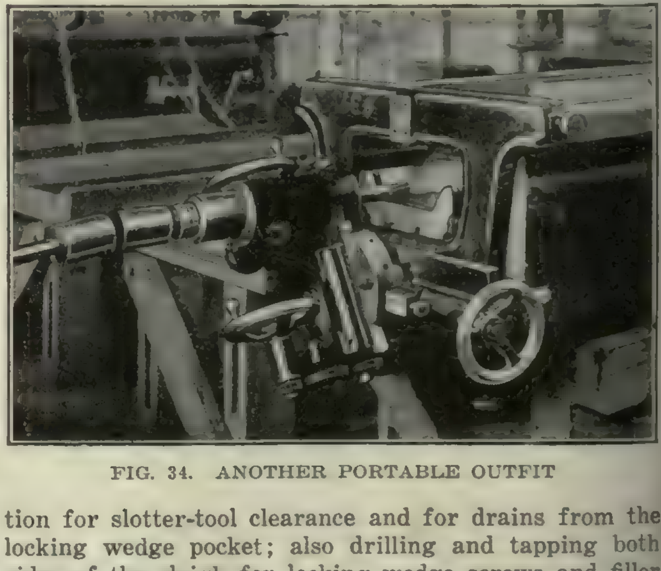


FIG. 34. ANOTHER PORTABLE OUTFIT

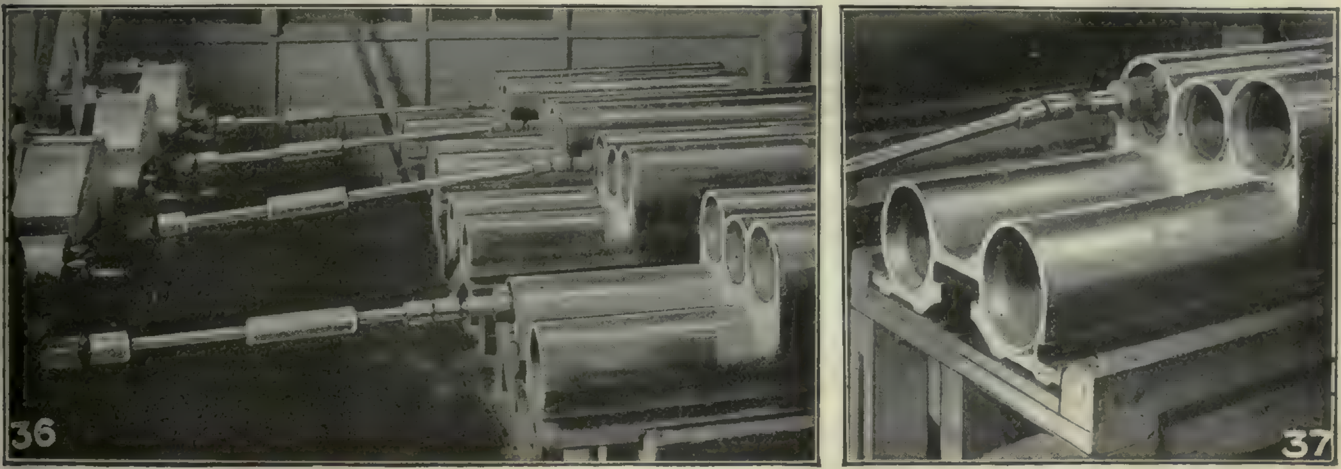
sleighs combining both operations, 16 hr. Average time on 10 sleighs, on which the same work was done with more efficiency, 10¼ hr. Operations 35, 38 and 49 were combined in a single operation at the Arsenal and the time given as 18.30 hours.

The "turn-over" holding fixtures used in these operations made it possible for the operator to readily set the sleigh in any required position by means of the handwheel which actuates the balanced fixture through a worm and gear. Locking-pin holes which register the location for each hole to be drilled, held the fixture in place while the machine was at work. The fixtures which were equipped with holding bolts made it possible to readily change the sleigh from one machine to another, and in that way utilizing the best operators for the more important work.

OPERATION 36

Planing four vertical recesses in the sides of the breech pocket into which the locking wedges are drawn when locking the gun in position and shown in Fig. 33.

Six portable slotting machines were designed and made for this operation; three right-hand for the work on one side, and three left-hand for the work on the other side of the breech pocket. The machines were quickly set in their correct positions by means of hardened setting plates fastened to them, the plates being pressed against the top and one side of the sleigh by means of handy clamps. The machines were driven by universal joint shafts from specially designed countershafts; the average time machining 280 sleighs was 29 hr.; average time machining 10 sleighs on which work was most efficiently done was 21½ hr. Arsenal time on this operation, 15.73 hours.



FIGS. 36 AND 37. PORTABLE THREAD-MILLING DEVICES

PORTABLE TOOLS

These portable tools, as in the case of others shown n following illustrations, were designed with the view of preventing spoilage by more or less inexperienced workmen and on account of the difficulty of securing deliveries on either standard or single purpose machine ools. Later developments proved that with a slight hange in the design of recesses permitting the termination of a milling cutter, the recesses could have been milled in much less time by means of a portable milling machine designed to rest on the locking wedge seat. That such a machine was not made was due to reduction n the number of recuperators required.

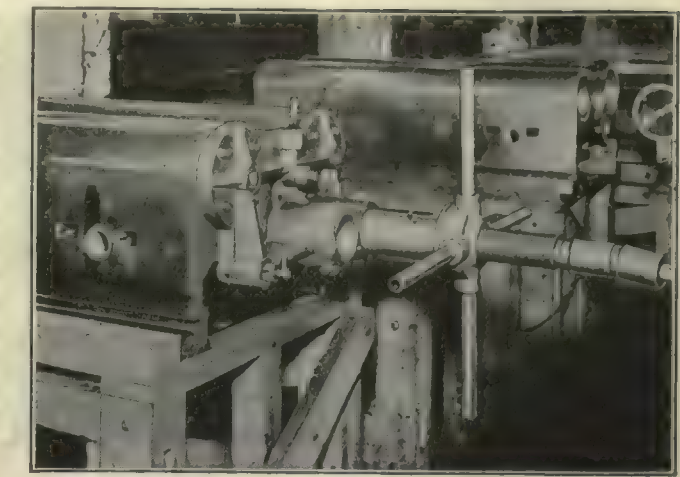


FIG. 35. A DRILLING AND TAPPING FIXTURE

OPERATION 37

Profile-milling the irregular shaped bridge at the end of the breech pocket is shown in Fig. 34. Five portable milling machines were designed and made for this operation. Average time machining 280 sleighs was 8¾ hr. This work, with some minor changes, was reduced to 4¼ hr. each on the last lot of 120 sleighs. The time on which work was most efficiently done was further reduced to 2½ hr. each. Arsenal time on this operation, 11.47 hr. The portable profile milling machines were quickly set in position on the end of the sleigh by means of hardened plates. Locating the machine in its exact relation to the work and with its hardened form plates for directing the milling cutter, proved to be a very safe and effective method for machining this portion of the sleigh. However all tools

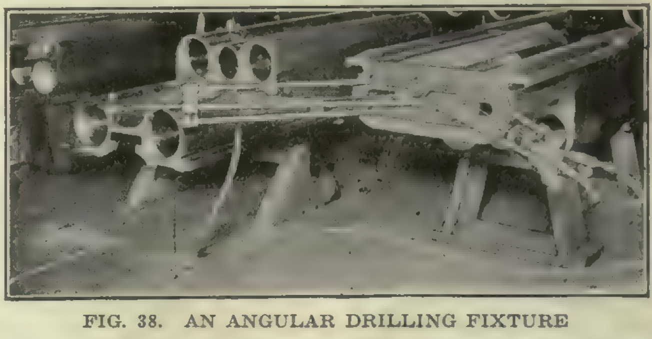


FIG. 38. AN ANGULAR DRILLING FIXTURE

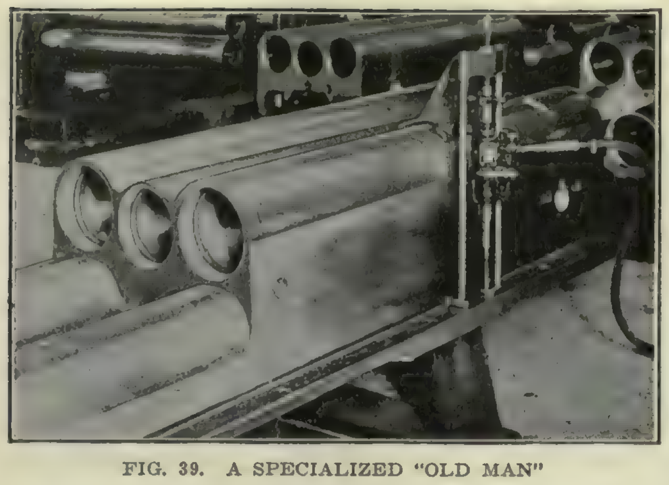
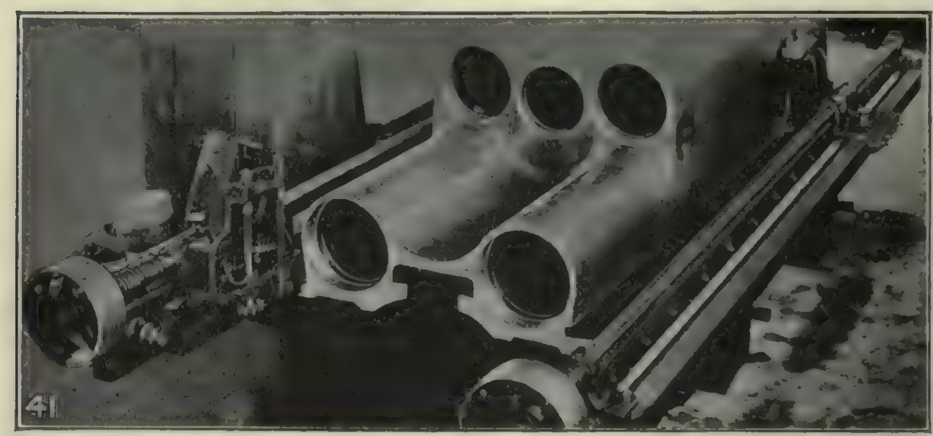


FIG. 39. A SPECIALIZED "OLD MAN"

that have no fixed feed, but are dependent on an operator's hand feed are subject to the whim of the operator and prove most efficient when a premium can be paid him for a full day's work.

OPERATION 38

Drilling and tapping the hole for the wedge locking-bolt and drilling the drain hole in the rear of the breech pocket are shown in Fig. 35. Two portable drilling machines were designed and made for this operation. The base was clamped in a fixed position by hardened locating plates, the feed being by hand power. The machines were driven by universal-joint shafts from specially designed countershafts. Average time for setting the sleigh and machining 280 sleighs was 8 hr. Best average time on 10 sleighs was 6½ hr. Operations 35, 38 and 49 were combined in a single operation at the Arsenal and the time given as 18.30 hours.



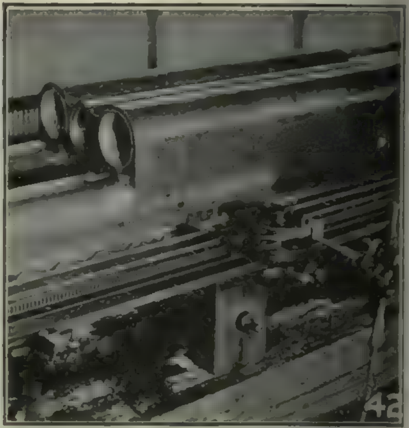


FIG. 41. A DOUBLE MILLING FIXTURE. FIG. 42. MILLING SINUOUS OIL GROOVES

OPERATION 39

Milling the threads in both ends of the recoil and recuperator cylinders is shown in Figs. 36 and 37. Five portable thread milling machines driven by universal joint shafts from specially designed countershafts were used. Average time in milling all cylinders in 280 recuperators was 12¾ hr. Best average time on ten was 8½ hr. Operations 34 and 39 were combined in one operation at the Arsenal and the time given as 31 hours.

The thread-milling heads were made with an outside expanding sleeve that was used for holding the head firmly in place in the cylinder. The inside of this sleeve has a lead screw corresponding to the pitch of the thread to be machined; inside of the sleeve is screwed the milling head with a corresponding thread on its periphery. Inside of the head is the driving shaft to the end of which the thread milling cutter is fastened, the bearings for this shaft being turned eccentric on the outside to permit feeding the cutter to the depth of the thread by means of a hand actuated feed screw. These milling heads proved very satisfactory, not only in their mechanical operation but also in the remarkable uniformity and smoothness of threads which were produced. The milling was done within 0.001 to 0.002 in. finished diameter and a hand sizing tap was used to bring the threads to exact size.

The benefit of using such a reliable device for machining these very important threads can be better realized by stating that in machining 1,680 threads only in one instance were the threads milled several thousandths large in diameter and this was caused by the day operator, who just before quitting changed a worn-out cutter and the night operator did not realize the machine had not been adjusted to the new cutter until two threads had been completed. Winter-strained lard oil was used on the threading hobs.

OPERATION 40

Milling both edges of the forward gunlock to reverse angle on each side. Detrick & Harvey horizontal boring machine was used on this operation. Average time for this operation on 280 sleighs was 2 hr. Operations

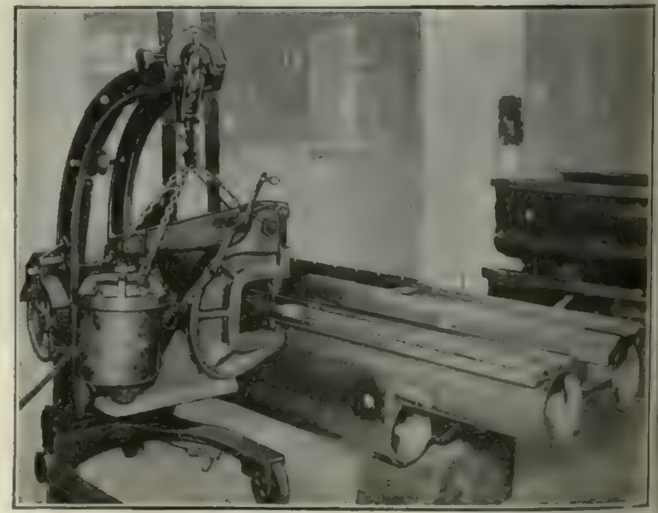


FIG. 40. RIVETING SLIDE LINERS

32-A and 40 were combined as a single operation at the Arsenal and the time given as 6.31 hr. The sleigh holding fixture was made to move on the machine table to the right and to the left, out of parallel with the cutter, the machine milling first one side with the sleigh set to the proper angle and then the other side after the fixture had been moved to the reverse angle. This opration was originally done with a hand broach.

OPERATION 41

Drilling two ⅜-in. holes commencing inside of each reservoir, both holes terminating at the same point about 8 in. from the end of the sleigh and is shown in Fig. 38. Four air drills with angle fixtures, were used. Average time on drilling holes in 240 sleighs was 1¼ hr. In the first lot of 40 the time was nearly 3 hr. each. Operations 41 and 47 were combined in a single operation at the Arsenal and the time given as 13.37 hr. The excess time on the earlier work was due to slow feeding of the drill, the workman being fearful of breaking the drills. Reducing the air pressure to a point where the machine would stop before breaking the drill, enabled the operator to proceed without fear. Operation 42 consisted in inserting the bronze slide liner. A 10-lb. sledge was used in this operation.

OPERATION 43

Drilling the rivet holes through the sleigh flange, using the holes in the liner for a templet is shown in Fig. 39. Four air drills and fixtures were used in this operation. Average time on 280 sleighs for operations 42 and 43 was 16 hr. Best average time on 10 sleighs was 10½ hr. No Arsenal time given on this operation.

OPERATION 44

Setting twenty-four 5/16-in. bronze rivets and ten 5/16-in. steel thrust rivets in the sleigh liner is shown in Fig. 40. One 8-in. reach, 8-in. gap Hannah Engineering Co. pneumatic squeezer was used in this operation. Average time on 280 sleighs was 7¾ hr. Best average time on 10 sleighs was 4 hr. Arsenal time on this operation, 19.53 hours.

OPERATION 45

Milling the bronze slide liner after it had been riveted into place in the sleigh is shown in Fig. 41. One special milling machine, was designed for this operation. Average time milling 280 sleighs, most of which required a roughing and finishing cut, was 4 hr. Arsenal time on this operation was 27.29 hr. On a number that had been previously rough planed, the finishing cut including the setting of the sleigh averaged 2¼ hr. The special milling machine was made to prevent spoilage which might more readily occur in a planing operation due to the difficulty of machining liners of this design. This milling machine proved to be a time saver and was less expensive than a planer. The design required that the slide liners be machined parallel with the cylinder bores and this was accomplished by setting the milling machine slides against the true machined edges of the sleighs as these surfaces and edges had been used in setting the sleighs on the hardened table-fixtures in all preceding operations. The location of the slide in relation to the side of the sleigh left insufficient space for a cutter arbor through which the cutter could be driven, so it was necessary to use the back of the cutter tooth for a gear tooth and the machine was designed so the driving pinion meshed into the cutter.

OPERATION 46

Milling oil grooves in both bronze sleigh liners is shown in Fig. 42. One special machine was designed and made for this purpose. Average time cutting oil grooves in 280 sleighs was 3 hr., operating one side at a time. Best average time on 10 sleighs was 1¾ hr. Arsenal time on this operation, 4 hr. The cutter head which was made in the shape of a cam, contained a small planer tool set into an adjustable toolholder. The head was moved along the slide of the machine which held a continuous rack into which the cutter-head driving pinion engaged. An air drill was attached to a worm that engaged a wheel attached to the driving pinion and in that manner the cutter head was moved along the slide. The toolholder was kept in motion by the revolving cam.

Why Not Put More Information in the Catalog?

BY GEORGE G. LITTLE

Getting the required information out of a catalog is sometimes like attempting to guess how many beans there are in a jar.

Wanting to order some machine chains the other day we looked up the kind and price and found that the cut showed No. 0 full size. As we wanted a larger size it was pure guesswork whether it would be No. 00 or No. 1, for the information given as to which way the sizes ranged, was entirely lacking.

In a machine catalog cuts are often shown giving some idea of the various attachments designed for special purposes, the descriptive matter merely stating that the method of manufacturing and assembling the attachments insure their being true and that there is no reason why they should not continue to remain true while in service when properly cared for. This is all good, interesting and valuable information to the purchaser, but there are those who would appreciate further information pertaining to the particular kind of work the attachment is designed for and similar work to which it would be adaptable.

Of course, it is understood that there are many persons fully acquainted with the attachments; but even so, attachments for machines are in a class with the carpenter's square—about one carpenter in a thousand knows anywhere near all the possibilities of the graduations on the square, while there are those who, could they get more detailed information out of the catalog, would see much more easily the adaptability of the attachment to their own requirements.

As an illustration, in a bench lathe catalog there are attachments illustrated that spell the story well enough perhaps for the initiated. But to the average lathe man doing small fine work, and the boss, superintendent or manager who is looking for a machine or an attachment that is easily adaptable to shorten the time on the work he is doing, a few words explaining one or more methods of using would help.

A bench lathe can be made adaptable to faceplate pattern work up to quite a large size, by fitting an extension quill driver that is long enough to allow the quill rest to be clamped at the end of the lathe bed and using a faceplate quill, the toolrest being secure at the proper height above the bench by blocking up.

Forge Shop and Other Railroad Shop Tools

Tools and Methods in Use in a Western Railroad Shop—Special Equipment to Utilize Air—A Unique Tap—Modern Method of Cleaning Castings

BY FRANK A. STANLEY

THE illustrations herewith represent some of the tools and methods used in connection with the work of the blacksmith shop and other departments in a railroad shop.

The halftone engraving, Fig. 1, illustrates a set of forging-machine dies for forming the ends of brake hangers. These hangers are later bent up to various lengths of arm and with different shapes of side arm, but the process of forming the ends, as illustrated by Fig. 1, is the same in the different designs. The sketch, Fig. 2, shows a typical hanger with straight bend for the side arms.

The sequence of operations as performed in the forging-machine dies (Fig. 1) is indicated by the numerical characters. In position No. 1 the bar of stock is upset and the metal driven up for the round head; position No. 2 forms the head round and flats its sides smoothly and to the desired thickness; the next position No. 3, is the one in which the hole is pierced through the round ends. Then in a set of bending dies the straight bar is formed up to the U-shape shown in Fig. 2.

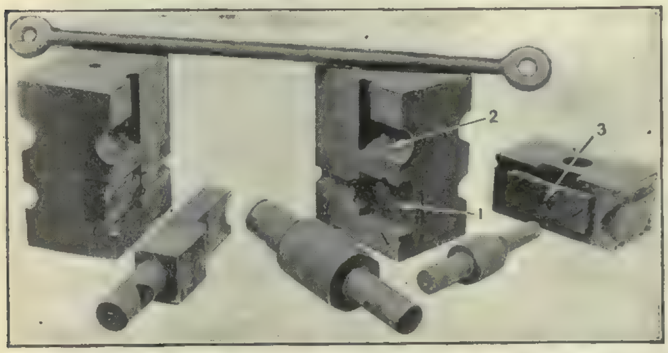


FIG. 1. DIE FOR FORMING ENDS OF BRAKE HANGERS

REINFORCING PLATE DIES

A set of bulldozer dies as used for forming up draft sill reinforcing plates for the construction of freight cars are shown in Fig. 3. These dies, which are of cast iron with straight forming edges from end to end, receive the flat plate and at one stroke form the channel-shaped member shown. A pile of the finished pieces is shown in the background.

The details in the drawing, Fig. 4, are of punch dies for holes $\frac{3}{4}$ in. square which are punched in tie plates.

The die block for this set of tools is shown at *A* and consists of a forged steel block finished 2 in. thick with a length of 7 in. and width of $5\frac{3}{4}$ in. This die block is seated in a holder or bolster *B* where it is secured by six setscrews, two placed at each side and one at each end. The center distance between die holes in the steel block *A* is 4 inches.

The dies are shown at *C*. These are finished $2\frac{1}{4}$ in. in diameter to fit the counterbored openings in the face of die block *A*. This counterbored seat is $\frac{15}{16}$ in. deep allowing the die face to project $\frac{3}{16}$ in. above the face of the block at the lower or inner side of the die, the opposite side of the die being cut angular to correspond to the angular surface under the tie plate. This is shown clearly in the detail section at *C*. The dies are locked in correct position in the block by a $\frac{7}{16}$-in. pin *D* which fits in a hole drilled in the block in such a position that half the diameter of the hole is formed in the edge of the dies themselves. There is therefore no possibility of the dies becoming improperly located in their holder.

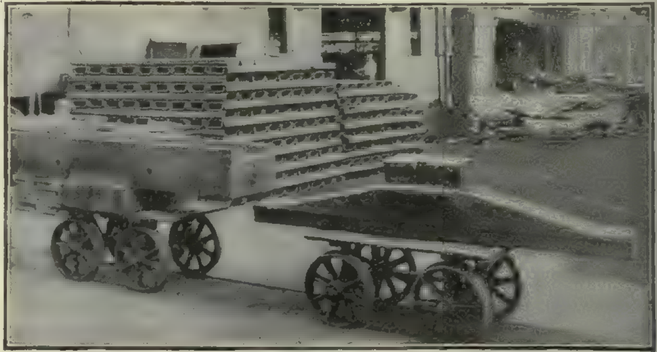


FIG. 3. DIES FOR DRAFT SILL REINFORCING PLATES

The punch holder, which is a steel forging, is shown at *E*. This holder is provided with rectangular seats at each side for the reception of the punches *F*, which are secured in position by clamps *G*. Each punch has an enlarged head, due to the offset for entering the punch holder openings and this head bears against a stop pin *H* which is fitted into the round hole *I* bored through the holder body.

In an earlier article reference was made to a convenient form of bolt rack for use in the forge shop and elsewhere where bolts are handled through various processes in large numbers. The view, Fig. 5, illustrates such a rack and shows its principle features clearly. As constructed here its frame consists of two flat sections of iron or steel bent edgewise to form uprights at the ends, the side members being connected

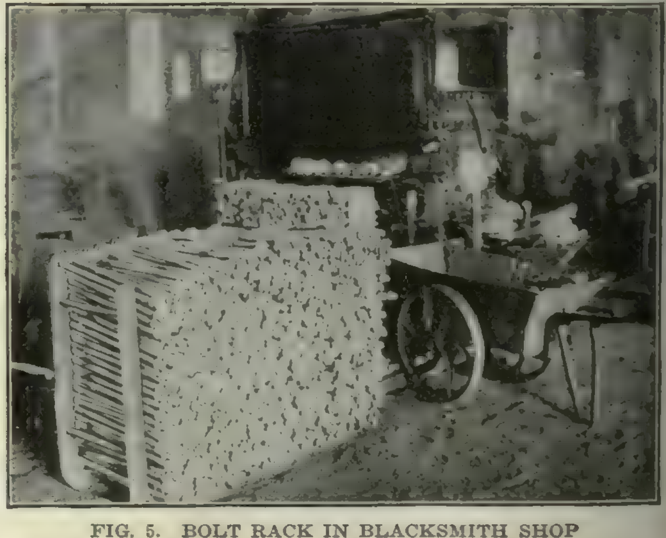


FIG. 5. BOLT RACK IN BLACKSMITH SHOP

by through bolts which pass through spacers made of pipe. With this construction, the rack can be made to any desired width of frame for different lengths of bolts simply by using holding bolts of necessary length.

FIXTURE FOR GRINDING-IN DRY PIPE

Some other appliances from other shop departments are illustrated in the engravings which follow herewith.

The halftone, Fig. 6, represents a convenient form of device for grinding-in the dry pipe in flue sheets. The method of setting up and operating will be apparent upon study of the illustration. The driving mechanism by which the work is operated back and forth in the grinding-in process consists of an air-motor mounted horizontally on a frame which is attached to the face of a steel plate bolted across the end of the boiler shell. Slots placed at different radii from the center allow the holding plate to be set at any position required to align the drive shaft closely enough with the work which is to be ground in.

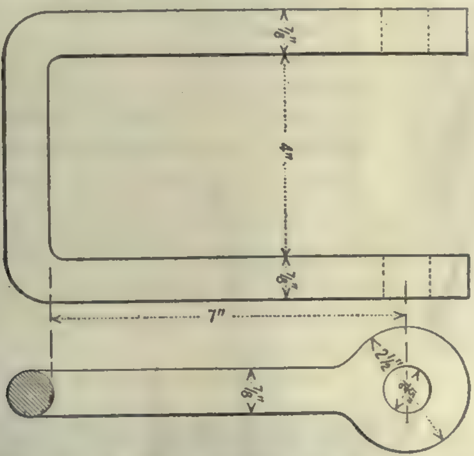


FIG. 2. BRAKE HANGER AFTER FORMING

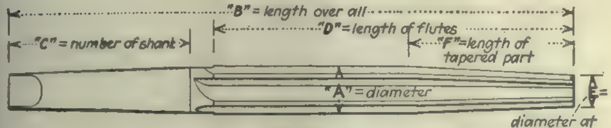


FIG. 7

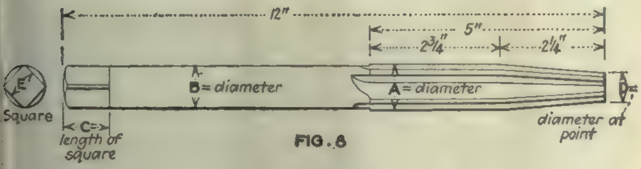


FIG. 8

Reamers for general work

A	B	C	D	E	F
1/4"	6 3/8"	Nº 1	3 3/16"	5/32"	1 1/2"
5/16"	6 3/4"	Nº 1	3 9/16"	3/16"	1 1/2"
3/8"	7 1/2"	Nº 1	4 1/16"	7/32"	2"
7/16"	8 1/4"	Nº 2	4 9/16"	1/4"	2"
1/2"	9"	Nº 2	5 1/4"	5/16"	2 1/2"
9/16"	9"	Nº 2	5 1/4"	3/8"	2 1/2"
5/8"	10"	Nº 2	6 1/4"	3/8"	2 1/2"
11/16"	11"	Nº 3	6 5/8"	3/8"	3 1/2"
3/4"	12"	Nº 3	7 5/8"	7/16"	3 1/2"
13/16"	12"	Nº 3	7 5/8"	1/2"	3 1/2"
7/8"	12"	Nº 3	7 5/8"	9/16"	3 1/2"
15/16"	12"	Nº 3	7 5/8"	5/8"	3 1/2"
1"	12"	Nº 3	7 5/8"	11/16"	3 1/2"
1 1/16"	12"	Nº 3	7 5/8"	3/4"	3 1/2"
1 1/8"	12"	Nº 3	7 5/8"	13/16"	3 1/2"
1 3/16"	12"	Nº 3	7 5/8"	7/8"	3 1/2"

Table for Fig. 7

Reamers for mud ring rivets

A	B	C	D	E
11/16"	21/32"	3/4"	3/8"	1/2"
3/4"	23/32"	13/16"	7/16"	9/16"
13/16"	25/32"	13/16"	1/2"	19/32"
7/8"	27/32"	7/8"	9/16"	5/8"
15/16"	29/32"	15/16"	5/8"	11/16"
1"	31/32"	1"	11/16"	3/4"
1 1/16"	1 1/32"	1"	3/4"	27/32"

Table for Fig. 8

FIG. 7. REAMER FOR GENERAL WORK. FIG. 8. REAMER FOR MUD-RING RIVETS

The chuck or gripping head of the device for attaching to the pipe carries three setscrews which are adjusted outwardly from the center to force their pointed outer surfaces into the shell of the pipe and thus cause the pipe to be worked back and forth with the oscillation of the drive spindle. This spindle is connected with the chuck by a form of universal joint to provide the desired degree of flexibility in the operating mechanism. The outer portion of the spindle which passes through and is housed in the main carrying plate for the motor, is fitted with a slotted arm which is actuated to and fro by an eccentric and rod as indicated. The position of the connecting stud for the eccentric rod in the slotted arm determines the throw or stroke of the main shaft for oscillating the dry pipe.

The air hose leading up from the shop supply line to the pneumatic device on the boiler is seen at the right in the photograph.

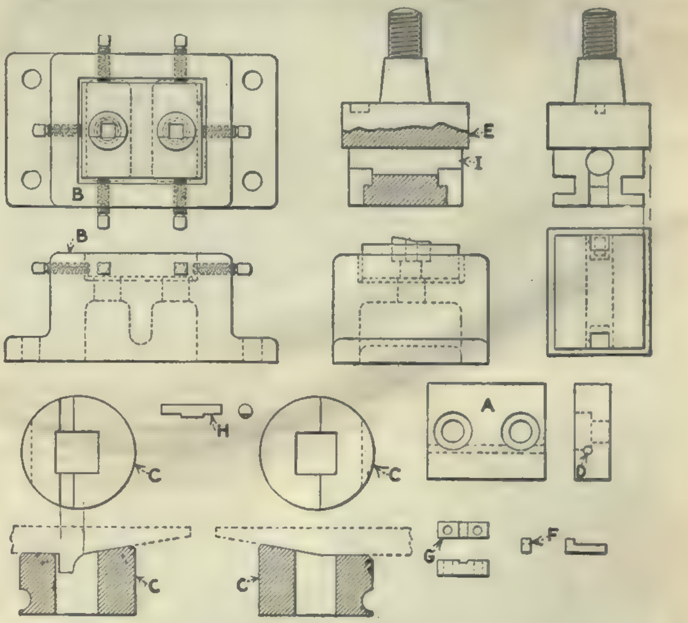
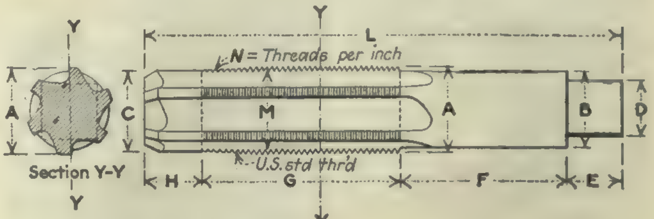


FIG. 4. ¾-IN. PUNCH DIES AND BLOCKS



A	N	L	B	C	D	E	F	G	H	M
2"	8	17"	1 3/4"	1.783	1 1/4"	1 1/4"	6 3/4"	7"	2"	1.837
2 1/4"	8	17"	2"	2.033	1 7/16"	1 7/16"	6 9/16"	7"	2"	2.087
2 3/8"	8	17"	2 1/8"	2.158	1 9/16"	1 9/16"	6 7/16"	7"	2"	2.212
2 1/2"	8	17"	2 1/4"	2.283	1 5/8"	1 5/8"	6 3/8"	7"	2"	2.337
2 1/2"	10	17"	2 1/4"	2.327	1 5/8"	1 5/8"	6 3/8"	7"	2"	2.36
2 1/2"	4	17"	2"	2.067	1 7/16"	1 7/16"	6 9/16"	7"	2"	2.176
3"	8	17"	2 3/4"	2.783	2"	2"	6"	7"	2"	2.837
3 7/16"	8	17"	3 3/16"	3.221	2 1/4"	2 1/4"	5 3/4"	7"	2"	3.27
3 11/16"	8	17"	3 7/16"	3.471	2 7/16"	2 7/16"	5 9/16"	7"	2"	3.525
3 3/4"	8	17"	3 1/2"	3.533	2 1/2"	2 1/2"	5 1/2"	7"	2"	3.587

FIG. 9. MACHINE TAPS FOR BOLT SHOP

The drawings, Figs. 7 and 8, illustrate two styles of reamers, one for general shop work, the other for mud-ring rivets. Both are made with long tapered portions leading the straight size of the body. The tables accompanying the drawings give dimensions for all sizes from 1/4-in. to 1 3/16-in. reamers and for the mud-ring tools from 11/16-in. to 1 1/16-in. reamers. The reamers for general work are shown as made up with tapered shanks for power operation, while the mud-ring reamers are for hand operation.

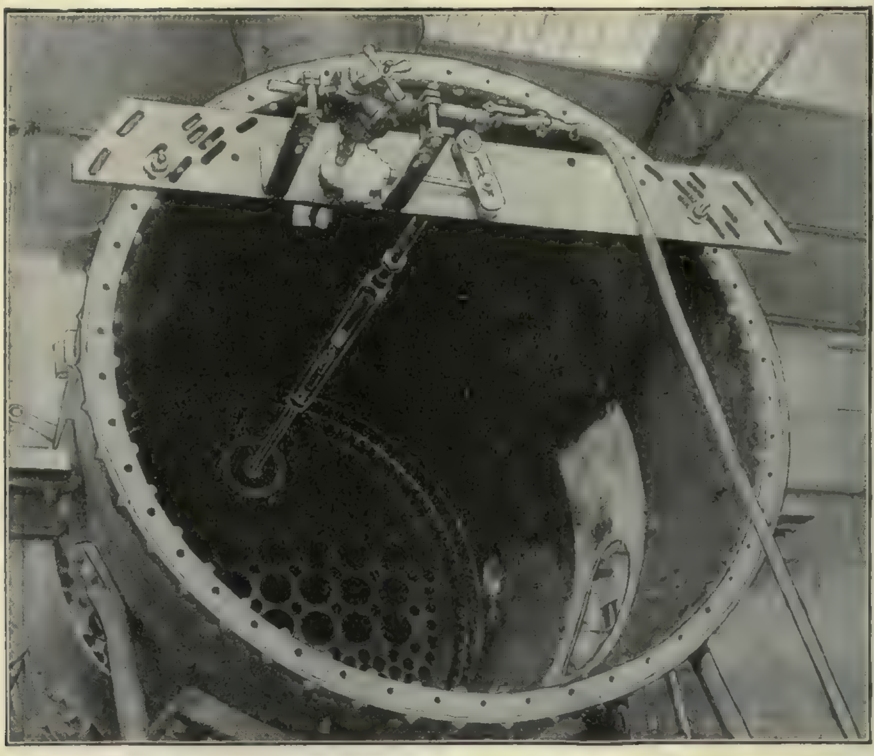


FIG. 6. APPARATUS FOR GRINDING-IN DRY PIPES

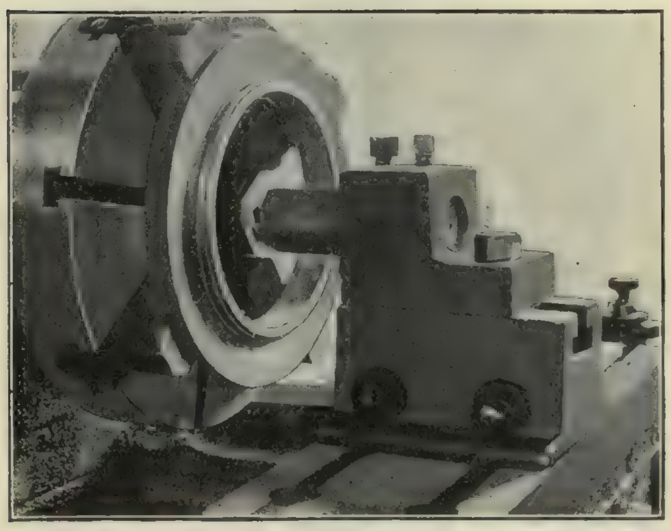


FIG. 10. A FLANGE THREADING TOOL.

In Fig. 9 a similar layout is reproduced for machine taps for use in the bolt shop. The range of sizes shown is from 2- to 3¾-in. taps. All taps are six fluted and each tap has a reaming diameter 2 in. long preceding the threaded portion.

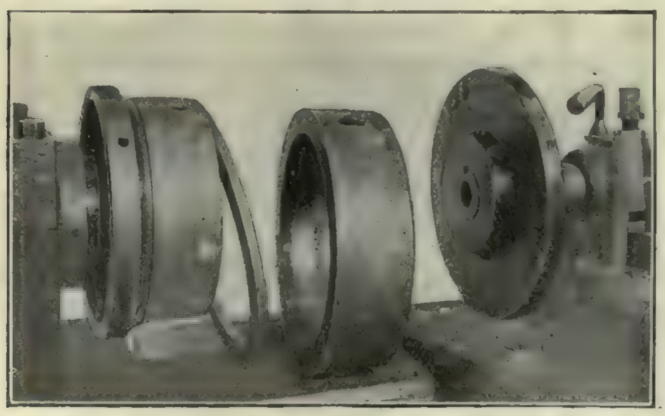


FIG. 11. VALVE-CAGE OR CHAMBER BUSHING MANDREL

The halftone, Fig. 10, illustrates a method of threading large pipe flanges in the turret lathe. For this purpose a tap is used as a chaser, the tap being secured in a special holder on the carriage of the machine. One land of the tap is of course set on the center line of the work and each land eventually becomes a cutting edge as the others become worn.

The tools in Fig. 11 constitute a mandrel for turning cages or bushings for piston valves.

The tailstock carries a coned disk to fit the tapered end of the bore in the cage, and the headstock of the lathe is fitted with a head which is also slightly tapered to correspond to the tapered interior of the cage end. At the back end of the mandrel head there is a threaded portion as indicated, upon which a ring is mounted which acts as a nut and can be operated by means of a pin wrench.

The thin ring shown resting against the front end of the chuck serves as a backing off or spacing ring which is placed on the mandrel before the work is put into place. This spacing ring prevents the mandrel from being crowded too tightly into the work and when the ring nut is turned it acts against the thin spacing ring to force the work from the mandrel.

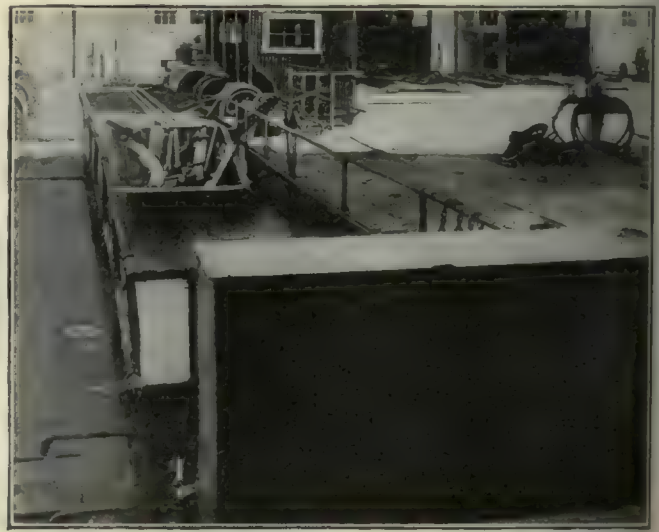


FIG. 12. CAR AND SODA PIT FOR CLEANING CASTINGS

The large ring at the front in the photograph is used as an adaptor for carrying a larger size of valve bushing.

The final illustration in this article, Fig. 12, shows a soda cleaning pit used for cleansing all sorts of parts from engines and cars. These are placed in the special car shown which is then run down into the hot cleaning fluid where grease and dirt are removed from the work.

The tank is protected from all sides by heavy guard rails, as illustrated.

The methods and devices shown in this article are from the practice of the Southern Pacific Shops at Sacramento.

Ideas From Practical Men

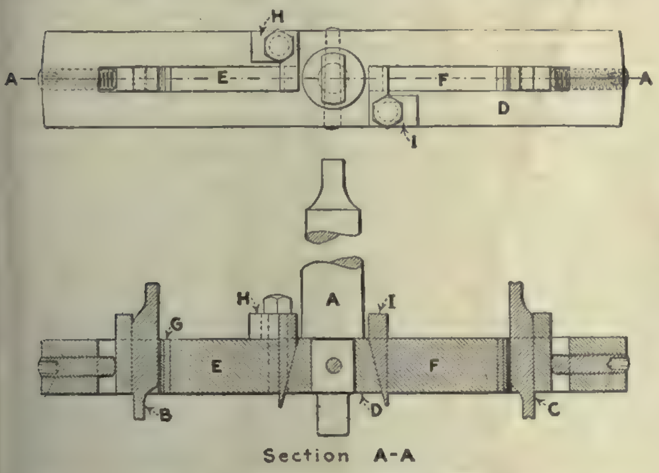
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

An Adjustable Trepanning Tool

By George H. Barker

Having a large variety of different size holes to cut in armor plate, I designed and made the adjustable trepanning tool shown in the accompanying illustration.

The shank A was made from high-grade machine steel and case-hardened, a No. 4 Morse taper being used.



AN ADJUSTABLE TREPANNING TOOL AND ITS DETAILS

The tools *B* and *C* are of half-inch square self hardening high-speed steel. It will be noted that tool *C* presents a grooved cutting surface, while tool *B* has square ends.

The cutter bar *D* is fastened to the shank by a substantial taper pin and has slots ½ in. wide and 4¼ in. long in each end. The ends are left solid for ½ in. headless setscrews. Various lengths of blocks *E* and *F*, supplemented by small spacing strips *G*, give the main adjustments for various diameters. Fine adjustments are secured by the taper wedges *H* and *I* which are actuated by the screws shown.

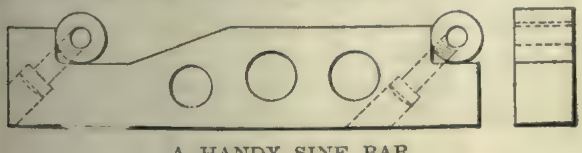
With this tool it was easy to cut any size hole desired from 3 to 10 in. in diameter.

A Handy Sine Bar

By Clarence B. Coe

Many toolmakers and machinists do not realize the value of a good sine bar for measuring tapers or angles on flat work, and in some cases on cylindrical work.

In the case of a taper wedge, where the dimensions given are the length and the size of the large and small ends, subtract the dimension of the small end from the large end, divide this by the length, and multiply by the distance between the rolls of the bar. The sine bar is used in the same way as a parallel but with one roll raised the above amount by the use of size blocks. This method will be found much quicker than to "cut and try" until the desired dimensions are secured.



A HANDY SINE BAR

If the taper is given in degrees, a table of the sines of angles will be necessary. All mechanical books have these tables. Find the sine of the given angle and multiply by the distance between the rolls on the sine bar.

The sine bar shown combines several features which will appeal to the man who uses one. It is neat in appearance, compact, easy to set up, and can be easily repaired if it should become inaccurate. The tendency to tip sideways, which is a fault common to others, is overcome by the rolls being directly under the center of the bar.

Most bars require the use of two sets of size blocks for setting, while this one needs but one set as one roll rests on the surface from which it is located.

The holes in the bar are to reduce the weight and for convenience in clamping the tool to an angle iron or other surface. These bars can be made any size, depending upon the nature of the work to be done. The writer finds that a bar with rolls 4 in. apart is the most convenient for the average work.

Turning Irregular Forms

By J. Davies

Recently we had a considerable number of punches to be made to the form shown in Fig. 1. These were to be used for punching chain links. At the first attempt we rough-turned one leaving enough stock on to get the shape; then marked off the profile on the end, milled as near as we could to the lines and filed the rest. This process was altogether too slow, so we did a little experimenting on the lathe with entirely satisfactory results.

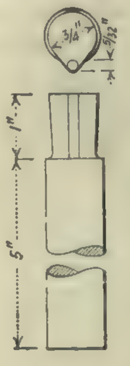


FIG. 1

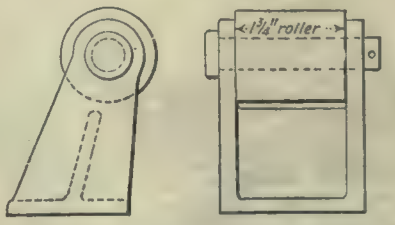


FIG. 2

FIG. 1. THE PUNCH TO BE MADE. FIG. 2. THE ROLLER AND BRACKET

Now I don't pretend to know the exact theoretical method of developing cams, but I will give an account of our experiments and I think it will be agreed that we did the job properly.

First we dug out a casting from the scrap heap and

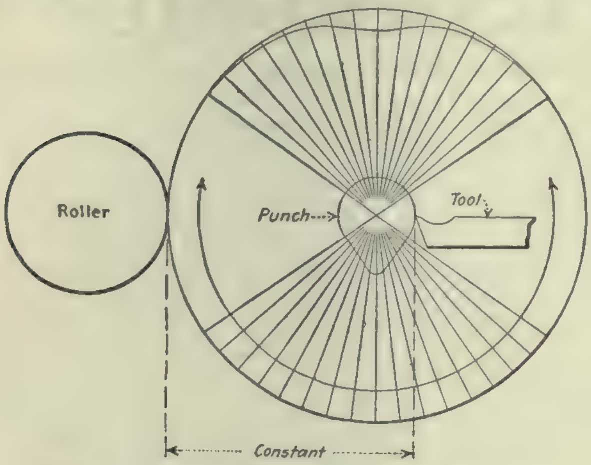


FIG. 3. METHOD OF LAYING OUT THE CAM

machined it to dimensions given in Fig. 2. Turned a roller to suit and then fitted the bracket on the back of the cross-slide so that the center of the roller was the exact height of the center of the lathe. Next we bored out a piece of cast steel 4 in. in diameter and 1¼ in. wide a close push fit for the body of the punches to be turned. This piece of steel was to be used for a cam, and could have been any convenient diameter but it was thought the larger the diameter the easier the action, as the amount of throw remained constant irrespective of the size of the cam.

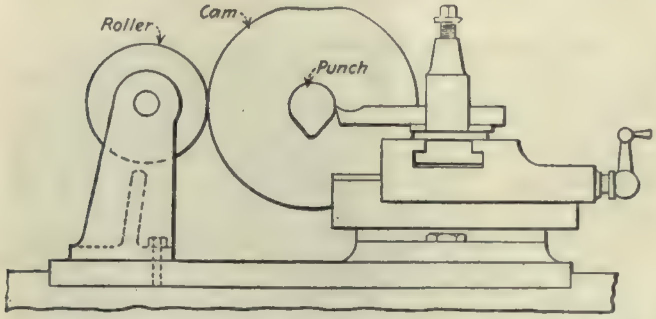


FIG. 4. ARRANGEMENT OF CAM, WORK AND ROLLER

The next operation was to lay out the cam to produce the desired shape. This was done as shown in Fig. 3. The basic method used for laying out the cam was adopted, because as the roller was constantly pressed against the cam, and the bracket carrying the roller and the toolpost carrying the tool were both attached to the same slide, the distance between the tool and the roller would always be the same when measured in a straight line through the center of roller and the center of cam to the cutting edge of the tool. I said this distance was constant. I mean it was constant during the same cut. The feeding for depth of cut was done by using the compound rest. This shortened the distance at every cut and produced a different shape on the punch. So it remained for us to develop our cam to produce the right shape at the right size. This we did by marking off the cam as shown in the sketch, taking the distance from roller to tool as a constant when the tool was on the finishing cut and marking off a number of lines through the center of work and cam to the cutting edge of the tool. The number of lines is immaterial. The more lines the more points in the curve and consequently greater accuracy.

Next we took out the crossfeed screw and inserted a strong spiral spring in its place at the back of the slide to keep the roller up to its work. The cam was fastened to the punch being turned by a ½-in. Bristo safety screw sunk below the surface, leaving enough stock sticking out through the end of the cam to form the punch. This gave us an entirely satisfactory job, the punches being finished perfectly to form and size. The arrangement is shown in Fig. 4. I venture to say that by this method any kind of irregular form can be accurately turned nearly as quickly as an ordinary round bar. This rig would be too expensive to produce a single piece but for repetition work I think it will prove very useful. We took the precaution to put taper dowel pins in the bracket at the back so that the whole attachment would be replaced on the lathe in about five minutes.

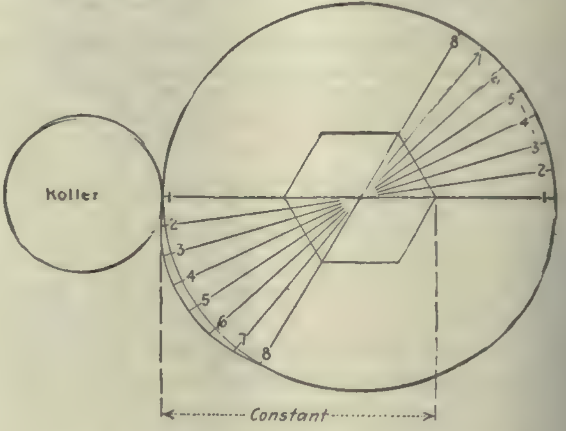


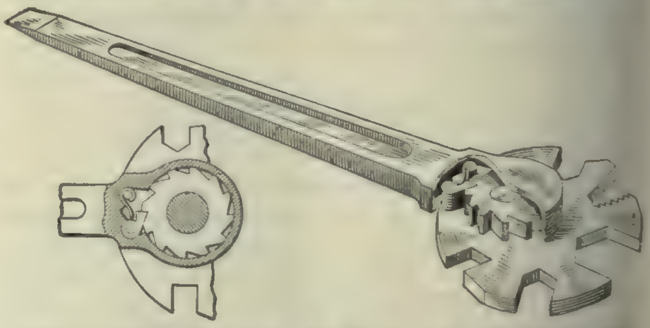
FIG. 5. CAM FOR TURNING A HEXAGON

We have not yet tried to turn a hexagon but I believe it could be done and in Fig. 5 I have shown a sketch of the cam required.

Combination Ratchet Wrench and Screwdriver

By C. F. George

The illustration shows a handy little tool that I have devised for working around automobiles, bicycles, etc., where there are many small nuts in places inconvenient to get at with the ordinary form of wrench. Openings in the disk may be provided for various sizes of nuts as required.



COMBINATION RATCHET WRENCH AND SCREWDRIVER

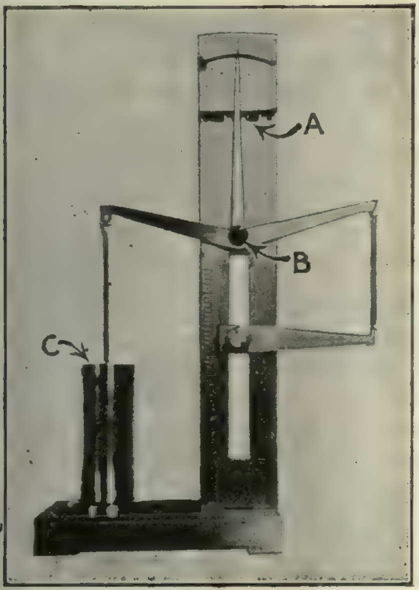
With the disk turned so that the smooth portion is uppermost, it makes a convenient handle for the screwdriver.

An Efficient Spring Tension Tester

By G. E. Bullock

The accompanying photograph is that of a spring tension testing device which was developed in our plant for our own use, and which we feel is quite superior to anything for the purpose that we have seen yet. The device consists of a vertical standard on a substantial base, and a pointer which is made with an arm projecting on either side. The pointer is fastened to the column at *B*, the pin which holds it running through an agate bearing so as to render the device as sensitive as possible. The standard is constructed with a T-slot at *A* to accommodate adjustable pointer stops which give and maintain a positive inspection limit. The stops are adjusted to the limits allowed on the various springs.

The arm which is shown holding the lower end of the spring is adjustable vertically to accommodate the different sizes of springs. The upper end of the spring is attached to one arm, while to the other a weight is suspended as shown at *C*. The proper location for the arm and the exact size of the weight have been calculated for each size of spring, so that if the tension of the spring is perfect, the pointer will rest at center as shown. If the pointer rests against either of the stops, the tension is not within the specified limits and the spring is rejected.



A SPRING TENSION TESTING DEVICE

Master springs are not necessary as the weights interpret the condition of each spring, thus enabling the standards to be maintained.

Grinding Flats on Cylindrical Work

By Albert L. Eddy

We had a quantity of pieces to make, similar to the ones shown in Fig. 1. The two flats at *A* and *B* were ground on a rotary surface grinding machine which, together with the holding fixture is shown in Fig. 2.

The fixture has taper holes in the periphery to hold the shanks of the pieces and is provided with a pilot for locating it on the magnetic chuck of the machine. The pieces were seated in the fixture by tapping lightly with a hammer, no screws or clamps for holding them being necessary. After the flats on one side of the work were ground, the fixture was turned over for grinding those on the opposite side.

The accuracy of the work was checked up by the dial indicator shown at the left in Fig. 2. With 0.093 in. of stock to be removed the production was 150 per hour.

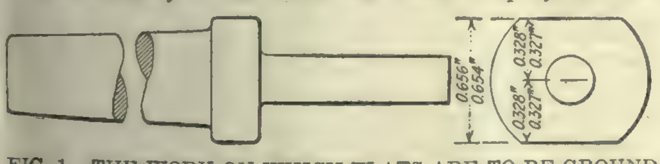


FIG. 1. THE WORK ON WHICH FLATS ARE TO BE GROUND

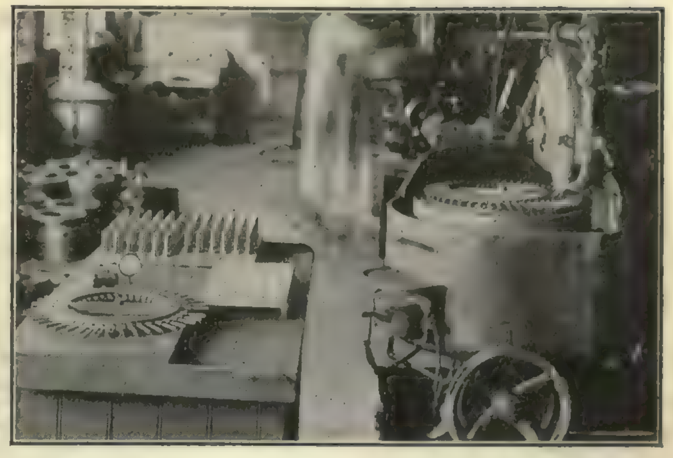


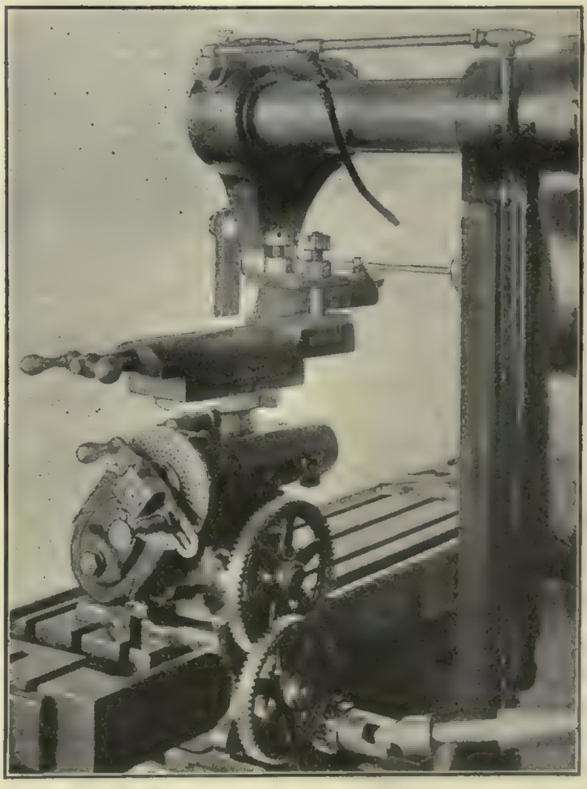
FIG. 2. MACHINE AND FIXTURE FOR GRINDING THE FLATS

Radius Turning on a Milling Machine

By H. W. Boulton

Herewith is an illustration of a radius-turning set-up on a Milwaukee milling machine which I think may be of interest to the readers of the *American Machinist*.

The work to be machined was a rod 0.4 in. in diameter, 12½ in. long, in the center of which a radius of 9⅞ in. was to be turned to a depth of 0.053 in. The dividing head of the machine was fitted with an adapter to which the compound rest of a lathe was attached. The feed was obtained through gears driven by the telescopic shafts as shown. The work was held in a draw-in chuck and supported by a center backed up with a spiral spring.



SET UP FOR RADIUS TURNING ON A MILLING MACHINE

IN THIS ISSUE

WE ARE trying very hard to get to you the many good things that we have gotten together. Our magazine isn't small but when we get right down to getting the articles in we feel somewhat limited in space. Something quite frequently has to be held over for a later issue. This week it is "Tool Engineering." We were all set with the nineteenth of the series, a seven-and-a-half page article dealing with the design of broaching and broaching fixtures, but found it necessary to postpone it until next week. Even then we shall be able to publish only half in one issue. It will be concluded the following week.

Among the good things that we did get in this week is the leading article, "Making an Optical Flat," by R. W. Porter of the Jones & Lamson Machine Company. In the fall of 1920 we published articles explaining the use of optical flats. Their use is becoming more general so that the present article which explains the making of the flats is not out of place.

On page 332 is the second of Prof. McCabe's articles on the economics of production. This week he takes up changes in demand.

We complete Chubb's series on machining the Wrigley automobile transmission gear with this week's article which begins on page 333. The sub-operations considered are those on machining the gear frame and axle parts, assembling a gear frame and the checking up of the various parts.

E. W. Leach has now reached a most interesting point in his advice on the organization and management of the small shop, namely, financing the company. How to get the money to organize and carry on his business may not be the first thing that a prospective small business man thinks about, but it is not very far from it. If he cannot interest capital he may as well forget about his project. Hard as it is to get capital he must be careful in his selection of the men who will supply the money for his business. "I am sorry," says Mr. Leach, "that it is not possible for you to know me personally so that you could not fail to appreciate the sincerity with which I advise you to exercise every possible caution and discretion in seeking the capital for your business." And, "capital is a peculiar commodity, earned only through hard work and parted with only under pressure or under promise of multiplication through investment. It possesses real potential energy, the power to do things; but it is possible of strange manipulations, and can easily be the basis of misunderstandings which can seriously interfere with the progress of a business organization." This extremely interesting and very true article begins on page 338.

Coming Features

"Tools for Manufacturing a Musical Instrument" will be one of the complete articles next week. An ordinary mouth harp doesn't look like a difficult manufacturing proposition yet there are some surprising problems provided in its make-up.

We have not exhausted the supply of automotive articles that Colvin has been working up, but lack of space has made it necessary to advance their publication dates. Machining the Peerless Crankcase will be run next week.

The first two articles of McCabe's "Economics of Production" have given a good indication of the nature and value of this economics series. The third article, with the sub-title "Cost and Price of Production," is scheduled for the next issue.

The conclusion of the first motor service article (on cylinder grinding) will appear, and there will be other complete articles.

We hope to get in the last of Sheldon's magnetic chuck series which has been postponed from week to week for a long time.

Then there will be the fourteenth article on metal cutting tools and the nineteenth on tool engineering.

The preparation of our series on motor service work is progressing, but we are not so far ahead with it that we feel protected against interruption if we should start publication. It will come along in several weeks and in the meantime we are supplying some extremely valuable articles along the same lines. This week, beginning on page 342, there is the first part of "Cylinder Grinding in Motor Repair Shops." This article will be concluded next week. In the second issue after that there will be an article on piston work in motor repairing. It will be followed by two or three articles on motor service stations, and they will be followed by the motor service articles proper.

Another series is finished this week, namely, "Incentive or Production Basis of Wage Payment," by Henry H. Farquhar. The current article begins on page 344. The series has been short, the articles have been right to the point, and many good things have been said. On the whole, it leaves a good taste. This week's article takes up the assignment and recording of production, co-operation with the workman, fitting the system to conditions, securing the co-operation of executives, and methods of reward.

The fourth of the articles by Col. Jenks and M. H. Christopherson relative to manufacturing with special machines vs. standard equipment, page 349, describes portable devices for plain and thread milling, an angular drilling fixture and a special machine for milling sinuous oil grooves.

A short railroad article by Stanley, page 354, takes up forge shop and other railroad shop tools. The tools and methods described are in use in a western railroad shop. They include special equipment to utilize air, a modern method of cleaning castings and some unusual fixtures. The apparatus for gringing-in dry pipes is of particular interest.

EDITORIALS

Abuse of Free Service

SOMEBODY has to pay for what is commonly called "Free Service." Nothing is free that is in the least worth having in this world we live in, but it is very hard to convince some people of this important fact. It seems to be human nature to try to get something for nothing. Some few may succeed in so doing but it is always at the expense of somebody else and in the long run everybody pays in one way or another.

The machine tool business is no exception to the general rule. There will always be some incompetent or unscrupulous purchasers who will play upon the manufacturer's fear of his competitors to exact free service from his field men in cases where the purchaser himself is solely at fault. It is comparatively easy for a man who knows the game to put the manufacturer in a position where it takes considerable backbone to do the right thing.

The motor truck industry has faced a very similar problem in the question of free demonstrations. At one time it was possible by playing the various agents against each other to secure an amount of free hauling that came to a sizable figure in the aggregate. A flat daily charge in proportion to the capacity of the truck, which was credited if the prospect placed his order, had the desired effect.

Charges for repair and adjustment service are made by the typewriter companies and paid without question by the typewriter users. Why should machine tool service be treated any differently?

Service in the passenger car field has also been referred to by men seeking machine tool service of the free variety. As a matter of fact, it seldom consisted of more than the replacement of defective parts, the customer having to stand the labor charge for tearing down and reassembling. Any other service has been charged to the car owner at regular rates.

The trouble in the machine tool field is largely due to purchasers who do not employ first-class mechanics to look after their equipment. Complicated tools are bound to suffer from the maltreatment of incompetent operators. Immediately there is a call on the builder to send a service man to correct the trouble and there is always strenuous objection to paying for the work.

What is the result? To protect himself the builder must add enough to his selling price to cover the cost of unnecessary free service. The buyer who doesn't use it pays for it just the same and thus helps to keep his competitor going. Efficiency is penalized.

If the other fellow were unable to get away with his demands for free service there would be no excuse for the inclusion of such an overhead charge in the price of the machine tool and competition would soon squeeze this water out of the selling price sponge.

The engineers' committee on the elimination of waste could well spend some time in investigating the amount lost to the community by this much-abused practice. We can ill afford to waste time, money and technical skill in bolstering up the weak brethren in our commercial struggle, particularly where their weakness is caused by unfair demands upon others who are not strong enough to resist them.

Machine tool service should be charged and paid for just as any other service is charged and paid for. When it is, it will be possible to reduce the cost of machine tools by the amount of overhead occasioned by the service charge, and both builder and seller will benefit.

The Cost of Handling Material

NO MATTER how many other problems present themselves at this time, we must never lose sight of the fact that the problem of economical production is always with us. And it is bound to be with us more and more as the days go by. For the huge war debts which we all must pay mean that we must be able to make our purchasing dollars go further than ever.

Economical production must be more than a by-word, it must be a reality. There are few shops where production costs cannot be decreased in various ways, and this without decreasing wages materially, if at all. For it is not what a man gets per day but what he produces for a dollar, which tells the story. It is not nearly so important to reduce the total wage as to make each wage dollar mean more in finished product.

There are many lines which can be studied to advantage in reducing production costs. One which is frequently overlooked is that of shop transport of materials. This begins with the delivery of the raw material and ends only when the finished machine has been delivered to the railroad.

This question of transportation includes overhead traveling cranes of various spans and hoisting capacity, jib and wall cranes, post cranes, air, electric and hand hoists, electric shop trucks, hand trucks, portable platforms and tote boxes.

It will pay to study them all carefully. Have we cranes enough to cover the length of the shop without undue loss of time? Are the cranes delaying workmen and holding expensive machines idle? Are we using our 10-ton crane where the electric shop truck should be used—or vice versa? Do we handle work too often and take too much time? Are there enough jib or post cranes to supplement the traveling cranes?

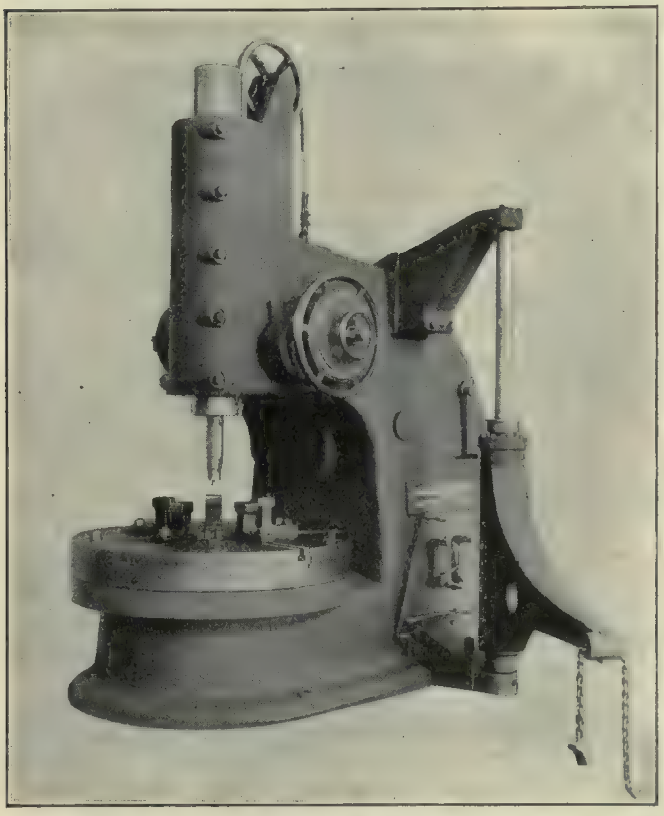
These are but a few of the questions to be asked. But before we have gone far we will see that not only the problems of cranes and transport, but the problems of routing are involved as well. There are few shops where the routing cannot be changed to eliminate considerable lost motion.

If the shop is of the multi-storied type, the question becomes more difficult and here the elevators play a most important part. Study them carefully, in connection with the method of carrying the material from floor to floor, and many economies can be effected. Make the elevators large enough and powerful enough to carry shop motor trucks and efficient loads. Better shop transport presents means of securing more economical production.

Shop Equipment News

Betts Car Wheel Boring Machine

The 52-in. car wheel boring machine illustrated is the latest addition to the line of heavy railroad tools manufactured by the Betts Machine Co., Rochester, N. Y. It was designed and constructed as a rapid production machine to cover the range of requirements of both car building and railroad repair shop work. Great care was taken to insure proper and adequate lubrication for all revolving parts.



BETTS CAR WHEEL BORING MACHINE

The bed and frame were made in one casting to secure rigidity. The table is proportionately heavy, revolves on a wide bearing and has a large spindle running in bronze bushed bearings. The spindle is provided with a locking collar on the lower end.

The boring ram is of large diameter and has a long bearing in the frame. It has hand adjustment, which is facilitated by a counterweight. When desired, the machine can be equipped with a facing ram, so constructed that the facing head is supported close to the cut to enable very heavy cuts to be taken. It can be slid back out of the way when chucking wheels.

The table is equipped with a five-jaw combination chuck that is built into the table. It can be readily adjusted for wheels of any size. Five operating stations are provided for convenience.

Six boring and facing feeds are obtained by means of a two-step cone and hardened sliding gears so arranged that change from roughing to finishing speed can be made instantly.

Ease of control is one of the features of the machine. All levers are within easy reach of the operator. The long lever shown at the right of the table is used for operating the friction clutch and brake for starting and stopping. The two short levers shown at the right of the long lever are for obtaining the speed changes. No two sets of gears can be in mesh at the same time..

The machine drive may be through single pulley or by direct connected motor, either constant or variable speed.

The regular equipment includes a quick acting air operated crane for handling wheels. The crane can be furnished to be operated by individual motor or by belt.

Velco No. 4 High-Speed Broaching Machine

The Velco Manufacturing Co., Inc., of Greenfield, Mass., has recently placed on the market the heavy-duty broaching machine shown in the accompanying illustration. The machine is said to be very rapid in operation, making the cutting stroke at a speed of 15 ft. per min. and the return at 55 ft per min. The manufacturer claims not only a gain in production, but that the work produced is superior to that done at a slower speed.

The broach holder is attached to a solid steel head, supported by bronze gibbed bearings sliding on steel ways. The driving rack meshes with a hardened steel pinion cut from the solid on a heavy shaft having long bearings at either side of the pinion, stub teeth being used. The broach is attached to the rack so that the pull comes directly on the rack pitch line. All vertical adjustments are made at the face plate. The teeth of the rack are on the under side and the sides of the rack are guarded, protecting the operator from injury. All moving parts except the rack are completely inclosed. The rack is supported and held in proper mesh with the driving pinion by means of rollers placed on the sides of the pinion and by guide bars fastened to the sides of the rack.

The pinion shaft is driven by a phosphor-bronze worm wheel and a hardened steel worm, running in oil. The worm shaft is provided with ball thrust and radial bearings, and all other important bearings are bronze bushed and ring oiled. The rapid return is accomplished by an internal gear cut on the worm wheel and driving the return gear shaft. The return motion is applied through the driving pinion and there are no high speed gears, the fastest gear speed used being a surface speed of 60 ft. per minute. The clutch is not operated during the cutting stroke, and acts as a positive coupling. There are no friction clutches employed.

In operation, the belt is first shifted to the loose pulley, thus relieving the load from the clutches, when a further movement of the shifting lever applies a friction brake to the driving pulley and withdraws the positive clutch. A still further movement of the same lever engages the reverse clutch, and then shifts the driving belt onto the tight pulley, thus reversing the machine.

The automatic stops are quickly adjustable and positive in action, non-removable emergency stops being

VELCO NO. 4 BROACHING MACHINE

provided to protect the mechanism. Centralized control is provided, a single lever regulating every motion of the machine. The direction in which the operating lever is moved indicates the direction in which the rack will travel. No countershaft is provided and the machine has one speed only, as it is designed to deliver its maximum effort at the high speed. The manufacturers contend that there is no necessity for operating the broaches at a slower speed, and that speed changes in machines of this type are usually provided to increase leverage, rather than to provide an efficient cutting speed for the broach.

The bed of the machine is of box section, strongly reinforced. It is supported at the front and back by cabinet bases, the front cabinet forming a storage space for the smaller equipment. All adjustments are simple, it is said, and the entire mechanism is easily accessible. Cooling fluid is supplied by a gear-driven pump of large capacity, and a pan telescoping into the bed catches the chips and returns the fluid to the reservoir.

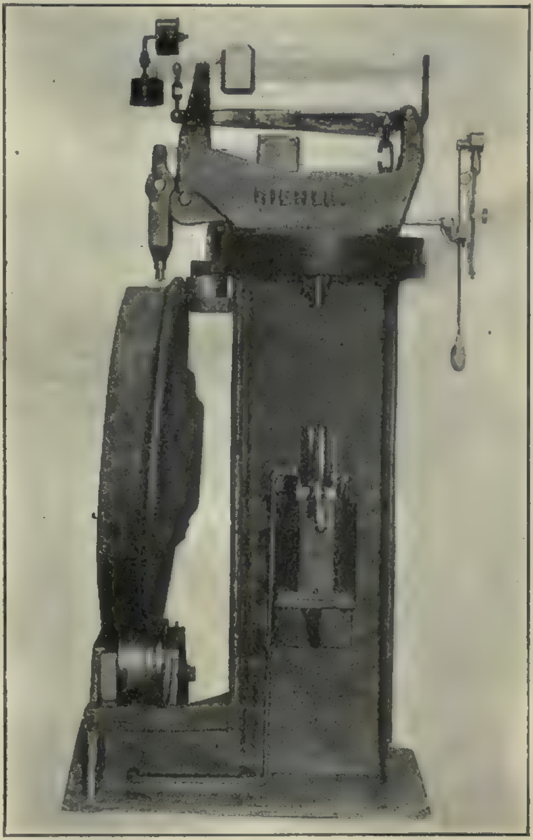
The maximum pulling effort requires 15 hp., although all ordinary broaching operations may be handled with a 10-hp. motor. The machine is furnished with either belt or motor drive, there being no change in construction necessary for either style.

Riehle Combination Brinell and Scleroscope Hardness Testing Machine

The accompanying illustration is that of a combinaion Brinell and scleroscope hardness-testing machine vhich has been developed by the Riehlé Bros. Testing Iachine Co., Philadelphia, Pa., for testing the hardness f chilled car wheels. The machine was designed prinarily to assist the Association of Manufacturers of 'hilled Car Wheels in making a study of the hardness f chilled wheels as compared to their wearing and reaking qualities. Incidentally the value of the hardess test as an indication of the general serviceability f the chilled iron wheel will also be determined.

The machine makes it possible to employ both the rinell and scleroscope methods on the same spot. The ıethod of registering the Brinell load is the Riehlé lever nd beam system. At the rear of the machine is the hore scleroscope. The scleroscope and Brinell weighıg systems are both carried by the same housing, which bolted to a turn table so that the whole upper part the machine can be revolved with the Brinell ball and leroscope dart in the circumference of the same circle.

To test a wheel, the turn table is revolved 90 deg. om the position shown and a car wheel rolled into place resting on the two ground rollers. An inclined track makes it possible to push a wheel into place. The turn table is now revolved until the scleroscope comes over the wheel. When the center position is reached the turn table locks automatically. The scleroscope is now lowered and a test is made. Then the turn table is revolved 180 deg., which brings the ball into position for the Brinell test. The rollers supporting the wheel rest on a hydraulic plunger and a few strokes of the hand pump shown raise the wheel against the ball. When the wheel touches the ball an initial reading of the depth indicating device is taken. A few more strokes of the hand pump put on the full Brinell pressure, which is indicated by the beam rising in the gate. A by-pass valve is opened, the wheel lowers slightly, a stroke or two of the hand pump again puts the wheel in contact with the ball and another reading of the depth device is taken. The difference between this and the first reading gives the actual depth of impression.



RIEHLÉ COMBINATION BRINELL AND SCLERESCOPE HARDNESS TESTING MACHINE

The by-pass is again opened, the wheel is lowered and is then turned into a new position. This is repeated as many times as it is desired to make tests around the wheel.

The depth indicating device, for measuring the Brinell impression, is entirely new in design and rests in the Brinell head directly over the ball. There are three specially shaped fingers, two of which rest on the tread of the wheel while the third finger rests on the ball. By this method the relative motion of the wheel and the ball is registered without any intervening mechanism which might tend to introduce errors. By eliminating these, extremely accurate depth readings are easily obtained. Such a combination as this makes possible the more extended use of hardness tests in many other lines.

Production Machine Co. Type R Utility Grinding and Polishing Machine

The machine shown in the illustration herewith has recently been brought out by the Production Machine Co., Greenfield, Mass., and is a combination of several types.

The base and head are in one casting, providing a rigid support for the spindle and bearings. The spindle runs in Timken roller bearings, which are packed in grease and sealed to exclude dust. Adjustment for wear is provided by a threaded sleeve and nut.

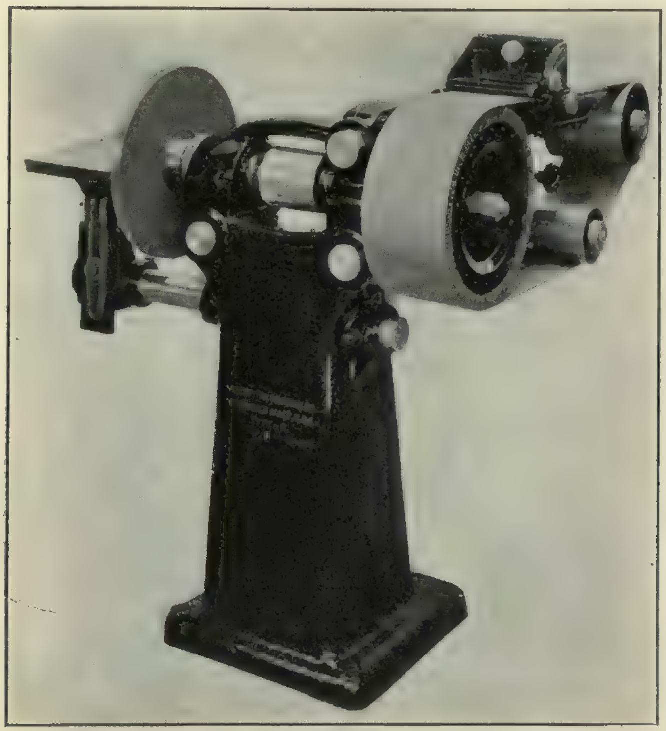


FIG. 1. UTILITY GRINDING AND POLISHING MACHINE (FRONT)

One end of the spindle is furnished with a double-faced disk and the other with a leather cushioned wheel over which runs a 6-in. endless abrasive belt. A quick adjustment for tracking the belt and an idler for keeping it tight are provided. At the rear of the machine is a table for surfacing work on the belt. The table is provided with an adjustable gage arranged for handling articles with straight or beveled edges and so attached that it may be quickly swung out of the way for changing abrasive belts. The table for disk grinding has both vertical and circular adjustments and is provided with a rocking seat to accommodate beveled work.

Specifications: Diameter of disk wheel, 15 in. Table for disk wheel, 9¾ in. Cushion wheel; 14 in. diameter, 6 in. wide. Abrasive belt, 6 in. x 7 ft. Surfacing table for belt, 6½ x 14 in. Driving pulley, 4½ x 4½ in. Spindle speed, 1,300 r.p.m. Abrasive belt speed, 4,764 ft. per minute. Hp. required, 3. Floor space, 36 x 37½ in.

T. C. M. Semi-Automatic Axle Machine

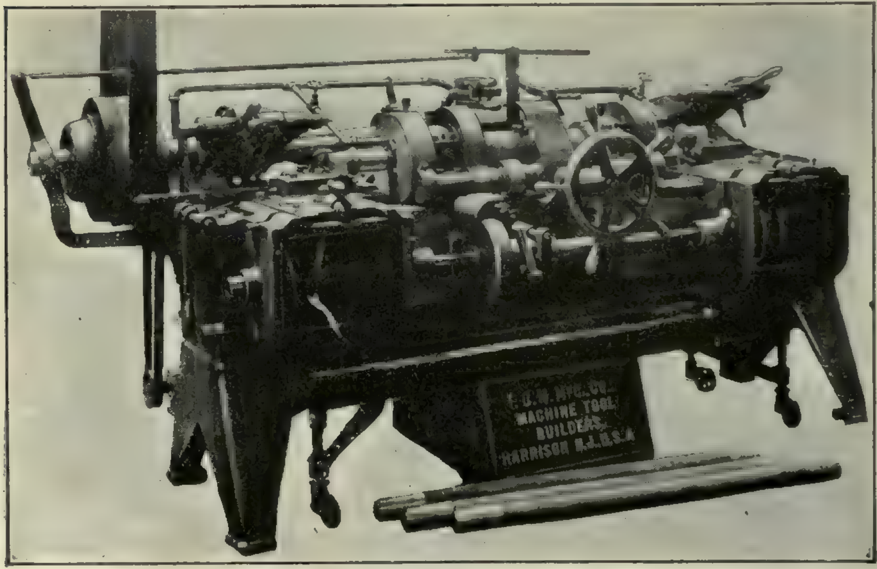
The accompanying illustration shows a special semi-automatic machine built by the T. C. M. Manufacturing Co., Harrison, N. J., for machining automobile and truck axle shafts of the full floating type. The shaft to be machined is placed in the hollow spindle of the machine and is held by two scroll chucks, one at each end. The two chucks are operated simultaneously by means of the handwheel shown at the front of the machine. Once started, the machine squares the ends of the shaft to length, turns down each end to the correct diameter and forms a bevel at one end and a check at the other.

The operator then swings the two center drilling spindles into position and centers both ends at once. These centers are required for the remaining operations such as holding the splines and for the finishing of the axles by grinding.

Two of the slides make several movements across the work, during each cycle of the machine, the tools being advanced the amount of the cut to be taken before each passage of the tool is begun.

The other slides are moved along the bed by cams which engage with cam rollers set in the bed, each slide carrying a cross slide controlled by separate cams. Variations of diameter are taken care of by screw adjustments on each cross slide.

To enable adjustments from one size of shaft to another to be made quickly, the slides at one end of the machine, with the corresponding drilling spindles for centering and the adjacent spindle bearing are all tied by bars to a bracket which can be moved along the bed so that by loosening the clamping bolts and turning the adjusting screw, all the required length changes are made simultaneously. A pump supplies the coolant to each cutter and a pan is provided to catch the chips with a tank to supply the pump. The cutting tools are either circular formed tools or may be solid rectangular tools as desired. The finished shaft is ejected from the machine by a bar which pushes the shaft far enough out so that the operator can remove it. Three spindle speeds and three feeds are provided for by quick-change gears. The hollow spindle is telescopic and the slides at one end of the machine are adjustable so that shafts varying in length from 36 to 48 in., and in diameter from 1¾ to 2¾ in. can be handled. The time required per shaft varies from four to ten minutes according to diameter and cutting quality of the forgings. The drive is through a single belt and clutch pulley.

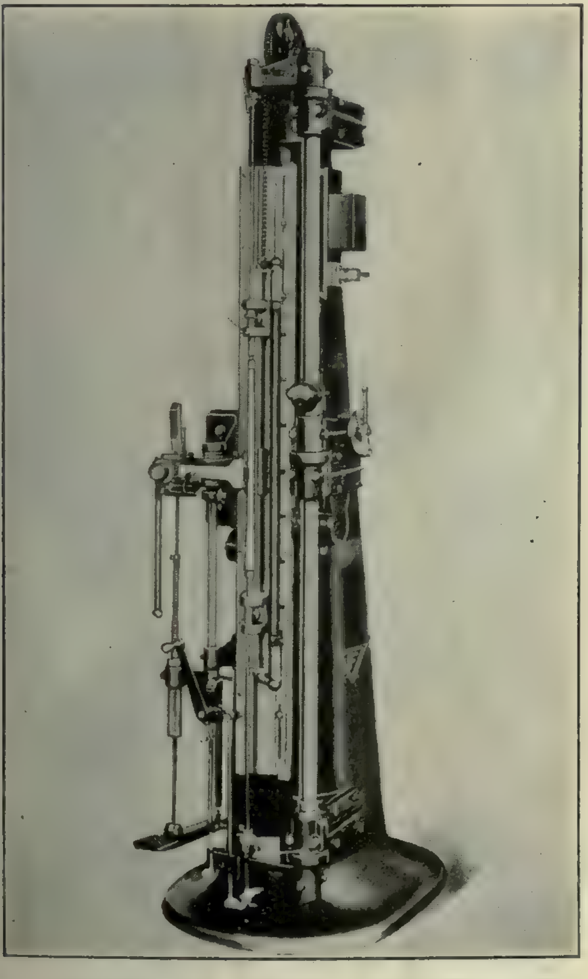


T. C. M. SEMI-AUTOMATIC MACHINE

Fairbanks Gun Barrel Calibrating and Straightening Machine

The illustration shows a calibrating and straightening machine for use on gun barrels, which has been developed by the Fairbanks Company, Broome and Lafayette Sts., New York, N. Y. It is said that this machine will straighten rifled barrels as easily as smooth bores, and that the method of testing for straightness is thoroughly scientific, precluding the possibility of error. The skill that has heretofore been required for this operation now becomes unnecessary, and it is claimed that an unskilled workman can, with a few hours' experience, straighten gun barrels to within a fraction of a thousandth of an inch. The claim is also made that barrels can be straightened to within 0.002 in. for their entire lengths, and in less time than is usual with the older methods.

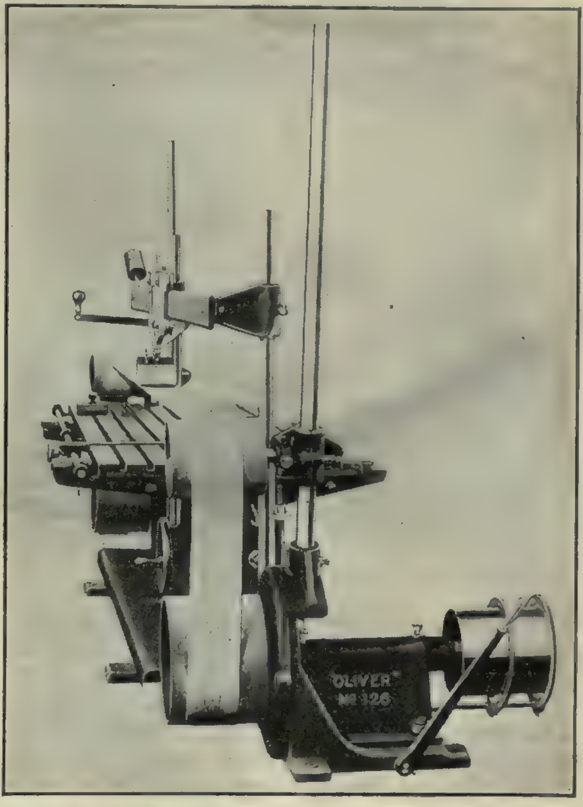
In operation, the gun barrel is held in a vertical position in the machine where it is rotated about its axis by the operator, thus bringing every part of the bore to pass by a fixed point or "feeler" within the bore, the barrel being raised or lowered to test the bore throughout its length. Whenever the feeler comes in contact with the bore it completes an electrical circuit which registers on a voltmeter. The amount of error is determined by moving a handle on a micrometer screw adjustment until the contact is broken. The error will be shown to 0.00025 in. When the peak of the crook has been determined both vertically and circumferentially by indications of the voltmeter, two jaws are brought into contact with the barrel and the necessary pressure is applied to correct the error. It is stated that the barrel can be placed in the machine and removed in less than two seconds. It is said that the machine is substantially built, has no parts to wear out, and will turn out perfect work indefinitely.



FAIRBANKS GUN BARREL CALIBRATING AND STRAIGHTENING MACHINE

Oliver No. 126 Belt Sanding Machine

The machine shown in the accompanying photograph is the Oliver No. 126 belt sanding machine which has been put on the market by the Oliver Machinery Co., Grand Rapids, Mich. The machine is intended for the rapid sanding and polishing of all kinds of metal parts and should be particularly adaptable in automobile body factories, implement factories, etc.



OLIVER NO. 126 BELT SANDING MACHINE

This machine is said to be quick in action, convenient for the operator and very safe. As shown, the machine is set up so that there is no overhead belt. The slack in the belt is taken up by means of a countershaft, so that a flexible tension to suit the work is maintained. The idler is adjustable up or down to height of work and can also be adjusted to a tilting position to keep the sand belt from running to either side of centers. The table top is constructed of plain wood strips with 1 in. gaps.

The table is 32 in. wide and 96 in. long and is equipped with an adjustable bar to hold work to be sanded. The machine is regularly equipped with roller bearing countershaft for belt drive, or arranged for motor drive. Equipment consists of one sanding shoe, necessary wrenches and edging attachments. The machine has a capacity to take work any length and sand to center of 72 in. It will take work on the table 54 in. high and over floor 72 in. high. The table travels 36 in. with a vertical adjustment of 14 in. Sanding belts up to 10 in. wide may be used. The weight is about 1,400 lb., and height over all, about 80 in.

Garrison Automatic Gear-Grinding Machine

A machine for grinding gear teeth by means of a wheel having a section like that of a rack tooth and which generates the bearing surfaces on the gear teeth has recently been developed, and is being placed on the market by the Garrison Gear Grinder Co., 26 St. Clair St., Dayton, Ohio. A general view of the machine is shown in Fig. 1, the gear to be ground being held on the arbor seen below the wheel. The teeth are not formed by means of a formed wheel nor by the use of a templet; but they mesh and roll with the tooth-shaped abrasive wheel, so to obtain a true bearing surface. A master gear and rack are employed for each different size and type of work, the tooth form of the master gear being that required on the work; and the accuracy of the work put out, of course, depends largely on that of the masters.

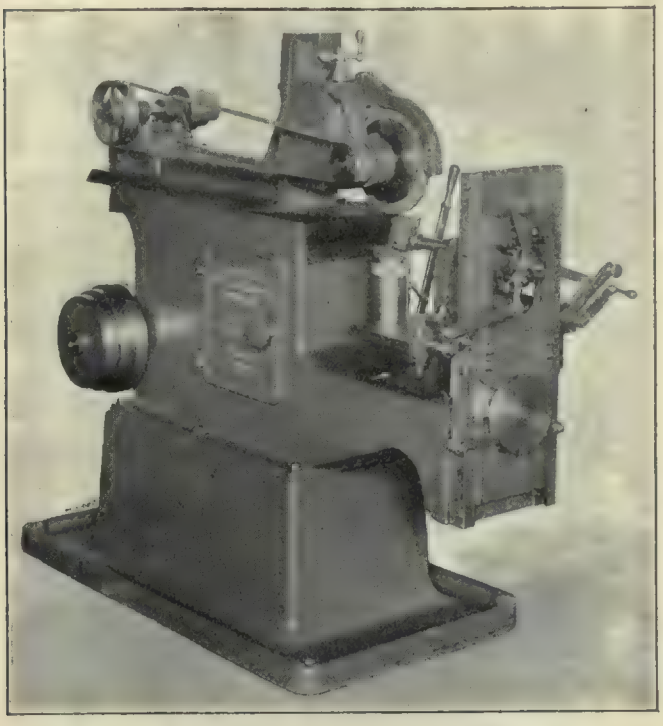


FIG. 1. GARRISON GEAR-GRINDING MACHINE

The motions of the various members of the machine when in operation are as follows. Besides rotating, the wheel is caused to reciprocate horizontally. It thus runs back and forth through the spaces between the gear tooth, the work being indexed entirely around without changing its position in relation to the wheel, so that the wheel passes once through each space. The table on which the work is mounted is then moved transversely to the wheel, the work is rolled slightly and the operation is repeated. Thus, after a series of steps, each tooth is completely ground on the contacting surface, the result being the same as though each tooth had rolled with the wheel as it would roll with the tooth of a rack. The small allowance left after roughing is, consequently, removed from the bearing surfaces, so that they are ground to involute form.

The base and bed are of box section, the former having a trough around its edge and the latter housing part of the mechanism. On top of the bed, a reciprocating ram 28 in. long, carrying the wheel mechanism, is mounted on dovetailed ways. The drive is from an overhead countershaft to the small three-step cone pulley. The shaft of this pulley is hardened and ground, running in cast-iron bearings and it carries a pulley which drives the wheel. A 10 x ½-in. wheel, running under a guard, is used. As the wheel wears down, the steel disks can be changed, so that it may be used down to 6 in. in diameter. The speed may be maintained, however, by changing the position of the belt on the cone driving pulleys. The wheel spindle is mounted on two S. K. F. self-aligning, double-row ball bearings on a carriage which has a vertical movement of 1 in. by means of a feed screw provided with a dial. The position of the whole head may be adjusted vertically, after loosening its fastening bolts.

The automatic movements of the machine are driven from overhead by a separate belt running on the three-step cone pulley at the rear of the machine. An expanding-band friction clutch is fitted inside the pulley, for use in starting and stopping the mechanism. In Fig. 2 can be seen the hand lever operating the clutch. The pulley on the side of the machine drives, through bevel gears, a crank having a vertical shaft and operating the ram, which can be given a speed of 23.6 to 40 ft. per minute. It also drives a horizontal shaft extending through the knee which is cast solid with the bed.

The position of the end of the shaft is shown by the disk on the front of the knee. Behind the disk are carried two cams, one of which serves to raise and lower the slide carrying the master rack, seen best in Fig. 1. The other cam causes the master gear, and also the work, to index one tooth between each stroke of the wheel. Thus, while the wheel touches the work the master rack and gear are meshed, so as to hold the work in position.

The spindle carrying the gears is mounted on a table having a transverse movement, although it is held stationary while the wheel is actually cutting. After the work has indexed a full revolution, the table is automatically caused to move slightly by means of a suitable mechanism operated by a cam back of the master gear. Since the master rack does not move transversely, although the master gear does, the effect is

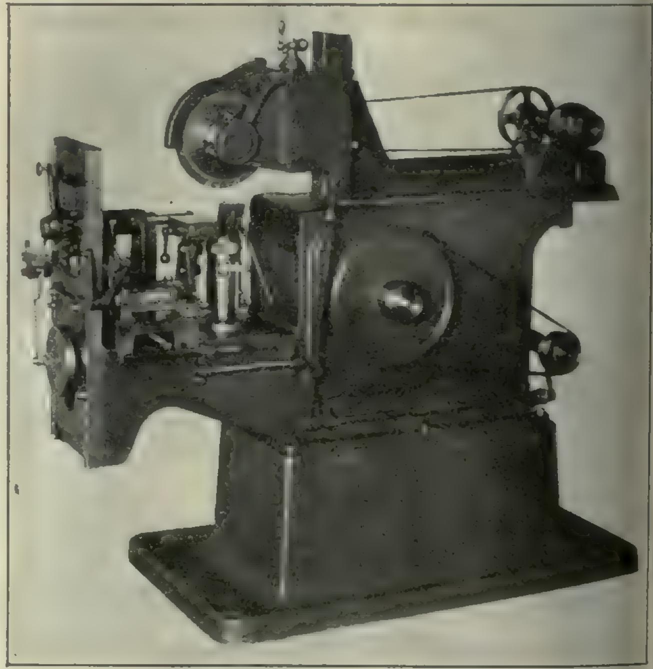


FIG. 2. CONTROL SIDE OF GARRISON GEAR-GRINDING MACHINE

to roll the work slightly. The wheel, being always aligned with the central tooth of the rack thus touches a different place on the teeth of the work, the result of a number of these steps being to generate an involute on the gear tooth.

The amount of movement of the slide can be controlled by the small vertical screw seen just to the right of the rack slide in Fig. 2. This adjustment permits of making the steps as small as necessary to obtain a continuous curve on the tooth. For a 6 to 8 pitch, 20 tooth gear, a cross movement of 1⅛ in. made in 3/32 in. steps is ordinarily used. To clear the work from the wheel, the slide can be brought to the right by means of a lever.

The movements are provided with automatic stops, so that at the completion of a gear the machine stops entirely, except for the rotation of the wheel. There is, also, a jaw clutch in the knee by which the movements on the latter can be stopped while the ram still reciprocates. In order that each gear may be quickly clamped on the arbor with the proper relation to the master gear, the stop to be seen at the right of the arbor is employed. It has a small vertical slide which can be brought into the tooth space of the gear, after its position has been adjusted.

An ingenious wheel-truing device is mounted directly beneath the wheel. Two diamonds are carried on the same bar. The one on top is for truing the periphery of the wheel, the top of the device being merely rotated to accomplish this. The other diamond dresses the sides of the wheel, being caused, by means of a lever, to move up and down on a slide placed at the proper angle. To dress the other side of the "V," the top of the holder is merely indexed through 180 deg. and locked. After the diamonds have been properly set for a given job by means of the screws provided, it is necessary to make no further adjustments, but merely to feed the wheel down and to redress. A different head for the device can be furnished for the required pressure angle on the gear, although it is not necessary to have different master gears for each pressure angle, provided that the number of teeth and the diameter are the same.

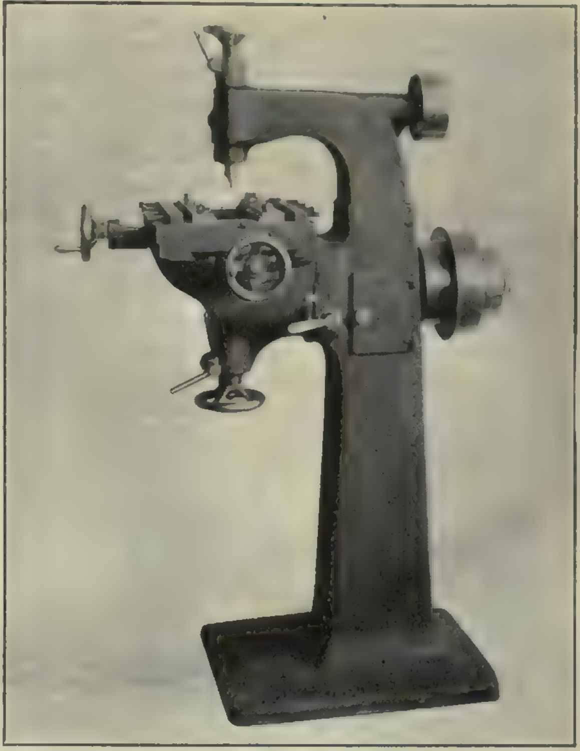
The machine can handle gears having pitch diameters from 2 to 9 in. Although the wheel stroke is 6⅜ in., the grinding stroke is only 3 in. Several gears having small face widths can thus be mounted at one time. Although the machine is shown fitted with an arbor or holding gears having through holes, special fixtures can be furnished for other styles, such as gears integral with shafts.

The machine ordinarily removes 0.007 to 0.012 in. of stock from the thickness of the tooth, the roughing requiring but one previous cut, either milling or hobbing. It is said to be very rapid in its operation, a 20-tooth, 6-pitch gear being ground complete in 6¼ minutes. It is claimed that the gears produced checked to within 0.00025 in. on the shape of the involute, and to 0.0006 in. on the two-pin thickness test of the teeth. The direction of rotation of the wheel is such that it cuts against the tooth on the return stroke, which is said to leave an excellent finish. Because of the narrow surface touched at each cut and the indexing of the work, the work does not become heated, it is said, so that accuracy can be maintained.

The machine measures 57 in. overall from front to back, 28 in. from left to right, and 54½ in. high. Its weight is about 1,500 pounds.

Johnson Die Milling Machine

The Johnson Tool Co., 201 Eddy St., Providence, R. I., has recently placed on the market a die milling and cutter plate machine, designed especially for use in the manufacture of punching dies and hubs. As will be seen by the illustration, the machine is provided with a tilting table, which has a capacity of 9 in., when not fitted with jaws; when jaws are used the capacity is 5½ in. The machine has two spindles, one carried under the vise table and the other above the table. The head in which the upper spindle is carried can be swung out of position when not in use, which is a labor-saving feature. Both spindles have been provided with taper bearings for taking up wear, and special adjustment has been provided for taking up the wear on both cross and longitudinal screws. A clutch arrangement inside the cone pulley allows the lower spindle to remain stationary while the upper spindle is in use. The crossfeed is 4 in. and the lateral feed 6 in. The height from the floor to the top of the table is 40 in. The cone pulley has two steps, the width of the faces being 2¼ in. The machine occupies a floor space of 29 x 40 in. and weighs 600 pounds.

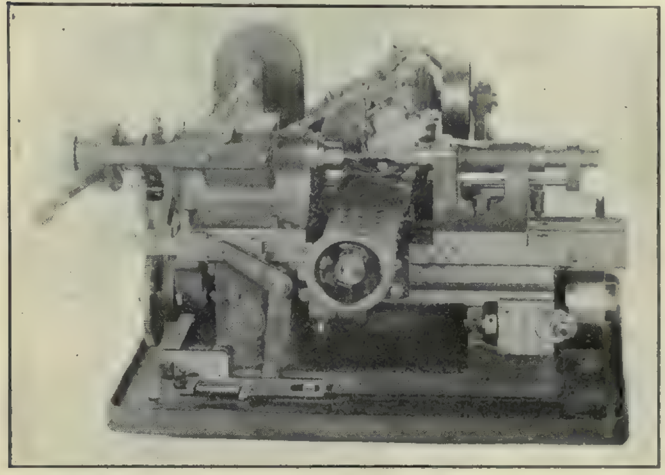


JOHNSON DIE MILLING MACHINE

Waltham Automatic Thread Milling Machine

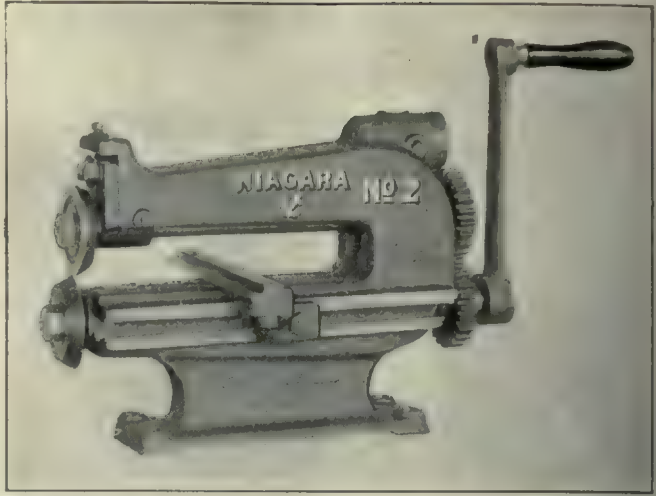
An automatic thread milling machine, intended for manufacturing purposes and so designed that it may be equipped for a variety of work, has been placed on the market by the Waltham Machine Works, Waltham, Mass. The automatic features of the machine are intended to make it possible for a number of machines to be handled by one operator. After the work has been placed in position, the movements of feeding the cutter into the work, the milling of the thread, the withdrawal of the cutter after the required length has been milled, the returning to the starting point, and the stopping of the machine are wholly automatic. The length of the thread is the same as the amount of rise of the cam that controls the workslide, its pitch being determined by the relation between the gearing from the workhead to the camshaft and the lead of the workslide cam. The indexing for multiple threads is obtained by a fractional proportion in the gearing. This method of indexing is said to eliminate all possibility of error, and as the workhead continuously revolves in the same direction there is no backlash to produce inaccurate spacing. The extreme travel of the workslide is 2 in. Threads of this length or shorter may be milled, but adjustment is provided so that this milling can be done either close to the work spindle or in any position not more than 6 in. distant.

The cutter spindle and its drive are of the same size and design as those of the Waltham thread milling machines built by the same firm. An angular adjustment of 45 deg. on each side of the horizontal is provided for the cutter head. The drive for the workhead is made by means of a geared connection and a universal joint. The mechanism for automatically stopping the machine can be adjusted so that the machine will stop at the end of one revolution of the camshaft or after any predetermined number of revolutions that are necessary when cutting multiple threads.


WALTHAM AUTOMATIC THREAD MILLING MACHINE

The machine shown in the photograph was equipped for cutting multiple threaded worms such as are used in phonographs, electric fans, vacuum sweepers, and so forth. By a slight change in the design it can be made to cut helical gears. For brass work the all-gear drive would be omitted and a special high-speed belt-driven cutter-head provided. The machine is designed for single purpose work and at the present time is built to order only.

Niagara Slitting Gage Applied to Re-designed No. 2 Slitting Shear



NIAGARA SLITTING GAGE APPLIED TO RE-DESIGNED NO. 2 SLITTING SHEAR

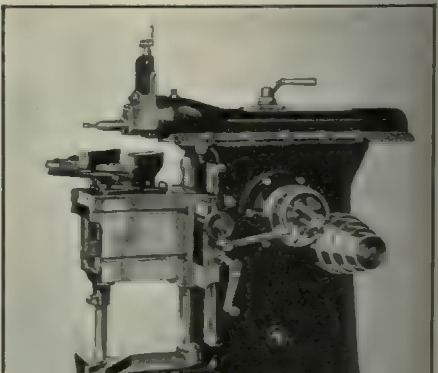
The Niagara Machine and Tool Works, Buffalo, N. Y., has recently developed a slitting gage for a rotary sheet-metal shear, an application of which, attached to a No. 2 Niagara slitting shear, is shown in the accompanying illustration. As can be seen, the purpose of the gage is to provide a simple though effective means of guiding work through the shearing machine. The gage is easily adjusted, one lock-bolt being sufficient to hold it firmly in position. Perfect alignment is assured by the fact that the lock-bolt has a large T-head which slides in the guideway, the bolt protruding through a guide block on the outside of the guideway. When the nut is tightened on the lock-bolt, the gage is locked firmly in position.

The No. 2 Niagara slitting shear has been re-designed and is now a miniature of the heavy Niagara slitting shear.

Milwaukee 9-Inch Shaper

The machine shown in the illustration is the Milwaukee 9-in. shaper which has recently been placed on the market by the Milwaukee Shaper Co., 1023 Cold Spring Ave., Milwaukee, Wis. This machine was designed for toolroom and similar work.

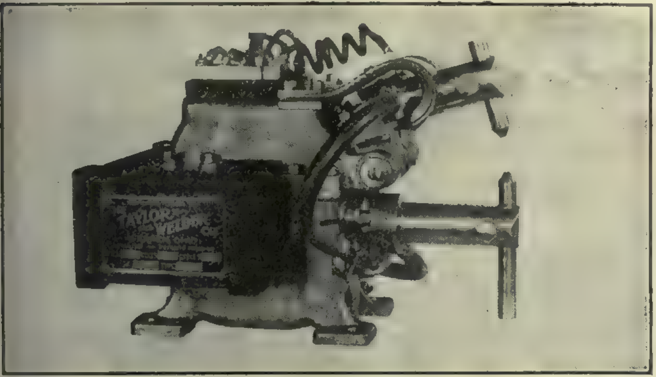
All iron castings used in the construction of the machine are said to contain 40 per cent of steel, and the base and frame are claimed to be ribbed sufficiently to resist all strains that they may be subjected to. The ram is designed for strength, wide bearings and V-shaped ribs, scraped to an accurate fit with the ram gibs, tending to eliminate vibration and make it easy to take up wear. The crossrail has wide bearing surfaces, scraped to the bearings, and the apron is provided with a taper gib to take up wear in the crossrail. The toolhead is graduated, swivels to an angle through an arc of 60 deg., and is provided with micrometer adjustment. The table is $8\frac{3}{4}$ in. long and 8 in. wide, and can be tilted 8 in. vertically to either side. The swivel vise has a graduated base, steel jaws, and an extra set of jaws for taper work.


MILWAUKEE 9-INCH SHAPER

Taylor Bench Type Spot-Welding Machine

The Tayler Welder Co., 12 Atlantic St., Warren, Ohio, has developed a welding machine known as the S-4-B bench type which is shown in the accompanying illustration.

The machine has a cast copper frame which acts as secondary, an arrangement said to make it very efficient. The horns are of cold drawn copper, 1¾ in. in diameter, and are cooled by a stream of water which circulates in both horns. The lower horn is adjustable to three positions. The distance between the horns is 3 in. when closed in the upper position and 5 in. in the lower position. Current is applied through an automatic single pole switch, stepped down through a 3 kw. transformer, which has a four-stop regulator for adjusting the current. The machine is designed for light work such as welding, brazing and soldering. Its particular field is spot welding light gages of sheet metal; cross wire welding; contact points of platinum or tungsten to steel; brazing and soldering of small parts of electrical instruments; watch cases, optical goods, and welding of gold to German silver or steel; small laboratory work. Dimensions: floor space, 10 x 17 in.; extreme height from bench, 12 in.; bench to welding dies, 6¾ in. Capacity: two pieces of No. 30 to No. 16 gage sheet steel. Weight, approximately 150 pounds.



TAYLOR BENCH TYPE SPOT-WELDING MACHINE

Thermit Welding Molding Material

A molding material for thermit welding has recently been developed by the Metal & Thermit Corporation, New York, which, it is claimed, when used in accordance with the regular thermit practice, will prevent blowholes and assure sound welds.

The composition of this material is based on the theory that good silica sand will stand the heat of thermit reaction very well and that the weakness in all molding materials is the clay binder. There should be as little clay as possible in the mixture, in order to make the mold more refractory and to increase its porosity. Therefore a plastic clay has been selected instead of a fireclay. The sand and plastic clay are ground together in a foundry pan or moller so as to coat each grain of sand with a minimum thickness of clay. This method has resulted in a good, clean molding material which, if rammed hard in the mold, will stand up well under the preheating flame. It is extremely porous and it is claimed that by its use a sound weld with a very clean exterior can be made.

The material is composed of three parts clean, sharp silica sand (all of which should pass through a screen having a 0.03-in. square opening, and 40 per cent of which should be retained on a screen having a 0.012-in. square opening), mixed with one part Welsh Mountain plastic clay. The ingredients are first thoroughly mixed in the moller together with one-fortieth part glutrin by volume and sufficient water (one-twelfth part) to bring them to the proper consistency. If mixed by hand, the sand and clay must be dried, being careful not to subject the clay to a temperature higher than 400 deg. F., and then thoroughly mixed before adding the glutrin and water. The glutrin should be mixed with the water before adding to the sand and clay.

Dumore Bench Type Portable Electric Drill

The illustration shows the Dumore model 2-BD bench type portable electric drill which has been developed by the Wisconsin Electric Co., Racine, Wis. The motor is the Dumore universal type, operating on either direct or alternating current, 25 to 60 cycles. Power is delivered to the drill through heat-treated gears of the helical type. The spindle runs in self-aligning annular ball bearings. The capacity in steel is ¼ in., and in wood ⅜ in. The motor and gearing are encased in an aluminum housing. The feed is through rack and pinion. The table is adjustable. The drilling strike is 3¼ in. A No. 1 Jacobs chuck, 10-feet of portable cord, plug and switch are supplied as regular equipment. The net weight is 21 lb. and the shipping weight, 27 pounds.

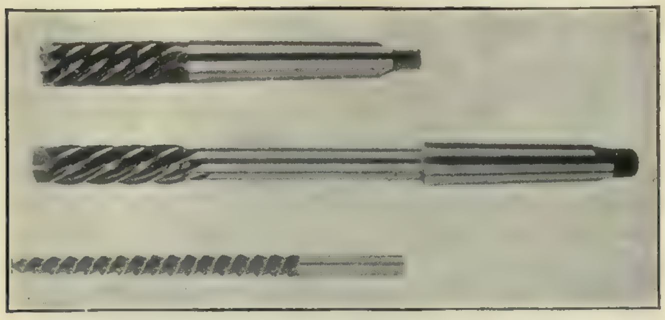
DUMORE PORTABLE ELECTRIC DRILL

Gammons End Mill and Reamers

The Gammons-Holman Co., Manchester, Conn., is placing on the market the style of helical-fluted end mill and chucking reamer shown in the illustration. The tools are similar to the concern's taper-pin reamer described on page 750, Vol. 52, of the *American Machinist*, in that the twist is carried to a greater extreme than is the usual practice. The angle of helix is reversed from the direction of rotation; that is to say, a left-hand helix is applied on the reamer and right-hand end mill; while the left-hand end mill has a right-hand helix.

It is claimed for this construction that heavy cuts may be taken without chatter, and that the tendency to "draw in," which is particularly noticeable in the operation of reaming, is entirely counteracted. A further advantage claimed by the makers is that a hole may be reamed to cut out into another hole for a considerable part of its diameter without the snagging and consequent breakage that would ordinarily follow such practice with a straight-fluted tool.

Both the chucking reamer and the end mill are made



GAMMONS-HOLMAN REAMERS AND END MILL

in all commercial sizes up to 2 in. in diameter, and larger sizes to order. The taper-pin reamer, shown at the bottom of the accompanying illustration, is now made in fifteen sizes, ranging from 0.101 in. at the small end of the smallest reamer to 1.050 in. at the large end of the largest. The sizes overlap, rendering it possible with the full set to ream any sized hole within these limits. It is claimed that the reamer can be run three-fourths as fast as a twist drill of the same size, and that there is little danger of it becoming stuck in a hole, as the left-hand helical flutes, which are ground to cut when rotating in a right-hand direction, automatically free it if any obstruction is encountered.

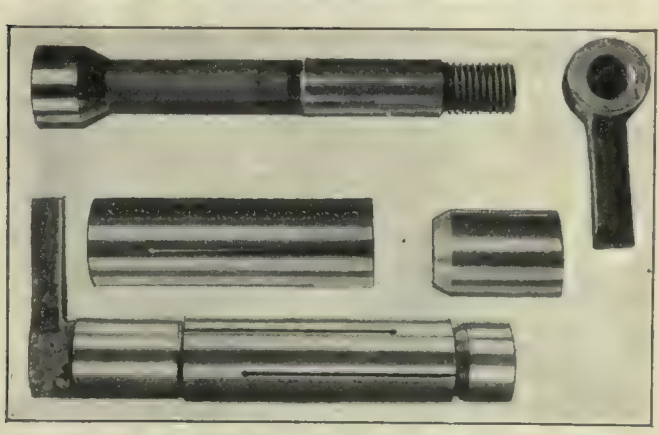
Bath Expanding Mandrel

The expanding mandrel shown in the cut is made by John Bath, Inc., Worcester, Mass., for use on cylindrical grinding machines where accurate workmanship is a prime requisite.

The body of the mandrel has a conical shoulder under the head which matches a similarly shaped cavity in the end of the split sleeve, while a loose bushing is fitted in the same way to the other end of the sleeve. The driving dog, which screws upon the outer end of the mandrel, serves the double purpose of driving the work and of expanding the sleeve in the bore of the piece to be ground, by forcing the two cones together.

The bushing is accurately fitted to the body of the mandrel but the split sleeve bears only upon the two conical shoulders. The sleeve has six slots cut alternately from either end so that the expansion is practically uniform over its length.

In making the sleeve the slots are not cut all the way to the end, but a small triangular section of metal is left by the saw to bind the piece together in the hardening operation. After hardening, these small sections are cut out with a thin elastic wheel.

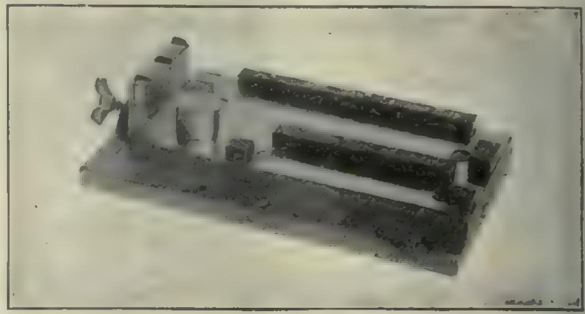


BATH EXPANDING MANDREL

All parts are, of course, carefully ground and lapped after hardening and the final grinding of the sleeve to diameter is done with the tool assembled. The mandrel is made in all sizes from 1 to 5 in., one body and bushing accommodating several sizes of sleeve. The cut shows the tool both in detail and assembled.

Kelly Plain Bench Plate

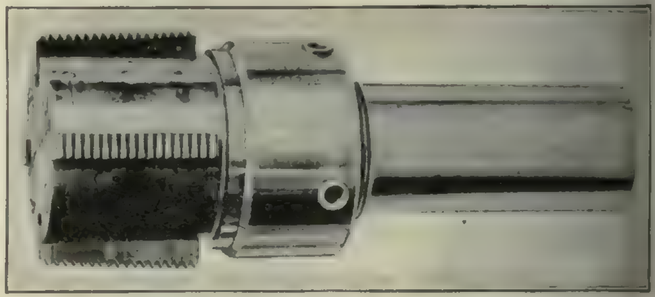
The bench plate shown herewith is one of the adjuncts furnished by the Kelly Reamer Co., 3705 W. 73rd St., Cleveland, Ohio, for taking care of "Kelly" reamers, and is intended to be used when adjustments are to be made for grinding the cutters.



KELLY PLAIN BENCH PLATE

Geometric Adjustable Tap

The illustration shows a threading tool or adjustable tap recently placed on the market by the Geometric Tool Co., New Haven, Conn. The tap is intended for use where a machine has no means of closing a collapsible tap, or for some other reason does not permit the use of a collapsible tap, being intermediary between an adjustable collapsing tap and a solid tap.

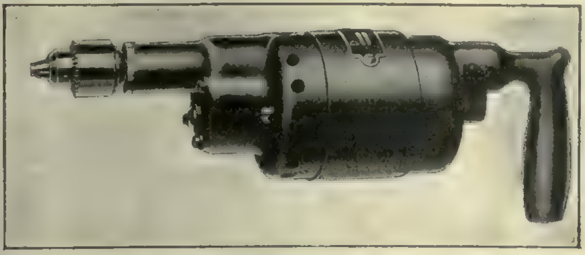


GEOMETRIC ADJUSTABLE TAP

The tap is not equipped with a collapsing device, but is claimed to have all the other advantages of a collapsing tap. Being adjustable, correct size can always be maintained. Each size of tap accommodates chasers for a range of diameters, and the chasers can be readily removed for regrinding. When necessary to renew the chasers, this can be done at slight cost, being a saving over the renewing of an entire tap, as when solid taps are used.

Dumore Model 1-BD Portable Electric Drill

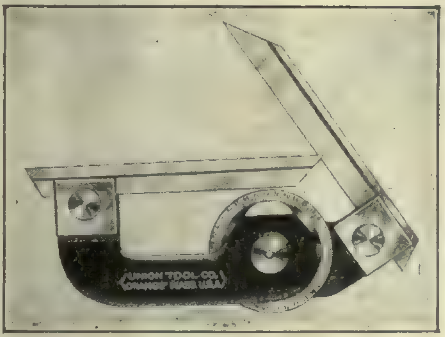
A small portable electric drill, known as the Dumore model 1-BD, has been placed on the market by the Wisconsin Electric Co., Racine, Wis. This drill, which is shown in the illustration, is built for use in drilling small holes where speed and adaptability are prime considerations. The motor used is the Dumore univer sal type, operating on either direct or alternating current, 25 to 60 cycles. The power is delivered to the drills through heat-treated, steel gears of the helical type. The shaft on which these gears are mounted is ground to size. The motor and gears are encased in an aluminum housing, the length over-all being 12½ in. The drill spindle runs in two self-aligning ball bearings, and is offset from the center $\frac{31}{32}$ in. Jacobs chucks are furnished as standard equipment. The capacity of the drill is, for steel, ¼ in.; for wood, ⅜ in. The net weight is 5 lb.; shipping weight, 8½ pounds.



DUMORE MODEL 1-BD PORTABLE ELECTRIC DRILL

Union Universal Bevel Protractor

The bevel protractor illustrated has been placed on the market by the Union Tool Co., Orange, Mass. It is so designed as to cover a very wide range of work. The dial is graduated to a full circle of 360 deg. and may be set at any angle. It is securely held in whatever position it may be set by means of a knurled thumbscrew.



UNION UNIVERSAL BEVEL PROTRACTOR

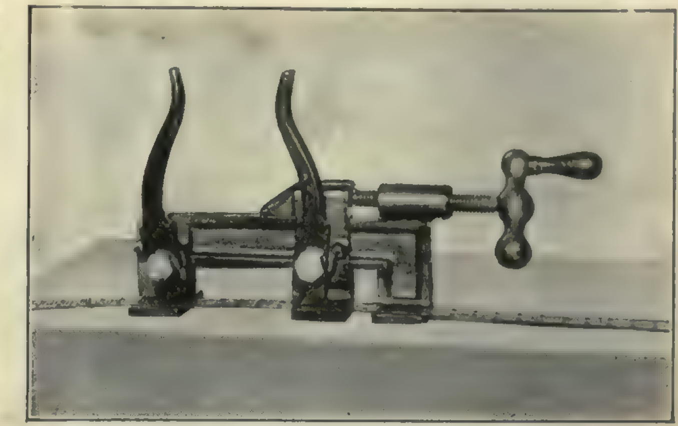
Both the stationary and movable blades may be adjusted to any position lengthwise, and when tightened by means of the clamping screw are drawn to a firm bearing in their respective seats by the action of the clamping device.

The blades and the clamping devices conform to the related parts of the combination square made by the same company and the 12-in. adjustable blade of the square may be substituted for that of the protractor, if desired. The blades and all working parts are of tool steel, hardened and ground.

Hill Box Banding Clamp

A device for stretching metal bands tightly upon acking cases, as is commonly done when packing heavy arts, especially in the case of foreign shipments, has een placed on the market by M. B. Hill, of Worcester, Iass. The device is quite simple and does easily and uickly a job that would be difficult of accomplishment y hand.

To operate it, the band is placed around the case n the desired position and the ends passed under the am levers of the device. The movable jaw is then dvanced along the frame by means of the screw until e requisite tension is put upon the band and the band is nailed to the case as close to the device as may be convenient.



HILL BOX BANDING CLAMP

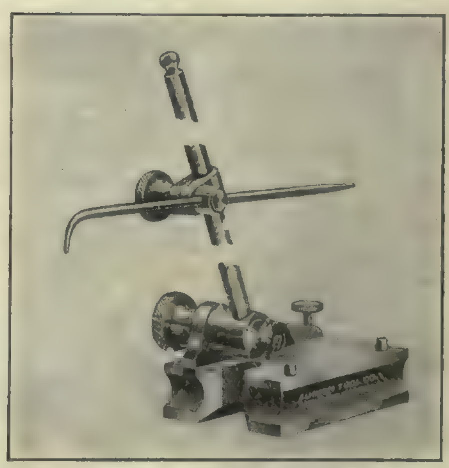
The screw is then loosened, the ends of the band are released from the cam levers, the device is removed and the free ends of the band are tacked down.

Union Surface Gage

The Union Tool Co., Orange, Mass., has added to its line of machinists small tools, the surface gage shown herewith.

The spindle may be set at any angle with the base over a radius of 270 deg. and tightened in position by means of a draw-sleeve and knurled nut. Close adjustment is provided in any of the positions by the small regulating screw at the end of the lever that carries the spindle.

A V-slot in the base provides for the use of the tool in connection with round work and a pair of push plugs in each end of the base enables the user to line up work from the top, side, or bottom of a plater or in correct relation to a slot in the work. The draw sleeve is provided with an extra hole to take the needle, so that the spindle may be removed and the gage used without it, retaining all the facility of adjustment without the range of the complete tool.

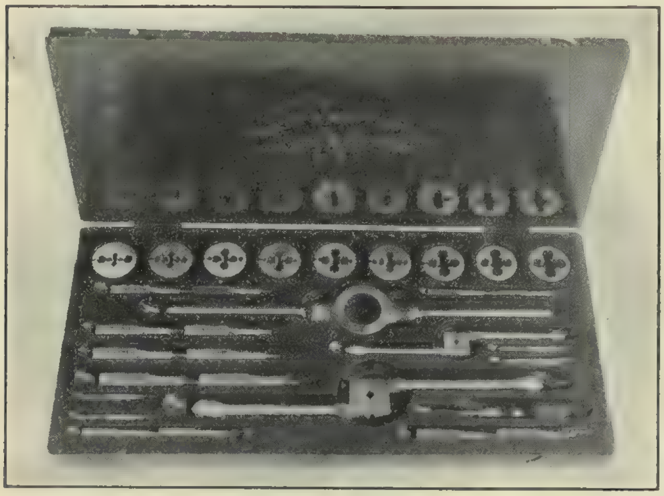


UNION SURFACE GAGE

The base is enamelled and all working surfaces are ground and polished. The base is 3$\frac{5}{16}$ in. long by 2⅜ in. wide. The height of the spindle is 12 in. The tool weighs two pounds.

Pratt & Whitney Screw Plate Sets

The Pratt & Whitney Co., Hartford, Conn., has placed on the market a screw plate set, as shown in the illustration. The taps and dies included in these sets are some of the regular product of this company, selected



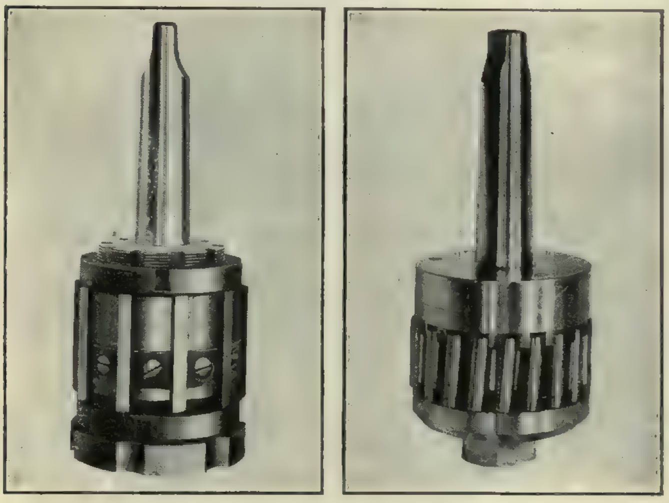
PRATT & WHITNEY SCREW PLATE SETS

to meet the requirements of the small shop, garage and toolroom. The various sets include from five to nine sizes of taps, either taper or plug or both, with corresponding dies. Either U. S., S. A. E., or Whitworth Standard threads are furnished as desired. The sets containing five or seven sizes of taps and dies also include one tap wrench and one die stock, while the sets of nine sizes contain two tap wrenches and two die stocks. Each set is packed in a finished case, suitably marked and including screwdriver.

Indiana Reamer and Burnishing Tool

The Indiana Tool Co., Richmond, Ind., has placed on the market the reamer and burnishing tool shown in the illustrations for use on cylinders of Fords and Fordson trucks. These tools are said to be similar to those now in use at the Ford plant and other motor plants. It is claimed that the use of these will give the cylinder walls a smooth, hard finish, superior to that obtained by other methods.

The reamer contains ten inserted blades of high-speed steel and of extra lengths to allow for grinding. The method of holding the blades keeps them at proper adjustment. The pilot, which is of tool steel, hardened and ground, is free to turn and guide the reamer.



INDIANA REAMER AND BURNISHING TOOL

The burnishing tool contains twenty floating rollers, made of high-carbon steel and hardened and ground.

Know Why You Do Things

By H. M. Ayrbn

In all the articles written on the setting of the tool in relation to the center of the work, one point has been ignored and that is the fundamental principle underlying the setting of the tool.

The correct theoretical position of a roughing tool is above center, but it has been accepted as good practice to set the tool on center, provided that the fundamental principle has been fulfilled, and that is that the tool shall be rigidly supported and securely fixed.

When these conditions do not exist other means must be taken to overcome the trouble and turn out the required quality of work in satisfactory time. The workman possessing the ability to perform the above in any workshop and on any type of lathe should be considered as a capable mechanic.

On page 72, Vol. 54, of *American Machinist*, Mr. Forbes shows a sketch of part of a lathe so distorted as to make clear his reasons for setting the tool below center. There is one point that I think he has overlooked and that is the overhang of the tool, as shown, and unless the feed used is very fine or the cut light the looseness of the V's will increase the trouble of digging in and necessitate setting the tool very low. In the rough-turning of heavy work where the feeds used are coarse and the cut heavy and not of an equal depth on account of the shape of the rough forging or casting, care must be exercised to prevent digging-in which occurs from many causes, and, apart from setting the tool below center, other means must be taken to prevent it.

In the setting of the roughing tool it is accepted that the tool should be of suitable weight for the work to be performed and should be held as rigidly and securely as possible. But where the heaviest tool procurable, say 2-in. square steel, proves inadequate to the task, what methods are we to adopt to overcome the troubles apart from setting the tool so very far below center that the slide rests will require to be made so very tight that they cannot be moved with freedom?

The feed or the cut can be reduced but these expedients are ruled out as they increase the time on the job. Another method is to clamp a tool of the same section of steel on the top of the cutting tool to give the required rigidity. Should this prove inadequate, bolts or packing pieces may be used to support the slide. Where it is necessary to have the tool overhanging to perform such work as roughing crankshafts, the tool should be supported by a jack of suitable proportions; the base of the jack resting on the lathe carriage.

The spring tool mentioned by Mr. Forbes in the above-mentioned article is a tool that should not be set on center but below it, for the same reason that the cutting edges of circular form tools are cut below the center of the cutter; and that is (apart from giving the necessary clearance) that the tool will continue to cut long after it has lost the initial keenness and so eliminate the necessity for continual grinding and re-setting.

In the finish turning of circular form tools the master tool is set below center the same amount as the center of the cutter will be above the work center when in use (see "American Machinist Handbook," pages 250 to 254). This is necessary in order to obtain the correct formation.

NEWS SECTION

Canada Orders All Imports to Be Marked as to Origin

The Dominion government has just issued regulations to govern the marking of imported goods, as required by an amendment to the customs act at the last session of the Dominion Parliament. The new law, which becomes effective on Jan. 1, 1922, follows closely the wording of the corresponding section in the United States tariff in requiring that "all goods imported into Canada, which are capable of being marked, stamped, branded or labeled without injury, shall be so marked in legible English or French words, in a conspicuous place . . . so as to indicate the country of origin."

All goods imported into Canada which do not comply with the new requirements are made subject to an additional duty of 10 per cent on the value for duty purposes, and in addition, will not be released from customs possession until they have been so marked, stamped, branded or labeled under customs supervision, at the expense of the importer. This provision is of great importance by reason of the volume of United States goods exported to the Dominion. For the last fiscal year the value of United States products imported into Canada for consumption was no less than $856,613,430.

Goldsmith Heads European Division of Commerce Department

Allen Goldsmith of Dayton, Ohio, has been appointed chief of the European division of foreign and domestic commerce, by Secretary of Commerce Herbert Hoover.

Mr. Goldsmith is a graduate of Kenyon college and served in the World War with the rank of Lieutenant-Colonel. Following the signing of the armistice, Goldsmith was assigned to duty under Hoover and placed in charge of the Rumanian food mission, with offices at Bucharest. In 1920 he was placed in charged of the American relief warehouses at Hamburg, Germany, and later transferred to Triest, Italy, for the distribution of food to the Austrians.

Milliken Bros. Get Australian Contract

A contract totalling approximately 75,000 pounds sterling, plus freight, was recently awarded to Milliken Brothers of New York, according to the announcement by the electricity commissioners of Melbourne, Australia. It covers the erection of a 112-mile line bringing high tension power from Victoria Falls, Australia, to Melbourne, and includes a total of 634 steel towers to carry a current of 132,000 volts.

One of the vice-presidents of Milliken Brothers is already en route to Melbourne to start the work. His company reports work under way also for contracts in Burma, South Africa and Norway, among other foreign countries.

Venezuelan Trade Agency Established in Boston

Carrying out the plan of the Venezuelan Minister of Foreign Relations to promote trade with this country, E. Arroyo Lameda, recently appointed commercial attache in Boston, Mass., has opened offices in the Little Building, that city. He will supply manufacturers, jobbers, exporters, importers and other business men with detailed information in regard to Venezuelan markets, and desires to receive catalogs and other literature from American business houses.

Report of Observers on Air-Naval Experiments

The joint board appointed by the Secretary of the Navy has submitted a report on the results of the aviation and ordnance experiments held during June and July, 1921. The experiments were made with the aid of the ex-German war vessels alloted to the U. S. by the Versailles Treaty.

The experiments definitely determined in each case that the projectiles used were superior to the defensive features of construction of the vessel attacked. It has long been recognized that the gun carried by any type of war vessel is superior at moderate ranges to the armor or protective construction of vessels of like type. In a large measure, therefore, the greatest interest in these experiments lay in the bombing of naval vessels by aircraft. The main features of this report, therefore, relate to the effectiveness of aircraft in offensive action against various types of naval vessels.

In the present state of anti-aircraft defense it is believed that, if an air force can obtain the mastery of the air, an effective percentage of hits can be obtained against surface vessels coming within the radius of action of bombing planes without an undue percentage of loss of aircraft. The history of war indicates that means of defense develope rapidly to meet the development of offensive weapons. The effectiveness of the bomb carried by aircraft emphasizes the necessity for the rapid development of anti-aircraft armament and for the provision of pursuit planes as a part of the fleet.

The aviation and ordnance experiments conducted with the ex-German vessels as targets have proved that it has become imperative as a matter of national defense to provide for the maximum possible development of aviation in both the Army and Navy. They have proved also the necessity for aircraft carriers of the maximum size and speed to supply our fleet with the offensive and defensive power which aircraft provides, within their radius of action, as an effective adjunct of the fleet. It is likewise essential that effective anti-aircraft armament be developed.

The joint board also recommended that the provisions of the previous orders of the War and Navy Departments relative to secrecy concerning the results of the aviation and ordnance experiments be rescinded and that the report, if approved by the War and Navy Departments, be issued jointly to the press. The report is signed by General John J. Pershing, as senior member

Three Auto Builders Cut Prices

A third cut in prices, announced in Detroit last week by the producers of Hudson and Essex automobiles, puts these well-known models at lower prices than they have ever sold for.

The Hudson super-six was in great demand last year and sold at $2,600. The new price is $1,895.

The Essex price last year was $1,795. It now is $1,375. These prices refer to open touring models. Similar reductions have been made on all models.

Officials of the two companies state that heavy sales during the summer have exhausted old inventories, reduced overhead costs and that they are now able to buy materials at new low costs.

King Motor Car Co. has announced its 1922 prices, which are $600 lower on open models and $800 lower on closed models. Costs are: Touring and foursome, $2.125; roadster, $2,140; coupe, $3,125, and sedan, $3,234.

Auto Race Feature of Steel Treaters' Convention

George Desautels, chairman of the entertainment committee of the convention and exhibition of the American Society for Steel Treating, to be held in Indianapolis. Sept. 19 to 24, has announced a match race between Frontenac and Duesenberg automobiles.

This 50-mile race will be staged on the speedway, Wednesday morning, Sept. 21, at 10 a.m.

There will be three or four Frontenac cars and three Duesenberg machines.

These two manufacturers of racing cars are located in Indianapolis, and are great rivals, and it will be a wonderful race in as much as both firms are particularly anxious to secure the valuable trophy which will be presented to the winner.

Mr. Duesenberg has also agreed to stage an exhibition with his special car which has made a record of 156 miles per hour.

It is also possible that "Jimmie" Murphy and his car in which he won the Grand Prix in France, will be in Indianapolis and enter the race that is being staged for the benefit of the visitors and delegates to the steel treaters' convention.

While the race will probably be the largest event, and probably of greatest interest to the visitors, Mr. Desautels has arranged for golf tournaments, tennis tournaments, and ball games between the Eastern and Western delegates. Dances, smokers, vaudeville, and a continual round of enjoyment are promised for the visitors.

Fokker to Build Passenger Planes in America

The Netherlands Aircraft Manufacturing Co. announces that it will shortly commence the manufacturing of Fokker machines of all types in this country. Anthony H. G. Fokker, whose machines are now carrying passengers on every airway in Europe, said when he visited this country recently that he regarded the United States as the most fertile field for aircraft exploitation, and signified his intention of invading the American field as soon as his European contracts would allow. The Fokker limousine, 5-passenger monoplane, is the first of the ships he has sent here to make good his promise. The fact that the limousine is a monoplane, with the wing high above the carriage, allows passengers an uninterrupted view when in flight. The wing, which is more than two feet thick, is built on the cantilever principle, and needs no struts or guys to support the carriage. This limousine is the most advanced type of passenger-carrying airplane. Arrangements have been made by the officials of the Netherlands company for a series of flights out of New York. One of the first of these will be a non-stop trip to Washington, where the machine will be demonstrated for the benefit of government officials.

China Buys Rails in Tennessee

The Chinese government has placed an order with the Tennessee Coal, Iron and Railroad Co. at Birmingham, Ala., for 13,000 tons of steel rails for the Pekin Huanhan railroad. The rails are to be shipped from the port of Mobile as soon as possible. An order was received from China some time ago by the Tennessee company for 12,000 tons of steel rails for the Manchurian railroad.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

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The outlook seems anomalous and is confusing. It reminds one of the changeable pictures sometimes used to advertise a toothache cure. From one angle a face in agony is to be seen; from another a smiling countenance is revealed. Commerce is undoubtedly improving but finance is depressed. The sequence is unusual. Formerly is was reversed.

The security dealers and bankers have always boasted that they could see farther ahead than the merchants and have been the first to sense a recovery in general business. Now the improvement in business is upon us but the stock exchange is still discouraged, and bankers, though they talk bravely, are acting with grave caution if not timidity. Wall Street in particular is blue, probably because the shores of its maelstrom are strewn with the wreckage of the recently rich who had come to think themselves invulnerable to the slings and arrows of outrageous fortune. Some who called themselves bankers are in this chastened class, for it seems that no one was entirely immune to the speculative contagion which swept over the world after the armistice. An idea of what it cost its victims can be had from a comparison between the high prices of 1920 and current quotations for a long list of industrial stocks. Some of them have declined more than $100 per share and the total depreciation runs into the billions.

But the chief sufferers by this decline are those who made paper profits during the war, and while their grief naturally affects those with whom they associate, the nation's wealth, as measured in things rather than money, is not reduced by their losses.

The depression in Wall Street may also be partially attributable to the unsettlement abroad upon which I commented last week. De Valera's reply to the English proposals seems truculent and defiant, but the statement that "the Dail Eireann is ready to appoint representatives to negotiate on the basis of government by the consent of the governed" is construed by some as indicating a willingness to parley further, and as those who are willing to parley generally make peace there may still be some hope of a settlement. As bearing upon Britain's other problems it is worth noting that Lord Milner made a speech in London on Aug. 23 in which he advocated an Imperial Parliament and a written constitution for the Empire, while on the very same day the cables brought news of a serious uprising in the Malabar district of British East India, where an "open rebellion" was reported.

In Germany bankers are said to be disturbed by the rapid fall in the purchasing power of the mark at home as well as abroad and the Reichsbank last week reported a sudden reduction of over 9,000,000,000 marks in the outstanding paper currency. This is probably due to the collection of taxes in which case the paper money taken in will soon be issued again. The contraction is otherwise inexplicable though it might have been accomplished by some unreported issue of government securities through which the currency paid in would have been temporarily retired. In this connection Secretary Hoover's warning to American buyers of German municipal securities should be mentioned. He points out that many German cities have already issued bonds payable in marks for sums that would be fantastically large and impossible of repayment if the mark recovered its gold value. From this it is to be inferred that he doubts any such recovery.

The Brighter Side

I have purposely grouped together all the financial depressants that are discernible, bringing them into relief that they may be weighed against the much longer list of the week's encouraging developments.

There is first the statement of the Federal Reserve system which shows a gain of $19,000,000 in the gold reserves and a reserve ratio of 66.5 as against 65.8 per cent the week previous. On these figures a further reduction in the rediscount rate is generally expected and the money market is informally easier though relatively high rates are still asked of impecunious borrowers. Then there is the sensational advance in cotton caused by the sensational reports of crop failure plus the fanciful suggestion of the American Cotton Association that the legislatures of the cotton states should prohibit planting cotton altogether in 1922 so that the boll weevil and the boll worm having nothing to feed upon would be finally eradicated.

The proposal is, of course, impossible, as the cure would be worse than the disease, but it is "a good enough Morgan until after the election" and it may be that cotton will be carried much higher, for the prospectve crop, plus the much exploited surplus, is not in excess of the prospective demand and will be rather insufficient if there is an economic recovery in Europe. The advance is, of course, benefiting the South where it is thawing out much frozen credit. But it is, however, even more important as evidencing a return of the speculative spirit which, much as it may be deplored by some, is always a noncomitant of the psychological condition that is called prosperity.

The *Coal Age* says that "there is unmistakable evidence of a quickening inquiry" for coal and that the turn seems to have come. As a generalization the same thing may be said of iron and steel for the steel corporation has cut prices again, and the *Iron Age* reports a slowly expending demand for some forms of steel. This is reflected by an advance in the price of pig iron, which is up $2 a ton. The well informed men in the steel trade expect an active business in September.

The demand for building material is better, at least in the New York district, and brick, lath and flooring are being freely bought. Despite the alleged unemployment, the *New York Times* reports a shortage of bricklayers, plasterers and carpenters.

The export movement of wheat is increasing. The cash demand is excellent and while prices are not yet much higher the bullish feeling in the grain market is becoming more pronounced and a sharp upward movement would not be surprising.

The encouraging report of the facts thus assembled seems to have been appreciated by those who have written the various trade reviews published during the week. The Irving National Bank of New York says that the outlook for renewed business activity is brighter than for some time and the First National Bank of Boston and the Merchants National Bank of that city are substantially in agreement with this view.

Fall Trade Coming

A careful survey of the dry goods and grocery trades made by the *Journal of Commerce* reveals minimum stocks, complete liquidation, bare shelves, easier credits, an under supply with advancing prices for canned goods and "evidence everywhere of a promising fall trade" while "the tone of public sentiment is optimistic with scarcely an exception."

My correspondents on the Pacific coast are equally optimistic. From Seattle a large increase in jobbing business is reported. "The lumber trade is improving on the demand from Japan, where six of the principal cities are to be rebuilt on American lines entailing a steady lumber order for 100,000,000 ft. during the next three years." "Australia and New Zealand are cabling that wool and wheat credits are being re-established in London and that they will want lumber in large quantities soon, while there is an eager demand from everywhere for the product of our canneries."

Throughout the United States the railroad traffic is increasing, the number of idle cars is decreasing and net earnings are improving. Net revenue for June was $67,000,000 against a deficit of $15,000,000 last year. Congress has adjourned without voting the roads the $500,000,000 for which they asked. Opposition to the grant is increasing and it may not be made, for public sympathy with the carriers has been somewhat cooled by Mr. McAdoo's analysis of the claims made for alleged inefficiency of labor during Government control. It is possible that the roads will be able to get along without it and strengthened by the self denial they will have to practice, for easy money is rarely good for any one.

The savings banks in the State of New York report a gain of $249,000,000 in deposits for the year ending June 30, 1921. As only $93,000,000 of this was interest some people must be making more than they spend.

A high commission of the American oil industry, headed by Mr. Teagle of the Standard and Mr. Doheny of the Mexican Petroleum, has gone to Mexico to confer with President Obregon. Conjecture is busy as to the purpose and result of the meeting but it is probably safe to assume that it will develop a mutuality of interest between Obregon and oil. Peace treaties with Austria and Germany have been signed during the week. As each must be ratified by the U. S. Senate and the legislative branch of the assenting European government, neither will become effective for some time. Foreign exchange has been steadier, reflecting, so it is stated, the constant though quiet absorption of South American and Canadian securities by American investors.

The account current of the week's news as above stated appears to have a handsome balance on the credit side and the only thing that appears to stand in the way of a national business revival is the "hang over" from which Wall Street is suffering as a result of its speculative debauch in 1920. Fortunately these "morning after" headaches are never fatal and young nations like young men soon recover from them.

	End of Last Week	End of Previous Week	Last Year
Bank clearings (Bradstreets)			
In thousands	$5,148,361	$5,817,771	$7,081,248
Business failures	395	376	133
Security prices, N. Y. Stock Exchange:			
20 Industrials	63.91	65.96	87.22
20 Railroads	70.21	72.28	76.55
40 Bonds	77.62	77.62	74.00
Commodity prices:			
Wheat, No. 1 spring	$1.66¾	$1.59¼	$2.75
Corn, No. 2 yellow	.74½	.73⅝	1.80
Beef, good dressed steers	15.00	15.25	24.50
Pork, mess, bbl	25.00	26.00	32.50
Sugar, refined	.0580	.0615	.17
Coffee, Rio No. 7	.07	.07 3/16	.08½
Cotton, middling	.1530	.1300	.3350
Print cloths	.04⅞	.04¾	.12
Wool, domestic average	.3988	.4173	.70
Silk No. 1, Sinshiu	5.55	5.70	5.60
Rubber, crude, plant	.14	.14	.30
Hides, pack. No. 1	.14	.14	28
Iron, No. 2, Phila	20.34	20.34	50.50
Steel billets	30.00	30.00	60.00

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Death of Percy M. Fowl

Percy M. Fowl, president and general manager of the Cadillac Tool Co., Detroit, Mich., died last week. He was also president of the Detroit Garage Equipment Co., and president of the Household Utilities Corporation. Full obituary notice will appear in our next issue.

French Machinery Imports and Exports

Special Correspondence

During the year 1920 France imported 516,965 metric quintals (a metric quintal equals 50 kilograms, approximately 100 pounds) of agricultural machinery, while the exports in the same line amounted to 58,362 quintals.

The imports of machine tools amounted during the same year to 569,406 metric quintals, as against only 73,037 quintals representing the exports. The chief items of importation in the machine tool line were the following: Turning lathes, 166,620 quintals; planing lathes, 45,460; drilling machines, 40,830; milling machines, 42,840; steam hammers, 25,290; presses, 24,010; circular saws, 33,480; metal shears, 17,040; vises, 14,170; chisels, 12,950; drills, 9,840; sawing machines, 8,720; bending machines, 8,520; straightening machines, 7,240; adjusting machines, 6,440; rolling mills, 6,270; punching machines, 6,220; woodworking machines, 5,460; grinding machines, 5,300; wire-drawing machines, 4,570; forging machines, 4,560; cog-wheel machinery, 4,340; followed then by smaller amounts of riveting, screw-cutting, polishing, metal-dressing, perforating, and other kinds of machines.

Chinese Demand for Machinery

American manufacturers should pay close attention to the possibilities offered by the Chinese market. In 1913 the total imports of machines into China amounted in value to 4.6 million taels and in 1920 to 22.3 million taels. Especially the demand for all kinds of electrical machinery is considerable and is steadily increasing. Already in 1911 towns with a population of scarcely 30,000 souls were in possession of an electric light plant, and this was especially the case in the south of the country. The demand for railway rolling stock, the importation of which had almost entirely ceased during the war, is also very great.

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Experiment Station at Tuscaloosa

The Southern experiment station of the Bureau of Mines is to begin its research work in the immediate future, it is announced by officials of the Department of the Interior. The station is located at Tuscaloosa, Ala., and has been virtually completed save for the installation of special equipment.

The station will devote its primary attention to research problems in iron ore ranging from the crude ore to the finished pig iron; by-products in their relation to blast furnace working of local ores; and the study of mineral fillers.

The mineral fillers study will be an important part of the work to be carried out on account of the special resources of the South in non-metallics. Fillers for paints, paper, rubber goods and fabrics will be studied in order to find some suitable material among these resources.

Creusot Firm to Build Machinery for French Markets

In a Paris journal, Eugene Schneider, head of the great Creusot works, has stated that German inroads on the French electrical industry are becoming more and more apparent and that prices for electrical machinery from Germany are, in general, 50 per cent lower than the same product of French manufacture. Continuing, he said:

"The Schneider firm at Le Creusot is making great preparations in its various plants to meet the need for electrical appliances in the French market."

This is virtually a new phase of this versatile French metallurgic firm. Mr. Schneider stated, also, that during a period of 30 years no strike has occurred at the Creusot works, that relations with their workmen are always of the best and that the elder Schneider, two generations removed, first established industrial and manual training schools in connection with the business so long ago that what is today called a modern idea is something that had been known in France for 40 years.

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Exports of Sugar-Mill Machinery to Cuba

That Cuba expended a portion at least of its war profits in providing for increased production of sugar is shown by the large increases in the exports of sugar mill machinery from the United States to that island, since 1915. The following figures have been compiled from the records of the Bureau of Foreign and Domestic Commerce:

Exports of sugar-mill machinery to Cuba

Year	Dollars
1911	1,252,647
1912	1,075,991
1913	1,382,959
1914	1,026,453
1915	1,320,246
1916	5,179,987
1917	9,121,512
1918	8,558,992
1919	7,385,602
1920	13,805,373
For the six months ending June 30, 1921	7,269,465

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American Machinery to Palestine

The first shipment of tools to the workers in Palestine was dispatched by the Palestine Tool Committee on the steamship City of York, which sailed for Jaffa on Aug. 18. A delegation accompanied the vessel on an excursion boat down the bay to wish bon voyage to the three mechanics, P. Irsbofsky, M. L. Kasselmen and William Rosen, who will look after the cargo of tools and machinery when the vessel arrives at Jaffa. The shipment consists of a complete road-making unit, several hundred pieces of agricultural machinery; complete equipment for a woodworking shop and a lot of blacksmith's tools, shoe repairing machinery, sewing machines and other tools.

EXPORTS OF METAL-WORKING MACHINERY, AS REPORTED BY THE DEPARTMENT OF COMMERCE FOR JULY, 1921, AND THE FIGURES FOR JULY, 1920, AS FINALLY REVISED, ARE AS FOLLOWS:

While July exports of metal-working machinery show some increase over the poor showing in June, they fall far below the value of this type of machinery exported in July, of 1920. The Bureau of Foreign and Domestic Commerce has just made public its figures for July, 1921, and the revised figures for July, 1920. The value of all exports of metal-working machinery during July, of this year, was $1,734,495. The details are shown by the following table:

	July, 1920	July, 1921
Metal-working machinery	$542,175	$191,983
Lathes	542,175	191,983
Other machine tools	915,074	281,936
Sharpening and grinding machines	396,246	105,293
All other	1,823,097	1,155,283
Total metal-working machinery	3,676,592	1,734,495
Exported to:		
Belgium	64,585	20,366
France	978,634	864,201
Italy	52,415	4,673
Norway	5,508	582
Spain	44,643	19,307
Sweden	32,303	572
United Kingdom	937,077	221,695
Canada	548,653	54,296
Mexico	44,438	68,275
Cuba	37,659	36,776
Brazil	16,131	10,145
Chile	15,948	13,016
China	36,294	1,251
British India	225,347	175,478
Japan	300,899	129,291
Australia	32,688	8,494
Netherlands	....	8,147
Argentina	....	7,542
Dutch E. Indies	....	1,135
Other countries	303,370	88,983

Business Items

The agency arrangement for the sale of sheet steel heretofore existing between Thomas Firth & Sons, Ltd., of Sheffield, England, and Wheelock Lovejoy & Co., of New York and Cambridge, has been terminated. Thomas Firth & Sons have appointed as their general sales manager for the United States, Horace G. Hides, of Hartford, Conn. The stock of Firth Sheffield sheets will be carried in the warehouse of the Firth-Sterling Steel Co., 312 Hudson St., New York City. Thomas Firth & Sons and the Firth-Sterling Steel Co. are also opening a joint office in Hartford, Conn., where Mr. Hides will have his heaadquarters and where Henry I. Moore will represent the Firth-Sterling Steel Co.

The Hampton Roads Equipment Co., Inc., 251-252 Arcade Building, Norfolk, Va., has been incorporated with $150,000 capital stock to act as representative to manufacturers of conveying machinery, contractors' supplies, etc. J. M. Sherrod is president, B. P. Bears, vice-president, and W. L. Duncan, secretary-treasurer and general manager.

The Metal Products Co., Youngstown, Ohio, has been incorporated with an authorized capitalization of $50,000. The incorporators are F. R. Weinreich, W. F. Ullman and others. The business will consist of the preparation and sale of metals of various descriptions.

Reeves Pulley Co., Columbus, Ind., announces that arrangements have been made with Manning, Maxwell & Moore, Inc., of 119 W. Fortieth St., New York City, whereby the latter assumes the exclusive agency for "The Reeves" variable speed transmission in the New York territory. Manning, Maxwell & Moore will carry a complete assortment of repair parts for these transmissions as well as "The Reeves" wood split pulley.

The Lumen Bearing Co., of Buffalo, N. Y., and Youngstown, Ohio manufacturer of "machine bronze" brass and bronze castings and bearings, solders and babbitts has established a branch office in Chicago that will supply and handle all business of the company west of and including Michigan with the exception of the city of Detroit; west of a line from Toledo, to Columbus to Cincinnati; Kentucky, Tennessee and Georgia. H. S. Huncke is the Western sales manager, with Henry Waters as associate salesman. The new office is located at 15 No. Jefferson St., Chicago.

A schedule of assets and liabilities was filed in the federal court on Aug. 9, by the bankrupt Kenworthy Motors Corporation, of Mishawaka, Ind., showing assets amounting to $124,433.38, and liabilities amounting to $174,859.49. The concern recently admitted bankruptcy in answer to a creditors' petition, filed against it on July 11 by the Auto Cape Top Co., the Western Brass Manufacturing Works, of Chicago, and the Cleveland Pneumatic Tool Co. The Kenworthy corporation lists its excise tax due on automobile sales at $6,980.77, and open accounts at $119,652.14. Of the assets $40,000 is in real estate and $65,683.28 is in stock in trade.

The Fitch Vending Machine Co., Inc., Buchanan, Va., has been incorporated with $15,000 capital stock. J. F. Fitch, is president, A. B. Land, secretary and O. E. Obenshain, treasurer. The company will contract for the manufacture of vending machine parts but will assemble the machines and manufacture cabinets at its own plant.

Southern Pacific Railroad is reported to have offered independent oil refiners in north Texas field any part of 500 tank cars each without charge, provided oil is shipped over company's lines. Idle tank cars in United States are said to number about 40,000.

Erie railroad is reported to have leased its shops at Marion, O., to a service company organized by local manufacturers, bankers and business men, and has given contracts for its repair work to the new corporation, which, it is believed, will not be subject to rules of Railroad Labor Board.

The Dodge Sales and Engineering Co., of Mishawaka, Ind., announces that the construction of its new million-dollar building at 49 Park Place, New York City, has been started. The products of the company include pulleys, rope drives, hangers, shafting, bearings, couplings and heavy oil engines.

The Osgood Bradley Car Co., with factories at Worcester, Mass., has recently been awarded the contract to build twenty-two electric cars for the electric zone between New York City and New Haven, Conn., for the New York, New Haven & Hartford Railroad Co. The cost is estimated at $1,400,000. Officials of the Bradley company announce that eight hundred employes will be given work on this order for the balance of the year.

The Aircraft Construction Corporation of New Haven, Conn., has been incorporated under the state laws of Delaware with a capital stock of $100,000,000. Charles B. Bishop, Samuel H. Baynard, Jr., and A. S. Bishop are named as incorporators. The business of the company will include principally general construction and transportation of aircraft.

The Gould Machinery Co., 232 East 74th St., New York City, has been organized by Herman Gould, formerly with the Latham Machine Co. The new concern will conduct a maintenance and repair business for bookbinding, printing and boxmaking machinery.

The Enterprise Foundry and Machine Works, Bristol, Tenn., manufacturer of roller bearing trucks for mine and industrial railways, is now extending its facilities for the manufacture of complete mine cars.

Sidney Thompson, president of the Defiance Screw Machine Products Co., Defiance, Ohio, has taken over the Napoleon Tool and Machine Co., increasing its capitalization from $40,000 to $50,000 and changing its name to the Napoleon Products Co. Automobile parts will be manufactured under the new management.

Operations of a part of the Bucyrus Machine Tool Co.'s plant at Bucyrus, Ohio, as a general machine and repair shop, is to be undertaken shortly by G. P. Young and A. W. Wheeler. Arrangements have been made with the receivers for the company which closed sometime ago after its operation by the Browarsky-Crumm Manufacuring Co. Mr. Wheeler has been manager of the Galion Iron Works, Galion, Ohio, and before that was superintendent of the Allen Motor Co., of Bucyrus. Mr. Young was with the Hadfield-Penfield Steel Co.

Charles S. McKinley, assistant manager of sales of the Republic Iron and Steel Co. at the Youngstown Ohio, office, has resigned to become associated with his brother, A. E. McKinley, an instructor in the University of Pennsylvania, in the management of the McKinley Publishing Co., Philadelphia. He had been with the Republic company since 1913, coming here from Pittsburgh where he had been manager of sales in that district. He will be succeeded by Walter H. Hall of the Pittsburgh office of the Republic Iron and Steel Co. Mr. Hall will be located at the Youngstown office.

Personals

Nels B. Lund, a pioneer in the design of aircraft instruments and gyroscopic apparatus and formerly with the Sperry Gyroscope Co., Brooklyn, N. Y., has become associated with the Pioneer Instrument Co., of Brooklyn, N. Y., as assistant to chief engineer M. M. Titterington.

Joseph A. Horne, vice-president of the Yale & Towne Manufacturing Co., of Stamford, Conn., sailed for Europe on Aug. 23 and expects to return in October. His object is to make a careful study of business conditions in Great Britain and on the Continent.

W. C. Reilly, general superintendent of the Youngstown Sheet and Tube Co., Youngstown, Ohio, is in Halifax where he had been called as an expert appraiser in a controversy between the Dominion Steel Company and the Nova Scotia Provincial Government. The controversy, which arose from war contracts, is said to involve claims of $9,000,000.

The W. A. Jones Foundry & Machine Co., Chicago, Ill., announces the appointment of Robert B. Moir as manager of the New York branch. He will assume his new duties immediately, making headquarters at the present sales office and transmission warehouse of the company at 20 Murray St. Mr. Moir has been actively connected with the home office and factory for a number of years.

Trade Catalogs

Auto Trestles. The Manley Manufacturing Co., York, Pa. Catalog No. 300, describing the Manley floor level under-worker auto trestle for elevating the front or rear end of a car to work on the under parts of the chassis.

Electric Furnaces. Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa. The new line of electric furnaces which has recently been added to the products of this firm is described and illustrated in catalog 9-C, which is being distributed. This type of furnace includes the multiple unit designed for use with heats of 1800 to 2000° F. The small Hevi-duty furnaces of the multiple crucible type may be operated continuously at 2000° F. Hevi-duty industrial furnaces with applications for annealing, hardening, drawing and enameling, are described in minute detail in this publication. A discussion of the characteristics of these furnaces is also given.

Jarvis Tapping Device. The Geometric Tool Co., New Haven, Conn. Catalog describing a high-speed tapping device, quick-change chucks and collets.

Pease Blueprinting Machine. C. F Pease Co., Chicago, Ill. A circular describing and illustrating the Pease "Peerless" automatic blueprinting, washing and drying machine.

The Iron Man. Pearson-Scott Co., Indianapolis, Ind. Catalog illustrating and describing a mechanical device known as "The Iron Man" which is an attachment for use with hand screw machines or turret lathes, taking the place of an operator.

"Little David" Pneumatic Tool Accessories. Ingersoll-Rand Co., 11 Broadway, New York. A twenty-four page catalog describing and illustrating air hose, hose couplings, hose clamps, drill chucks; chisels and chisel blanks, rivet sets and blanks, wire brushes, oils and greases, rail bonding drills, rail drills and railroad kit boxes.

Milling Machines. Ingersoll Milling Machine Co., Rockford, Ill. Circular illustrating and describing a circular Ingersoll continuous milling machine with which the bottom surfaces of the upper crankcases of a four-cylinder motor is milled.

Bath Micrometer and Master Ring. John Bath & Co., Inc., Worcester, Mass. Describing a new type of measuring tool. It can easily be set to conform to any existing shop standard, or adjusted to correct standard size by resetting the graduated ring and is available in U. S. Standard and S. A. E. Standard sizes.

Catalogs Wanted

J. Worner & Co., Budapest, Hungary, would be pleased to receive catalogs on flour milling machines and equipment, printing presses and coal pulverizing machines. This company serves an extensive clientele in Hungary, the Balkan States and Russia. Until Sept. 20 all catalogs should be sent care of L. J. Calder, 348 Madison Ave., New York City; thereafter to the firm's home address.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A mercantile company in South Africa desires to purchase pipe threading and cutting machines, pipe fitting and tapping machines, socket making and tapping machinery, bending presses and bend-threading machinery. This machinery is urgently needed and will probably be ordered by cable. Reference No. 35314.

A manufacturing firm in Switzerland desires to secure an agency, or purchase on own account, bright polished, hardened and tempered heddle steel, with rounded edges, sizes: 11 by 0.2 millimeters; 12 by 0.2 millimeters; and 10.8 by 0.2 millimeters; polished, hardened and tempered, yellow or blue, gramophone spring steel; clock spring wheel; and heald wire. Quotations should be given c.i.f. Antwerp. Terms: 30 days monthly account. Reference No. 35329.

An American citizen with offices established in Hungary desires to secure representation of firms for the sale throughout all the Balkan States of adding and calculating machines; typewriters; automobiles and supplies; automobile tires; agricultural machinery and implements; trucks and tractors; fertilizers; and tin plate: Terms: Cash on delivery. Quotations: C.i.f. European port, preferably Trieste. Sample lines to be forwarded when possible, and in every case catalogs, price lists and details as to terms, etc., should be given in first letter. Reference No. 35349.

A commercial agency firm in Jugoslavia desires to purchase and secure an agency for the sale of cultivation and harvesting machinery for use with tractor. Quotations should be given c.i.f. Trieste, or f.o.b. New York, preferably the former. Payment: Cash against documents in New York or Trieste in United States currency. Reference No. 35353.

A mercantile company in Southwest Mexico desires to purchase large quantities of hardware and machinery for machine shops, tools, car-repair materials and in general a supply of all material used in building a harbor. Quotations should be given c.i.f. Mexican port, or f.o.b. point of shipment. Reference No. 35354.

Obituary

Peter Cooper Hewitt, American scientist and inventor, died in the American Hospital, Paris, on Aug. 25. He was sixty years old. He was best known in the scientific world for his invention of the "Cooper-Hewitt Lamp," which is in common use throughout the world, and the Cooper-Hewitt Rectifier," by which direct current machinery can be used when only alternating current is available. He was also deeply interested in the study of aeronautics, having made extensive experiments with hydroplanes. During the war he was made first vice-chairman of the United States Naval Consulting Board and rendered valuable service to the country. He was a member of many technical societies including the American Institute of Electrical Engineers, American Physical Society, Society of Naval Architects and Marine Engineers, New York Society of Electrical Engineers and the General Society of Mechanics and Tradesmen.

Col. Samuel P. Colt, chairman of the board of the United States Rubber Co died at his home in Bristol, Conn., on Aug 13. He was in his seventieth year.

Forthcoming Meetings

The second International Cost Conference will be held at Cleveland, Ohio, on Sept. 14, 15 and 16, under the auspices of the National Association of Cost Accountants.

The third annual convention and exhibition of the American Society for Steel Treating will be held in the Manufacturers Building, State Fair Grounds, Indianapolis, Ind., during the week of September 19 to 24 inclusive.

The annual congress of the National Safety Council will be held at Boston, Mass., during the week of September 26 C. W. Price, 168 North Michigan Ave., Chicago, Ill., is general manager.

The twelfth annual convention of the American Manufacturers Export Association will be held in the Waldorf-Astoria Hotel, New York City, on October 5 and 6. A. W. Willmann is secretary.

A joint meeting of the American Society of Mechanical Engineers, the Society Automotive Engineers and the Army Ordnance Association will be held at Aberdeen Md., Friday, October 7.

The American Gear Manufacturers Association will hold its semi-annual meetin at Rochester, N. Y., October 13, 14 and 1 F. D. Hamlin, 4401 Germantown Ave Philadelphia, Pa. is secretary.

The National Machine Tool Builders' Association will hold its fall meeting at th Hotel Astor, New York City, October 1 19 and 20.

NEW *and* ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

N. J., Jersey City—motor driven shear for cutting off round iron, up to 1¼ in. dia. and arranged for 440 volts, 2 phase A.C. or 110 volts, 1 phase A.C.

N. Y., New Haven—A. A. Hamlin—One 36- or 42-in. veneer lathe.

N. Y., New York—Nielsen & Winthers, 59 Pearl St.—Lennox type rotary level shear for ⅜ in. plate.

Pa., Philadelphia—The Bureau of Water, 792 City Hall—Contract 518—machine tools for repair shops. Contract 523—one electric crane for Shawmut Pump station.

Pa., Pittsburgh—F. A. French, Braddock Ave. and Guthrie St.—No. 10 Brown & Sharpe type grinding machine or similar (used).

Va., Richmond—Anderson & Childress, 1605 West Broad St.—drill and arbor presses, emery wheel, medium size lathe, air pump for auto repair shop (used; in good condition).

Va., Wytheville—R. P. Johnson, O. M. Johnson, Purch. Agt.—Hays or Jenkins double end tenoner for machine shop.

W. Va., Raiville—The Sewell Valley R.R. Co.—one 1,200 lb. steam hammer, 20 in. engine lathe with power cross feed and taper attachment to swing 8 ft. between centers or same turret type, with turret on carriage, belt driven, one No. 2 or 3 universal milling machine, belt driven, a 24 in. high speed upright drilling machine back geared, belt driven, a 58 or 68 in., 250 ton wheel press, inclinable type, belt driven and a 60 in. driven lathe to turn straight connectors, belt driven, also 2 Shay type drivers.

Ill., Chicago—The Chicago Metal Mfg. Co., 216 West Ontario St.—one 10 ft. power shear, 10 or 12 gage.

Ill., Chicago—E. M. Heller Co., 144 West Kinzie St.—two Hoeffler piston boring machines, 20 in. x 14 ft. bed lathe.

Ill., Chicago—Atchison, Topeka & Santa Fe R.R., Railway Exchange Bldg., M. J. Collins, Purch. Agt.—One vertical boring mill, heavy duty type, 76 in. swing, 2 heads on cross rail, swiveling type. Proposition wanted also on alternates, one with 84 in. swing and one with 100 in. swing.

One double end car wheel axle lathe, heavy duty type, 52 in. swing, complete with bushings for standard size axles, calipering attachments, set of centers for engine truck wheels (inside journals) and complete with all required dogs.

One vertical drilling machine, sensitive type, heavy duty, capacity 1½ in. in steel, reach 18 in. drill to column, belt driven through gear box, single pulley driven preferred.

One car wheel journal truing machine with all usual attachments, motor driven.

One radial drill press, heavy duty type, 5 ft. swing, belt driven through gear box with single pulley drive.

One engine lathe, belt driven, heavy duty type, 36 in. swing over bed, compound steady and follower rests quick change gear, taper attachments complete with all steel chucks with independent steel jaws fitted to lathe. Also give propositions on several types of back gears, bidders, makes, geared head and lathes as above but with 42 in. and 48 in. swing respectively.

One engine lathe, belt driven, heavy duty type, compound steady and follower rests, quick change gears, taper attachments complete with all steel chuck with independent steel jaws fitted to lathe. Also give propositions on several types of back gears, bidders, makes and geared head and lathes as above but with 30 in. and 36 in. swing respectively.

Mich., Detroit—L. Spinks, 6083 Vermont Ave.—lathe with 1⅛ in. hollow spindle and chuck.

O., Canton—McKinley High School will receive bids about Sept. 16 for machine shop equipment. Former bids rejected. Noted July 28.

O., Cleveland—Chesterfield Junior High School, Durant and East 117th Sts.—equipment for machine shop.

Wis., Milwaukee—Auto Mutual Service Co., 531 Grand Ave., A. De Pierre, Purch. Agt.—lathe and drill press.

Wis., Milwaukee—Joe's Garage, 684 3rd Ave.—drill press to drill 1 in. hole.

Wis., Oshkosh—Kaerwer Auto Co.,—machine and power machinery including lathes, presses, etc.

Md., Baltimore—The Western Maryland Dairy Co., Linden and Dolphin Sts., A. B. Gardner, Pres.—$250,000 worth of refrigeration machinery.

N. Y., Buffalo—A. D. Cutting Co., 1170 Jefferson St., A. D. Cutting, Purch. Agt.—mortise machines.

N. Y., Buffalo—Duffy Silk Co., 1270 Bway., C. Duffy, Owner—equipment for proposed silk mill.

N. Y., Highland—D. H. Starr & Son, Vineyard Ave.—Saw bench with tipping table 39 x 48 in.

Rip saw.

Complete Post Borer with one self centering chuck to hold drill shanks up to 1⅛ in. dia.

One automatic knife grinder.

One Wheland railroad cut-off saw.

One straight frame saw mandrel

Pa., Phila.,—Tazewell Mfg. Co., Tazewell, Va.—bottling equipment, for proposed plant here.

Pa., York—The Reed Machine Co., 231 North George St.—machinery.

Fla., Ft. Myers—The Florida Doll Mfg. Co., B. F. Roessling, Purch. Agt.—machinery for use in manufacture of toys, including automatic lathe to turn out doll bodies, legs, arms and heads, presses to manufacture heads by the die process, mixing machinery to mix composition for doll heads, paint spraying outfits, etc.

Fla., South Jacksonville—The South Side Concrete Co.—all kinds of concrete machinery.

S. C., Hartsville—F. D. Slaght—bakery equipment, including dough mixer, cake mixer, etc.

S. C., Spartanburg—B. G. Sanders—complete baking machinery and other equipment.

Tenn., Chattanooga—The Cumberland Oil Co., 8½ West 8th St., E. B. Clark, Mgr.—complete oil drilling machinery.

Va., Richmond — J. W. Montgomery, mill work, 1716 West Cary St.—mortising machinery, belt sander and combination rip saw.

Va., Richmond—E. K. Vieter, 1800 Simms Ave., manufacturers of tobacco, W. F. Lee, Purch. Agt.—Complete line of drying machinery operated by motors.

Wis., Hartford—Portz Bros. Malt & Grain Co.—special machinery, cooking apparatus, etc., for proposed plant.

Wis., Hawkins—The Northern Sash & Door Co., J. Jesdahl, Purch. Agt.—woodworking machinery including sticker and planer, etc.

Wis., Menasha—United Paper Corp., c/o J. S. Frankland, Pres.—machinery, etc., for proposed paper factory.

Wis., Milwaukee—Acme Grey Iron Fdry. Co., 470 37th St., C. W. Brown, Purch. Agt.—foundry equipment.

Wis., Milwaukee—The Red Star Yeast Co., 79 Buffalo St.—conveying machinery.

Wis., Milwaukee—Rosenberg Elevator Co., 174 Reed St.—one 5 ton traveling crane.

Wis., Neenah—E. A. Wettengel, 578 Pierce Ave., Appleton—two paper machines, 8 beaters and washers.

Wis., Oconomowoc—E. O. Otto, Inc., P. O. Box 134—equipment for wood-working shops including, jointer, rip saw, band saw, hollow chisel mortiser, mitre machine, etc.

Wis., Shawano—United Fruit Packing Co., c/o H. Opgenorth, Pres., Sheboygan—woodworking machinery.

Wis., Stevens Point—G. A. Sutherland, 1210 Division St.—one 20 ton press, lathe, power machinery, etc.

Wis., West Allis—O. Klasske, 3919 National Ave.—tinners' machinery.

Mo., Joplin—Joplin Center Cord Tire & Rubber Co., 815 Main St.—rubber mill-tire making jacks and small calender pipe.

Mo., Rockville—The Keystone Products Co.—tools and machinery for soap factory.

Cal., Los Angeles—Swift & Co., 922 East 1st St.—refrigerating machinery and equipment.

Ont., St. Thomas—The Elgin Milk Products Co., E. Giles, Mgr.—new modern equipment for the manufacture of butter, ice cream and pasteurized milk, etc.

Metal Working Shops

MIDDLE ATLANTIC STATES

N. J. Bridgeton—I. Tove Co., 353 Bank St., will build a 1 story, 40x80 ft. foundry. Estimated cost, $12,000. W. P. Cameron, Witherspoon Bldg., Phila., Pa., Engr. Noted Aug. 18.

N. J., Florence—The Florence Pipe Fdry. & Machine Shop has awarded the contract for the construction of a smith shop and storage house. Estimated cost, $25,000.

N. Y., New York—Soan & Moeller, c/o Magnuson & Kleinert, Archts., 52 Vanderbilt Ave., will soon receive bids for the construction of a 2 story, 100x125 ft. garage at 327 East 64th St. Estimated cost $60,000.

The Weekly Price Guide

This Week's Market

Steel warehouse prices and quotations on mill shipments have remained unchanged, in New York, since last week. Cutting under the official Pittsburgh schedule of $1.85, for steel plates, has been rumored, quotations having been made as low as $1.70@$1.75. Reductions in tin plate, blue-annealed and galvanized steel sheets are quoted at the mills. Tin plate is quoted at $4.75, as against $5.25; blue-annealed sheets have been reduced from $3 to $2.75 and the price of galvanized has dropped from $4 to $3.75.

Cleveland reports a drop of 15c. per 100 lb. in cold-finished steel, and a general decrease of ½c. per lb. on old metals. Floor plates are quoted at 2.74c., as against 3c. per lb. The only advance in price is 3¼c. per lb. on solder, making the present price 23½c., as compared with 20¼c. previously.

Chicago prices remain firm, with steel quotations, particularly structural shapes, comparing very closely with those of New York.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	*$24.50
Northern Basic	†21.52
Southern Ohio No. 2	†22.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	†30.26
BIRMINGHAM	
No. 2 Foundry	*20.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	†21.76
Virginia No. 2	†28.74
Basic	†20.26
Grey Forge	†22.26
CHICAGO	
No. 2 Foundry local	*20.00
No. 2 Foundry, Southern, sil 2.25@2.75	†26.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	21.96
Basic	19.96
Bessemer	21.96

*F. o. b. furnace. † Delivered.

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.75	3.53	3.25	3.53
No. 12	2.80	3.58	3.30	3.58
No. 14	2.85	3.63	3.35	3.63
No. 16	2.95	3.73	3.45	3.73
Black				
Nos. 17 and 21.	3.40	4.05	3.80	4.45
Nos. 22 and 24.	3.50	4.10	3.85	4.50
Nos. 25 and 26.	3.55	4.15	3.90	4.55
No. 28	3.65	4.25	4.00	4.65
Galvanized				
Nos. 10 and 11.	3.75	4.25	4.00	4.95
Nos. 12 and 14.	3.85	4.35	4.10	5.05
Nos. 17 and 21.	4.15	4.65	4.40	5.35
Nos. 22 and 24.	4.30	4.80	4.55	5.50
No. 26	4.45	4.95	4.70	5.55
No. 28	4.75	5.25	5.00	5.65

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of July 7, 1921:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	64½	52	¾ to 1½	39½	24½
LAP WELD					
2	56¼	44	2	34½	20½
2½ to 6	60½	48	2½ to 4	37½	24½
7 to 12	57½	44	4½ to 6	37½	24½
13 and 14	45	37	7 to 12	35½	22½
15	42½	32			
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	62½	51	1 to 1½	39½	25½
2 to 3	63½	52			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	54½	43	2	35½	22½
2½ to 4	58½	47	2½ to 4	38½	26½
4½ to 6	57½	46	4½ to 6	37½	25½
7 to 8	53½	40	7 to 8	30½	18½
9 to 12	48½	35	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
¾ to 3 in. steel butt welded.	60%	46%	52½%	43½%	62½%	50%
2½ to 6 in. steel lap welded.	51%	37%	55½%	40½%	48½%	46%

Malleable fittings. Classes B and C, Banded, from New York stock sell at plus 6%. Cast iron, standard sizes, 15% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (heavy)	5.00	6.50	8.25
Spring steel (light)	8.00	6.50	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.03
Hoop steel	3.88	3.29	3.48
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	4.85	2.74	5.23
Cold finished shafting or screw	4.23	3.85	3.85
Cold finished flats, squares	4.73	4.35	4.35
Structural shapes (base)	2.88	2.74	2.88
Soft steel bars (base)	2.78	2.64	2.70
Soft steel bar shapes (base)	2.78	2.64	2.70
Soft steel bands (base)	3.43	....	.....
Tank plates (base)	2.88	2.92½	2.88
Bar iron (mill 2.50)	2.78	3.52	2.78
Drill rod (from list)	55@60%	55%	50%

Electric welding wire........ New York $\frac{3}{32}$, 8½c. per lb. ⅛—7.15c.; $\frac{5}{32}$ to ¼—6.75c. Swedish iron sells at 18½c. per lb. in Chicago

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	12¾@13
Tin, 5-ton lots, New York	26.00
Lead (up to carlots), St. Louis, 4.35; New York	4.75
Zinc (up to carlots), St. Louis, 4.60; New York	5.00

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.00	25@26	30
Antimony (Chinese), ton spot	5.25	6.00	6.00
Copper sheets, base	20.00	20.75@21	20.00
Copper wire (carlots)	15.50	15.50	14.00
Copper bars (ton lots)	18.50	22.00	18.50
Copper tubing (100-lb. lots)	19.00	23.00	20.00
Brass sheets (100-lb. lots)	15.75	18.00	15.75
Brass tubing (100-lb. lots)	18.50	20.00	18.50
Brass rods (1,000-lb. lots)	13.75	15.50	13.75
Zinc sheets (casks), (8% dis. carlots)	11.00	11.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ½), (case lots)	17.75	23.50	17.50
Babbitt metal (best grade)	70.00	35.50	35.00
Babbitt metal (commercial)	30.00	13.50	9.00

—Shop Materials and Supplies

MONEL METAL Base price in cents per pound, f.o.b. Bayonne, N. J.

Shots and blocks...	$35.00	Hot rolled rods (base)....	42.00
Ingots............	38.00	Cold rolled rods (base)...	56.00
Sheet bars.........	40.00	Hot rolled sheets (base)..	55.00

Special Nickel and Alloys

Malleable nickel ingots..................................	45
Malleable nickel sheet bars................................	47
Hot rolled rods, Grades "A" and "C" (base)..................	60
Cold drawn rods, Grade "A" and "C" (base)................	72
Copper nickel ingots......................................	37
Hot rolled copper nickel rods (base).......................	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible......	9.50	9.00	9.50
Copper, heavy, and wire..........	9.00	9.00	9.00
Copper, light, and bottoms.......	7.00	7.00	7.00
Lead, heavy....................	3.25	3.00	3.00
Lead, tea......................	2.00	2.00	2.00
Brass, heavy...................	5.00	5.00	7.25
Brass, light...................	4.00	3.00	4.25
No. 1 yellow brass turnings.......	4.50	4.00	4.50
Zinc..........................	2.50	2.00	2.50

TIN PLATES—American Charcoal Plates—Bright

	New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:			
IC, 20x28, 112 sheets.......	.....	......	....
IX, 20x28, 112 sheets.......	.....	......	....
IXX, 20x28, 56 sheets.......	.....	......	....
IXXX, 20x28, 56 sheets.......	.....	......	....
IXXXX, 20x28, 56 sheets.......	.....	......	....
"A" Charcoal Allaways Grade:			
IC, 20x28, 112 sheets.......	.....	......	....
IX, 20x28, 112 sheets.......	.....	......	....
IXX, 20x28, 56 sheets.......	.....	......	....
IXXX, 20x28, 56 sheets.......	.....	......	....
IXXXX, 20x28, 56 sheets.......	.....	......	....

Coke Plates, Bright

Prime, 20x28 in.:		(Base)	
80-lb, 112 sheets..............	.....	......	....
90-lb., 112 sheets..............	.....	......	....
100-lb., 112 sheets..............	.....	6.50	....
IC, 112 sheets..............	.....	6.65	....
IX, 112 sheets..............	.....	......	....
IXX, 56 sheets..............	.....	......	....
IXXX, 56 sheets..............	.....	......	....
IXXXX, 56 sheets..............	.....	......	....

Terne Plate

Small lots, 8-lb. Coating:			
100-lb., 14x20..................	$7.50	5.50	....
IC, 14x20..................	7.75	5.75	....
IX, 14x20..................	8.00	6.00	....

SHOP SUPPLIES

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in............	—50%	50–10–5%	—60%
1⅛ and 1¼x3 in. up to 12 in..........	—40%	60–10–10%	—55%
With cold punched sq. nuts........	......	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%).......	......	....	.. ..
Up to 1-in. diameter, with cold punched hex. nuts (plus std. extra of 10%).................	......	....	.....
Button head bolts, with hex. nuts.....	......	390 base	.....
Hex. head and hex. nut bolts.........	......	....	.....
Lag screws, coach screws............	......	....	.....
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	60%	—55%
Bolt ends, with hot pressed nuts.......	......	....	.....
Tap bolts, hex. heads...............	......	....	.....
Rivets, $\frac{7}{16}$ in. dia. and smaller. *New list*	–50–10%	60–10%	–60–10%
Rivets, tinned....................	–50–10%	60–10%	—45%
Semi-finished nuts, all sizes...........	—75%	80%	.....
Case-hardened nuts.................	......	....	.....
Washers, wrought iron, ½ in., per 100 lb.	$3.00	$4.50 off	$4.50
Washers, cast iron, ⅝ in. and larger, per 100 lb........................	4.25	3.75 off	4.50
Washers, round plate, off list per 100 lb.	......	....	.....
Nuts, hot pressed, sq..........Off list	2.00	2.25	3.00
Nuts, hot pressed, hex.........Off list	2.00	2.25	3.00
Nuts, cold punched, sq.........Off list	1.50	2.25	3.00
Nuts, cold punched, hex........Off list	1.50	2.25	3.00
Rivets:			
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb..................	$4.40	....	3.68
Cone heads, ditto.................	4.50	....	3.78
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb.................	......	....	....
⅞ in. diameter.......... *EXTRA*	......	....	....
½ in. diameter.......... *EXTRA*	......	....	....
1 in. long, and shorter..... *EXTRA*	......	....	....
Longer than 5 in......... *EXTRA*	......	....	....
Less than 200 lb......... *EXTRA*	......	....	....
Countersunk heads....... *EXTRA*	......	....	....
Copper rivets...........	50–10%	40–10%	50%
Copper burs....................	25–10%	15%	50%

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb....	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb....	055@.09	.09	.10
Wiping cloths per M., 13½x13½..	....	55.00	55.00
Wiping cloths per M., 13½x20½.	....	65.00	65.00
Sal soda, 100 lbs.............	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb........................	2.55	3.25	2.75
Linseed oil, per gal., 5 bbl. lots...	.78	.83	.80
Fire clay, Ottawa, per 100 lb...	.80	.80	
White lead, dry or in oil.......	100 lb. kegs.	New York, 12.25	
Red lead, dry................	100 lb. kegs.	New York, 12.25	
Red lead, in oil..............	100 lb. kegs.	New York, 13.75	
Coke, prompt furnace.........	$2.90@3.00		
Coke, prompt foundry.........	4.00@4.50		

Pa., Philadelphia—L. M. Davis, 1616 Chancelor St., will receive bids until Sept. 5 for the construction of a 2 and 3 story, 60 x 60 ft. addition to garage, on Chancelor St. Estimated cost, $75,000. R. Priest, 1627 Sansom St., Engr.

Pa., Pittsburgh—The Point Motor Co., 36 Penn Ave., is receiving bids for the construction of a 3 story, 75x110 ft. addition to its garage on Penn Ave and Bell Alley. Estimated cost, between $40,000 and $50,000. J. P. Piper, Archt.

Pa., Pittsburgh—A. J. Schmitz, 237 Collins Ave., is receiving bids for the construction of an 8 story, 60x110 ft. garage and warehouse on Penn Ave. Estimated cost, $150,000. S. Waller, Nassau St., New York City, Archt.

Pa., York—The Reed Machine Co., 231 North George St., has awarded the contract for the construction of a 2 story, 40x100 ft. machine shop. Estimated cost, $15,000.

MIDDLE WEST STATES

Ill., Chicago—C. H. Eckstrom, Archt., 5 North LaSalle St., is receiving bids for the construction of an 8 story addition to printing plant, at 500-10 North Dearborn St., for W. D. Boyce, 508 North Dearborn St. Estimated cost, $400,000.

O., Cleveland—The Aetna Welding Co., c/o J Haag, 4613 Bway., has awarded the contract for the construction of a 1-story, 40x66 ft. welding shop, on Bway. Estimated cost, $10,000.

O., Cleveland—The Carris-Franklin Sales Co., L. C. Carris, Mgr., 3622 Prospect Ave., is having plans prepared for the construction of a 2 story garage on Prospect Ave. Estimated cost, $100,000. Private plans.

O., Cleveland—E. A. Kilroy, 9407 Ramona Blvd., will build a 1 story, 34x100 ft. steel shop at 13800 Miles Ave. Estimated cost, $15,000. Private plans.

O., Cleveland—J. Kirby, Kirby Bldg, has awarded the contract for the construction of a 5 story, 62 x 130 ft. garage on West 6th St. and Frankfort Ave. Estimated cost, $200,000.

Wis., Edgerton—The Highway Trailer Co., c/o J. W. Menhall, Pres., is having plans prepared for the construction of a 2 story, 60x180 ft. trailer factory. Estimated cost, $55,000. Private plans.

Wis., Elkhart Lake—The Public Service Co., c/o W. A. Burke, secy., is receiving bds for the construction of a 1 story, 60x110 ft. power and machine shop. Estimated cost, $100,000. Private plans.

Wis., Manitowoc—The Manitowoc County has awarded the contract for the construction of a 1 story, 40x92 ft. machine shop. Estimated cost, $40,000.

Wis., Milwaukee—The Rosenberg Elevator Co., 174 Reed St., will soon award the contract for the construction of a 1 and 2 story, 120x220 ft. factory, on Franklin St. M. Tullgren & Sons, 425 East Water St., Archts. and Engrs.

Wis., Oshkosh—The Kaerwer Auto Co. has awarded the contract for the construction of a 2 story, 73 x 97 ft. garage, on Main St. Estimated cost, $40,000. Noted July 7.

Wis., Stevens Point—G. A. Sutherland, 1210 Division St., has awarded the contract for the construction of a 1 story, 55x100 ft. garage, etc., on Main St. Estimated cost, $40,000.

WEST OF THE MISSISSIPPI

Kan., Wichita—The Wichita Visible Pump Co., c/o E. P. Hayes, 701 Gilbert St., plans to build a 2 story factory, for the manufacture of pumps, on Gilbert and Santa Fe Sts. Estimated cost, $50,000. Architect not selected.

Mo., St. Louis—The Eagle Motor Truck Co., c/o J. P. Reis, 6154 Bartmer Ave., has awarded the contract for the construction of a 1 story, 50x150 ft. factory. Estimated cost, $50,000. Noted May 19.

Mo., St. Louis—The Midwest Piping Co., c/o A. G. Stoughton, Pres., 1452 South 2nd St., has awarded the contract for the construction of a 1 story, 40x151 ft. factory, on South 2nd St., Estimated cost $50,000.

Tex., Dallas—E. G. Knight, 3617 Cedar Springs St., has awarded the contract for the construction of a 5 story, 116x153 ft. garage on Masten and Pacific Sts. Estimated cost, $167,000.

WESTERN STATES

Cal., Pasadena—The Pasadena Transfer and Storage Co., 65 South Bway., plans to build a 6 story, 66x250 ft. garage and warehouse, on South Marengo St. Estimated cost, $150,000. Architect not selected.

Our Machinery Exchange

Somehow, if a man *does* his share he *gets* his share. At least, that's how it seems to work out in this particular world that we know a little about. We do all we can to produce a weekly Machinery Exchange that will be of value to—You!

Our regular reporting service is able to dig up about one page of tips. Therefore, if you just *use* these columns without *contributing* to them, there will be only three columns per week. If, on the other hand, a few dozen concerns will send us their machine-tool and machinery requirements each week we can publish six columns, two pages.

We will publish your machine-tool and machinery wants free of charge, thus putting you in contact with the best machinery selling interests in the world. We tell you this frankly, because you are not one of those who fear a host of inquiries. You want all the inquiries you can get, so that you may select from them the best proposition. This is the sound principle of modern purchasing.

Won't you advise us to-day what you are going to need "to-morrow?" The item or list will be freely published in

Our Machinery Exchange

CANADA

Ont., Simcoe—The Comet Automobile Co., 156-60 South Water St., plans to build a factory here. Estimated cost, $50,000.

T. H., Pearl Harbor—The Bureau of Yards and Docks, Navy Dept., Wash., D. C., will receive bids until Sept. 21, for the erection of steelwork for a 1 story, 181 x 520 ft. machine shop.

General Manufacturing

NEW ENGLAND STATES

Conn., Hartford—The New England Brewing Co., 513 Windsor Ave., has awarded the contract for the construction of a 3 story, 85 x 200 ft. factory, on Windsor Ave., for the manufacture of food products. Estimated cost, $75,000.

R. I., Providence—Williams & Anderson Co., 33 Broad St., plans to build a factory on the block bounded by Highland Ave., North Main, 3rd and 4th Sts., for the manufacture of emblems. Architect not selected.

MIDDLE ATLANTIC STATES

Md., Baltimore—The Western Maryland Dairy Co., A. B. Gardner, Pres., Linden and Dolphin Sts., is having plans prepared for the construction of a dairy plant, etc. Estimated cost, $260,000 J. E. Sperry, Calvert Bldg., Archt.

N. Y., Albany—The Gibson Snow Drug Co., Bway. and Orange St., has awarded the contract for the construction of a 4 story, 38 x 106 ft. factory. Estimated cost, $160,000.

N. Y., Buffalo—The Duffy Silk Co., 1270 Bway., has had plans prepared for the construction of a 3 story, 60 x 175 ft. silk mil. Estimated cost to exceed $50,000. Esenwein & Johnson, Ellicott Sq., Archts.

N. Y., Buffalo—The Danahy Packing Co., 25 Metcalfe St., is having plans prepared for the construction of a 4 story 60x67 ft. cooler building on Metcalfe St. Estimated Cost, $45,000. H. Brown, 28 Glenwood Ave., Archt.

N. Y., Buffalo—The Iroquois Natural Gas Co., Iroquois Bldg., is having plans prepared for the construction of a plant for the manufacture of gas. Estimated cost, $4,000,000. L. Brown, Iroquois Bldg., Engr.

N. Y., Long Island City—R. Hellman, Inc., 501 Steinway Ave., Astoria, is having preliminary plans prepared for the construction of a 100x125 ft. factory at 602 Jackson Ave., for the manufacture of mayonnaise dressing. Estimated cost, $150,000. J. K. Turton Co., Inc., 101 Park Ave., New York City, Archt. and Engr.

N. Y., Syracuse—Onondaga Pottery Co., 1858 West Fayette St., has awarded the contract for the construction of a 1 story, 140 x 700 ft. pottery on Court. St. Rd Estimated cost, $200,000.

MIDDLE WEST STATES

Ill., Chicago—E. W. Bredemeier & Co., 213 North Morgan St., has awarded the contract for the construction of a 3 story, 125 x 132 ft. printing plant at 314-20 South Honore St. Estimated cost, $250,000. Noted May 26.

Ill., Chicago—The Sewell Clapp Envelope Co., 23 Desplaines St., has awarded the contract for the construction of a 1 and 2 story printing plant on Belmont and Tripp Sts. Estimated cost, $250,000. Noted March 17.

Wis., Milwaukee — The Red Star Yeast Co., 79 Buffalo St., is having plans prepare for the construction of a 1 story, 50 x 10 ft. addition to its vinegar plant. Estimate cost, $15,000. E. R. Liebert, 432 Bway. Archt. and Engr.

WEST OF THE MISSISSIPPI

Mo., Monett—E. L. Jerome plans to re model ice cream plant on Bway. Estimate cost, $5,000. Private plans.

WESTERN STATES

Cal., Los Angeles — H. Guyot, 2300 3 Ave., has awarded the contract for th construction of a 2 story, 72 x 100 ft. fac tory for the manufacture of furniture, 740 Clanton St. Estimated cost, $20,000.

CANADA

Ont., Tillsonburg — R. Myrick has pu chased a factory and plans to remodel ar equip same for the manufacture of butte

American Machinist

Volume 55 NEW YORK, SEPTEMBER 8, 1921 Number 10

Tools for Manufacturing a Musical Instrument

Press Tools for Work Requiring Close Limits — Milling Strips of Thin Brass Concave with a Straight Cutter — Tuning to a Master Instrument

By C. R. BAGGETT

SHORTLY after the armistice in 1918, the writer was concerned with the proposition for producing mouth organs on a large scale in an English shop. A close examination of a German sample showed that it was not such a simple proposition as might be imagined. Considerable time was spent in searching for literature dealing with the manufacture of mouth organs, but after enlisting the aid of the Board of Trade and the Patent Office without success, we came to the conclusion that an original investigation and analysis of the German sample must be resorted to.

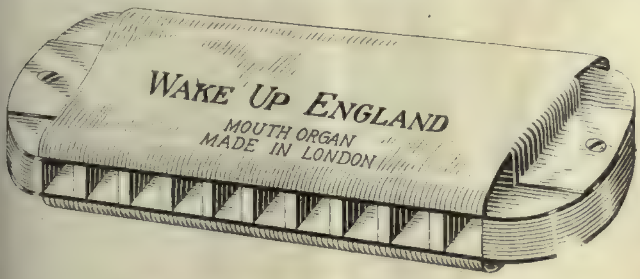


FIG. 1. THE FINISHED MOUTH ORGAN

This was done with the aid of the microscope, microphone, scleroscope and by chemical analysis, and I think that the knowledge gained is well worth recording and that rough sketches of the tools used will be interesting. Fig. 1 represents the organ in its finished state; a twenty-reed instrument with a metal comb. It is perfectly hygenic in so far as it can be boiled in water without detriment. This is a great advantage over the organ with a wooden comb which swells and distorts after being played a short time. In addition to the comb there are twenty-four components necessary for the completion of one organ; two reed plates, twenty reeds and two covers. It will be seen that it is essentially a press-tool job, and that it necessitates extreme accuracy will be realized later. The reed plates are stamped out of ordinary strip brass, but the reeds themselves must be made from a special brass rolled as hard as possible, and blanked out with the grain of the metal running lengthwise along the reed. This compelled us to cut the metal into strips 4 in. long, the width to which the brass was rolled. To produce the varying notes the reeds are not only made in two widths and different lengths, but they are milled to different thicknesses. The smallest reed produces the highest note and has to be milled to 0.002 n. on the extreme end. This is where the element of accuracy creeps in. Furthermore, to produce a good full-bodied note without having to blow hard, the clearance between the reed and the slot in the reed plate should not exceed 0.001 in. at the sides and 0.003 in. at the ends, when assembled. On the other hand, should the reed touch the sides of the slot, no note at all can be produced. There are four possibilities of error in this respect; the width of the slot in the reed plate, width of reed, position of hole in reed plate in relation to slot and position of hole in reed. An error of 0.00025 in. multiplied by four will cause the reed to touch the sides of the slot unless one error counteracts another. This need for accuracy, in addition to the fact that the reeds had to be blanked after the milling operation convinced us that a subpress type of tool should be used where possible.

The tools for producing the covers of the organ are so simple that they do not warrant much description beyond saying that for blanking and piercing, a French type progressive tool was made, and the subsequent operations were simply forming and embossing. It may be interesting to add that the covers were blanked from steel sheets 30 x 20 x 0.020 in. previously nickel-plated on one side.

The comb is a die casting of suitable alloy, similar in shape to the wooden comb, and made as light as possible. It is finally nickel-plated and polished. Fig. 2 shows the manner in which the reed plate was stamped by giving just an outline of the tool sectioned in the center. Brass strip the same in width as the finished plate was fed through the tool to a stop (not shown) and each blow of the press produced a plate complete by rounding the ends and piercing the slots and holes at the same time. The die *A* was dovetailed in the bolster, while the punches *B* were held in the punch holder *D* by riveting them at the back. A great deal of pressure was required to strip the brass from the punches, and the stripper *C* actuated by the four rubber pads through the plungers *E*, served this purpose in addition to keeping the fragile punches steady

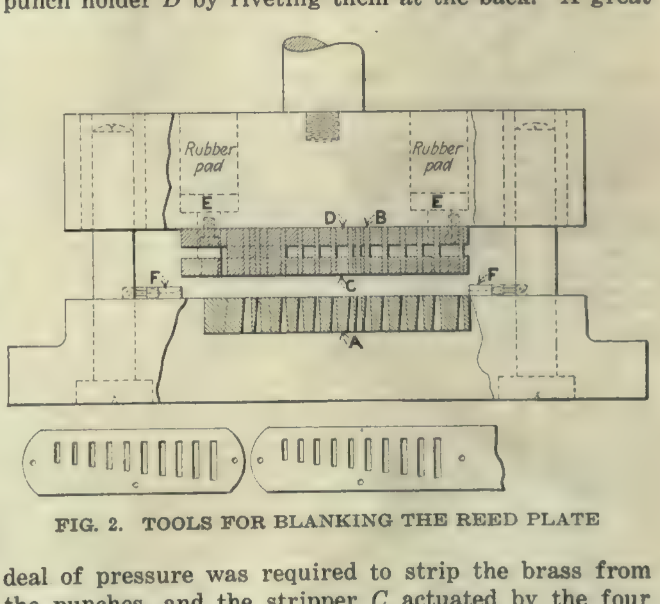


FIG. 2. TOOLS FOR BLANKING THE REED PLATE

when entering the die. Since only a rough idea of design is intended in these sketches, no further description is necessary with the exception perhaps of explaining that four pillars were used, and *F* and *F* represent two guides with spring plungers to keep the work in position. The ten small holes in the plate for riveting on the reeds were pierced by the tool shown in Fig. 3. The die *A* is shown built up in sections with one piercing hole in each piece. This enabled the necessary accuracy to be obtained by eliminating the shrinkage in hardening that would occur if made in one piece. The small punches *B* are let into round holders *C* to strengthen them and also to make broken punches an easy matter to replace. The diameter of these punches is 0.040 in. and the thickness of the reed plate is 0.035 in. The plate is placed in the die so that the stops *D* and *D* fit in the slot at each end, and the stripper *E* holds the plate in a flat position while it is being pierced, and finally strips it off the punches. To eject the plate from the die, the plungers *F* and *F* are operated by a single lever in front of the tool.

It will be seen that the slots in the plate for the reeds are of ten different lengths varying from 3/8 to 7/32 in. In order to blank out the reeds with the grain of the metal lengthwise, it was necessary to cut the roll of metal, which was 4 in. wide, into strips of the various widths. This was done by a simple shearing tool in the press. The next operation involved the milling of the strips and as the metal was only 0.011 in. thick and had to be milled, in the case of the high notes, to 0.002 in. on the ends. The operation was indeed a delicate one. Furthermore, in the case of some reeds, the milling had to be slightly concave in the middle. To avoid the chattering on this operation a fine-pitched spiral milling cutter was used, and to obviate the difficulty of grinding the cutter slightly convex, the necessary shape was put on the milling jig. In other words, the shape was transferred from the cutter to the milling jig, and the thin brass being forced by the action of the cutter on to the jig, the required shape was produced. Of course, the brass strip was held down on the edges by clips. When we came to the blanking of the reeds we had to decide upon the method of feeding the strips into the press tools. Owing to the length of the strips being limited to 4 in., roller feed was out of the question. To adopt side-cutter feed was difficult and expensive since it would have to be embodied in each of the ten reed tools. So the idea of notching one edge of each strip, as shown in Fig. 4, was resorted to. The whole edge was notched in one operation by a simple press tool arranged to accommodate the different widths of the brass strips, Fig. 4 gives a rough idea of how the reed tool was constructed; *A* is the top die which is screwed solid to the top bolster; it is circular, recessed at the back and cut away to miss the guides *C* and *C* in the manner shown; *B* is the bottom die, also circular and recessed at the back, but is not screwed down. When in action it slides down on bottom punch *D* as the top die approaches and is returned to position by three springs *E* and kept there by the three screws *F*. Punch *D* has the small piercing hole opened out at the back for the piercings to get clear away, and is riveted to the pad shown doweled and screwed to the base *G*. The top punch *H* is the same as the bottom punch *D* with two exceptions; it is not doweled but slides up and down inside top die *A*, and the small hole is made parallel to support the piercing punch *J*, which in its turn is riveted to the pad, as shown screwed to the top bolster.

The function of plunger *K* with the spring at the back is obvious. It will be seen that by this method the unevenness, caused by the strip being milled, did not affect the blank, as the metal was held between the faces of the tool while being blanked and pierced in the one blow. The blanked pieces, of course, were forced back again into the stock and only the pieces from the small piercing hole dropped away from the tool. In one of the guides *C* and *C*, three spring plungers were inserted with ends shaped to fit the notches in the brass strip. These plungers insured the feeding of the strip through the tool and kept it in position.

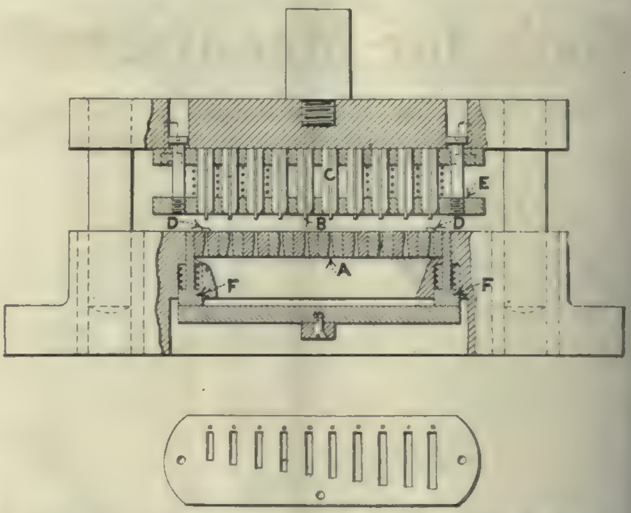


FIG. 3. PIERCING TOOLS FOR THE REED SLOTS

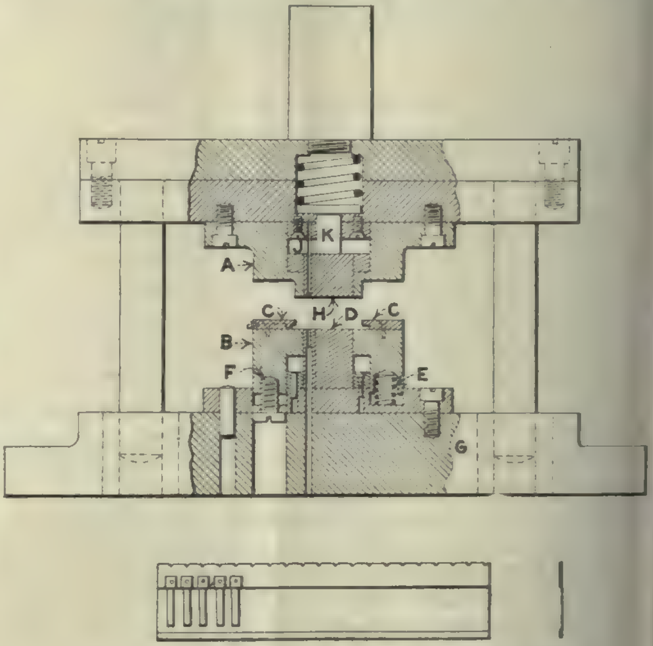


FIG. 4. TOOLS FOR BLANKING THE REEDS

The next operation was riveting the reeds on the plate. This was effected by placing the reed in th slot in the plate and holding it with thumb and finge in position in a small power riveting press whic riveted the reed in one blow. Small iron rivets wer used and applied with a pair of tweezers. The reed were then tuned before assembling the organ. On th question of tuning it is generally known that the greater the number of vibrations per second given off by a reed or string the higher the note. The vibrations of the reeds cannot be altered in this respect by blowing hard or less hard, but by increasing or reducing the flexibility. This is effected by filing the reed thinner at the tip or at the heel. For instance, if the reed was half a note sharp, just a touch with a small file at the heel would be sufficient to correct the note, as the reed is made more flexible and consequently the number of vibrations per second are lessened. Filing the tip of the reed thinner has a tendency to stiffen it and increase the number of vibrations per second. On the face of it this may seem strange, but the effect of it is certainly to produce a higher note. Fig. 5 shows the instrument devised for tuning the reeds. *A* and *A* are pipes to which rubber tubes are attached, carrying a blast of air into the reservoirs *B* and *B*. The arrows indicate the direction of the air through the ten brass tubes *C*. The valves *D* are shown both open and closed. There are two sets of valves, one to operate the master organ shown at *E* to which the reeds are tuned, the other to operate the reeds being tuned.

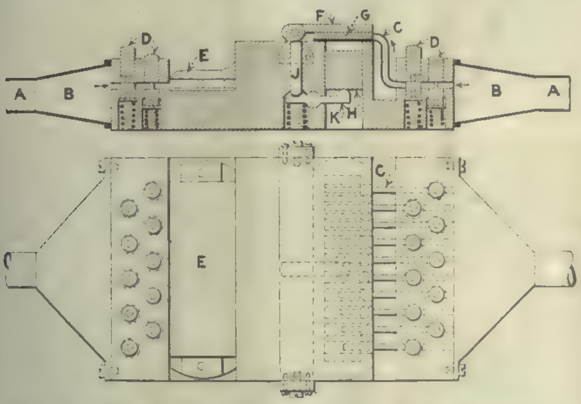


FIG. 5. THE MASTER ORGAN AND ARRANGEMENT FOR TUNING THE REEDS

By this means each reed can be treated until it is in complete harmony with the master. The flap *F*, when raised to an angle of 45 deg., allows the plate to be pushed in between slides. Attached to flap *F* is a piece of sheet rubber *G* cut to the shape of the comb for the purpose of making it as airtight as possible, when pressed onto the reed plate. To facilitate the filing of the reeds, a rectangular platform *H* with raised pieces to fit the slots in the reed plate, moves up to support the reeds as the flap *F* is raised to a vertical position. The cam on the hinge of flap *F*, the plunger *J* and lever *K* explain how platform *H* is raised. In operation the plate is slid in when the flap is at 45 deg. The flap is then closed and a reed is tested by pressing the valve down with the finger. If the note is sharp or flat by the master note, the flap is raised to a vertical position and by so doing the platform *H* is raised to support the reeds while they are filed at the tip or the heel as the case may be. It was possible to get the milling of the reeds so accurate that only 50 per cent needed tuning. To complete the mouth organ it only remained for the parts to be assembled with three brass screws and nuts.

Cut the Force or Reduce Working Hours?

By A. W. Forbes

It is often recommended that we should reduce hours instead of reducing the number of employees in times like the present so as to give a small amount of work to a large number. This would have the additional advantage of keeping together the organization so as to be ready for the coming rush of work.

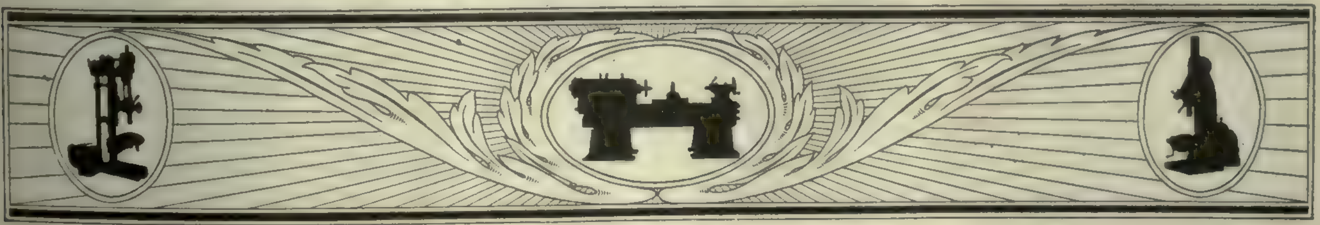
This sounds very good, and if conditions could be adjusted to make it practical I believe it would be the best way, but it has not worked out that way with me. As business started to slow down I had a number of workmen, all of whom were desirable employees. Some were advancing in their work and promised to be more valuable in the next time of plenty than they were last. There were others for whom I could see no future with me. They were doing their work satisfactorily, but that was all. If I should keep them over the lean years they would probably change about the time that they were needed, and that would be best for them as I should consider them as misfits in my shop.

Under these circumstances I kept all those whom I desired to start business with. and found that I was able to keep them all on full time. I hope the others will find better jobs for some of them are capable of filling them.

Fewer Applicants for Positions Than During War Time

Most of us expect business to improve soon, and I am looking around for persons to put on my waiting list. I have a few names on the list now, and every one has a good job now at full time, but they have expressed a preference for the kind of work that I offer, over the job they are holding. We hear a lot now about the people who are out of work, but why don't they apply for work. I have not received half the applications that I did a year ago, and there are even less than during war time. To be sure I do not want anyone today, may not need anyone this year, but on the other hand I might want to double the force next week, as I have orders pending that if released would make this necessary. You would at least think that anyone out of work would go round to each of the shops in his home town and let them know what he could do. Yet I do not know of a single person who is out of work, and who has let me know of this fact within the last three months, whom I should want to employ when men are needed.

It would seem strange if it were necessary to hire away from another employer in times like these.



Machining the Peerless Upper Crankcase

The Sequence of Operations—Milling Fixtures Used—Drilling Fixtures on Track with Turn- and Transfer-Tables—Some of the Inspection Gages

By FRED H. COLVIN
Editor, *American Machinist*

THE method of handling the upper or main crankcase in the shop of the Peerless Motor Car Co., comprises thirty operations in the following sequence:

Operation 1. Cut off tubes and lugs.
Operation 2. Rough mill bottom.
Operation 3. Rough mill right cylinder bolting face at both ends.
Operation 4. Rough mill left cylinder bolting face.
Operation 5. Finish mill bottom.
Operation 6. Finish mill both cylinder bolting faces.
Operation 7. Mill at apex.
Operation 8. Straddle mill water tube flanges.
Operation 9. Drill eleven holes.
Operation 10. Bore and ream distributor hole. Drill sixteen holes and tap four holes.
Operation 11. Drill thirty-seven holes and ream four holes.
Operation 12. Drill thirty-five holes.
Operation 13. Tap sixty-four holes.
Operation 14. Stud twelve holes.
Operation 15. Bolt crankshaft bearing caps to crankcase.
Operation 16. Bore and ream crankshaft and camshaft holes and face rear end of camshaft holes.
Operation 17. Drill and tap pipe hole at front end.
Operation 18. Straddle-mill center bearings.
Operation 19. Unbolt front and rear bearings for lathe operation. After this they are again bolted to face and upper half bolted to lower.
Operation 20. Bore and face rear end and face front end.
Operation 21. Drill twenty holes.
Operation 22. Drill twenty-four holes and ream two.
Operation 23. Tap forty-two holes.
Operation 24. Unbolt lower half.
Operation 25. Bore and face camshaft hole, bore and ream starter-motor housing hole.
Operation 26. Unbolt caps.
Operation 27. Spot face four motor arm holes.
Operation 28. Drill three dowel holes and four holes for oiling system.
Operation 29. Solder all sand and blow holes and file burrs.
Operation 30. Inspection.

The cutting off of the projections left by the foundry is done on a bandsaw. Then comes the rough milling of the bottom as shown in Fig. 1. The milling cutters in the vertical spindles face the bottom of the crankcase which is held upside down in the fixtures as shown. The side mills face the projecting arms which form the bearers that support front end of the motor on the frame of the chassis.

In milling the face to which cylinder castings are bolted, fixtures having surfaces at 45-deg. angle from the table are used as shown in Fig. 2. These fixtures hold the crankcase at the proper angle, locating them from the bottom surface previously milled. Both ends of the crankcase are also milled at this setting, milling cutters of large diameter being necessary in order to cover the entire surfaces of the end at one setting.

In finish milling the bottom, the crankcase is located on the cylinder bolting faces, which fit the V-shaped blocks shown in Fig. 3. The fixtures are so arranged as to readily clamp the casting firmly in place without distortion and so as to insure the finished surface being flat and true. It will be noted that the type of fixture is quite different from that used for the roughing cut in Fig. 1.

Locating from the finished bottom surface and using an indexing fixture, the cylinder bolting surfaces are finally finished with a light cut on the Brown & Sharpe vertical milling machines shown in Fig. 4. This view also shows the meeting line of the two cuts on the roughing operation, which is removed by a finishing cut.

The water flanges on each side that form the connections between the cooling system and the cylinders, are faced by straddle mills as shown in Fig. 5. The holding fixture is practically identical with that shown in Fig. 3, the work being done on a Cincinnati knee-type milling machine.

The drilling operations begin in Fig. 6, which includes four holes for the distributor and the two holes in each of the arms which support the motor in the frame. This view shows the construction of the fixture in which the crankcase is mounted on trunnions so as to be readily revolved to present different faces for drilling. It also shows how the fixture is mounted on four wheels which run on the track shown. At the left of the fixture is shown part of a transfer table *A* on which the fixture can either be rolled to the next machine in line or transferred, at right-angles to this track, to another track at the rear. The track is used while loading the fixtures so as to insure practically continuous operation of the machine and save losing time while castings are being put in or taken out of the fixtures.

The next drilling operation is shown in Fig. 7 in which the crankcase is turned on its side. Some of the tools used are shown on the stand at the right where they are kept conveniently near the work. This view also shows the transfer table *A* previously referred to, used as a bridge between the two machines.

REVERSING FIXTURE ON TURNTABLE

Still another drilling operation is illustrated in Fig. 8 and shows a turntable in the track line instead of the transfer table previously shown. The turntable is for moving the fixture and its work at right-angles or for reversing it as shown in Fig. 9. Here the crankcase is turned upside down for drilling the flange holes and to complete the drilling operations under the Baush multiple spindle drilling machine shown.

The beginning of the tapping operations, is shown in Fig. 10, which also gives an idea of the angle fixture on which the crankcase is held. The tapping is done on a large size Rickert & Shafer tapping machine with jointed arms which make it possible to move the tapping spindle readily from one position to another. The taps used are kept conveniently in a toolblock as shown, and the gages are also shown on the table of the machine near this block.

After putting in the studs which hold the three bearing caps in place, the crankcase goes to the boring fixture shown in Fig. 11, being mounted on a Rockford horizontal drilling machine. The crankcase is supported by its angular faces and the boring bars are guided by suitable bushings so as to insure the correct center distances between the holes bored.

Then the center bearing is straddle milled, the bearing caps removed and the lower half of a machined crankcase is bolted in place so as to make a complete unit. The complete crankcase is swung on a suitable mandrel. The driver shown at *A* is bolted into position and the stud projects through it to the faceplate. The rear end of the crankcase is faced and bored to insure the centering of the transmission housing, and the front end is faced by reversing in the lathe.

The rear end is then drilled for the transmission housing under a Baush multiple drilling machine as shown in Fig. 13. No special fixture is used, only a drilling plate carrying bushings and properly located,

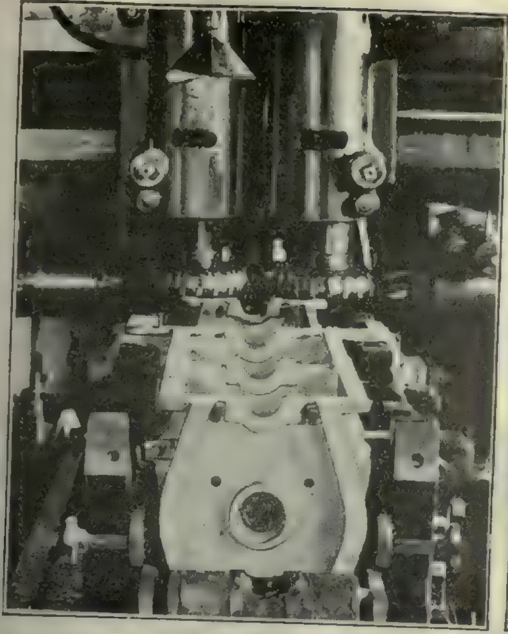


FIG. 1. ROUGH MILLING BOTTOM SURFACE.

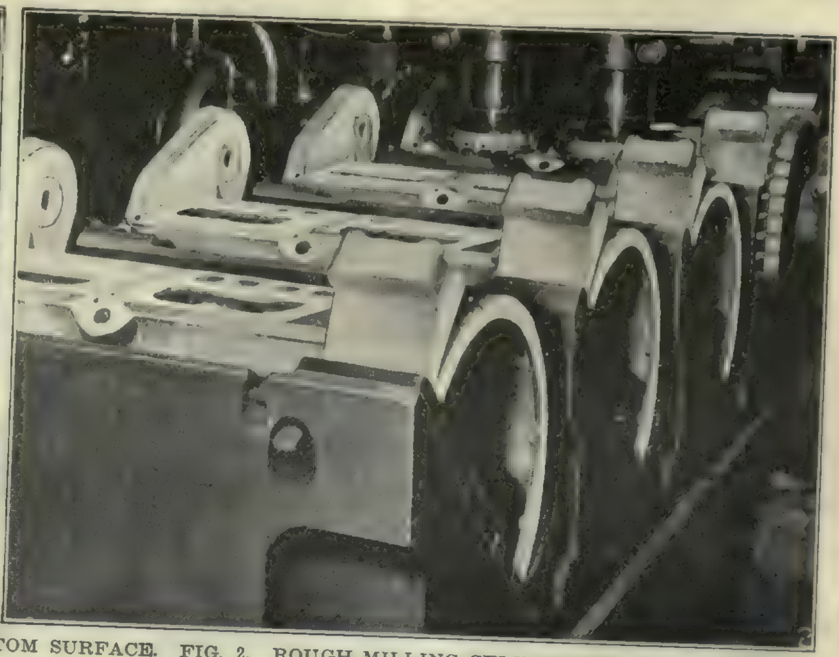


FIG. 2. ROUGH MILLING CYLINDER SEAT

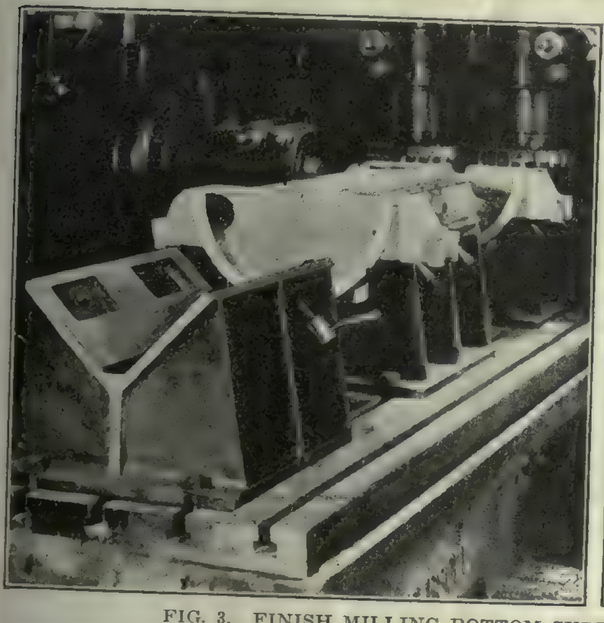


FIG. 3. FINISH MILLING BOTTOM SURFACE.

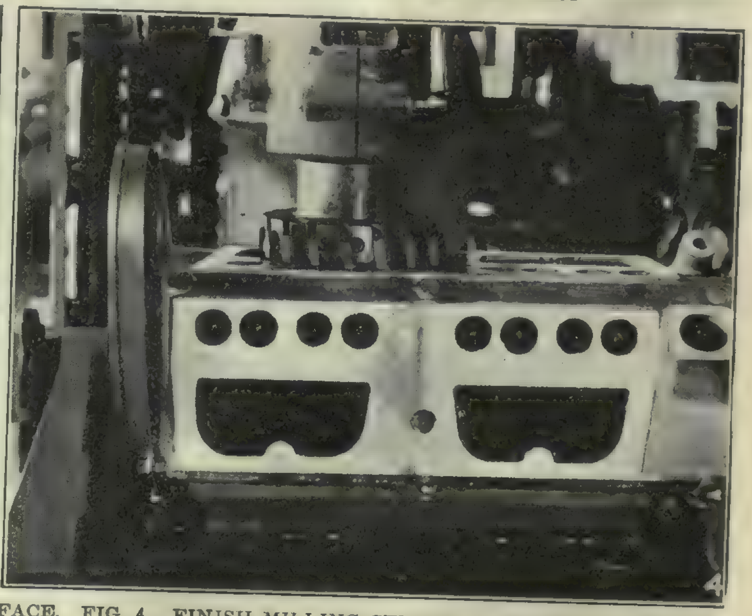


FIG. 4. FINISH MILLING CYLINDER SEAT

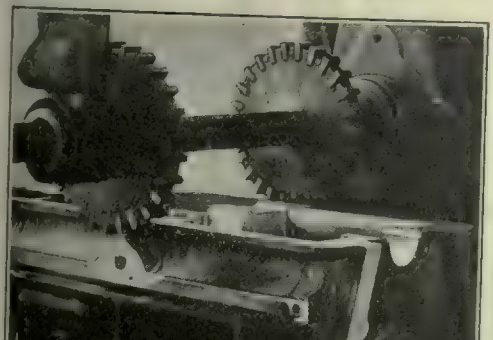


FIG. 5. MILLING WATER TUBE OPENING.

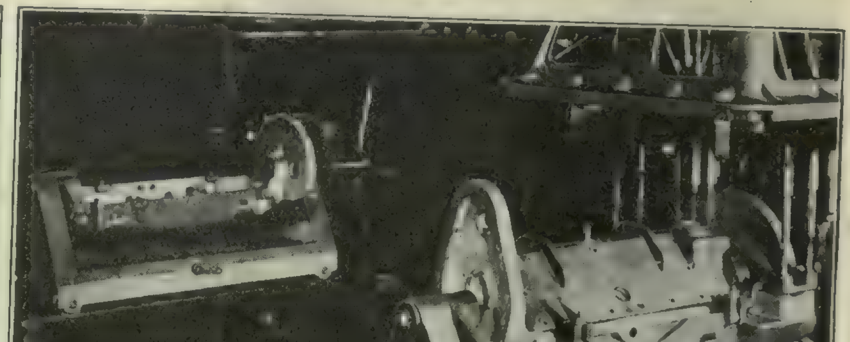


FIG. 6. FIRST DRILLING OPERATION

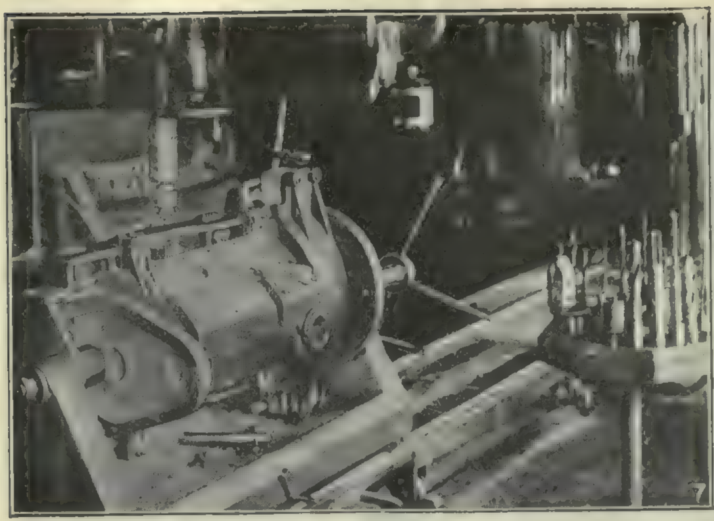


FIG. 7. ANOTHER POSITION ON DRILLING FIXTURE.

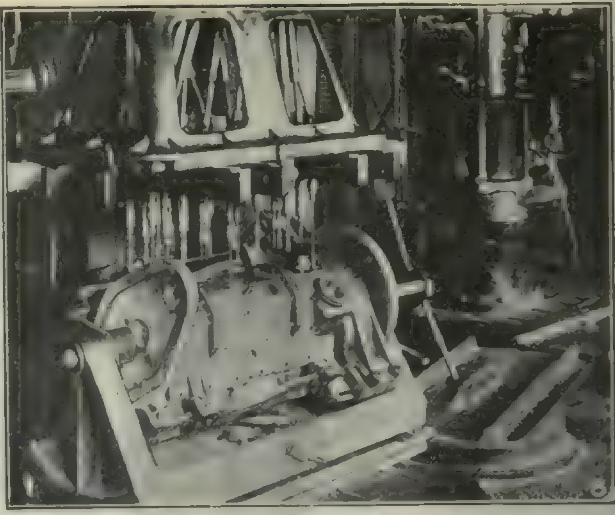


FIG. 8. TURN TABLE IN DRILLING TRACK

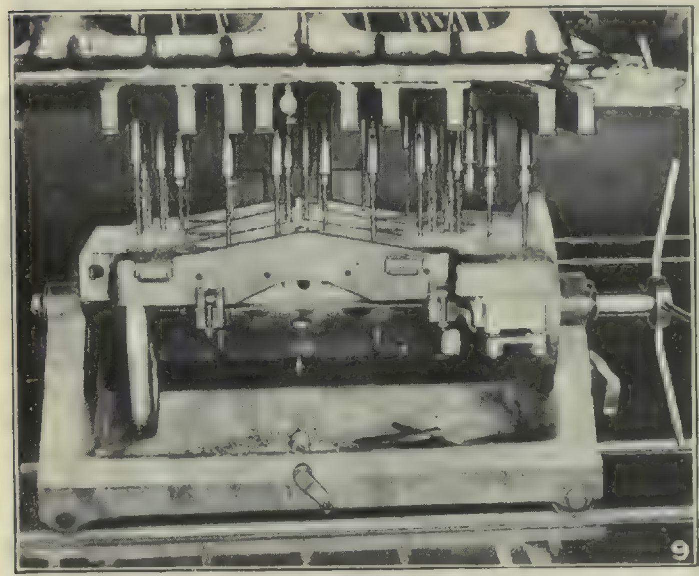


FIG. 9. DRILLING BOTTOM OF CRANKCASE.

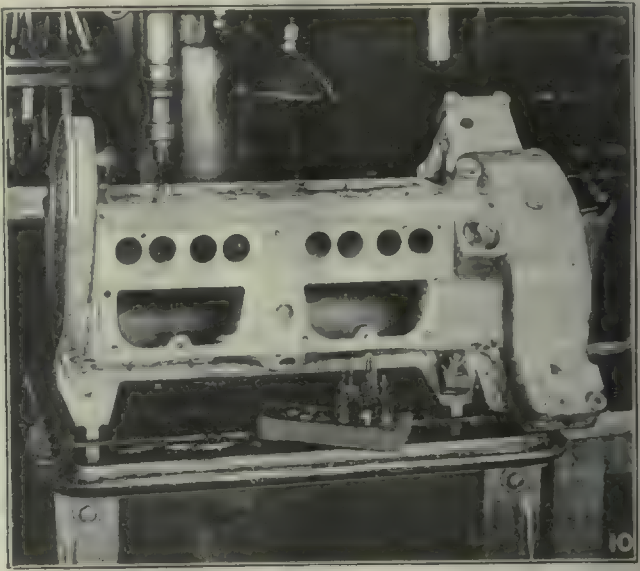


FIG. 10. ONE OF THE TAPPING FIXTURES

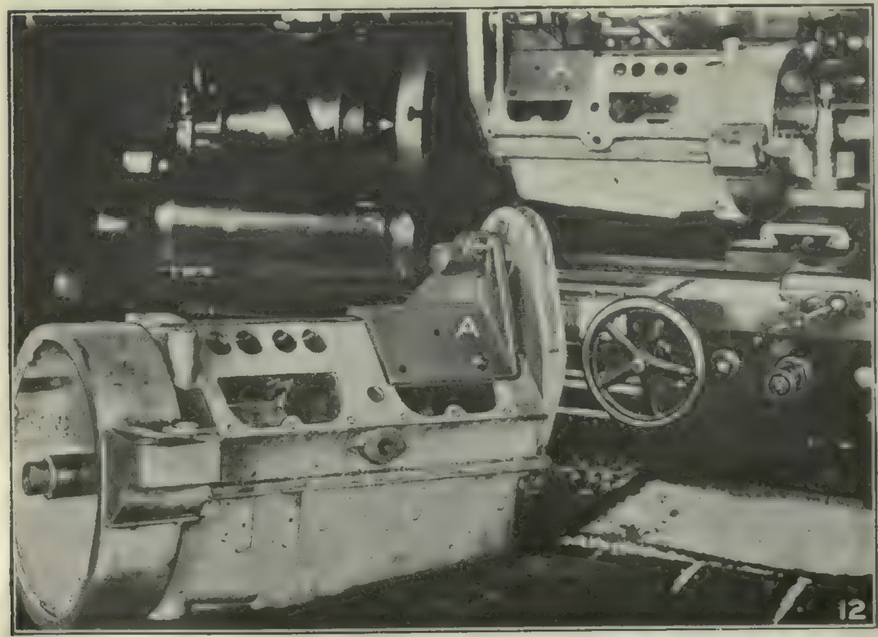


FIG. 12. BORING AND FACING ENDS.

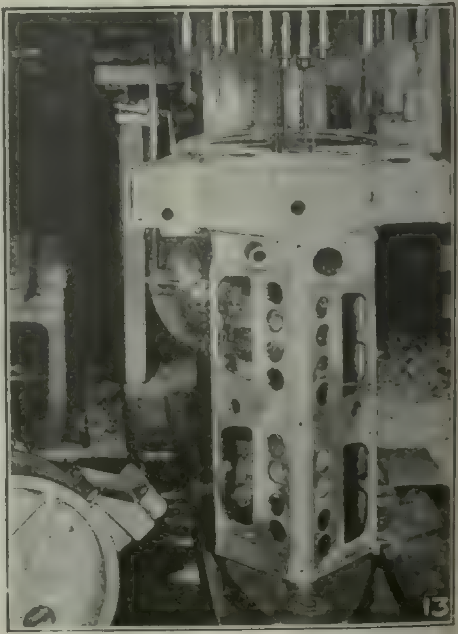


FIG. 13. DRILLING REAR END

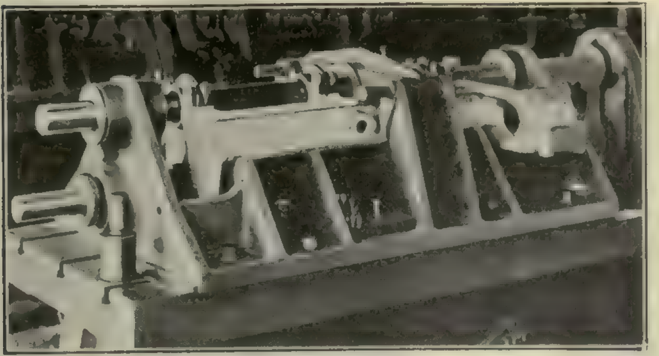


FIG. 11. BORING CRANKCASE BEARINGS

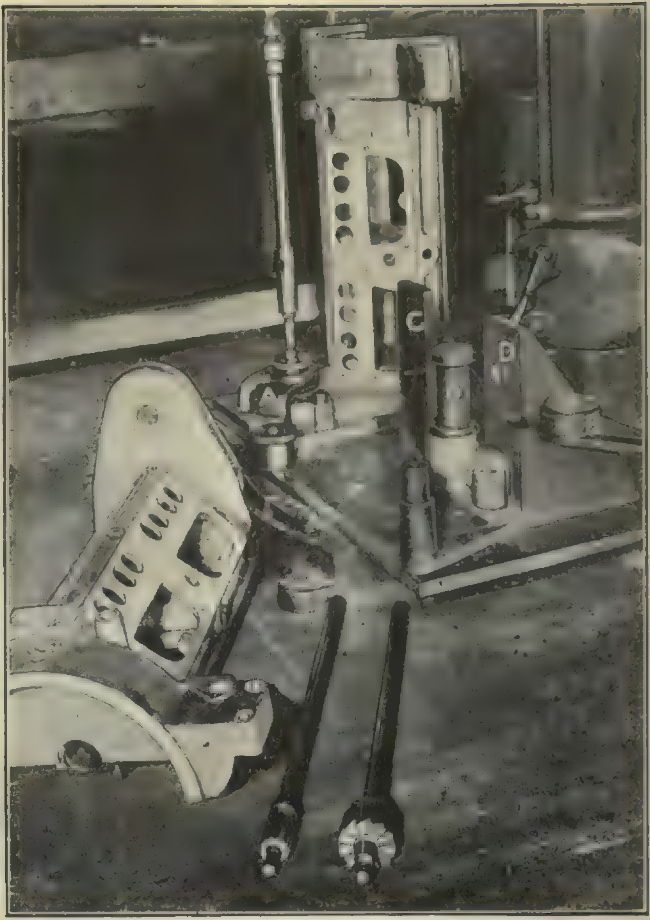


FIG. 15. BORING FOR CAMSHAFT HOLE

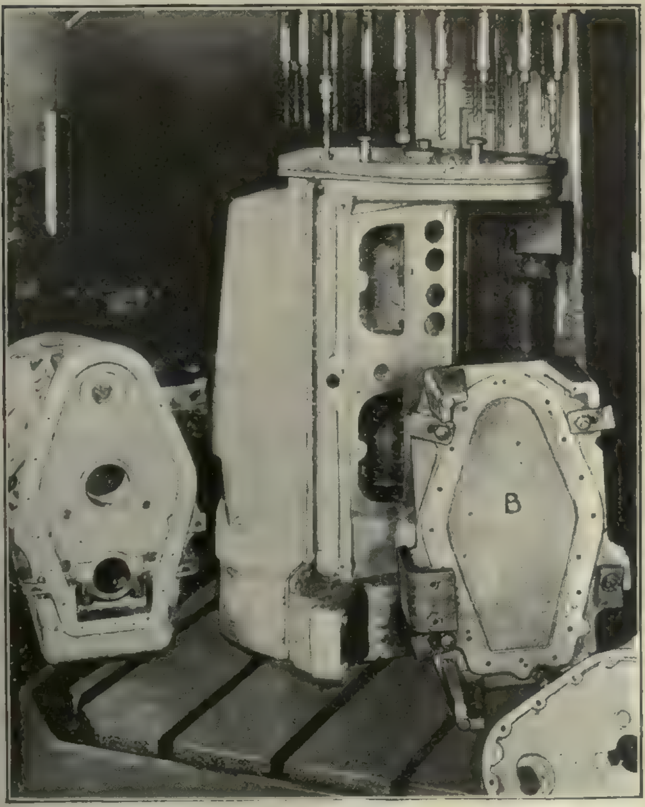


FIG. 14. DRILLING FOR FRONT COVER PLATE

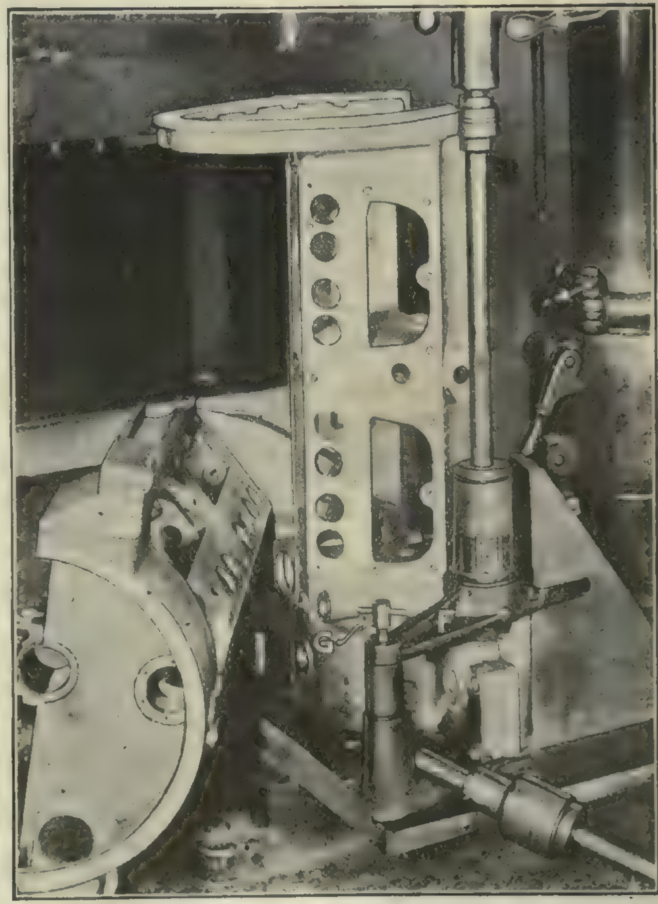


FIG. 16. REAMING STARTER MOTOR HOLE

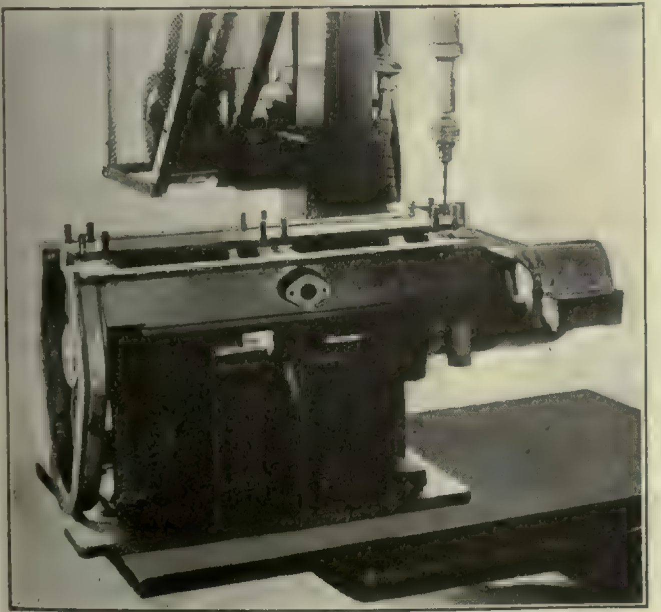


FIG. 17. THE FINAL DRILLING

being necessary. Another drilling operation covering the front end of the crankcase is shown in Fig. 14, both halves being bolted together in both operations. This view shows the plate *A* used for drilling the crank case and at *B*, the fixture used in drilling the cover.

GUIDING LONG BORING BARS

The two halves are then unbolted and the holes for both the camshaft and the starter-motor housing are bored and faced as shown in Fig. 15. The camshaft hole is being bored at *A*, the curved bracket carrying the bushing which guides the drill. The other end of the crankcase is then centered on the stud *B* by its main bearing, the bottom of the case locating against the upright *C* and *D*. The bushing *E* carries the pilot of both the boring and facing bars, insuring correct alignment and center distances. The upper guide bushing is carried in the arm *F*. Fig. 16 shows this operation in progress, the arm *F* being swung into position and locked by the pin *G*, carrying the upper guide bushing.

The final machining on the main crankcase is shown in Fig. 17 and consists of drilling special oil holes and dowel holes in a V-shaped fixture similar to those which have already been shown. This leaves only soldering all sand and blow holes, filing off burrs and the final inspection to complete the main portion of the crankcase.

Two of the gages used are shown in Figs. 18 and 19. The gage in Fig. 18 is for checking the location of the bushing holes in the crankcase front end and consists of a plate having two handles *A* and *B*, and three bushings *C*, *D* and *E*, through which plugs *E*, *G* and *H* are inserted.

The gages for checking the relation between the location of the distributor hole and the crankshaft hole are a little unusual. The holes are shown at *A* and *B* in Fig. 19. The gages, Fig. 20 have been made to take care of variations up to 0.005 in. but the work is held to 0.001 in. limit. The plug *A*, Fig. 20, goes in hole *A*, Fig. 19, and the plug *B* in the corresponding hole in the crankcase. Plug gage *A*, Fig. 20, is a plain plug with a flange for sighting the tapped holes for the distributor. When making a thorough check the flange is held in place by two screws, to make it more rigid.

Plug *B* is eccentric on the end, 0.0025 in. on each side, making a total of 0.005 in. By inserting plug *B* in hole *B* of the crankcase, and noting the point of contact between the eccentric end and plug *A*, shows the exact center distance of the holes.

If the plugs make contact when the eccentric is at the center or zero point, the center distance would be 2.263 in. If the plug turns to the left to the first line, the distance is 2.264 in. each division reading 0.001 in. Should the distance be less than 2.263 in. the plug will turn to the right, this giving the *minus*, while the left gives the *plus* reading. This has proved to be a very satisfactory method of determining the distance of these right-angled holes.

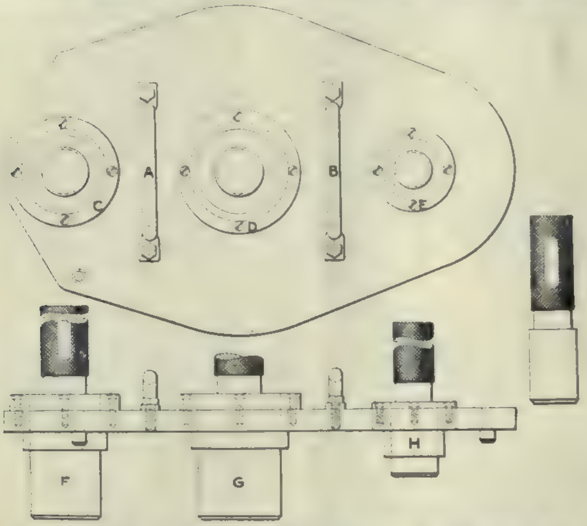


FIG. 18. GAGE FOR LOCATING HOLES IN FRONT END

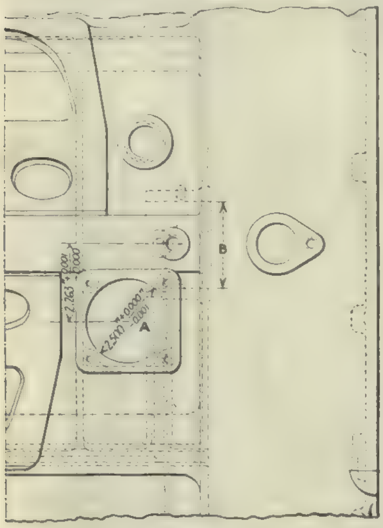


FIG. 19. CRANKCASE HOLES TO BE GAGED

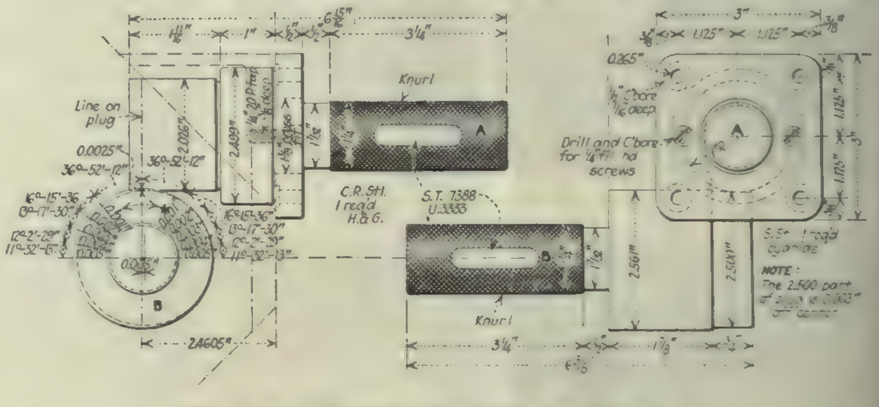


FIG. 20. GAGE FOR DISTRIBUTOR HOLES

The Economics of Production

III. COSTS AND PRICE AND PRODUCTION

BY PROF. D. A. MCCABE, PH. D.

IT IS a very common belief that costs of production govern prices. It is taken for granted by many that if costs rise prices will have to rise, and that prices cannot fall unless costs have been reduced.

Costs undoubtedly exercise an influence on prices, but the connection is not so simple as one of absolute control. It is important that we understand clearly just what the relation is between costs and prices. It is particularly important that we do not hold to the notion that cost alone controls price, that cost is an independent boss whose word must be obeyed without delay and without grumbling by price. Men who fall into that way of thinking are likely to get a bit careless about cost, in the easy belief that the price will carry off the cost without any disturbance.

> Costs exercise an influence on prices, but the connection is not so simple as one of absolute control
>
> The costs that affect prices most are the costs of new or current production, not the costs that have been incurred for the goods already made.
>
> A producer's costs are largely determined inside his plant. They are affected very materially by the degree of efficiency with which the materials are converted into the finished commodity.

We need go no further back than the cost-plus contracts of the war for an illustration of this. It was a simple matter to get labor and materials away from the other manufacturer by paying more for them when the increased cost went automatically into the bill. It was easy also to overlook mounting costs in other lines where they took care of themselves in the same accomodating fashion.

To go back a bit, we have already seen that demand has an important influence on price. To take an extreme case, we may say that without demand there would be no price—that is, no price at which the goods would be actually sold. To take a more practical case, we should say that *the demand fixes the price for any particular quantity.* Therefore if cost is also to affect price, it must affect it through *affecting the quantity offered.*

If the demand for a particular kind of motor is for 10,000 at $50, or 9,000 at $55, and if 10,000 motors are offered at $50, the price will be $50. If, however, only 9,000 are offered, the price will be $55. Whether the motors will be offered at $50 or at $55 in sufficient quantity to meet the demand at either of these possible prices, will depend largely on the cost of producing them. A difference of $5 in the cost of production may make the difference between a price of $55 and a price of $50. But it makes that difference in price only through making a difference of 1,000 in the number of motors sold.

If, now, the cost of producing the motors should be raised to $75, would the price too be raised to $80, or even to $75? We are assuming, of course, that the demand has remained unchanged. Under these circumstances the producers might raise the price, but if they did they could not expect to sell the old number of motors. It is easy to see that the price *must* go above $75 if they are to make any money, but how much money will they make if they get $80 apiece and sell only 5,000 motors? Costs do affect prices, yes, but for increases in price to cover increased costs the producers have to pay the penalty of reduced sales, if the demand remains unchanged. The producers cannot raise the price and sell the same quantity, costs or no costs.

A second point that we must bear in mind in this connection is that *the costs that affect prices most are the costs of new or current production, not the costs that have been incurred for the goods already made.* It is the adjustment of the amounts offered at particular prices to the amounts demanded at those prices that produces the actual price at which trading takes place. *The prices at which goods are offered do not necessarily depend upon what it cost to produce those goods, but upon what it is likely to cost to produce other goods of the same kind to meet the expected demand.*

If, for example, the cost of producing the motors in the above illustration advanced $5, the motors produced at the old costs in the expectation of a price of $50 would probably not be offered at $50, but would be held for the higher price that the *new* costs seem to make necessary for the future. On the other hand, motors that it cost more than $45 to make would have to be sold for $45 if a drop in costs occurred and new motors were already coming on the market at $45 with a profit to their makers.

A change in demand would also affect prices in the same way, regardless of the costs already incurred. An increase in demand results in a price increase on the goods in the stockroom. A decrease in demand forces the sale of finished goods at less than the expected price, and often at less than it cost to make them.

A third important point in the relation between cost of production and price and the quantity produced is that *it is not any one producer's costs that makes the relation between cost and price* in the ordinary case. If a producer is making a patented article for which there is no good substitute close to his price, he is concerned only with his own costs, within reasonable limits. But if he is competing with others who are producing the same article, or articles of the same kind under different trade marks, the situation is quite different. No matter what his own costs are, the price at which he can sell is limited by what the other producers can continue to sell their articles for at a profit that induces them to continue in the competition. This leaves out of account the fact that he may at times have to meet prices quoted by them that do not return them their costs. The point of permanent bearing here is that the price which covers their costs and a sufficient margin to keep them producing their quantities is the price which he must meet if he is going to sell on price in competition with them.

The final point to be emphasized in this article is that costs are not merely a matter of prices or rates of wages. Where there is competition for materials and labor, the producers have to pay about the same prices and the same rates of wages. These prices and rates are determined by the various demands for the available materials and labor for the production of goods—not goods of the same kind only but goods of different kinds. A manufacturer of looms will probably have to pay about the same price for coal as a shoe manufacturer in the same district. He will also have to pay about the same daily rate for machinists as the manufacturer of automobiles in his neighborhood. The prices of material and rates of wages which he has to pay are largely determined by forces outside his plant.

But beyond this a producer's costs are largely determined *inside* his plant. They are affected very materially by the degree of efficiency with which the materials are converted into the finished commodity. And this efficiency affects to a very important degree the volume of production of that plant. The demand being what it is, the costs affect the quantity that the plant can sell, even if it has no competition. Where it has competition, the costs affect not only how much it can sell, but whether it can continue in that business.

In the next article we shall consider the causes of changes in demand and the readjustments in the volume of production and in costs which these changes make necessary.

The Selection of Apprentices—Discussion

By A. W. Forbes

In F. P. Adelbert's article under the above title on page 84 of the *American Machinist*, he asks one question that needs an answer. He says, "Can Mr. Forbes honestly say that his shop, or any other that he has in mind, would give an equal foundation for advance or equal distinctions to a graduate of their apprentice course?" The comparison is with the college course. The answer Mr. Adelbert doubtless expects is no, but I am fully convinced that my shop, as well as several others that I know personally, give opportunities for a better foundation for advance in certain occupations than any college or school, perhaps not as broad a foundation, but one that is more thorough, and one that is really superior.

Among the occupations that my shop gives a good foundation for are electric motor designer, machine designer and manager in technical lines. I might also add research engineer, a field which the college does not attempt to touch till after graduation.

As for the results in actual practice, this is a difficult thing to determine, as comparisons are of no value unless care is taken to compare boys of equal natural ability, but what little evidence we have seems to show that apprentice boys have done better in business and manufacturing than the college graduates.

College Men and Captains of Industry

Roger Babson estimated a short time ago that but 15 per cent of the captains of industry were college graduates. Now it is evident to anyone with experience with boys that most of the boys of exceptional ability go to college. While this was not as true a generation ago as it is today, still, even making due allowance for this, it does not seem likely that the training that produced 85 per cent of the industrial leaders could be much inferior to that which only produced 15 per cent from the highly selected group of students. Personally, I am of the opinion that the college graduate has a poorer preparation for industry than the apprentice in most of our factories, and that if the college graduate is successful it is in spite of the college training, not because of it.

The college was organized to make ministers and professional men out of farmer boys, but it has come to be looked upon as a kind of magician's wand that prepares anyone for anything. This is largely the result of extensive advertising.

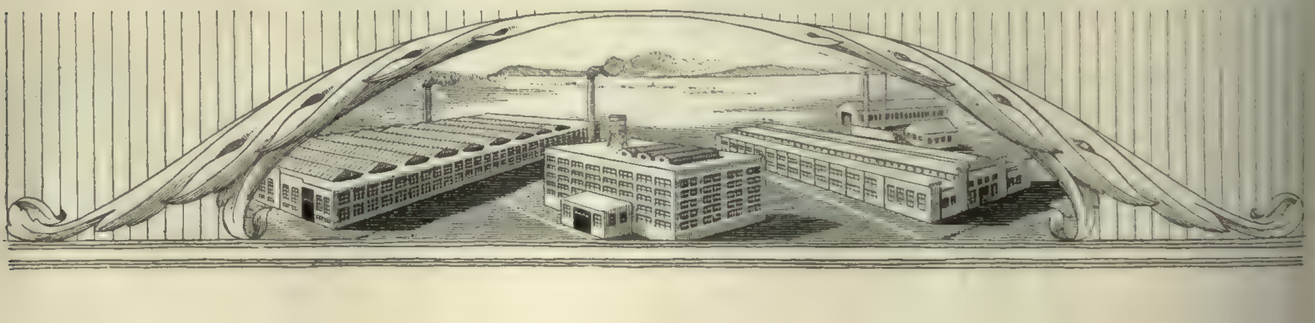
The colleges have improved a little since the day that our great men were educated, but the opportunity for the boys in the shop has increased tremendously. If 85 per cent of our leaders could have come to the highest positions without the aid of the college under the old conditions, it would be much easier for them to do so today, if we could only get boys of equal caliber to try it; but we cannot get the boys as long as the colleges advertise so effectively while the shops take anyone the colleges do not want.

Many apprentices, as well as the boys in our trade schools, are deserving boys, who will make good citizens in the capacity of machinists, patternmakers and other respectable trades, but few of them would be accepted by the colleges, as they have not the capacity to advance to the higher positions regardless of anything in the shape of education or opportunities that may be offered.

Planer Kinks in a Small Shop

By John P. Wheeler

I saw the following scheme in a small shop for a quick job in removing straps on planer and miller beds. The nuts were about twice as long as usual and, after tapping, had a clearance hole put through at an angle—about 30 deg. at a rough guess. The nut could be slid down onto the straps then tilted back square and tightened up. I thought the threads would strip easily, but was informed they last about as long as ordinary nuts and, of course, they escaped a lot of wear.



Magnetic Chucks

Ellsworth Sheldon
Associate Editor American Machinist

IX. Supporting Pieces of Irregular Shape on a Magnetic Chuck—Blocking Must Be Made to Match the Chuck—Testing a Chuck to Determine Its Class

UNTIL a very few years ago, the fact that a magnetic chuck would hold pieces of work of irregular shape almost as well as flat pieces, was not well-known. Even yet there are many toolmakers who, having a piece of work with perhaps a projection or a shoulder upon its otherwise flat surface that prevents it from resting squarely on the chuck, will discard the latter as a holding proposition and waste a deal of time in doing with bolts and straps what the chuck would do much better if it were only given the chance.

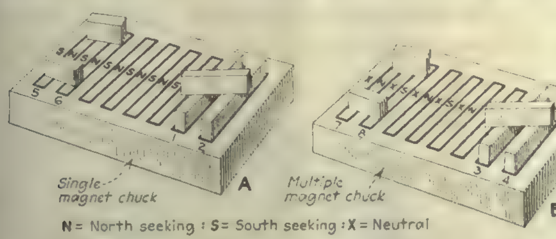


FIG. 1. SHOWING THE DIFFERENCE IN THE WAY IN WHICH HOLDING POWER IS EXERTED IN SINGLE MAGNET AND MULTIPLE MAGNET CHUCKS

Many have tried to hold work having what we call a "two plane" surface, by supporting it on two parallels of different heights to match the surface; and, because it would not hold, condemned the chuck. Others have tried practically the same thing, and, finding that it *would* hold, criticized their brother's lack of knowledge for affirming to the contrary.

Neither were right. A chuck is perfectly capable of holding a piece of magnetic material of irregular shape at almost any reasonable distance from its surface provided the magnetic flux, or lines of force, can be properly transmitted from the chuck to the work, but unless the characteristics of the chuck are known, the principles of magnetism understood and the supporting pieces placed with due regard for its limitations, the experimenter is likely to be disappointed.

Ordinary Parallels Will Not Hold

If a parallel be placed upon the surface of a magnetic chuck in such position that it comes in contact with two or more poles of opposed polarity, or two or more pairs of poles, the parallel will be held strongly but, unless the parallel is very thin, there will be little tendency for any pieces of magnetic material to cling to it, and two parallels will be not one whit better than one; but if two parallels be so placed that one touches *only poles of north seeking polarity* and the other touches *only poles of south seeking polarity*, the parallels themselves will be but lightly held until a single piece of magnetic material is placed across the top of *both* parallels, when work and parallels will be rigidly bound together and held almost as firmly as a single piece.

The difference between the experience of the man who says a piece may be thus supported away from the surface of the chuck and yet held strongly, and that of the man who says that it will not hold at all under these conditions, is simply that the former puts his supporting pieces in the right place and the other does not.

The confusion in this respect is not lessened by the fact that chucks having decidedly different characteristics sometimes have a very similar appearance. One of the skeptical brethren may witness a demonstration and become convinced that he is wrong; the chuck will hold by this method. He then goes to his own shop, builds up a similar cob-house on his own chuck, turns on the current, and finds that what he knows isn't so; the work is not held at all. He has merely failed to take into consideration the characteristics of his chuck.

There need of necessity be little difference in external appearance between a single magnet chuck and one with a multiple magnet; in fact some makers have made both, the top plates of which were identical so far as a casual observation would disclose. In Fig. 1 may be seen a sketch of two top plates, one of a single and the other of a multiple magnet chuck. There is no visible difference between them, but magnetically they are quite opposed. If we were to lay a couple of small parallels on the chuck *A* in such manner that one parallel rested entirely within the rectangular pole face marked 1, and the other entirely within the pole face marked 2, we would find that upon laying a third paral-

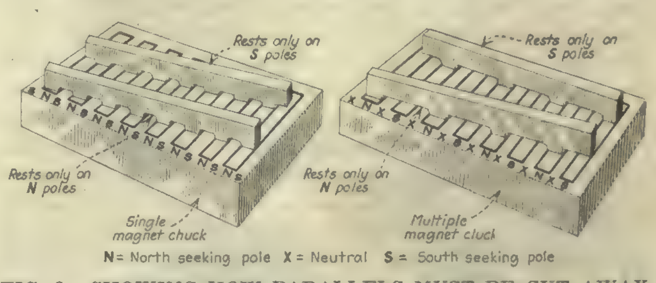


FIG. 2. SHOWING HOW PARALLELS MUST BE CUT AWAY ON THE UNDER SURFACE IN ORDER TO TAKE ADVANTAGE OF THE CHARACTERISTICS OF EITHER TYPE OF CHUCK

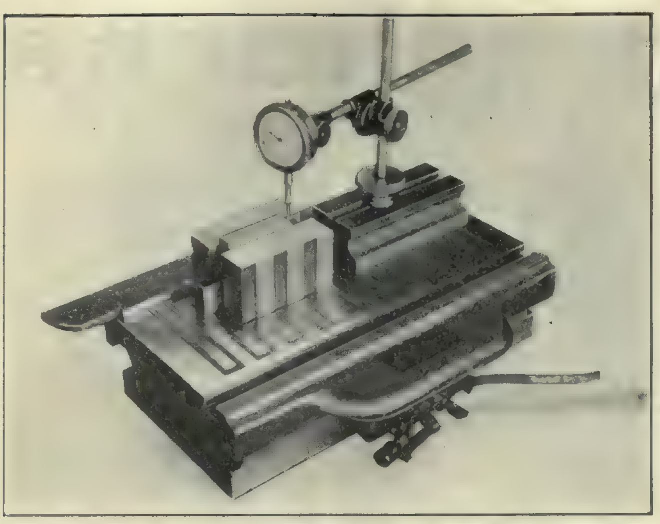


FIG. 3. A PRACTICAL APPLICATION OF THE CUT-AWAY PARALLELS

lel across the two that it would be held very lightly. On the other hand, if two parallels were similarly placed upon pole faces 3 and 4 of chuck *B*, while of themselves they would be held no more strongly than in the previous case, yet, when a third parallel was laid across the top of the pair, all three pieces would be held with practically the full power of the chuck.

Blocking Must Be Correctly Disposed with Reference to Polepieces

Two parallels, or one parallel, placed across the pole faces 5 and 6 or across the pole faces 7 and 8, would be held very strongly. If each chuck were properly calculated for current carrying capacity, magnetic section, etc., there would be little if any difference in the strength of pull. A third parallel placed across this pair would not be held *at all* in either case unless the underlying pair were of so small sectional area that they would not carry all of the magnetic flux.

From this illustration it may quickly be reasoned out that if a pair of parallels were made with one surface so cut away that one of the pair would bear entirely upon north seeking poles and its mate entirely upon south seeking poles we would have a new holding surface practically as good as the top plate of the chuck and raised above it by the thickness of the pieces.

This is precisely the case. Further than this, the parallels need not be of the same height, nor indeed, need they be parallels at all; they may be of any shape or size required so long as they fulfill the two fundamental conditions—they must be of magnetic material, and neither must touch more than one *kind* of pole. Their object is two-fold; mechanically to furnish a support for the work and magnetically, to provide a metallic path through which the lines of force may flow to and from the work and thus complete their necessary circuit through the magnets.

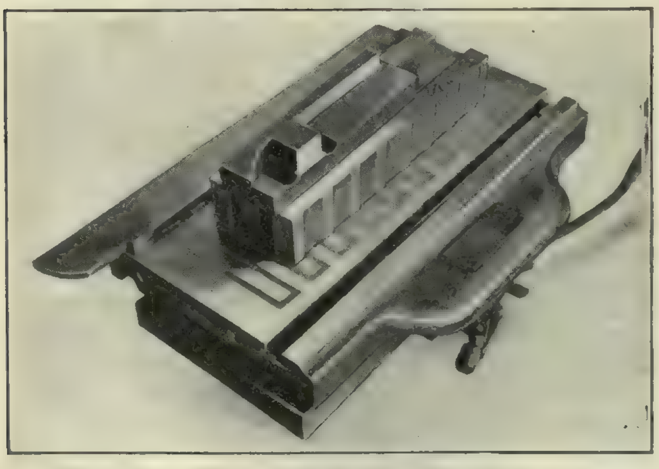


FIG. 4. HOLDING A PUNCH BY THE SHOULDERS ON PARALLELS

Instead of the parallels shown in Fig. 2, with their under surfaces cut away to avoid contact with every other pole let us consider the poles of the chuck to be covered with short blocks or cubes of metal, each cube carefully placed so as to rest squarely upon a pole face but not to span any of the soft metal divisions in such manner as to come in contact with two opposed poles. We may have a piece of work that is very irregular in shape and yet if each block is carefully fitted to just the right height to take its share of the weight of the work, the latter will be held with all the power of which the chuck is capable.

Composite Blocks or Parallels

Now if we are to grind or otherwise machine a number of duplicate pieces we would want to locate our blocks of metal with some degree of permanency so that they would not become jostled out of place when lifting and resetting work; therefore, we would drop pieces of brass, wood, or other non-magnetic material between them, of suitable thickness to just fill the space. We might go further and drill one or more holes lengthwise of each group of blocks, put brass rods through them, and rivet over the ends. We could then machine the under face of our composite parallel to a true plane, the upper face to whatever shape was necessary to fit the work (though if the latter were irregular we could hardly call the composite piece a parallel) and we would then have a semi-permanent work support that would transmit practically all of the holding power of the chuck.

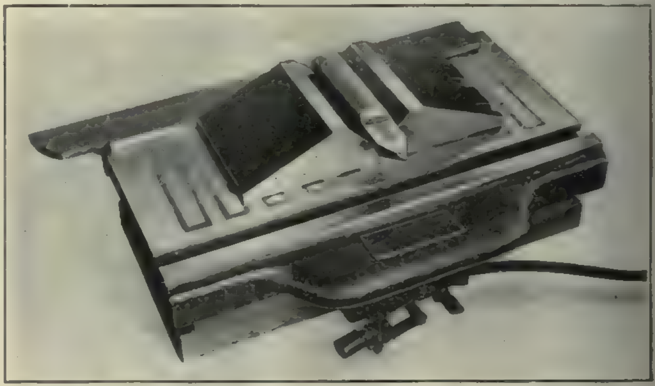


FIG. 5. A V-BLOCK TO BE USED IN CONNECTION WITH A MAGNETIC CHUCK

Such composite pieces have long been on the market, under the trade name of "radnetics"* though it is the writer's belief that they are not as well-known as their merit warrants. They are made in many shapes; even with concave upper surfaces fitted with a rocker of the same composite construction so that work may be tilted to any desired angle. The chuck manufacturers carry this principle a little farther and furnish auxiliary top plates, the construction of which corresponds exactly to

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*These tools are now marketed under the trade name of "Karnetics" and are made by the Kar Engineering Co., 79 East 130th St., New York City.

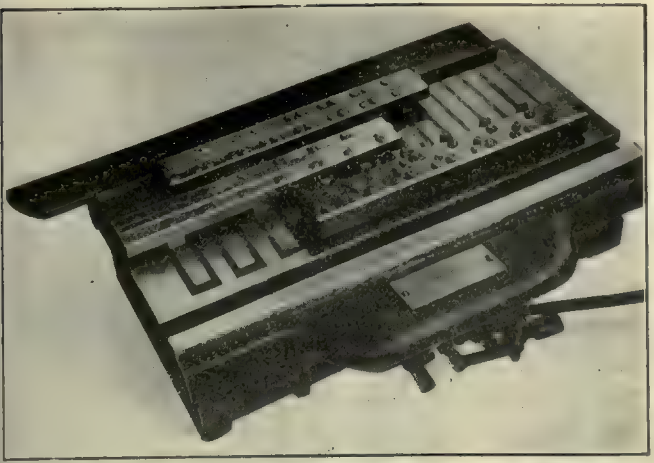


FIG. 6. PIECES TO HOLD THIN WORK ON THREE-POINT BEARINGS

that of the regular top plate. The auxiliary plates may have one surface machined with recesses, shoulders, or whatever is necessary to make them match the work; the under surface being left flat to make contact with the chuck face. These plates may be fastened to the chuck with screws if the latter is to be used constantly on one kind of work, as in manufacturing; but the fastening is not necessary, as with the current on and the work in place the auxiliary plate becomes rigidly a part of the chuck.

It is obvious from a study of the principles involved in Figs. 1 and 2, that such pieces, whether they be loosely made up, joined together as radnetics or made into a permanent plate, must match the chuck with which they are to be used; plates made for a single magnet chuck would be of no value whatever when placed upon a multiple magnet chuck, unless the patterns of the holding surfaces were *exactly alike*, which is not likely to happen.

If blocks, or short pieces, placed widthwise of the chuck, are used, the placing of the blocks so that each individual one rests upon but one pole face and does not touch its neighbor, automatically takes care of the distribution of magnetic flux so that no "short circuiting" takes place; but with radnetics or with the cut-away parallels shown in Fig. 2, it is necessary for the worker to know his chuck.

Fortunately, there is an appreciable difference in appearance between the standard chucks as made by the various manufacturers, and anyone who has followed this series of articles should be able at a glance to recognize the class in which nearly any chuck belongs; but, as has been stated before, this is not always safe. There are some multiple magnet chucks that so closely resemble in appearance the standard single magnet chuck that even their builders might well hesitate to place them without testing for polarity.

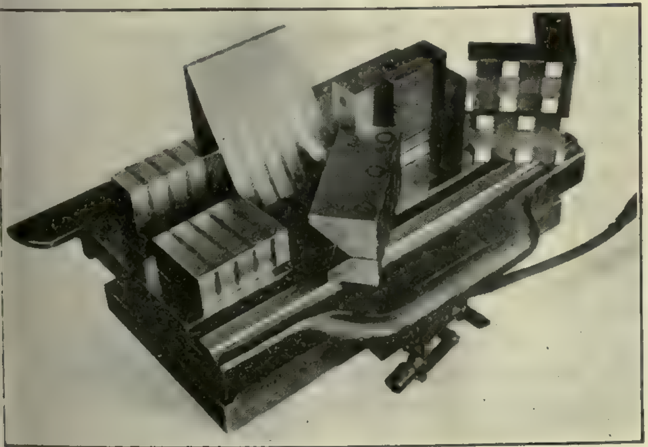


FIG. 7. OTHER COMPOSITE BLOCKING PIECES

Testing may be done with a compass. A compass, however, may easily be put out of business as an indicator of geographical north if brought into too intimate contact with a chuck, and a valuable one should not be used. By holding a short wire or rod of soft iron vertically with its lower end in contact with a pole face of the chuck, and bringing the compass near its upper end, the needle will instantly indicate its polarity. We do not care whether the compass indicates north or south but we must remember which one is indicated. Moving the wire across one divider on the chuck surface, if the chuck be a single magnet the compass needle will instantly swing the other way. If the compass responds indifferently or not at all, this second pole is probably neutral, but moving the wire across the *next* divider will show us with certainty; if the chuck is single magnet the compass will indicate the same polarity as in the first position, if multiple magnet, the opposite pole will be shown. Use a *soft* iron wire or rod for this purpose; a drill rod may retain sufficient magnetism to confuse the compass.

If No Compass Is Handy, Use a Sewing Needle

If no compass is handy a common sewing needle with 6 or 8 in. of thread makes a good indicator. Magnetize the needle by drawing its point against one pole face of the chuck. Now suspend it by the thread so that the point is ½ in. or so above the surface of the chuck and pass it slowly back and forth over the pole faces. Though the movement of the hand be steady the needle will move in a series of jumps; being strongly attracted by some poles and seeming to want to float over others. If the needle is attracted to every other division of the chuck surface, the chuck is single magnet; if it moves across in a series of long jumps, passing four soft metal dividing lines instead of two at each jump, the chuck is multiple magnet.

Though the independent magnet is, mechanically considered, a multiple magnet, its construction permits the doing away with the neutral surface between poles, and to this test it would appear as a single magnet chuck.

In Fig. 3 is shown a practical application of the parallels with the under surface partly cut away. The two short parallels are each cut away on two sides, so that they may be used flatwise, or on edge as shown. The cut-away surfaces are so calculated that one piece touches only north seeking poles and the other only the opposed poles. When they are used in the manner shown with a piece of magnetic material between them they are not only held down to the chuck, but are drawn together like the jaws of a vise. The two small taper parallels upon which the work is resting are of brass, otherwise they would interfere with the magnetic currents and weaken or destroy the grip of the parallels upon the work.

The block upon which the dial indicator shown in this illustration is mounted is of cast iron but its entire under surface is formed by a thick piece of brass fastened to the iron by brass screws, so that little or no magnetism reaches the indicator. The chuck is a Walker single magnet.

Another application is shown in Fig. 4. This is a very common job in any toolroom; the grinding of the cutting edges of a blanking punch, which must be supported by the shoulders of the punch with a clearance space for the shank. The punch is held in this manner quite as firmly as if the shoulders were resting directly upon the surface of the chuck.

In Fig. 5 is shown a V-block divided in the center by a strip of brass running transversely across it, and all parts are held together by brass bolts. The chuck is the same as previously shown—a Walker single magnet—and it may be noted that while one-half the V-block rests entirely upon the pole faces enclosed within the non-magnetic dividers, the other half rests only upon the bars of the grid; which in this chuck forms the other pole. This block will hold a square piece very well indeed, but its hold on a round piece is restricted by the fact that the circular outline of the piece will make but a narrow line contact with each side of the block. It holds, however, with sufficient firmness for light grinding cuts.

A set of pieces for holding very thin work is shown in Fig. 6. The pull of a magnetic chuck may by no means be ignored, for it is quite capable of deflecting by several thousandths any overhanging portion not over ⅛ in. thick. The work for which these fixtures were made is square pieces somewhat thinner than this dimension and must be ground absolutely flat as far as the limitations of the grinding machine will permit. For this purpose it was desirable to support them on a three-point bearing to forestall the tendency of the pieces to rock.

The first fixtures made were of machinery steel with part of the bearing surface resting upon one set of poles and the other part upon opposed poles, but it was found that the machine-steel bodies became sufficiently magnetic to deflect the thin pieces of work even though the latter were separated from the body of the fixture by 1/16 in. of space. The successful fixture is made of brass, with only the lower ends of the steel supporting pins resting upon the chuck.

A collection of holding devices including angle plates, V-blocks, triangles, etc., is shown in Fig. 7. These are all made to match the Walker single magnet chuck and would be of little or no use upon another kind. Similar tools, with their divisions so spaced as to match the divisions of the Heald, Simmons, D. & W., or other makes of chuck would, however, be equally serviceable in their respective places.

Chatter in Milling Machines

By P. V. Vernon

Referring to A. L. DeLeeuw's article on page 610, Vol. 54, of the *American Machinist* dealing with chatter, I venture to think that Mr. DeLeeuw has omitted one of the most common causes of chatter and a cause which appears to be unknown to a very large number of machine tool users. I allude to chatter caused by having the tools too sharp.

In 1912 I made several tests on one of our No. 16 vertical milling machines. In order to be quite sure that the tests would be reliable and not be affected by varying degrees of sharpness in the cutter, I had the cutter carefully watched and sharpened as soon as the slightest sign of bluntness began to appear. To my astonishment I found that on the majority of cuts the cutter chattered severely and considerable suspicion was therefore thrown upon the machine. The machine was carefully gone over with a view to ascertaining whether the bearings were in good condition and properly adjusted, and whether the slides were properly bedded and adjusted, but no defects could be discovered.

Feeling somewhat desperate I determined that as chatter was apparently a concomitant of most of the cuts taken, the only thing to do was to make a record of the chatter in the hope that such might enable me to discover the laws which governed it. I therefore had a series of cuts made, using an inserted-tooth face cutter 7 in. in diameter, 11 teeth, working on a cast-iron test block 5 in. wide, taking cuts ⅛ in. and ¼ in. deep, and feeds varying from ⅝ to 22½ in. per minute. Care was taken to insure that the clearance behind the teeth of the cutter was not excessive.

A further but more limited series of tests was made on cuts ⅛ in. deep using a 9-in. cutter, 12 teeth. Various cutting speeds were used, varying from 29 to 85 r.p.m. The results of the tests show that at ⅛ in. deep the chatter began at 35 r.p.m. and became very bad at 69 r.p.m., becoming less at 85 r.p.m., and that the tendency to chatter became less as the rate of feed was increased, so that at the higher feeds there was no chatter at all.

The results of these tests were not sufficiently consistent to enable a law to be deduced, except that there was a general tendency for increase of feed to decrease chatter.

During these tests the cutter was not sharpened, as such did not appear to be necessary, and after the tests were completed, in order to be sure that no mistake had been made, I decided to repeat some of them using the same cutter, which was used exactly in the condition in which it happened to be, not quite sharp. To my surprise I found that no chatter was produced, and on repeating some of the cuts which, in the first set of tests had produced the worst chatter, I was unable to obtain any chatter at all. This put me on the scent, and I immediately made an expedition into our own milling department and interviewed the various operators, from whom I soon learned that a common practice with them when chatter existed was to slightly blunt the edges of the teeth by holding a free cutting oilstone against them while the cutter was revolving, and that this nearly always removed the chatter.

Although this practice had been in use for many years in our works it was a curious fact that it was apparently unknown outside the milling department, and so far as I know to this day is not generally known by the directing powers of factories although possibly quite familiar to the operators.

Having satisfied my mind on this point and storing up the experience gained for future use, I let the matter drop until a month or two ago I found a milling machine under test in our testing department. It was taking some fairly heavy cuts in steel and chattered very badly. Various attempts were being made in the department to overcome this by fitting additional steadies, but recalling my previous experience I asked that the cutters might be blunted in the manner described and a fresh test made. This was done and as a result the chatter completely disappeared and the cutters cut perfectly free without requiring any additional steadies or other appliances.

I think this aspect of the chattering of tools has not been previously published.

Cylinder Grinding in Motor Repair Shops

SPECIAL CORRESPONDENCE

(Continued from last week's issue.)

THE prices charged for regrinding vary in different sections of the country, as well as in some localities in the same sections. It is best to get several price lists from the nearest concerns doing business and charge according to the conditions in your particular city. Never cut below a fair price as regrinding is a quality proposition and it will cheapen your work and eventually be a losing proposition.

On the other hand remember you cannot make a fortune overnight. Excessive prices will only be an incentive for your customers to buy new blocks, to refinish by the boring method, or for new shops to start up.

Table I is an average of prices taken from several shops in each section. Those in the East, South, and the middle West include regrinding, fitting new pistons and rings. It does not include fitting pins to the pistons. Those in the far West include grinding cylinders, furnishing finished pistons, rings, and pins.

TABLE I—
AVERAGE PRICES IN DIFFERENT PARTS OF THE COUNTRY

Size	Cyl.	East	South	High Middle West	Low Middle West	Far West
Under 3 in................	2	$22.50	$24.00	$23.00	$17.00	$28 00
	4	43.00	41.50	45.00	34.00	42.00
	6	58.00	60.00	64.00	51.00	60.00
	8	74.00	77.00	83.00	66.00	76.00
	12	109 00	100.00	120.00	101.00	107.00
From 3 in. to 3½ in. dia......	2	22 50	27.00	24.00	18.00	32.00
	4	46 00	45.00	48.00	36.00	50.00
	6	59 00	64 00	68.00	53.00	71.00
	8	75 00	79.00	87.00	68.00	90 00
	12	114 00	.....	131.00	106.00	128.00
From 3⅝ in. to 4 in. dia......	2	24.50	29.00	28.00	23.00	36.00
	4	44 00	49 00	54.00	42.00	58.00
	6	66 00	70.00	76.00	63.00	81.00
	8	82 00	.....	104.00	85.00	104.00
From 4⅛ in. to 4½ in. dia.....	2	25 00	35.00	32.00	24.00	43.00
	4	50 00	55.00	60.00	46.00	69.00
	6	68 50	77.00	84.00	68.00	97.00
From 4⅝ in. to 5 in. dia......	2	28 00	37.00	35.00	26.00	49.00
	4	53 00	62.00	67.00	50 00	79.00
	6	72.50	82.00	93.00	73.00	111.00
From 5⅛ in. to 6 in. dia......	2	28 00	40.00	42 00	26.00	60.00
	4	55.00	66.00	78.00	50.00	93 00
	6	72.50	.....	130.00	73.00	136.00
		Prices without Pins				Prices with Pins

Prices on the Western coast and those on the Eastern coast are approximately the same. The prices for a complete job on the Western coast include fitting pins to the pistons. This is not done in any other section of the country. Therefore, while the price of a complete job on the Western coast is a little higher than in the East, for the amount of work that is done they are approximately the same.

In the South they are a little higher than in the East; in the middle West, cities like St. Louis, Chicago and Dayton are the highest to be found anywhere, while in Milwaukee, Indianapolis, and Cincinnati they are lower even than on the Western coast. These are local conditions and will have to be met with by each individual concern.

PRODUCTION TO BE SECURED

It has been found that, taking shops as a whole, under all conditions there is no reason why a good operator cannot average regrinding a hole every 30 minutes in a day's run. This would be very poor time in a manufacturing plant where the work is similar, as there they grind cylinders in from 6 to 10 minutes per hole. An experienced operator, even on miscellaneous work, should do better than half an hour, and does in many cases. As an example of what is possible, the following report is made by a Heald demonstrator:

"I ground the four holes of a Ford block, removing 0.010 in. stock, in 25 minutes from floor to floor. Used a 36-H precision wheel, 3 in. diameter, 1 in. face, and on the first time through removed 0.006 in. On the second pass I removed the other 0.004 in. and by letting the wheel go through the third time without feeding, the hole finished up nicely. I ground the four holes with one dressing of the wheel and worked to the dial graduation.

"These holes did not vary 0.0005 in. in size and were within 0.0003 in. of being round and straight. The work was done on a No. 55 machine."

This, of course, was exceptional time, but it shows what can be done. At the Trindl Company's shop in Chicago, on one machine that is running 24 hours a day, they are turning off 60 holes regularly in that time from Ford blocks.

The average wages paid regrinding operators vary with the locality. It is not profitable to have a poor operator, nor does it require an expert mechanic. It is well to pick out from the organization one man whom you wish to do this work all of the time and let him keep at it. He will gain proficiency not only in quality, but also in production. Some concerns put a premium on the work done. This has its advantages and disadvantages and should be determined by each local shop.

SAVE TIME BY USING WHEEL FEED DIAL

Many operators lose sight of the value and increased production that can be obtained by the proper use of the graduated dial on the wheel feeding device.

Having finished one hole to a size to which all the others will clean, take a reading of the graduated dial and turn back the feed about one-half a turn on this dial. This will put the wheel in position to enter the next hole to be ground, without danger of its touching the wall of the cylinder until you are ready to begin grinding.

The second hole can be ground approximately to the same size as the first without stopping to caliper, by simply feeding the wheel into the work until the dial is brought around to nearly the former reading. You will then have stock enough left for finishing. This device is a great convenience, for it saves stopping continually to caliper the hole at a considerable loss of time; and the new hole will always be smaller than the finished diameter until the former reading has been reached.

AMOUNT OF STOCK TO REMOVE

A cylinder grinding machine is a precision tool and cannot be expected to remove stock in big chips like a lathe, a planer, etc. On the other hand, it is built to remove stock very rapidly for a grinding operation and should not be considered a polishing proposition. With a little judgment and experience one will soon know just how much stock to take off in roughing out and also in finishing.

As an example, suppose there were 0.015 in. to remove. Be sure the wheel is trued up and then, using

TABLE II—WHEEL SELECTION FOR THE AVERAGE CYLINDER

Grade of Cast Iron	Abrasive Co.		American Co.		Carborundum Co.		Cortland Co.	
Soft	30-J	Electrolon	36-J	Carbolite	365-P-OF	Carborundum	36-W Plus	Carbora
Medium	30-I		36-I		303-S-OH		36-W 1	
Hard	30-H		36-I		303-S-OH		36-W 2	
For Steel	46-J Borolon		7736-J Corundum		36-P-L6 Aloxite		36-K Oxaluma	

Grade of Cast Iron	Detroit Co.		Norton Co.		Vitrified Co.		Waltham Co.	
Soft	36-I	Staralon	36-I	Crystolon	46-H	Carbofied	46 s-I	Carbowalt
Medium	36-H		36-H		36-I		36 s-I	
Hard	36-H		36-H		36-H		36 s-H	
For Steel	36-I Staralox		3836-I Alundum		46-H Corundum		36 s-I SpecialAlowalt	

the slowest speed of the table on the No. 55 and the medium speed on the No. 60 (referring to Heald machines) with the fastest speed of the eccentric on both machines, take out 0.004 in. on the first pass in, 0.002 in. coming out; 0.004 in. second pass in, 0.002 in. coming out; 0.002 in. third pass in, and 0.001 in. coming out. Let the wheel go in a fourth time with no feed at all. This will give in practically all cases a round, straight hole with a good commercial finish.

SELECTING WHEELS FOR THE WORK

A most vital factor for successful work is the wheel. Unless all conditions governing the wheels are of the best, results will not be satisfactory. Too hard a grade or grit of wheel will glaze or load, and the holes will not be round or straight; while, on the other hand, too soft a wheel will break down and wear away too fast.

Certain wheels seem to work very satisfactorily in practically all regrinding shops. Of course, different makes of cylinders vary, but taken as a whole, the best success in grinding cast iron is obtained with the wheels listed in Table II.

The wheels listed for hard cast iron are best for such castings as Mack, Pierce-Arrow, and Packard trucks. Their cylinders are extremely hard, in fact, are almost a semi-steel. Wheels for medium cast iron will handle 90 per cent of all regrinding jobs, taking them as they come.

Occasionally soft blocks are received that even the medium wheels do not cut freely, in which case be sure you are using the highest eccentric speed and use wheels listed under "soft." This hardly ever fails to give the desired results. Remember also that the finish can be only as good as the surface on the wheel and that it should be always perfectly true and smooth.

Steel cylinders sometimes find their way into regrinding shops, in which case be careful to use the wheels listed for steel.

Even if you have the correct wheel in regard to grade and grit, it will be useless unless it is up to speed. Wheels 2½ to 3 in. in diameter should run 6,950 r.p.m. These wheels will handle holes 2½ to 5½ in. in diameter. Wheels 3½ to 4 in. diameter should run 5,930 r.p.m., and can be used for holes 3 to 6½ in. diameter.

WEAR ON WHEELS

There is sometimes a question as to the wear on a wheel when grinding. Taking the proper wheel on the average job, the wear on grinding 0.010 in. from four holes in one block will be so little that the holes will not vary 0.0005 in.

The actual wear on the wheel from grinding is hardly perceptible, most of it coming when the wheel is trued off.

In centering your wheel, be sure it is about half-way down the length of the hole. If you center at one end and the cylinder is badly out of round or not at right angles with the flange, when you get it to the other end it will be either cutting too much or too little. The hole can be best located by centering it with the wheel halfway along.

VIBRATION OF THE WHEEL

If you are sure your bearings are up as snug as they should be with the machine running at proper speed and there is still a vibration in the wheel, possibly a firmer foundation for the entire machine will cure it. A cement foundation is recommended whenever possible, with the machine carefully lagged to it.

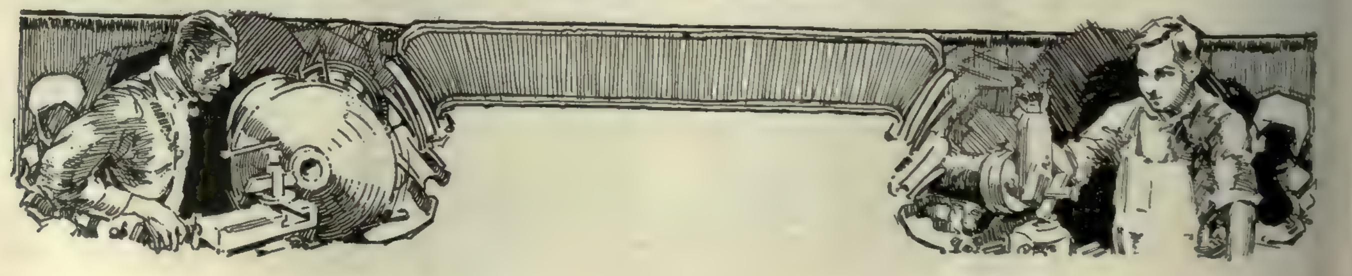
If the wheels are not of even thickness or are leaded, you will have vibration troubles. If they are not of even thickness, true off the sides of the wheel with a diamond; and for the second trouble, when buying new wheels specify them without lead bushings. These bushings quite often throw the wheel out of balance and heat up, causing the wheel to break more easily.

Occasionally internally ground surfaces have a wavy or chattered appearance. This does not in any manner affect the working of the motor. They sometimes appear more prominently on certain jobs than on others, due in a great measure to an improper wheel for that particular job.

If all bearings are carefully adjusted and the speed is right, a correctly selected wheel will practically eliminate them. They are immeasurable and have been found by laboratory test to entirely disappear with a lapping operation that did not remove more than 0.00025 in.

Dry grinding is used exclusively in regrinding shops. Water on the surface that is being ground will not give a good finish nor allow for satisfactory production. An exhaust fan can be furnished to carry away the dust.

Where large amounts of stock are to be removed, the cylinder becomes overheated, so that when cold the diameter of the hole is likely to change. It is best to rough out all the holes to within 0.002 in. of the finished size, and then by coming back to the first hole it will be nearly cool and ready for finished grinding. The usual custom when a nominal amount of stock is to be removed is to finish each hole as you go along.



Keller Automatic Die Sinking Machine

All Movements Electrically Controlled—Inexpensive Masters of Wood or Plaster Used—Tracer Bears Lightly on Master, While Cutter Works Under Pressure

SPECIAL CORRESPONDENCE

THE advent of the automobile, particularly the use of sheet metal automobile bodies, has made it necessary to make dies of increasingly large size. With the demand for larger stampings, the press manufacturers have developed presses capable of turning out work of a size undreamt of a short time ago.

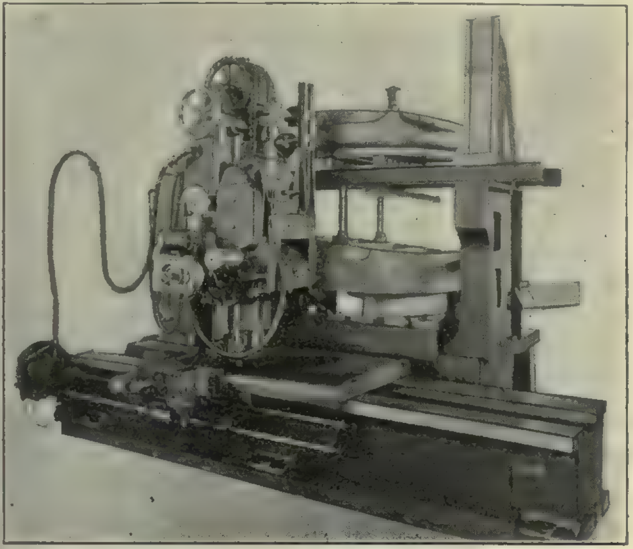


FIG. 1. KELLER AUTOMATIC DIE SINKING MACHINE

With the increase of the size of presses, making the dies for them became a serious problem. The machinery heretofore available for making such dies was dependent entirely on the skill of the operator and it was necessary to take the work from one machine to another. After all that could be done by them, the most particular part of the work had to be done by chipping, scraping and other hand methods.

The production of dies by such methods is very costly and it is practically impossible to calculate in advance with any degree of accuracy, either the time in which they can be finished or their ultimate cost.

The Keller Mechanical Engraving Co., Brooklyn, N. Y., has developed an addition to its line of die sinking machines which can be operated either automatically or semi-automatically, following a form or master and reproducing this form accurately in iron or steel. This machine is the result of long years of experience in the construction of automatic die sinking or profiling machines, and combines unusual cutting power with extreme accuracy in following and reproducing a pattern. It has the further advantage of working from a master which need not be of metal. Masters of cement, plaster or wood suffice. By an ingenious control of the tracing mechanism, the master is faithfully reproduced in all dimensions with only a slight pressure of the tracer against it. At the same time all the pressure necessary is applied to the cutting tool to carry a heavy cut with a substantial cutter.

A general view of the machine is shown in Fig. 1, where the master for an automobile fender is shown above the die being cut. Fig 2 is a close-up view of the upright carrying the cutting and tracing spindles as well as the push button control from which all feeds are electrically operated. All feeds are entirely automatic, and rapid traverse in every direction is provided. The setting-up is simple and the electrical control is capable of forcing the largest cutter suited to the work

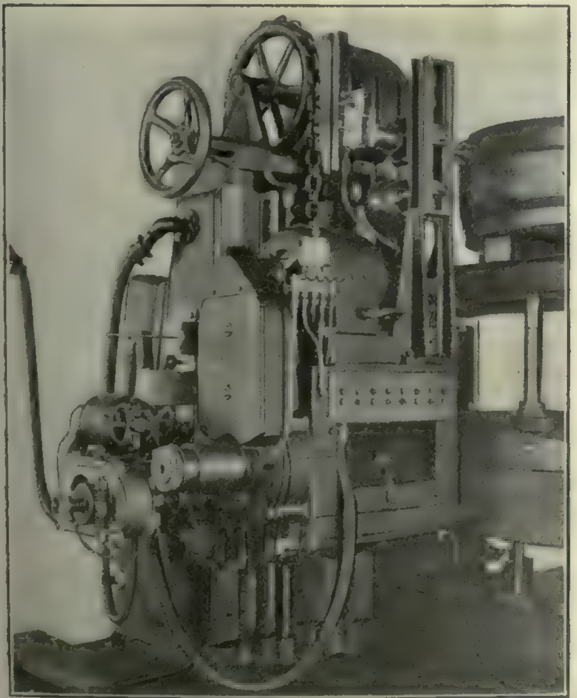


FIG. 2. OPERATING PART OF KELLER DIE SINKING MACHINE.

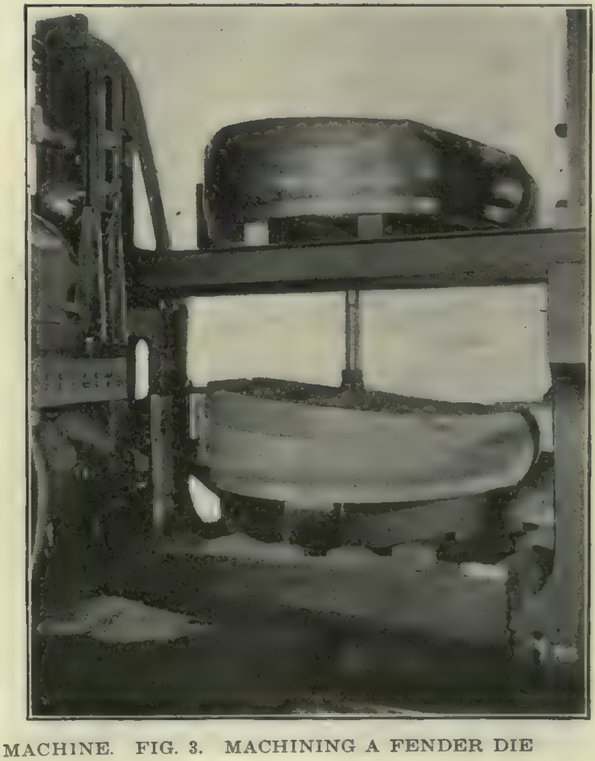


FIG. 3. MACHINING A FENDER DIE

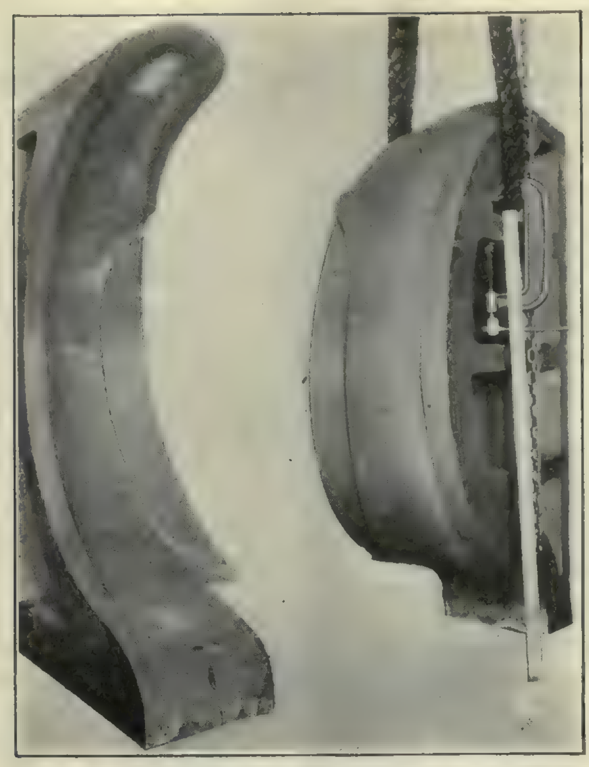


FIG. 4. A PAIR OF FENDER DIES JUST AS THEY LEFT THE MACHINE

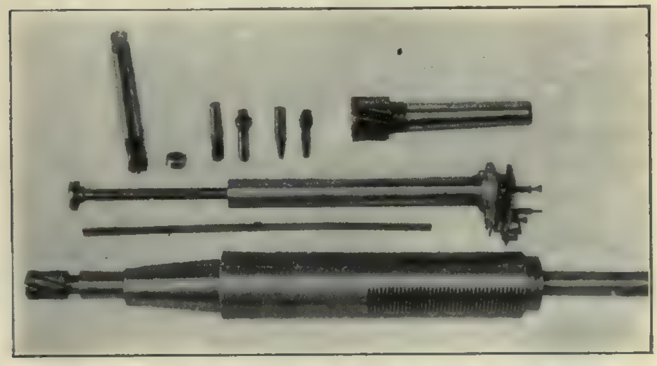


FIG. 6. CUTTER AND TRACER SPINDLES WITH CUTTERS AND TRACER POINTS

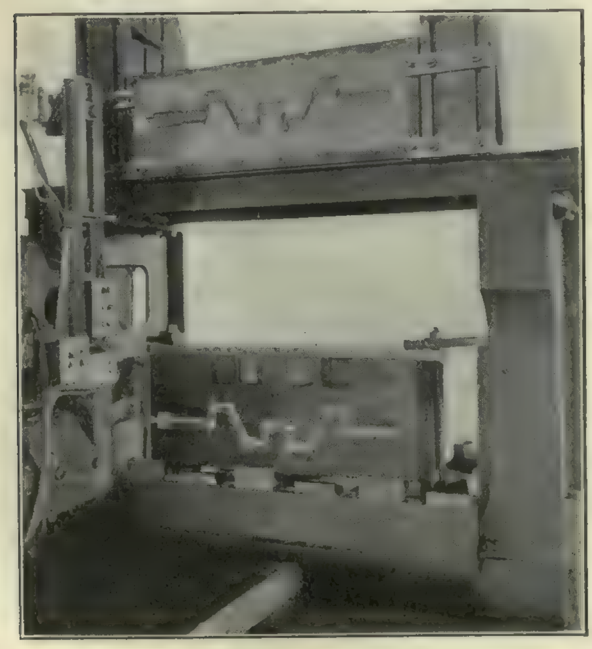


FIG. 5. MACHINING A CRANKSHAFT DIE

to the limit of its capacity without distress to the machine.

The entire machine is free from handwheels or cranks as every movement is controlled from a specific push button so that all physical exertion in operating the machine is eliminated.

The work leaves the machine in a condition requiring the minimum amount of hand work, as may be seen by the dies shown in Fig. 3. Fig. 4 shows a pair of fender dies after the machine work has been completed.

The original pattern is made of wood or plaster and from it a negative can be cast in cement or plaster and used as a master for the female die. From this negative a cast may be made for a master to be used in cutting the male die. Allowance for the thickness of metal to be worked in the dies can be made by applying sheet wax of the desired thickness to the first piece before casting the counterpart from it.

Though the use of this machine for producing dies for large sheet metal work has been dwelt upon, it is obviously applicable to dies for drop forge work. A die for a six throw crankshaft, for example, can be made entirely without any preparatory machining or even laying out. A die for a four throw crankshaft is shown in process in Fig. 5.

The cutter and tracer spindles are shown at *A* and *B* in Fig. 6, while above them are some of the different types of cutters and tracer points.

Suggestions for Methods of Dimensioning Drawings

By Martin H. Ball

The chances of a recurrence of an event such as Alonzo G. Collins related on page 1022, Vol. 54, of the *American Machinist*, of a fly spoiling an expensive job, seems so remote that most of us will do nothing more than "swat the fly" with a little more determination and continue to make drawings as before.

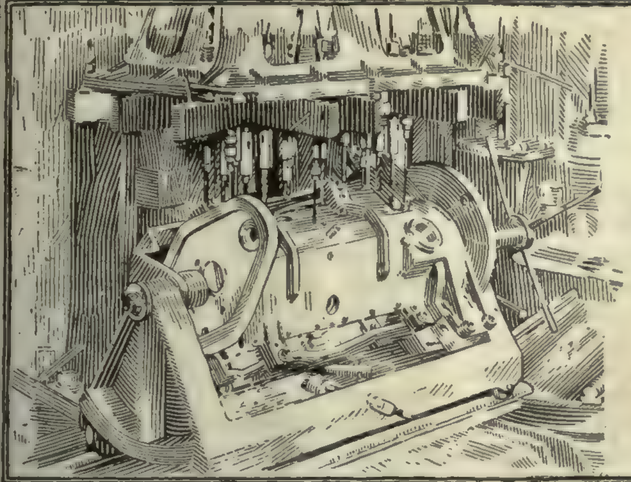
Dimension figures placed in the way shown by Mr. Collins—thus 3′ 8″, and this method is largely used I believe—have been responsible for many errors. When poorly written, carelessly read, or because of a dull, dirty or worn blueprint, all of which are avoidable, errors are likely to occur.

A better method which is used by some concerns is to use the abbreviation "ft." for all dimensions given in feet—thus 3 ft. 8″.

This mark can, if limited space demands it, be made quite small with safety for the reason that it cannot easily be mistaken for anything else. The mistakes that have been made by a wrong reading of figures, that have come under the writer's notice, have been most frequent in cutting up stock, when gages are not used to the extent that they are in succeeding operations.

Where dimensions are given with the abbreviation "ft." it is quite common for all dimensions under 24 in to be given in inches. This gives more room for dimensions on a drawing of small scale, and I believe the limi of showing dimensions in this way could well be extended up to at least 37 in. and in some instances up t 49 in.; thus 48$\frac{15}{16}$″, 4 ft. 1″, etc.

Present-day practice seems to be to use longer measuring instruments than formerly and in the hands o the average user, inches seem to be less confusing tha the combination of feet and inches in the length recommended above.



Tool Engineering

By

Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Albert A. Dowd Engineering Co., New York City

Broaches and Broaching Fixtures—Principles of Design—Tooth-Spacing and Chip-Clearance—Burnishing—Keyway Broaching—Multiple Fixtures—Index Broaching—Spiral Broaching

THE process of broaching is very old and dates back several hundred years when holes of various shapes were made in metal by forcing one or more tools of the required shape through the work by driving with a hammer or other means. Later on, short broaches with teeth were made and pushed through the work by means of hand presses or those operated by power. It was not until 1901, however, that the present process of pulling broaches through the work was developed. Before this time broaches were pushed through the work; now they are pulled through it in the majority of cases.

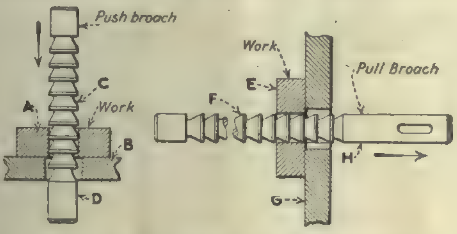


FIG. 186. TYPES OF BROACHING

Push broaches are short while pull broaches are long and it is evident that the latter types possess distinct advantages over the former, in that a greater number of teeth can be used and as a consequence the cutting action is more uniform and sizes can be held much more easily. In addition to this, broaches that are pulled through the work do not tend to "run" or crowd to one side or the other, which fact is also a decided advantage. We must qualify this statement somewhat, because a dull broach will run out of alignment more or less. If the pull broach is sharp, however, it should run true if properly used.

There are a number of factors which influence the design and general construction of broaches and broaching fixtures. The tool engineer who attempts the design of tools of this sort must first familiarize himself with the important features and method of operating a broaching machine. There are several types on the market, the general features of which are more or less similar. Different methods of centralizing the broach in relation to the work are used, but other than this the construction is much the same in all types. In the horizontal types of machines, the work rests or is held by a fixture of some sort against a vertical faceplate through which the broach passes while in operation. Some types of broaching machines have only one spindle while others have two. In the two spindle variety one spindle is operating while the other is returning so that the lost time in setting up is reduced to a minimum.

Let us now consider the various points of importance in connection with the design of fixtures for broaching and also some pertinent matters regarding the broaches themselves:

(1) Material to be broached; as in other machining operations, the material to be broached is an important factor in determining what tools are best adapted for the work. So, in broaching, the material affects not only the design of the broach but the fixture that is to be used as well. The shape of the broach teeth and the amount of material that each tooth will have to remove are important factors which influence the production.

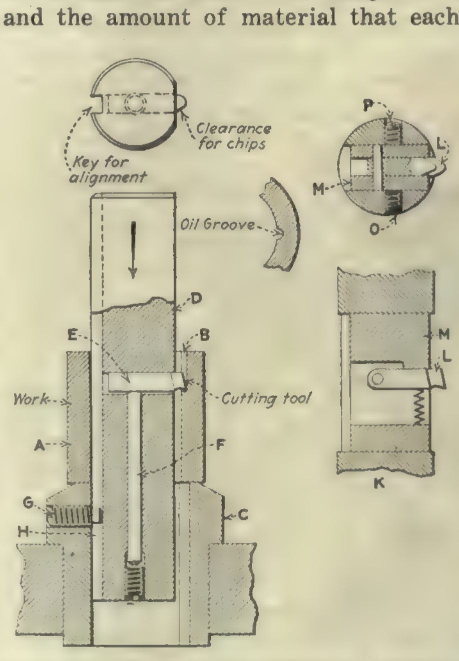


FIG. 187. SIMPLE BROACHING OPERATION

(2) Thickness of the metal; this matter is of great importance in broaching operations as it affects the spacing of the broach teeth. It is difficult to cover the situation in a general note but detailed information will be given on the subject later on in this article.

For authors' forthcoming book. All rights reserved.

(3) Production required; this matter must always be taken into consideration in designing a fixture as the cost of tools should be as nearly as possible in proportion to the amount of work that is to be produced. In broaching fixtures, this factor may easily affect the design of both broach and fixture and also determine the type of machine on which the work should be done.

(4) Preparation of work before broaching; unlike many other operations, work that is to be broached usually requires a certain amount of preliminary machining. A hole must be provided in which to insert the broach and a square surface should be provided on that side of the work which locates against the faceplate of the broaching machine. This point is of importance and, unless due consideration is given to it, may affect the accuracy of the work to an appreciable extent.

(5) Accuracy required; it is seldom that a broached hole is required within an accuracy greater than from 0.001 to 0.002 in. and as it is not particularly difficult to keep within these limits it is evident that the broaching process can be applied to many kinds of work in general manufacturing. If very close tolerances are required both roughing and finishing cuts can be taken as in other machining processes. In some cases it is necessary to locate a broached hole in relation to another one which has been previously machined, in which case it may be found desirable to use the outboard sliding support with which broaching machines are provided in order to support the end of the broach and keep it in correct alignment while in operation.

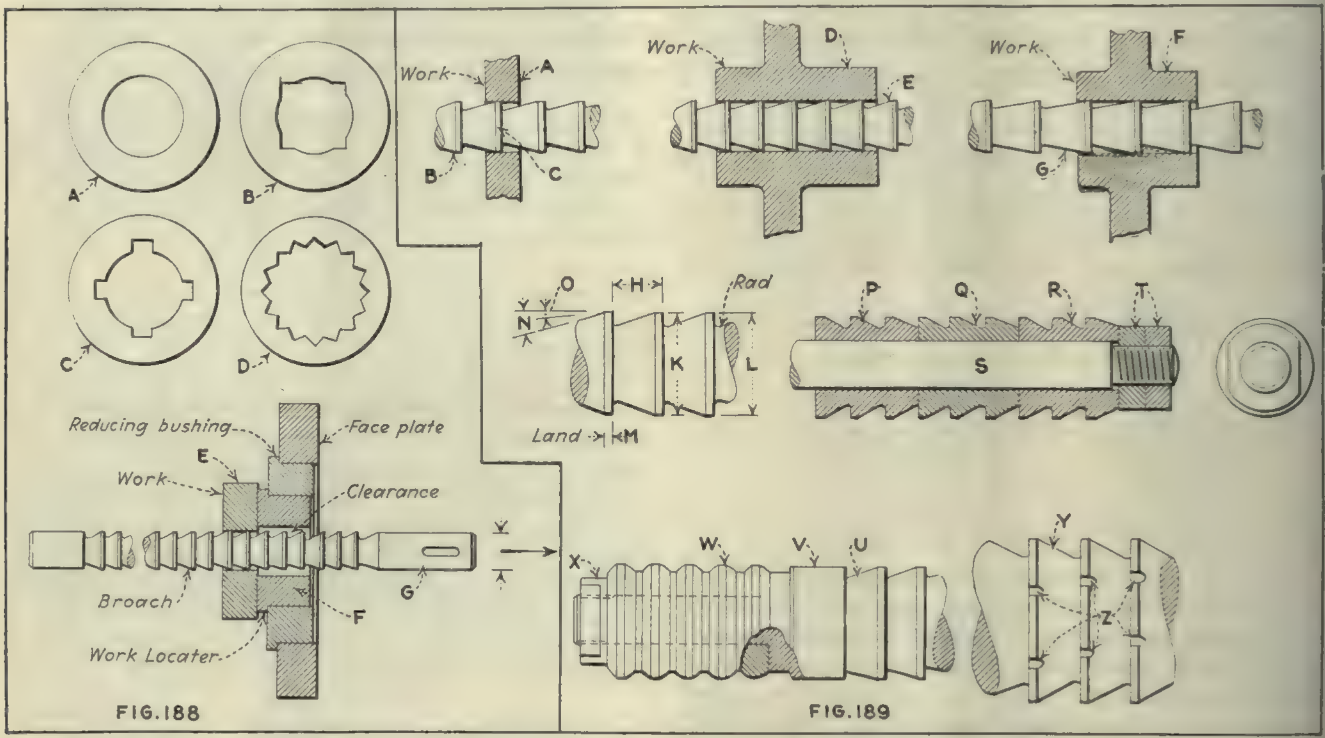


FIG.188 FIG.189

FIG. 188. EXAMPLES OF PLAIN BROACHING AND METHOD OF SETTING UP.
FIG. 189. PRINCIPAL POINTS IN BROACH DESIGN

(6) Lubrication; all broaching machines are provided with means of directing a stream of cutting lubricant into the hole while it is being broached, and this must be considered in making up a fixture in order that the lubricant may reach every part of the broach. For example, a square hole should be broached with a corner upward and not flat, so that the lubricant will reach all four sides of the broach and will not spatter off as it might otherwise. In broaching splined work, the channel between two of the splines should be at the top, so that it will retain the liquid and serve to carry it into the hole with the broach. The kind of lubricant used depends upon the material that is to be cut.

(7) Rigidity; it is highly important that all work that is to be broached should be supported properly in order to preclude the possibility of "chatter" or of the material springing away from the broach during the process, which would cause inaccuracies and tend to injure the broach. When several pieces are to be broached together or when the work is thin, particular attention must be given to the method of holding. Suitable supports or jacks must be provided for work which is irregular in shape in order to avoid any of the troubles mentioned.

(8) Clamping; various types of clamps have been described in previous articles so that it is only necessary to refer to some of these to cover practically all conditions of clamping such as may be required in broaching fixtures. Particular attention should be paid to any work which is thin or of irregular shape so that there will be no distortion due to improper methods of clamping.

(9) Cost of tools; usually the fixtures used for broaching are simple in design and inexpensive to make. There are cases, however, when something more elaborate is needed in order to decrease the setting up time or when the work is of such a character that i cannot be supported and clamped properly in a simpl type of fixture.

In considering the design of broaching fixtures, th designer must first realize that there are two method in use. Fig. 186 illustrates diagrammatically bot forms of broaching processes. The work shown at is set up on the table of an arbor press at *B*. Th
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broach *C* is short and is pushed through the work by means of the press spindle. Attention is called to the fact that all push broaches must be short and that the usual method is to push several of them through the work, one after another, each one being so proportioned that it will remove a little more stock than the one which preceded it. The end *D* should be so made that it will act as a pilot when entering the work. The teeth are so proportioned that each tooth is slightly larger than the preceding one. The amount of this variation is dependent upon the material to be cut and the shape and size of the hole.

The piece of work shown at *E* is broached by pulling the tool through the work instead of pushing it as in the first instance. This work is done on a horizontal broaching machine designed strictly for the broaching process. In contrast with the other example shown, the broach *F* is long, usually from 24 to 36 in., depending on the capacity of the machine and also upon the amount of stock to be removed. It will be noted that the pulling action of this broach is resisted by the faceplate *G* on the machine itself. The portion *H* acts as a pilot and centers the broach in the hole, as in the preceding example.

A bushing which acts as a shaft bearing is often provided with an oil groove. When the work is manufactured in small lots a cold chisel of the proper form is frequently used and the operation is done by hand. If the production is large, other methods can be used according to the depth of the groove, the material which is to be cut, and the machines which are available.

Fig. 187 shows a piece of work *A* in which an oil groove is cut at *B*, this groove being shallow as indicated in the illustration. In this case the work rests on a bushing *C* and the machine used can be an arbor press or other similar machine. It might be possible to use a drill-press spindle to apply the pressure if no other machine were available. The cutter or broach bar *D* is a sliding fit in the bushing and an adjustable cutter is provided at *E*. By means of the screw and binding shoe *F* the cutter can be held in any position desired.

The bar itself is located in the bushing by means of the teat screw *G* which enters the slot *H* in the bar. It is evident that the depth of the groove is controlled by the position of the cutter, and there may be cases when two or three cuts are needed in order to produce the desired results. Oil grooves are usually shallow so that a single cut will often be found sufficient. In the event of a deep cut being required, it would be better to run the work through several times, adjusting the cutter a little more for each successive cut, rather than to attempt an adjustment several times on each piece of work. It would be possible, however, to make a bar with rapid adjustment features if this seemed desirable.

A method of this kind may be found useful occasionally for work that is being rushed, or when production is such that the expense of a broach of the regular form is not warranted. This process can also be used for high production if the cut is very shallow, in which case certain refinements may be found advisable. A bar can be made in such a way that the upper end is held in a drill press spindle, and the cutter *L* mounted in an adjustable block *M*, as shown in the sectional illustration at *K*. The block can be held by setscrews as at *O* and *P* in the upper view. After the cutting has been done the drill press spindle is raised. The cutter rubs lightly against the groove during the movement, but does not injure the work.

Certain varieties of work that are to be broached do not require fixtures of any kind, although occasionally bushings may be necessary if the work is small. In Fig. 188 are shown several examples of work which require nothing but a bushing large enough to admit the broach. Example *A* is a cylindrical piece in which the round hole is to be broached after it has been drilled; *B* is a square hole broaching proposition; *C* is a four keyway job; *D* is a collar having a number of inside serrations.

Each one of these pieces can be broached without fixtures by using the method shown in the diagram. The work *E* may be any one of the pieces illustrated above, and it may be seen that the only thing which must be provided except the broach itself, is the bushing *F*. Even this is unnecessary if the work is of sufficient diameter so that it will rest firmly against the faceplate on the machine. The broach is so made that the portion *G* acts as a pilot in the work, thereby centering it so that as soon as the first tooth strikes the work it is drawn back against the faceplate and held there during the cutting action.

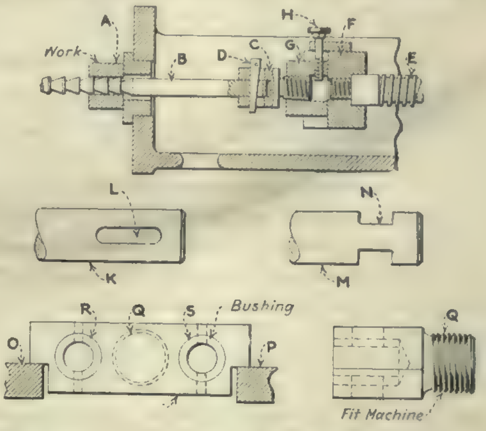


FIG. 190. METHODS OF BROACH PULLING

A number of matters must be taken into consideration in the designing of broaches for various purposes. Some of these points have been taken up under another heading in the first part of this article. There are others, however, which cannot be properly covered in a general way, therefore these will be mentioned specifically.

A few examples are given in Fig. 189 in order to make some of these points clear to the tool designer. The work *A* has been properly prepared for the broaching process by drilling a hole and facing one side square with the hole. It will be seen that this piece of work is not very thick so that if a broach were to be used such as that shown, only one tooth of the broach would be cutting at a time. In other words, the distance between *B* and *C* is too great so that the work may drop down—off center—and thus either break some of the broach teeth or produce work which is off center or otherwise inaccurate. Two or more teeth of the broach should always be in the hole at the same time, and yet there should not be too many to allow for clearance for chips. As there is no way in which chips can get out from between the teeth until they reach the end of the hole it is evident that an accumulation is likely to clog the broach, causing breakage or rough work.

The example *D* shows a long hole and it can be seen that there are too many teeth engaged in the work at the same time. It is advisable therefore in designing broaches for long holes, to space the broach teeth farther apart than when the work is thin. The example *F* shows a good arrangement in which there are always two and sometimes three teeth in the hole at the same time as indicated at *G*. There is plenty of chip clearance, however, so that the cutting action is good and the work produced will be both accurate and smooth.

It can readily be understood from the foregoing discussion that a broach of the same diameter may not always be suited to two different pieces of work if one happens to be thick and the other thin. This objection can be overcome if the work can be arranged or stacked two or three pieces at a time. If the condition is similar to the one shown at *A*, suitable provision must be made for clamping the various pieces together so that they can not drop down on the broach during the operation.

SPACING OF TEETH AND CHIP CLEARANCE

The diagram of the broach at *L* illustrates the points that are of importance in designing broaches. The *pitch* of the teeth is the distance between them as indicated at *H;* the amount of variation being determined by the material to be cut and the length of the hole. A formula which is often used for determining the correct distance, is here given. Assuming *P* as the pitch and *L* as the length of the hole, then: $P = \sqrt{L} \times 0.35$. This formula can be considered as reliable for average conditions and it will serve as a basis on which the designer can determine the correct pitch for any given condition. As a general thing, very large broaches which will permit a deep space for chips can be designed with a decreased pitch, while those broaches which are to be used for tough or hard materials may require a slightly increased pitch.

The variation in the size of successive teeth is indicated at *K* and *L;* this amount, ranging from 0.001 to 0.003 in. for steel and sometimes double this amount for soft cast iron and brass, is influenced by the length of the hole to be broached so that too great an amount of metal may not be removed by a number of teeth in engagement at the same time. The *land* on the teeth is indicated at *M*, the amount usually being about $\frac{1}{32}$ in. for medium sized broaches. The land on the teeth is sometimes ground straight but ordinarily there is a back taper of from 2 to 3 deg., as indicated at *O*.

N indicates the clearance, which depends largely on the length of the hole to be broached and the amount of metal which each tooth is to remove. It is also affected by the diameter of the hole as previously mentioned. An important point in this connection is the fillet at the root of the tooth. This should be made as large as possible, both for strength and also so that there will be less likelihood of cracks during the hardening process.

PLAIN BROACHES

Plain broaches are usually made with the last few teeth the same size in order to assist in the upkeep of the tool. After grinding a few times the number of teeth of the same size will be gradually reduced until finally there is only one sizing tooth left, after which nothing further can be done and the broach must be discarded or used for a smaller size after re-grinding. Some forms of broaches can be made up in a series of units as indicated at *P*, *Q* and *R*, and mounted on an arbor *S*. It is evident that the units can be provided with a keyway for location and they can be held on the arbor by means of check nuts as shown at *T*. If the size of the broach permits, it is as well to put the nuts on the forward end and provide a shoulder at the rear for the various cutters to be drawn against. The size and method of coupling used have an effect on this part of the design.

BROACHING ROUND HOLES

When round holes are to be broached, a good finish can be given to the work by burnishing it or swaging it as shown at *U*. In this case a burnishing broach *W* of rounded form is drawn up against the shouldered portion *V* by means of the nut at *X*. After the cutting has been done the rounded portion is pulled through, thus producing a very fine finish and also compressing the metal so that a hard wearing surface is obtained.

Broaches having considerable area often can be made to cut more freely by nicking the teeth as shown in the diagram at *Y*. The nicks must be so arranged that they overlap each other as at *Z*. An arrangement of this kind breaks up the chips and assists in cases where hard metal is encountered or on broad surfaces.

BROACH COUPLINGS

The method of connecting the broach to the pulling member of the broaching machine permits the operation of coupling and uncoupling the broach to be done rapidly. Provision of some sort must also be made so that either the work may be adjusted vertically in relation to the broach, or that the broach itself can be adjusted in relation to the work. Sometimes the faceplate is adjustable up and down and in other cases the broach coupling is provided with adjustment.

In Fig. 190 is shown a piece of work *A* and a broach *B*, the latter being connected to the pulling member of the broaching machine by means of the taper pin *D*.

The coupling slide *F* is mounted on the ways of the machine and suitably fastened to the screw *E*. The holder *C* screws into slide *G*, which can be adjusted by means of screw *H*, so as to bring the broach into the correct position with relation to the work.

METHODS FOR SLOTTING THE ENDS OF THE BROACH

The detail at *K* shows a common method of slotting the end of the broach when a pin coupling is used like that shown above. Another method is indicated at *M*, this arrangement consisting of a milled slot on each side of the bar. There are occasional instances when it is desirable to pull more than one broach at a time in a horizontal plane and when this becomes necessary it is obvious that some other form of coupling must be used. A case in point is shown at the lower left-hand corner of the illustration, the coupling member *X* being mounted on the ways of the machine at *O* and *P*. The screw portion *Q* fits the pulling member of the machine while the broaches are held in the usual manner at and *S*. In such a case care must be taken by th designer to see that the pulling action is distribute equally on both broaches so that there will be no chanc of cramping during the operation.

(Continued in next week's issue.)

Hydraulic Press with "Oilgear" Control

Control Adapted to Both Linear and Rotary Drives—Flexibility and Accuracy of Control Render it a Valuable Adjunct to Many Types of Machines

SPECIAL CORRESPONDENCE

ANOTHER use for the variable delivery pump (illustrated with the "Oilgear" transmission in a previous issue) is in connection with an hydraulic press as shown in Fig. 1. The press is driven by the standard Oilgear feed controller, requiring only a belt drive from the lineshaft. It has a rapid traverse of the ram of from 3 to 4 ft. per minute up or down, with pressing speed of about 6 in. per minute at 20 tons per square inch. Larger pumps would give more rapid ram traverse for production work.

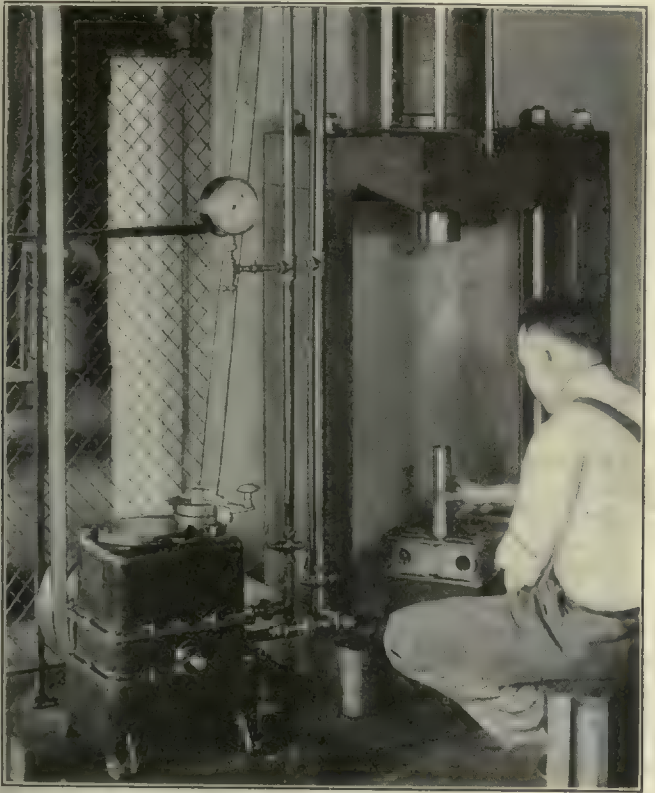
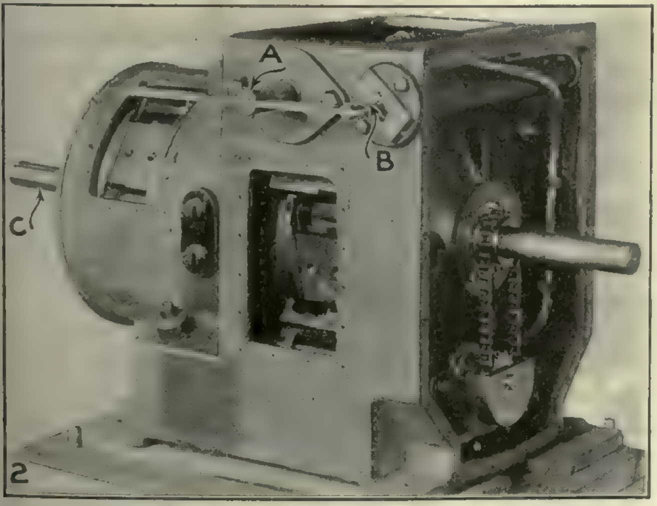


FIG. 1. OILGEAR CONTROL ON PRESS

The Oilgear Company, Milwaukee, Wis., has also built and tested a small lot of a larger type of machine designed to drive the spindles of machine tools at any desired speed, either from lineshaft, constant-speed electric motor, or gasoline engine. A general view of one of these units of about 10-hp. capacity, designed for driving a large lathe is shown in Fig. 2. Through the hand holes, which are shown with the covers removed, any or all of the plungers may be removed and replaced in a few minutes should inspection of them be required. The open end of the casing shows the swinging cradle by which the pump stroke is changed, the hydraulic operating gear being shown at *A*. The rod connecting an overload control cylinder to the operating lever is indicated at *B*. This rod remains stationary and acts as a fulcrum for the control lever so long as the predetermined safe pressures are not exceeded. When the pressures become excessive from any cause whatever, the automatic overloaded gear takes control and shifts the pump stroke until the excessive pressure is relieved. For instance, when driving a machine tool, the hydraulic drive will begin to reduce the speed if the cut becomes excessive, even to the point of stopping the machine entirely until the operator either withdraws the tool from the cut or reduces the feed or depth of cut. On the other hand, if the overload is only temporary, the hydraulic transmission will automatically start the machine again as soon as the load is reduced. The driving shaft of the variable speed motor is shown at *C* extending from the end of the casing at the left.

Fig. 3 shows the pump end of casing with the swinging pump unit removed.

The manufacturer states that long-continued runs of the hydraulic transmission mechanism under heavy continuous loads, prove that very little wear occurs as all revolving and sliding fits work on oil films without metallic contact. It will be noted that all of the plunger thrusts are taken on roller bearings, and that there are no connecting rods or wristpins.



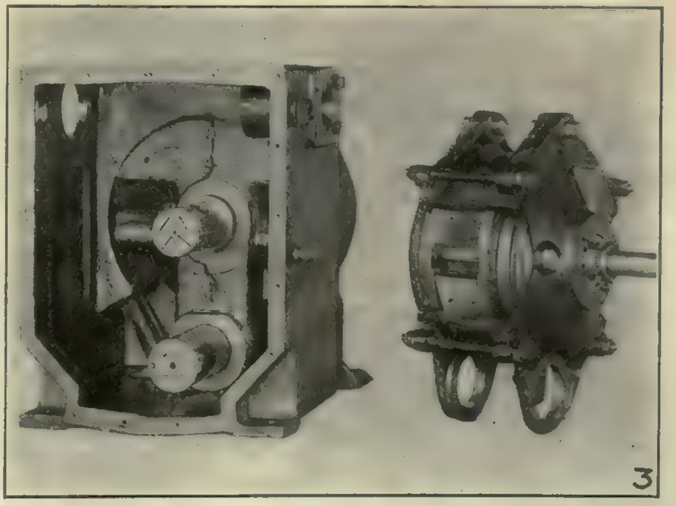


FIG. 2. A 10-HP. CONTROL. FIG. 3. SWINGING PUMP REMOVED

Non-Productive Costs

A Recent Editorial in the "American Machinist" and the Comments of Several Machine Tool Builders

MACHINE-TOOL builders, shop managers and production men are all keenly interested in reducing the cost of production, and rightly so, for much remains to be done in that direction. But the problem of getting business on a normal basis includes much more than shop costs which are often relatively small.

Take, for example, the case of a well known automobile where the production cost is but 10 per cent of the selling price. The car sells for approximately $3,000. The shop builds the motor, transmission, front and rear anxles, and many other parts—more in fact than with most cars of similar grade. Yet the actual production cost is less than $300.

Nor does this necessarily mean that an exorbitant profit is being made. The great discrepancy is due to non-productive costs, between the shop and the consumer. These costs may include shop overhead, elaborate cost systems, too much office expense, high selling costs and various other expenses. But as long as these costs exist the shop man can hardly be expected to worry much about reducing shop costs. It also shows the futility of ascribing all our troubles to high wages in the shop. If these men worked for nothing it could not make more than $300 difference in the cost of the car to the consumer.

One has only to recall the days when bicycles were distributed from expensive showrooms and to remember that we paid $150 each for them. Today we buy a better wheel for $40 or less—and the manufacturers, we trust, make a good profit at that. But they have eliminated much of the non-productive costs which formerly existed.

Just how far this condition is true of other lines is known only to those in the various industries. But whether large or small, non-productive costs must receive at least as careful attention as shop costs. They form one of the glaring economic wastes to which Mr. Hoover is so well devoting so much of his attention.—From the *American Machinist*, June 9, 1921.

By Ralph E. Flanders
Manager, Jones & Lamson Machine Co.

A year or two ago in going over our cost reports we were suddenly struck by the fact that our productive or direct labor expense was a comparatively small percentage of the whole cost of manufacture and selling. In fact it was so small a percentage of the cost that if we had eliminated it entirely it would not have enabled us to make a big enough profit extra, to put us in the class of profiteers. It, therefore, became evident to us that the real place to work for cutting down costs was not on the direct labor but on the indirect charges of all kinds.

We would not be surprised if this were the case with most companies who have, as we have ourselves, made an intensive study of machining operations over long periods of time, with the idea of cutting down the direct labor cost to the smallest possible amount consistent with good wages and good workmanship. We will, therefore, follow with interest your campaign on this subject, which we believe to be badly needed.

By August Marx
Vice-President, G. A. Gray Co.

We were very much interested in your recent editorial on "Non-Productive Costs." We agree absolutely that present conditions demand a rigorous scrutiny of each expense item, whether it be part of the so-called "non-productive cost" or the direct labor and material cost.

We feel, however, that the machine-tool industry as a whole cannot be charged with wastefully elaborate cost and production systems, excessive or overpaid engineering and office personnel or extravagant advertising and selling practices. To our minds the faults along this line lie not so much in the total amounts expended but in the results obtained.

For example, we feel that the industry would not be benefitted by reducing the amount spent on cost and production systems but that the management of each shop should make certain that it is getting useful information for the salaries paid and not merely compiling impressive but valueless statistics. Too many cost figures are like post mortems. They may help posterity but they are of little good to the patient. A real cost system is not a luxury to be cast aside as soon as hard times come but a warning beacon that should be of quite as much value in times of industrial storm as under normal conditions.

Again, instead of disrupting a carefully built up engineering force, might it not pay to set your force to work on a constructive criticism of the present design of your product, with the following aims in view:

(1) To determine whether any particular device is really worth while from the user's standpoint, i.e., whether it is a commercial feature or a mere talking point.

(2) To cheapen the production cost by more careful investigation of the design than was practical during the rush years.

(3) To insure dependability and low upkeep cost of the product.

(4) And perhaps most important, to make the operation of the various devices as simple and convenient as possible so as to secure maximum production.

While such a plan would not reduce non-productive costs it would give the customer machines of the highest productive efficiency at the lowest cost at which they could be built and that is all that can fairly be expected.

By E. F. DuBrul
General Manager, National Machine Tool Builders' Association

The editorial on page 1011, Vol. 54, strikes me as presenting a very good subject for business men to consider; that is, reduction in their overhead, or nonproductive costs.

The three theological virtues are Faith, Hope and Charity, and as the Good Book says, "the greatest of these is Charity." So with costs, the three main elements are Labor, Material, and Overhead, and during the last few years in a great many cases "the greatest of these was Overhead."

Perhaps not many businesses would show such a large percentage of overhead as on the automobile mentioned in the editorial, where the direct production costs were less than $300 on a car retailing for approximately $3,000. The spread of $2,700 is certainly ample to take care of very large expenditures for the most efficient overhead possible and leave a very handsome profit besides. If there are very many cases of this sort, competition in a buyers' market can well be trusted to whittle down the price. The wise manager who has an excessive overhead will begin to turn off the excess in that overhead with a very drastic knife, before his competitors force him to do it.

The world today is so short of capital, due to the destruction of war, that wastefulness in overhead cannot be tolerated, and the sooner this condition is recognized the quicker will overhead costs be gone after. It is in overhead and in elimination of unnecessary idleness that manufacturers must look today for big savings, perhaps larger than they can find in their production. Of course production savings should not be neglected. If the Committee on Waste is right in its preliminary surveys, there is a fruitful field in the study of waste. Stopping a loss is just as good as making a profit when it comes to the balance sheet figures at the end of the year.

The aftermath of the war, coupled with the shortage of capital means a strongly competitive era just ahead. The man who cuts out his losses will be better able to make a profit than the one who lets his losses ride. Many a loss has existed in overhead that could well be eliminated. Such losses were easily imposed on business during the war period. But now it is time to mercilessly reduce them.

By H. Ezra Eberhardt

Secretary, Gould & Eberhardt.

Non-productive costs, especially in such a depressing period as the present, seriously affect every manufacturer, and since they represent and constitute such a large part in the element of costs, it is necessary to control and reduce and keep this portion of expense to a minimum at all times.

A general interchange of ideas in the methods of administering, applying and regulating non-productive costs would form very interesting as well as constructive reading matter, and would no doubt aid many manufacturers in the operation of their plants, not only during the present readjustment period, but in prosperous times as well.

As for ourselves we find that there are a number of fundamental departments in our organization that must be carried on if we would hold our shop together. For instance, the following departments must not be dropped even though only a few repair orders come in, and these departments constitute the making up of an overhead account: (1) Managing; (2) opening of mail; (3) answering correspondence; (4) entering orders; (5) shop production, which includes supervision, designing, routing of work and inspection, timekeeping, repairs, power, and stockroom; (6) shipping, boxing, painting; (7) paymaster; (8) cost department; (9) general expenses, which include taxes (city and government), water, light, interest on investment, insurance, sales promotion literature, service men on road, engineering service, advertising.

Of course all of the expenses enumerated vary according to the amount of business done and the amount of production carried on in the factory, but each item is an essential part of a well organized business if it would "carry on," even in the dullest times.

The important question at present is to see how to continue these functions with the least amount of help. In many cases one man can "overlap" or do the necessary work to keep two or three or more of these departments going, whereas formerly it might have taken two, three or more men to keep the one department going. This, then, is the important point to consider now, that is, how much can one man do or, how many men does it take to keep all of the fundamental departments going. We are endeavoring to accomplish the work by having each man work 100 per cent efficient, both as to his methods of work and physical application, instead of 50 per cent as was the common practice of us all, over the entire country during the rush boom.

By C. R. Snoke

Comptroller, the Bullard Machine Tool Co.

The problem of keeping items of non-productive cost down to a minimum is one that requires careful attention and eternal vigilance. Careful analysis of any classification of non-productive costs will almost invariably reveal the fact that many wastes and extravagances are present.

One of the best known means for its control is the establishment of an expense budget, sub-divided into departments or other suitable divisions. The actual expenses of each department or other division may then be arranged in columns and compared with the estimated budget. In this manner unnecessary expenses may be discovered and a remedy applied.

Successful manufacturers of today make no attempt to route work through their factory without careful planning. There is no good reason why non-productive work should not be planned with the same degree of care. If this planning is not done, there is a tendency for the superintendent or foreman to find something for the men to do solely for the purpose of keeping them busy. The losses from this source will probably be amazing to anyone who has never before attempted the planning of non-productive labor.

Non-productive material in the nature of supplies, repair parts, etc., should be placed under control of the storeskeeper and issued only on properly signed requisitions. This will permit purchasing in larger quantities, taking advantage of quantity prices and the cutting down of the amount carried on hand throughout the plant. It will also be found possible to standardize the various kinds of supplies and parts.

Nearly every manufacturer, particularly in the metal goods line, was concerned with the making of war materials of some kind, and in a great many instances purchased extra or special equipment for this work. In cases where this equipment is not required, or is not suitable for use in connection with the turning out of the regular product, it is unfair to charge the cost of carrying this equipment, depreciation on the same and other expenses in connection therewith, to the cost of the present output. Equipment of this kind should be disposed of to the best advantage possible so as to make the space available for profitable use.

It is quite as important to plan and route the office work as that of the factory. Better results will be obtained with a smaller clerical force and duplication of records avoided, as well as the apparent necessity for obtaining additional office space and equipment.

In making additions to the office personnel, it has been found economical to have new employees, after getting an idea of the work they are to do, spend some time in departments other than those in which they eventually are to work. In this way they acquire an understanding of the correlation of their work with that of other parts of the office, and details which may seem monotonous and unimportant are given better attention when employees have a knowledge of the use made of their contribution of effort in connection with the work of the office as a whole.

It is a well known fact that if particular attention is paid to the little things, the big ones will take care of themselves. With this in mind the following notice was handed to all employees in the office, and within a very few days it was talked of as the "Think" memorandum:

To: Office Employees.
From: Comptroller's Office.
Subject: *LITTLE THINGS*

"Many littles make a much."

This applies to items of expense, the same as to anything else.

Let us watch the little items.

THINK

before incurring expenses for, or using extravagantly—

Telephone toll calls
Telegrams
Office Supplies
Service Car
Messenger Service
Paper Towels
Electric Light
Power. (Do not permit motors on office appliances to run idle.)

Last, but not least, do not waste Time—yours or others.

"The hour you lose has the same money value as the one you use."

If another part of the office has information you require, ask for it—by telephone, don't walk—and do not spend time getting the same facts together again. But—THINK—before asking someone to take time from his work to do something for you.

No one has a moral right to waste anything—his own property or that of others.

THINK

Torsional Strength of Multiple-Splined Shafts*

By C. W. Spicer
Vice-president and chief engineer, Spicer Manufacturing Corporation, South Plainfield, N. J.

There has been some discussion at various times regarding the torsional strength of splined shafts. So far as I am aware this discussion has led to very little available published data on the subject. The results of some recently completed tests will, therefore, be of interest. In presenting this brief paper it is intended to describe only the actual tests, the conditions under which they were carried out and the results obtained. No attempt will be made to develop the theory involved.

The discussions referred to have, so far as I know, been principally along the line of personal opinions; some believing that the torsional strength of a multiple-splined shaft is little if any greater than a full round shaft of a diameter equal to the small diameter of the splined shaft. Superficially, it would seem obvious that the torsional strength of a multiple-splined shaft is greater than that of the full round shaft just referred to. Whether this is so will be evident shortly from an experimental point of view.

A series of tests was run on 15 carefully machined shafts, as indicated in Fig. 1. The dimensions shown are the actual ones of the test-pieces, there being not more than 0.0005-in. variation in any shaft from the diameters shown. Heat-treating was very carefully carried out, and each specimen checked by Brinell instrument on the ends and by sclerescope throughout the length, the Brinell numbers lying between 220 and 235, and the extremes of scleroscope hardness being 38 and 43. It was at first intended that the small diameter of shafts Nos. 1 to 5 should agree exactly with the small diameter of shafts Nos. 6 to 10. It was decided after the heat-treating had been done to avoid any straightening operations and, therefore, the small diameter of shafts Nos. 1 to 5 was reduced to a size that would clean up the most badly warped shaft by grinding. This also accounts for the large diameter of shafts Nos. 6 to 10 being below the 1⅝-in. nominal diameter. However, none of these details materially affected the results, as will be seen later.

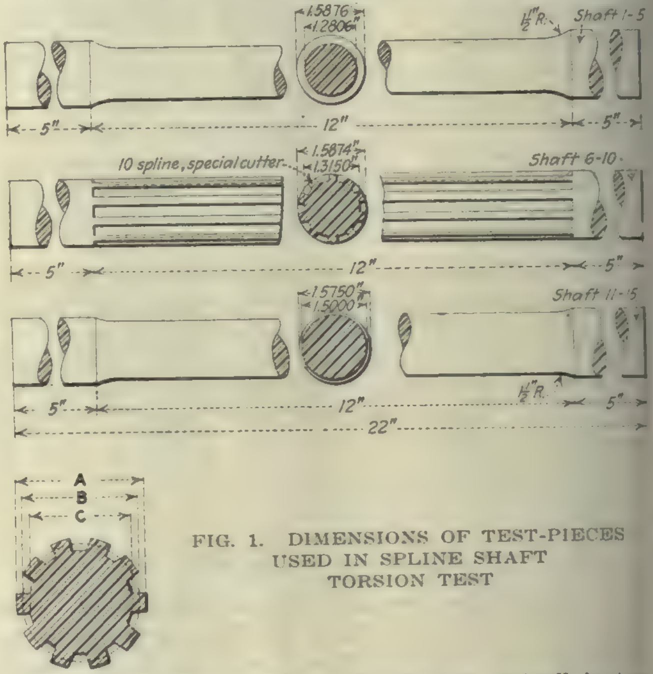


FIG. 1. DIMENSIONS OF TEST-PIECES USED IN SPLINE SHAFT TORSION TEST

It will be noticed that the small diameter of shafts Nos. 11 to 15 lies between the large and the small diameters of shafts Nos. 6 to 10 in approximately the relation shown in the lower left corner of Fig. 1. This diameter represents a shaft which, according to one authority, is hypothetically equivalent to the splined shaft in torsional strength. That it is far from equivalent will be seen later.

All readings from which the curves shown in Fig.

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*Presented at the Annual Meeting, Jan. 12 and 13, 1921, of the Society of Automotive Engineers.

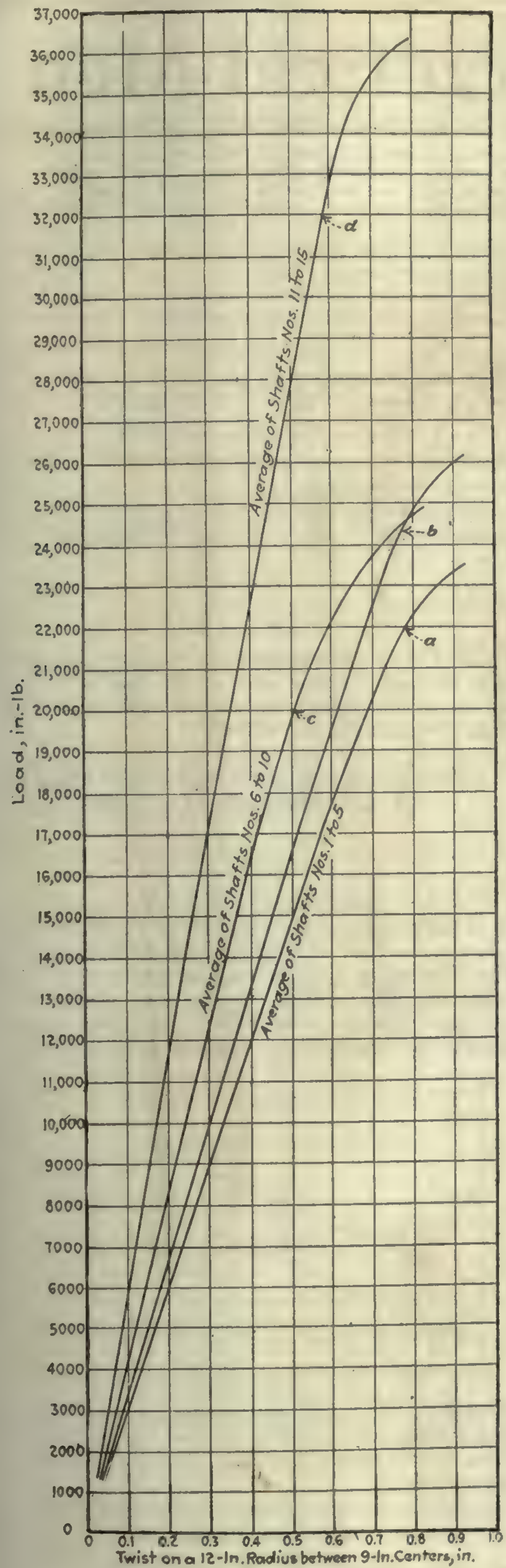


FIG. 2. COMPOSITE CURVE OF TEST RESULTS

2 were prepared were taken by the Olsen troptometer attachment.

The results of the individual tests of the five specimens of each group were very uniform and it therefore does not seem necessary to give the detail curves of each specimen. The curves shown in Fig. 2 represent the average of the five shafts in each group, and are self-explanatory. Curve *a* is the plotted average of shafts Nos. 1 to 5. Curve *b* is curve *a* corrected for a diameter equal to the small diameter of shafts Nos. 6 to 10. Curve *c* is the average of shafts Nos. 6 to 10; and curve *d* is the average of shafts Nos. 11 to 15.

The positions of the letters *a*, *c* and *d* also indicate the location of the so-called Johnson elastic limit; that is, the point at which the unit increment of deflection per unit of load increase is 50 per cent greater than at the beginning.

Comparing curves *b* and *c* it will be readily seen that a splined shaft of the dimensions given has a torsional elastic limit of approximately 18 per cent less than a full round shaft of a diameter equal to the small diameter of the splined shaft. The elastic limit of the hypothetically equivalent shaft is very much higher.

A Mechanical Encyclopedia

BY ALBERT F. GUYLES
Beeston, England

On pages 385 and 942, Vol. 54, of the *American Machinist*, C. V. Lovell and P. A. Fredericks describe and comment on a "Loose-Leaf Mechanical Encyclopedia," formed from pages cut from mechanical journals. I tried that method of preserving information a number of years ago and have often regretted it. I still have the folders but for the most part the information I desire is in the other half of the article on the back of the sheets which I have retained.

The trouble arises from the fact that the information which we consider of the most interest to us today is not necessarily that which will be of the most use to us in the future. We may read an article with interest this week on an object or operation which will not be of the slightest use in the line in which we are engaged; men do not often change their occupations suddenly, but men and firms change the articles they manufacture gradually, and in a few years we recollect having read of a tool or operation which would help with our new class of goods. We remember the general idea but the detail can only be obtained by re-reading the article. Of course that is one of the things we did not save. Who would have thought that we would now be making typewriters, when twelve years ago or less our line was steam-engines?

Some years ago I commenced to save the whole of the issues and have them bound up with the publishers' index and I often look at those old folders and wish that they were in the same condition as the later copies.

Of course eighteen volumes of the *American Machinist* take up a little room, and articles on the same subject do not come together, but for reference I find them more convenient than the folders; and they will stand on a bookshelf, while there is not the tendency to shove them "anywhere out of sight" which one has with folders.

Even with the volumes, a subject index is useful; my own being a thumb-indexed notebook. The subject being at the top of the page it is only necessary to note the initials of the journal, volume and page. A quickly made, easily found and not bulky reference.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Cutting Odd Shapes on a Milling Machine

By Lawrence H. Bailey

In the manufacture of odd-shaped punches on a milling machine it has been found a great time-saver to lay out the shapes on a large scale and then draw in radial lines, corresponding to the divisions of some index circle on the milling machine head. Tangents to the odd-shaped curve made perpendicular to the radial lines, cut the radial lines at distances from the center of the figure which correspond to the distances from the center of the work to the face of the cutter.

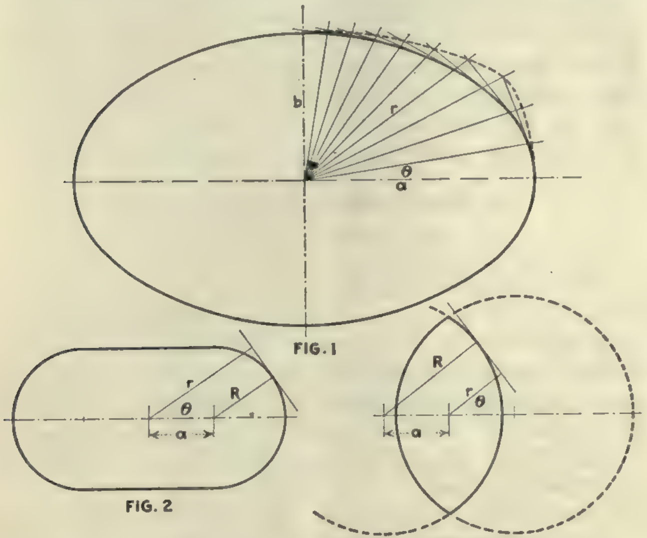


FIG. 1

FIG. 2

FIG. 3

FIG. 1. LAYOUT FOR ELLIPTIC PUNCH. FIGS. 2 and 3. METHODS OF LAYING OUT IN POLAR CO-ORDINATES

This procedure saves all cut and try methods, and the use of templates. The milled punch is smoothed up with a file to remove the slight ridges left between the successive cuts.

This method as applied to an ellipse is shown in Fig. 1. A still more accurate and rapid method can be used in the case of regular figures for which a mathematical expression is known. From the equation of the curve, it is a simple matter to derive the equation of the locus of the intersection of the radial lines with the perpendicular tangents. By substituting the various angles in this expression, the perpendicular distances corresponding to each angle can be accurately figured.

For an ellipse, the semi-diameters of which are a and b, the mathematical expression is

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1.$$

The radial line may be expressed thus:

$$y = mx.$$

The tangent line to the ellipse at right-angles to this is

$$y = \frac{-x}{m} + \sqrt{\frac{a^2}{m^2} + b^2},$$

where m is the tangent of the angle between the x-axis and the radial lines.

The locus of the intersection may be found by eliminating m from these two expressions. The result is

$$x^2 + y^2 = \sqrt{a^2x^2 + b^2y^2},$$

which may be more easily applied to the work in question if expressed in polar co-ordinates, thus:

$$r = \sqrt{a^2 \cos^2 \theta + b^2 \sin^2 \theta}$$

These last two expressions are the equation of the heavy dotted curve in Fig. 1.

Entirely similar methods may be applied to the shapes shown by Figs. 2 and 3. The result in the case of Fig. 2 is

$$r = R + a \cos \theta;$$

and for Fig. 3,

$$r = R + a \cos \theta;$$

Values of r in these equations, which are the distances from the center of the work to the face of the cutter, can be readily calculated with the aid of a table of natural trigonometric functions.

Calculating the Size of a Gage Plug by Triangulation—Discussion

By C. E. Pearce

Associate Professor of Machine Design, Kansas State Agricultural College

Here is a solution for the problem proposed on page 31 of the *American Machinist* by A. D. Hallet on "Calculating the Size of a Gage Plug by Triangulation." The solution of a biquadratic equation, such as that obtained in this problem, is easy in an algebraic sense, but very difficult when figures are used instead of letters. An approximate method of solution that is probably close enough is, therefore, given. I believe a special slide rule might be devised to solve such equations, but I have not had time to look into that side of the matter.

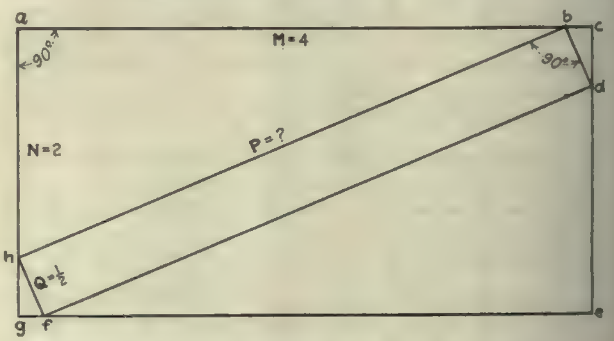


DIAGRAM OF GAGE AND HOLE TO BE CHECKED

Referring to the accompanying figure, here is a solution by similar triangles. Δabh is similar to Δghf.

Then $$\frac{ab}{hg} = \frac{ah}{gf} = \frac{bh}{hf}. \quad (1)$$

Also $$bh^2 = ab^2 + ah^2; \quad (2)$$

And
$$ac = ab + gf, \qquad (3)$$
$$ag = ah + hg. \qquad (4)$$

Let, $ac = M$; $ag = N$; $bh = P$; and $hf = Q$.

From equations (1) and (3),
$$ac = ab + ah.\frac{hf}{bh}$$
$$\therefore M = ab + ah.\frac{Q}{P} \qquad (5)$$

From equations (1) and (4),
$$ag = ah + ab.\frac{hf}{bh}$$
$$\therefore N = ah + ab.\frac{Q}{P} \qquad (6)$$

Taking (5) and (6) together,
$$ab = \frac{P}{Q}\left[N - P\left(\frac{MQ - PN}{Q^2 - P^2}\right)\right] \qquad (7)$$
$$ah = P\left(\frac{MQ - PN}{Q^2 - P^2}\right) \qquad (8)$$

Substituting these values in equation (2),
$$P^2 = \frac{P^2}{Q^2}\left[N - P\left(\frac{MQ - PN}{Q^2 - P^2}\right)\right]^2 + P^2\left[\frac{MQ - PN}{Q^2 - P^2}\right]^2 \qquad (9)$$
$$o = \left(\frac{MQ - PN}{Q^2 - P^2}\right)^2 (Q^2 + P^2) - 2NP\left(\frac{MQ - PN}{Q^2 - P^2}\right) + (N^2 - Q^2) \qquad (10)$$

And this simplifies to,
$$P^4 - P^2(M^2 + N^2 + 2Q^2) + 4PMNQ - (M^2 + N^2 - Q^2)\ Q^2 = 0 \qquad (11)$$

There does not seem to be any general solution for this equation that can be used conveniently.

In the problem proposed for solution, $M = 4$ in.; $N = 2$ in.; and $Q = \frac{1}{2}$ in.

Equation (11) then becomes,
$$P^4 - 20\tfrac{1}{2}P^2 + 16P - 4\tfrac{15}{16} = 0 \qquad (12)$$

The following approximate method of solution for (12) will probably be satisfactory:

If, $P = 4$, the equation $= -12\frac{15}{16}$;
$P = 5$, the equation $= +187\frac{9}{16}$.

Thus the answer is known to be between 4 and 5, and probably close to 4.

If, $P = 4.1$, the equation $= -1.367$;
$P = 4.2$, the equation $= +11.81$.

It is, therefore, known that the answer is between 4.1 and 4.2.

The differential of equation (11) is:
$$4P^3 - 2P(M^2 + N^2 + 2Q^2) + 4MNQ = 0 \qquad (13)$$
Or,
$$4P^3 - 41P + 16 = 0 \qquad (14)$$

If (F) be used to represent equation (12) and (F') to represent equation (14), then Newton's method of approximate solution is as follows: Since we know that $4.1 < P < 4.2$, let us assume a first approximation as $P = 4.15$. Then, substituting this value in (F) and (F'), that is, in equations (12) and (14), we get,
$$\left(\frac{F}{F'}\right) = \frac{+5.02}{+131.75} = +0.0381 \qquad (15)$$

With a positive value for (F), it is known that the answer must be less than $P = 4.15$. So let us correct this value by that of equation (15), or
$$P = 4.15 - 0.0381 = 4.1119.$$

Substitute this value in (F) and (F'), as before.

Then
$$\left(\frac{F}{F'}\right) = \frac{+0.12}{+125.50} = +0.00096 \qquad (16)$$

The approximate answer to equation (12) is, therefore.
$$P = 4.1109$$

If this answer is not close enough, the method outlined may be continued; but a logarithmic table of more than five places will be needed to get (F) and (F') to the same accuracy as that required by the answer.

Machining and Hardening Punches

By C. F. Dorr

In all machine accounting based on the Babbage system, small holes are punched in cards, the cards being afterwards sorted and tabulated by machine. The punches used are less than one inch in overall length, being turned and centered on one end to $\frac{3}{32}$ in. diameter up to within $\frac{1}{8}$ in. of the end in an automatic screw machine from stock $\frac{1}{8}$-in. square.

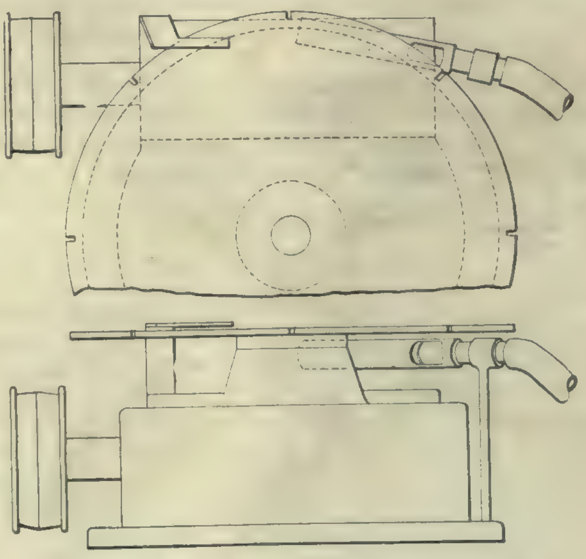
The hardening of these punches has always presented difficulties, as when case or pack hardened in even small quantities they would come distorted, some being too hard and others too soft.

To overcome these troubles, it was suggested that the punches be hardened individually by passing them through a torch flame until heated to the proper degree and then dropping them into a quenching tank.

This proved to be quite a simple and successful method, so a small circular table was made, slots cut in the periphery at equal distances to hang the punches in, and the table mounted on the wormwheel shaft of a rejected drive so that when in operation the table would rotate in a horizontal plane.

As both gas and compressed air were used in the shop, lines were run to where the table was mounted, and a torch placed in position so that the punches would pass through the flame. The sketch shows the general arrangement, the operator placing the punch in the slots by hand as the table revolves. The punches pass through the flame and continue on, until pushed out of the slots by the kickoff bar when they drop into a quenching tank below.

Placed conveniently for the operator are valves for both air and gas regulation. Even at the slow speed



DEVICE FOR HARDENING THE PUNCHES

of table travel it is possible to harden the punches at the rate of 15 per minute.

After hardening, the punches are ground and lapped. The requirements for size are quite severe, not more than 0.0005 in. either out of round or in diameter being permissible.

The punches when ground ran as much as 0.001 in. out of round and the wheel marks showed plainly on the surface. An investigation showed that when the grinding machine was installed, the proper pulley to drive the machine was not available. So a smaller diameter pulley was used until the proper pulley could be ordered—and then the matter was promptly forgotten.

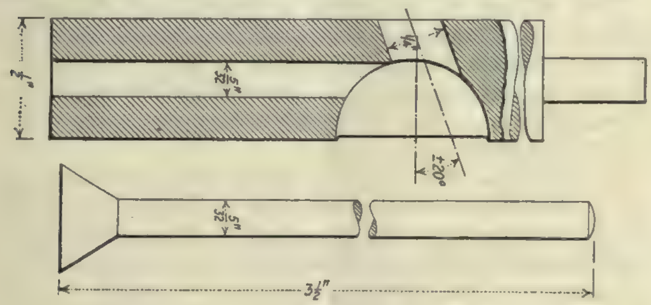
When this was corrected and the grinding machine was run at the proper speed, the punches, when ground, had a mirror finish and could be held within the limits.

Drawing Gear Teeth Rapidly

By Homer S. Trecartin

The work of laying out gear teeth should not be shirked on a finished assembly view, as it adds greatly to the good appearance and clearness of a drawing to have the gear teeth detailed. I applied a little time-saving idea to this work, which proved better than anything I know of for rapid detailing.

I laid out one gear tooth accurately on a piece of stiff paper. Then I carefully cut this out for a template, including in the piece the center point of the gear circle. I drew in pencil on the drawing, the circles for the outside diameters of the gears, and spaced them off for the proper number of teeth. On the center line of my template I pricked a small hole at the proper radius from the original line and fastened it over the gear center with a thumbtack, as shown by the accompanying illustration.



USING TEMPLATE IN DETAILING GEARS

It was easy to locate this template for each tooth, by indexing its center line to the spacing marks on the circle. The outline of the gear was thus quickly drawn, either with a pencil or with a drawing pen.

Mechanical Illusion

By H. S. Nitracent

Almost every one is familiar with the optical illusions by which straight lines are made to appear curved and by which figures all of one height seem to the eye to be of varying heights. There are illusions of this sort common to everyday life and held by most of us. Illusions about mechanical things are indulged in by many whose work consists of dealing with mechanical things, who apparently should know better. Some instances of this were recently brought to my attention.

The frame of a foot power punching machine which we manufactured had been breaking in use. A recommendation came to me, as consulting engineer, that the frame be strengthened by filling in the holes in the back rib of the frame. This suggestion was made by one of the branch managers, and the idea was highly approved by the official who conveyed the recommendation to me. To the untrained man it might seem quite natural to try to strengthen this frame by filling in the holes. But calculations showed that only about 1 per cent strength would be added to the frame by applying the metal that way. I recommended that the frame be strengthened by adding an inch to the back of the rib, which added 40 per cent to the strength with no greater addition to the weight than filling the holes would have involved.

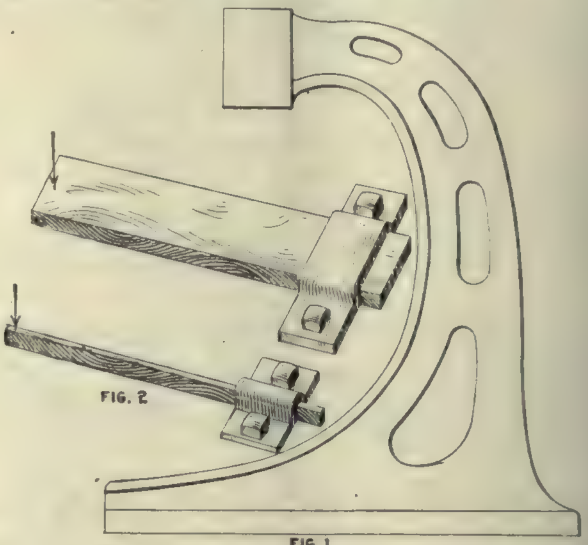


FIG. 1. PRESS FRAME TO BE STRENGTHENED. FIG. 2. A DIVING BOARD, AND A STRIP CUT FROM THE EDGE TO ILLUSTRATE THE SPRING

On another occasion there was under discussion a spring which had been breaking. It was shaped as shown in the sketch and measured about ⅛ in. thick by ¾ in. deep. The superintendent of the steel department was called in for advice about the spring and he became obsessed with the idea that the spring broke because it was bending "the wrong way." He was used to seeing flat springs which bent the thin way of the metal. It was impossible to convince him that it made no difference how wide the spring was, as it would be bent through the same distance, and the fiber stress would be the same.

It is often helpful in explaining such things to refer to familiar examples which will illustrate the principle, especially where the scientific theory cannot be comprehended. So I drew the diagram of a plank, supported at one end, like a diving spring-board. This was the superintendent's conception of a proper flat spring, and he understood how that could bend without breaking. But when I asked him to visualize a strip an eighth of an inch wide cut off the edge of the board, he could only conceive of it as springing the thin way. Some people are slow to grasp an idea, but I believe that after this man had turned the problem over in his mind a few days, the idea probably came to him suddenly,—that it does not make any difference in the fiber stress of a flat spring, how wide it is, if it is positively bent to a predetermined degree.

Another popular misconception is held regarding the strength of parts. A great many people, including shop men and mechanics, would believe that doubling the depth of the flat spring referred to above would double its strength or load capacity. Surprisingly few would know that its strength would increase as the square of its depth; or that doubling its depth would increase its strength four times, and that making it three times as deep would make it nine times as strong.

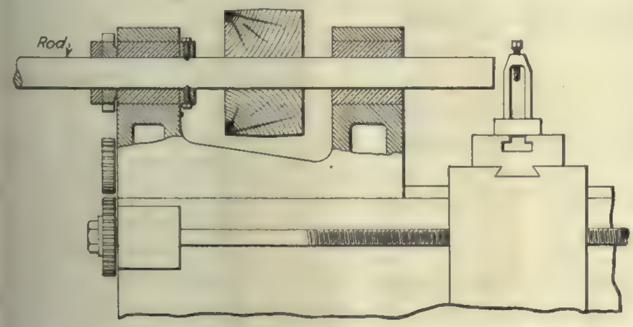
Even in such simple problems training in mechanics demonstrates their practical value. The trained man finds it advisable, occasionally, to apply his scientific reasoning to convince himself of the correctness or error of some of his assumptions in similarly simple analysis. Often what seems to the senses to be a readily apparent fact, proves to be an illusion when checked by scientific theory. So let the worker beware of trusting too greatly the evidence of his senses, which he may think are infallible.

Threading the Ends of Long Rods

By C. F. Dorr

In cutting the threads on rods running from 20 to 40 ft. in length, a repair shop doing mostly hydraulic elevator work, solved the problem as follows: As the bore of the lathe spindle was too small to admit the rods, two cast-iron bushings were first turned up, the bores being the same diameter as the rod, while the outside diameter was the same as the outside diameter of the spindle bearings.

One of the change gears needed to cut the required pitch was then backed up with a heavy cast-iron disk screwed and pinned to the gear, and both were bored the rod diameter. The spindles and bearings were then removed from the lathe; the gear, jury bearings and collar were placed on one of the rods and the rod placed in the headstock.



HOW THE ROD WAS MOUNTED IN THE HEADSTOCK

A wood split pulley was then clamped down on the rod, belted to the countershaft and the thread cut, using the rod itself as a spindle. As these rods were used as piston rods on hydraulic elevators of the cylinder type, it was necessary to thread both ends, one end passing through the piston and the other through the sheave guide, so any score or spot mark made on the rod while revolving did not materially affect it, as the maximum piston stroke would not push or draw the rod past the score and cause leakage or score the stuffing box.

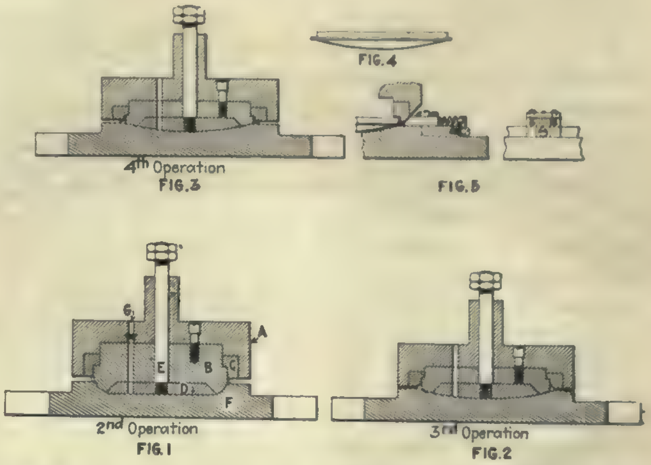
A peculiar thing is that the first pair of rods threaded in this manner were the same diameter as the lathe spindle, and did not require a set of bushings for the headstock.

The sketch shows the rod, bearings, pulley and gear mounted in the lathe headstock.

Dies for Forming a Flanged Cover

By S. A. McDonald

The three dies shown in Figs. 1, 2 and 3 are the second, third and fourth operation dies, necessary to make the cover shown in Fig. 4. The first operation is done by a standard combination blanking and drawing die, without unusual features.



FIGS. 1 AND 2. SECOND AND THIRD OPERATION DIES
FIGS. 3, 4 AND 5. FOURTH OPERATION DIE, THE FINISHED COVER, AND SECTION OF THE LOCATING PLUNGERS

In the second operation the cast-iron holder *A* contains the center *B* also of cast iron, which clamps the hardened tool steel ring *C*. A machine steel knockout pad D is screwed to the stem *E*. The cast-iron die *F* is turned to conform to the outside, and the punch center *B* and pad *D* are turned to the shape of the inside of the cover as it comes from the first operation die.

This die operates as follows: A cover is placed in the die and when the punch descends, the edge of the tin is piloted by the round corners on the center *B* into the groove between the ring *C* and the center *B*, until it comes up against the shoulder in the ring. At this stage the cover is so confined that it can only bulge out between the punch *A* and the die *F*, as shown in Fig. 1. This bead is the bending point for forming the flange. When the punch ascends the knockout *D* strips the cover from the punch.

The third operation die is similar to the preceding one. The punch center is made to fit the inside diameter of the cover and the die is turned to conform nearly to the finished shape. When the punch descends the ring turns the edge of the cover in until it meets the center, which turns it up until it hits the shoulder in the ring. This leaves the cover in the shape shown in operation three when the punch and die come together. The fourth operation dies flatten the flange as shown.

In the last two operations difficulty was experienced in locating the covers centrally in the dies, due to the small rounding on the corners of the punch center; so three locating plungers, shown in Fig. 5, were made to locate them. The punch is cut away on a bevel to slide the locating plungers back as soon as the cover is located by the punch center. An air hole, as shown at *G*, is necessary in all three dies.

About 15,000 covers were turned out per day on these dies and they came through without a wrinkle.

IN THIS ISSUE

THE leading article describes tools for the manufacture of a mouth organ. As shown in the illustration the completed instrument seems to be simple enough, but we find that there are twenty-five components which enter into its makeup—a comb, two reed plates, twenty reeds and two covers. Its manufacture consists chiefly of press work, and the dies designed are extremely interesting. Strange as it may seem the work on a good mouth organ must be carried on within close limits. Even then a certain amount of hand work, chiefly filing, is necessary when tuning.

The second article, page 376, "Machining the Peerless Upper Crankcase," is the first of several automotive articles which explain the machining operations on the Peerless crankcase, making the ring gear and spider, machining some of the rear axle parts and special fixtures used in the Peerless plant. The first article lists the thirty operations on the upper crankcase in their proper sequence, and details the most essential and unusual of them. The pictures tell more than half the story.

The McCabe economics articles hold our attention through every line and they must be having the same effect on you. They are almost short enough to memorize. The laws laid down and the conclusions reached should not be forgotten, and it would do no harm to memorize such sections as these: "The costs that affect prices most are the costs of new or current products, not the costs that have been incurred for the goods already made. . . . The prices at which goods are offered do not necessarily depend upon what it cost to produce those goods but upon what it is likely to cost to produce other goods of the same kind to meet expected demand." Page 381.

Coming Features

Effect of Heat-Treatment on Steel Castings and Drop Forgings—A. A. Blue.

Machining the Peerless Lower Crankcase and Front Cover—Fred H. Colvin.

Characteristics of the Forged Milling Cutter—William G. Calkins.

Tools Used in the Manufacture of P & W Adjustable Limit Snap Gages—Ellsworth Sheldon.

Economics of Production (IV)—Prof. D. A. McCabe.

Organization and Management of the Small Shop (V)—Elmer W. Leach.

Modern Production Methods (XXI)—W. R. Basset.

All of the articles listed above will be in our next issue.

We have been waiting a long time to conclude the Sheldon magnetic chuck series. He was delayed in preparing the last article and then it just naturally got off schedule, but we hope that you will be able to tie it up with the previous installments. This last chapter, page 383, takes up the subjects of supporting pieces of irregular shape on magnetic chucks and testing chucks to determine their classes.

Beginning on page 387 is the conclusion of the first motor service article, "Cylinder Grinding in Motor Repair Shops." It treats of the matter of regrinding, getting right down to basic facts such as production that may be expected, how much feed to use, how much stock to remove, and how to select wheels for the work. There is also a table showing the average prices for regrinding, prevailing in different parts of the country. The next of the motor service articles will appear two weeks hence and will be on the subject of piston grinding.

A recent development in die sinking machinery makes it possible to machine dies of metal using a master of a comparatively soft material such as wood, cement or even plaster. The master is reproduced with only a light pressure against it, while at the same time all of the pressure necessary to carry a heavy cut is applied to the cutting tool. This machine is described on pages 389 and 390.

"Tool Engineering" has now reached the subject of broaching. The article beginning on page 391 takes up the principles of broach and broach fixture design, going into great detail and giving very careful explanation.

A one-page article, page 395, tells how the "Oilgear" hydraulic control has been applied to a press.

The subject of non-productive costs has proved to be one about which many people are thinking. Several weeks ago we had an editorial on that subject. Some of the comment which it aroused from executives is well worth your while. The editorial is reprinted and the comments are given in an article that begins on page 396. We see from the several short articles that non-productive costs are a very large share of the total costs of manufactured goods, and that the importance of keeping them down to a minimum is well realized. One executive says that the productive or direct labor expense was a comparatively small percentage of the whole cost of manufacture and selling; so small in fact that if it had been entirely eliminated the company would not have been able to make enough extra profit to have been considered as belonging to the class of profiteers. Another says, "The wise manager who has an excessive overhead will begin to turn off the excess in that overhead with a very drastic knife before his competitors force him to do it."

EDITORIALS

Importance of Proper Cost Accounting

THE present depression has actually been a benefit to certain phases of business and industry in that it has emphasized their importance. The example which we have in mind is cost accounting. Although the idea of its value has been high and has steadily risen, the need of even more information regarding costs is making itself felt.

When business is very good it is not generally thought necessary to know every detail of costs, as the price can usually be placed at a safety point. When competition becomes very keen, however, prices go so low that profits are sacrificed. Then it is that the concern having the fullest and most reliable information regarding its costs is the best equipped to bid safely for business.

Even when doing a greatly decreased volume of business, most concerns have not found it advisable to reduce the staff of the accounting department. On the contrary, cases have been pointed out to us where it has actually been increased recently. This may be due in part to the same reason that we see so many firms keeping practically all of their office force busy and only a part of their plant. The volume and the value of the business has been reduced, it seems, but not the amount of detail required for carrying it on, as it takes about the same time to write an order for one file as for a gross of them.

Cost accounting is a subject having such wide ramifications that we shall not attempt to go into detail. Of course, the nature and the thoroughness of the accounting depend upon the purpose for which it is carried on, whether for price fixing, or for the determination of the profit or of the efficiency of the production department. But, in order that cost accounting may become a more useful art and science, so to speak, considerable standardization in terminology and definitions of fundamental principles is necessary. At present, the Industrial Cost Association is working upon the matter. At a convention held at the end of last May this association discussed the matter of standardization of terminology as well as other matters, notably those relating to uniform cost systems.

By a uniform cost system is meant the use of the same method of accounting throughout an entire industry, or in all similar plants. It is thus possible to compare the costs of similar operations in various plants, with the object of finding the leaks that may occur in some of the plants. The idea has been proved successful in several fields, notably the textile-making industry. An organization of firms doing similar work must, of course, sponsor the plan. It would be a surprise to many of us to know that cost data are freely exchanged among concerns, even the names of firms being given in many cases. Note, however, that the exchange of costs does not enter as a basis for the fixing of selling prices, and uniformity of method, not necessarily of price, is obtained.

Another live problem for the cost accountant is the question of how to handle abnormal burden. Since the burden rate varies quite appreciably in good and bad times, the method of handling it is difficult. Each concern usually determines by experience what it calls its "normal" burden. But what to do with abnormal burden charges which appear when the plant is running at only part capacity is a real problem. Ordinarily these costs are distributed over the entire year, but now many plants include abnormal burden in the current monthly cost. There are arguments for both ideas, of course.

Some accountants say that since it is the ultimate or average cost which counts, costs should not be figured for monthly periods, or even yearly periods in some cases. The monthly cost is usually too fluctuating to permit of setting stable selling prices. The best argument for including all of the abnormal burden in the month in which it occurs is that it gives a more accurate statement of the true conditions. In periods of depression when nothing but a loss is expected, why not show it on the books, rather than carry over the burden to penalize future operations?

Assistant President of the United States

IT HAS been currently reported in the daily press that proposals have been made to the joint committee on reorganization in Washington to create an office that would virtually be an Assistant Presidency of the United States. The suggestion is to appoint an executive secretary who will have much broader powers of initiative and decision than those granted to the President's secretary and that he be assigned the duty of supervising, on behalf of the President, the executive departments of the Government, and to give attention to such matters of minor detail as now encroach on the President's time.

Why create a new office for a new incumbent? What is the matter with having the Vice-President fill the position and do what he can to assist in the operation of the Government? Is not that what he is paid for? The days when vice-presidents in business life were figureheads has passed. In every large business corporation specific duties are assigned to the vice-president.

While the Vice-President of the United States has always been more or less of a figurehead, the time has come when he should be of some real use—and President Harding promised that the present incumbent should be.

Especially in times of stress, such as we are now passing through, it is up to every officer of the Government to assist in making his work as efficient as possible.

In the interest of economy and efficiency, put the Vice-President to work.

Automobiles and Ice Cream

SAMUEL GOMPERS is reported to have said that every worker is entitled to an automobile and to ice-cream. We agree—when they earn them. And this applies to everybody else as well.

Shop Equipment News

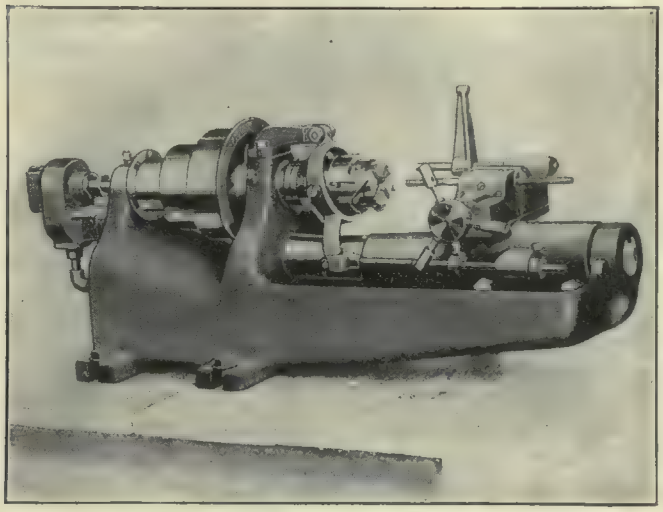
Geometric Bench Threading Machine

A bench threading machine, shown in the illustrations herewith, for use in threading small work has been placed on the market by the Geometric Tool Co., New Haven, Conn.

The machine is fitted with a Geometric rotary die head which will cut threads of fine pitch on $\frac{1}{16}$ to $\frac{5}{16}$ in. diameters, inclusive.

The bed of the machine consists of a single casting, carrying a spindle mounted on liberal sized bronze bearings. The spindle is driven by a three-step cone pulley and carries a Geometric self-opening rotary die head, which is operated by a yoke lever and trip rod. Adjustable stops, arranged on the trip rod, govern the point of opening and closing the die head.

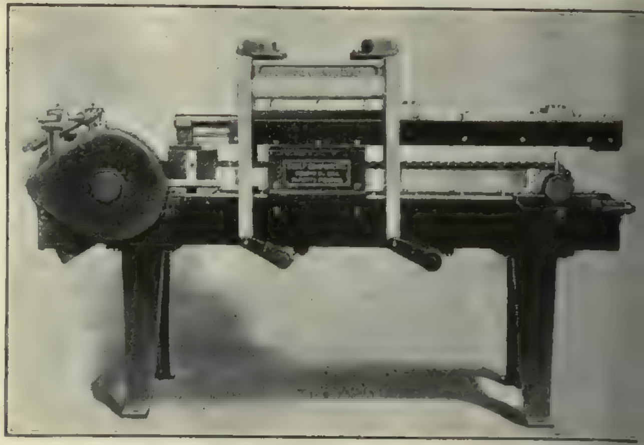
The carriage is equipped with a two-jawed chuck, which is operated by a handwheel. Collets, expanding arbors or special holders can be furnished if the work requires. The carriage travels on a round shaft and is guided by a large bronze key, which engages a keyway on the shaft. This construction allows the maximum space for the removal of chips from the bed of the machine. A geared pump with direct drive from the spindle forces oil from the reservoir in the bed of the machine through the spindle and against the work. The machine is arranged for bolting to a bench, or it may be mounted on a separate pedestal, which will be furnished on request.



GEOMETRIC BENCH THREADING MACHINE

Stolp Automatic Lockseaming Machine

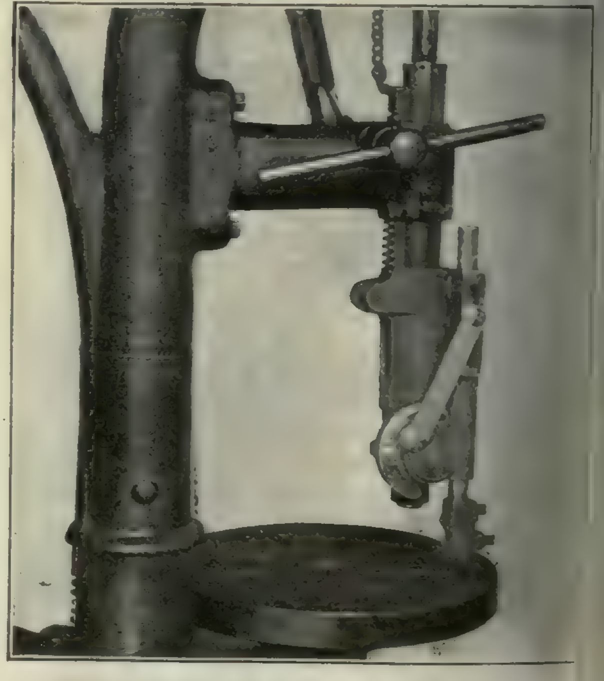
A lockseaming machine which is claimed to be a departure in this field has been developed by the Stolp Company, Geneva, N. Y. The machine produces lockseamed articles direct from the blank without an extra operation, and it is also equipped with a self feeding attachment by which lockseamed tubes can be produced direct from a coil of metal. It will lockseam tubes of any thickness of metal and will lockseam taper tubes within certain limits. The machine can be used for the manufacture of tin cans and metal containers of kinds, mailing tubes, pipes of all kinds, muffler tub radiator tubes, shade rollers, pump cylinders, and oth articles of this nature.



STOLP AUTOMATIC LOCKSEAMING MACHINE

Utility Filing Attachment

The Utility Tool and Manufacturing Co., 2717 L fayette Ave., St. Louis, Mo., has brought out a fili attachment that was designed for application for dri ing machines. It consists of a housing which sli on to the spindle sleeve, the housing containing a p of bevel gears which operate with the machine spind To one of the gears is attached a crank that operates lever, which in turn drives a small shaft up and do The file is attached to the lower end of the shaft. It said that the attachment can be applied to any make machine within one minute and will accommodate



UTILITY FILING ATTACHMENT

hape of file from the smallest up to 16 in. It is also aid to be adaptable for either heavy duty or small die vork, and to be adjustable for any angle from 1 to 90 leg. The attachment is of heavy construction and the gears are of steel, hardened and ground. Bearings are hosphor bronze.

General Electric Small Resistance Furnace

The General Electric Co., Schenectady, N. Y., has eveloped an automatic furnace, known as the semi-ylindrical type. This furnace, which is said to possess nany improved features in design and construction, is rimarily designed for operation at 1,800 deg. F., lthough by removing the temperature limit fuse it can e safely operated at 2,000 deg. F.

The complete equipment consists of the furnace, ransformer, automatic control panel and a temperature ntrol instrument which is mounted on the sub-base the panel. The furnace consists of a large sheet-steel sing, supported on legs, lined with insulating material, d having a semi-cylindrical chamber.

GENERAL ELECTRIC SMALL RESISTANCE FURNACE

The heating element consists of a continuous strip resistor ribbons formed into an arch, or succession semi-circular turns conforming to the arch of the rnace chamber and extending the whole length of the ter, the proper spacing between turns being main-ined by means of insulators. This gives a winding hich is self supporting yet still flexible to expansion d contraction. The two ends of the winding are ought out at the back wall of the chamber, so that e cables of the power supply may be attached. The at is radiated direct to the charge, and the absence a muffle allows a lower temperature gradient, as no at has to be forced through it to reach the charge. so, since the resistor is of large cross-section, the mbination of the two factors allows a high power pact for the heating-up period.

The spacing of the resistor ribbon is said to aid in the heat distribution of the furnace. The whole heating unit can be pulled out bodily for inspection or repair by removing the front of the furnace and disconnecting the terminals at the back. The transformer, which is mounted on the pipe frame of the control board, has four primary coils, insulated from the secondary. The coils may be connected in multiple, multiple-series, or series, for 110, 220, or 440 volts respectively, at 60 cycles. The secondary has two taps, one 70-volt giving 10 kw. for rapid heating; the other 50-volt giving 5 kw. for normal operation. The transformer is rated 7.5 kw. normal, but will give 10 kw. for short periods such as mentioned above. The time required for heating is 1½ to 2 hours, depending on whether or not the furnace was used the day before.

Kimball Portable Garage Crane

The illustration shows a portable crane recently developed by Kimball's Garage, 139 Ashmun St., New Haven, Conn. It is for use in garages or upon the road wherever it may be necessary to lift all or any part of a wrecked or dismantled car.

The legs of the crane are of standard wrought-iron pipe. They fit into welded steel brackets that are attached to the ends of the crossbeam by means of taper pins and they may be of any length desired. The crossbeam is a standard I-section of structural iron and is furnished either 4 or 6 in. in depth according to the service for which the crane is required.

The hoisting apparatus is a complete unit, consisting of a winding drum and wormwheel cast in one piece and of a worm and crank handle which are supported by a bracket on one of the legs. A bar of cold-rolled steel passing through this and a corresponding bracket upon the opposite leg holds the whole in place and it may be set at any convenient height from the ground.

The wire hoist rope passes over a sheave that is

PORTABLE CRANE FOR ROAD AND GARAGE USE

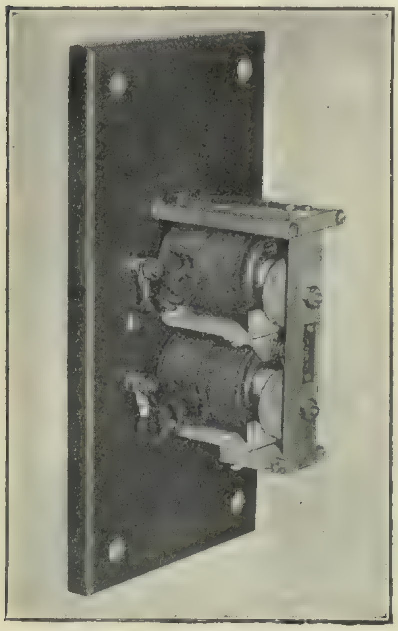
supported by a wrought-iron yoke encircling the beam. The yoke is so shaped that, though it may easily be moved in either direction along the beam when there is no load upon the rope, it grips the beam firmly in whatever position it may be left when the strain is applied.

The long jacks are supplied as a part of the equipment and are used as temporary supports whenever it is desired to support any part of a car in an elevated position.

The whole apparatus may be assembled and disassembled by two men in five minutes, and when down may be loaded into the back of an ordinary delivery wagon with only the legs projecting.

G. E. Voltage-Drop Relay

The General Electric Co., Schenectady, N. Y., has placed on the market a type of control for direct current motors, for either reversing or non-reversing applications. It is intended to combine time and current limits, allowing high torque where necessary, and minimizing current peaks on light loads. The system is known as the voltage-drop system, from the fact that the relays which control the accelerating contactors are operated by the voltage drop across the motor's starting resistor. Since the voltage across the starting resistor is proportional to the current in the resistor, the system gives a form of current limit control. The system is said to be best suited for motors that are subject to frequent starting and stopping, and that are required to operate under varying conditions of torque and load.



GENERAL ELECTRIC VOLTAGE-DROP RELAY

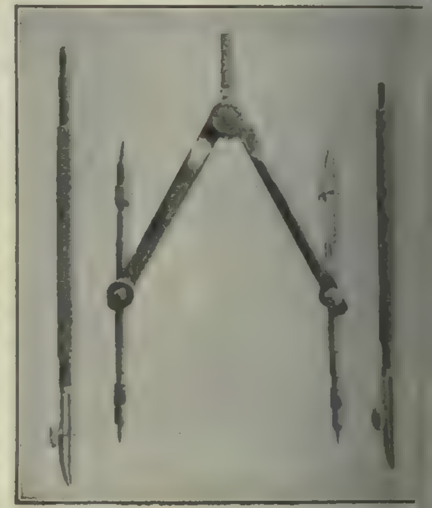
The voltage-drop relay, shown in the accompanying illustration, has two independent magnetic circuits, the upper one energized by a calibrating coil and the lower one energized by an assisting coil. A compression spring normally holds the relay contacts closed. Both coils of the relay are energized to open the relay contacts, but in actual practice the lower, or assisting coil, is short-circuited by a contactor. The voltage at which the armature will close the contacts may, therefore, be adjusted by means of the upper adjusting nut.

The relay possesses a small time lag in the releasing of the armature after the assisting coil is shorted, caused by the self induction of the shorted coil creating a relatively slow decrease in the magnetic flux. The lag may be varied from approximately 0.05 to 0.3 seconds, but it does not affect the calibration of the relay as a whole, as fixed by the calibrating coil adjusting nut. Thus, the relay may be set to close the contactors at a relatively high value of current when the motor is heavily overloaded, and still prevent high current peak when it is accelerated under light loads. The smal time lag permits the motor's speed to rise enough be tween the closing of one contactor and that of the next to reduce the peaks for light loads. It is said that th heating of the starting resistor, which changes th resistance of the resistor, and the voltage drop acros it, is nearly balanced by the heating of the relay coi due to the passage of current.

Only one size of coil is required for all sizes o motors of the same voltage, making relays interchange able, including the coils. The relays are entirely sepa rate from the contactors, and can be mounted in a grou on one corner of the panel and covered. Since the con tacts never break the circuit, they are not subjected t burning. The relays, in conjunction with shunt con tactors, have been applied to standardized panels, fo the control of various types of motors.

"Cyma" Combination Compass and Divid

The illustration shows the "Cyma" combination co pass and divider, made by the Tavennes Watch C Switzerland, and marketed in the United States throu Edgar Bourquin, 1347 Main St., Waltham, Mass. Fo tools—two divider points, a lead and a pen—are i cluded in the construction of the instrument, as shown. Any of the four tools can be brought into play, thumbnuts being provided to lock the legs in the position desired. The divider points are claimed to be strong enough for inscribing on metal, and reversing these points produces similar points for use on the drawing board. It is said that the various joints and fulcrums perfect fits and that they can be rigidly locked. T illustration also shows a "Cyma" combination rul pen and pencil point, and a "Cyma" single ruling p which are made and marketed by the same people.

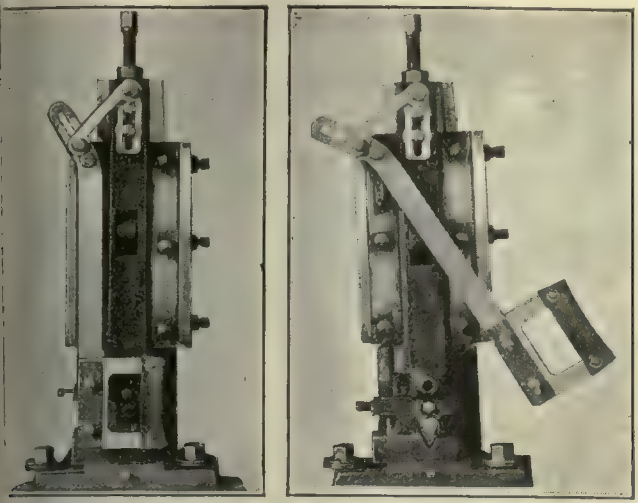


"CYMA" COMBINATION COMPASS AND DIVIDER

Woodward and Wolf Press Guard

The accompanying illustration shows a safety gu recently placed on the market by Woodward & W 213 Rosemont Ave., Trenton, N. J., for attachment small foot-actuated presses. At the beginning of stroke of the press the guard is well out of the w where it cannot interfere with the placing or rem of the work.

When the press begins its downward stroke, guard is said to swing well across the danger zon only $\frac{3}{8}$-in. movement of the punch or upper die, so the hand of the operator will be removed before punch descends, should the hand be in a dange

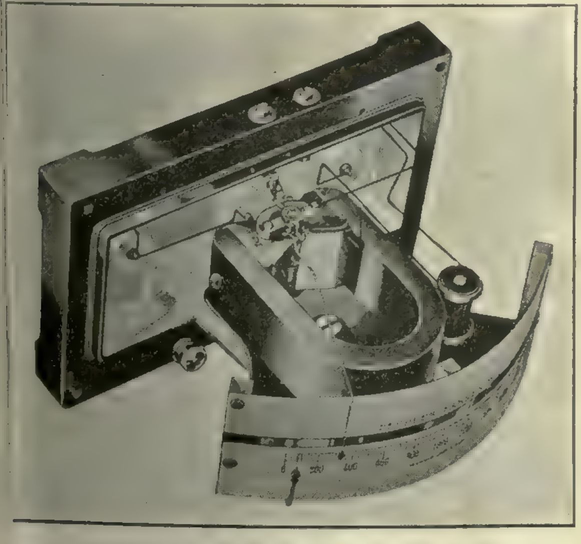


WOODWARD & WOLF PRESS GUARD

sition. The view on the left shows the guard in a sition in front of the die, while on the right the gard is at the limit of its stroke, the punch being a the bottom of its travel. It is claimed that the cerator cannot work around or back of the guard. e position of the guard can be readily changed to cerate either clockwise or anti-clockwise, for either rht- or left-handed operators.

Brown Compensated Pyrometer

The Brown Instrument Co., Philadelphia, Pa., has pced on the market a thermo-electric pyrometer which i automatically compensated in the instrument for clnges in cold junction temperatures and which incides means for setting the pointers of the instrument t zero in the usual manner. No cold well in the ground n compensating box is necessary with this instrunent. It is only necessary to bring the compensating o extension leads from the thermo-couple to the instrunent. After mounting the instrument, the instrument pinter is set by the zero adjuster to correspond with t index on the scale. If the values for a thermocuple have been determined based on a cold junction o 75 deg. F., the index will indicate 75 deg. F., proved the instrument is subject to that surrounding teperature. If the instrument pointer does not correpond with this index, it is set accordingly. When the temperature surrounding the instrument and the cold junction of the ends of the compensating leads at the instrument rises to 90 deg. F., the index automatically rises to 90 deg. F., and the Briguet spiral attached to the instrument pointer causes it to move up to 90 deg. F., automatically adjusting for the temperature of the cold junction of the thermo-couple.



BROWN COMPENSATED PYROMETER

It will be understood that any number of thermocouples with their extensions or compensating leads can be brought to the one instrument having this automatic compensation. Likewise, recording instruments can be equipped with this automatic compensation and means for setting the pointer to zero.

Hilliard Ball-Bearing Clutch and Cut-off Coupling

The Hilliard Clutch and Machinery Co., Elmira, N. Y., has developed a ball-bearing sleeve clutch, which is of the same general design as the standard Hilliard clutch with the exception that the sleeve is extended and contains Fafnir ball bearings of the annular type. The use of the ball bearings is for high-speed purposes, as many clutches are used for speeds up to 2,000 r.p.m. Ball bearing sleeves are said to insure that the sleeve member will be kept at all times in proper alignment with the other member, which keys to the shaft, and also that the friction surfaces will at all times be in proper relation to each other. The bearing caps are fitted with felt washers which exclude dust and retain the lubricant. These ball bearings are said to reduce friction loads to a minimum, prevent wearing the shafts, and need lubrication only three or four times a year. A general view of the clutch is shown in Fig. 1, while the sectional view in Fig. 2 shows the construction.

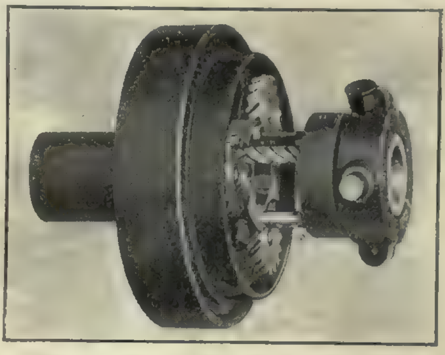


FIG. 1. HILLIARD BALL BEARING CLUTCH

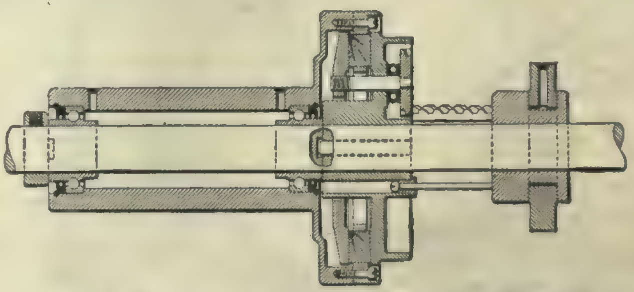


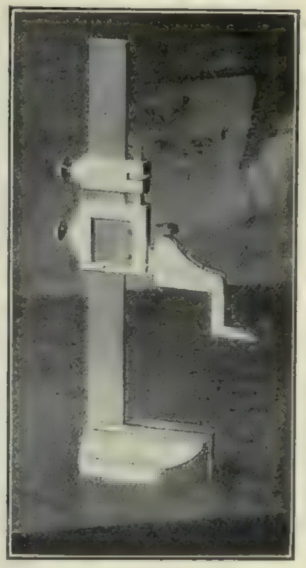
FIG. 2. SECTIONAL VIEW OF HILLIARD CLUTCH

Fafnir ball bearings are also used in the Hilliard high-speed friction cut-off couplings, for use in connection with high-speed gas engines for driving centrifugal pumps, blowers, air-compressors, etc. Perfect alignment between the driving and driven shafts is of importance, and such alignment is said to be insured by the use of ball bearings. The cut-off couplings are made for shafts 1$\frac{3}{16}$ to 3$\frac{15}{16}$ in. in diameter.

Art Tool Co. Base Block for Vernier Height Gage

The Art Tool Co., 16 Montgomery St., Bridgeport, Conn., has placed on the market a base block designed to hold vernier calipers or height gages in an upright position when using them for laying out or testing work upon a bench plate. The blocks are made of carbon steel and are ground and finished all over.

A groove of rectangular section passing lengthwise through the upper side of the block is fitted to take the thick jaw of a standard height gage so that no packing pieces need be used, and the sides as well as the bottom of this groove are machined with great care so that the instrument will stand square with the base in both planes. A flat sided taper key passes through a correspondingly shaped hole that intersects the groove, and pressure is applied to this key by means of a headless screw on the under face of the block so that a firm grip is secured upon the gage without danger of marring it and without projecting screws to interfere with its use.



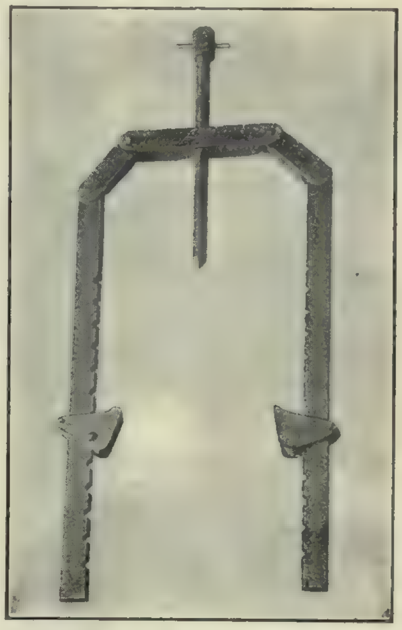
BASE BLOCK FOR HEIGHT GAGE

Art Tool Co. Diemaker's Clamp

A clamp for holding die and punch together when scribing or "offsetting" the latter, is being made by the Art Tool Co., 16 Montgomery St., Bridgeport, Conn.

This is an elaboration of the tool that every diemaker usually constructs for himself and possesses added advantages in the way of adjustable toes for accommodating punches of different heights, as well as toggle joints in the crossbar to permit the tool to adapt itself to varying widths. There are no screws or loose pins in the toes. These are free to be moved up or down when no work is in the clamp and will hold firmly against the pressure of the screw when the permanently located pins fall into any of the notches upon the bars.

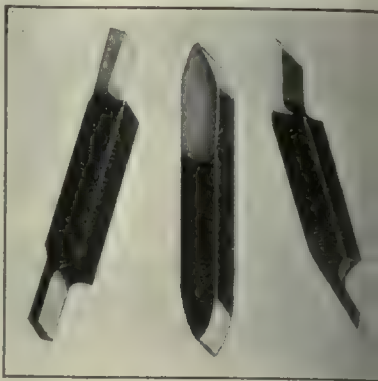
The clamp is made of mild steel, casehardened and left in the natural color. It will be found adaptable to a wide variety of uses by the toolmaker.



CLAMP FOR DIEMAKER'S USE

New England Toolbits

The New England Tool and Machine Co., Inc., Taylor St., Springfield, Mass., has produced a line standard toolbits, some of which are shown in the illu tration. The toolbits are said to be cut from annealed bars of highest quality high-speed steel. They are formed, hardened and ground to standard shapes, with standard clearances. Cutting edges are provided on both ends. It is intended that a supply of these toolbits be kept in the toolcrib and checked out to the operators. This intended to conform with modern methods which pr vide for the use of standard tools and do away wi tool-grinding on the production floor. The line includ R. H. diamond points, L. H. diamond points, R. H. si tools, L. H. side tools, round-nose tools, U. S. Standa thread tools for all pitches, V-thread tools and cut-o tools. The sizes furnished are $\frac{3}{16}$, $\frac{1}{4}$, $\frac{5}{16}$, $\frac{3}{8}$, $\frac{7}{16}$ and $\frac{1}{2}$ inc



NEW ENGLAND TOOLBITS

Scrapers Quickly Made

By R. McHenry

I find that very satisfactory scrapers may be easi made from worn-out blades of a power hacksaw.

The saws used on these machines are of the hea type, hardened throughout, of about $\frac{1}{16}$ in. thickne by 1 in. wide, and 14 in. or more in length.

The ends are first snapped off to allow for a tool in. long. The toothed edge is then ground smooth a the width narrowed slightly to within an inch or so each end. These ends are now shaped at the grindi wheel to suit the work in hand. Also the sides sho be dressed lightly near the cutting edges to remove scale.

The result is a hard flexible scraper, a set of wh made up of different varieties will require but li space in a toolkit.

Cutting Off a Crankshaft

By F. E. Ervin

Elias J. Parks' experience in cutting off an extra r shaft, detailed on page 920, Vol. 54, of *Ameri Machinist*, calls to mind a method used in a similar e by a farmer who had recently purchased a gaso e engine.

He desired to replace the plain pulley with a fric n clutch pulley and it was necessary to cut off about 6 n. of the crankshaft. He simply started the engine d used a common hacksaw, cutting off a $\frac{3}{4}$-in. shaft a t as smoothly as a lathe tool would have done it. T e, about $\frac{1}{2}$ hour.

This taught me two valuable lessons which I e never forgotten: First, how to do it; second, that u can often get splendid ideas from most unexpe d sources.

NEWS SECTION

Industries Confer With Census Bureau

At the request of Commerce Secretary Hoover, representatives of industries gathered in Washington July 29 to discuss methods of bettering the next census of manufacturers. At that meeting, a committee was appointed to make specific recommendations. The first of these recommendations, as outlined below was made last week. Those present at the meeting were Nathan B. Williams of the National Association of Manufacturers; W. Compton, the National Lumber Manufacturers Association; H. C. Morris and W. D. Brookings, Chamber of Commerce of the United States; B. M. Price and Pyke Johnson, National Automobile Chamber of Commerce; W. D. Biggers, American Hardware Association; Paul T. Cherington, National Association of Wool Manufacturers; L. M. Fanning, American Petroleum Industry; Albert E. Marshall, Chemical Division of the American Engineering Council and Allan H. Willett, of the National Coal Association.

In suggesting improvements in the gathering of industrial information by the Bureau of the Census, the committee representing the industries, has suggested that no effort be made to collect statistics from establishments having an annual output of $5,000 or less. Heretofore the census has sought returns from every establishment having an annual output exceeding $500 in value. The committee also discussed in detail the draft of the schedule proposed by Director Steuart, of the Census Bureau, for the 1921 census of manufactures. No public discussion of these schedules will be undertaken at this time.

These representatives of the industries, who met with the Commerce Department officials, emphasized the need of preventing duplication in government questionnaires and statistics. Another important point made at the conference was the need for greater safeguards to prevent the disclosure of individual returns.

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Louisiana Manufacturers Perfect Organization

With an attendance of over one hundred and fifty manufacturers at its first meeting, the Louisiana Manufacturers Association was organized on Aug. 26, at New Orleans. The association was formed for the purpose of safeguarding the interests of manufacturing industries throughout the state by co-operative methods which will enable these industries in the proper way to appear before the legislature and other lawmaking bodies and voice the united sentiment of the manufacturers on questions of law which affect their business. The meeting was addressed by several prominent business men of Louisiana.

The election of officers resulted in the following being chosen: Wilmer Johnson, president; Charles H. Behr, first vice-president; Dr. W. D. Hass, second vice-president; S. Odenheimer, third vice-president; Peter Jung, Jr., secretary-treasurer.

◆

Auto Taxes Increasing

An analysis of the tax collections during the fiscal year ended June 30 shows that the levy on automobiles produced $115,545,760.38. This shows a decrease from the preceding fiscal year when $143,922,792.01 was collected.

P. M. Fowl, President of Cadillac Tool Co., Dead

Percy M. Fowl, president and general manager of the Cadillac Tool Co., Detroit, Mich., died on August 24, following an operation for appendicitis. Mr. Fowl was thirty-eight years old.

He was born at Elyria, Ohio, where he received his early education and training. After working in several plants in and near Elyria, he came to Detroit in 1907, where he was employed at the Ford plant and also at the Burroughs Adding Machine factory. Later he became associated with Strong, Carlisle & Hammond as a salesman and it was in this capacity that he became a popular figure in the machine tool industry.

PERCY M. FOWL

In 1917 he became president and general manager of the Cadillac Tool Co. and continued in that position until his death. Mr. Fowl had a legion of friends in the machine tool industry who deeply mourn his death.

He is survived by his wife, Alice MacLean Fowl, and a daughter, Marjorie Ann; also by his father, a sister and a brother.

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Hearings on Metric Bill

A sub-committee of the Senate Committee on Manufacturers has been designated to conduct hearings on a bill by Senator Ladd, of North Dakota, providing for the compulsory adoption, after ten years, of the metric system of weights and measures. Senator McNary, of Oregon, will act as chairman of the sub-committee. The other members are Senator Weller of Maryland, and Senator Jones of New Mexico.

It is the intention to have limited hearings shortly after the congressional recess, so that the proponents and opponents of the legislation may state their views as to the desirability of such a law. It then is the intention to circulate as widely as possible a stenographic record of the hearing, with the idea of acquainting the public with the problems involved. Later, during the regular session of Congress which begins in December, it is planned to have further hearings, after which an attempt will be made to secure favorable action by the committee, thereby securing a place for the bill on the Senate calendar where its consideration would be taken up in due course.

To Resume Manufacture of Marlin Firearms

A new corporation, known as the Marlin Firearms Corporation, has purchased the former Marlin Firearms plant, at New Haven, Conn., and has acquired all of the machinery, tools, fixtures, gages, patents, good-will, inventory, etc., of the Marlin business, which has heretofore been conducted by the Marlin Firearms Co. and the Marlin-Rockwell Corporation.

The business was originally established in New Haven by John M. Marlin, in 1870, and was carried on successfully by the Marlin family until 1916, at which time the plant was acquired by the Marlin-Rockwell Corporation and used principally for the manufacture of machine guns throughout the war, these plants being recognized as the largest producers of machine guns in the world. The new corporation will manufacture the full Marlin line of repeating rifles and repeating shotguns; also single-shot rifles, single guns, double-barrel guns and revolvers.

The work of reorganization is already under way and the company expects to progress rapidly, re-establishing the business so that within a short time the plant will be able to operate with a full force in regular production. The factory organization includes all of the important men of the old Marlin firearms organization—practical gun makers with from 15 to 20 years of experience in the manufacture of high-grade firearms. These men, combining their experience in making sporting firearms with that of producing automatic machine rifles and guns and other firearms, insure that the new Marlin firearms will be in every way equal to, or even superior, to the Marlin products manufactured by the old company.

The officers of the new company are: John F. Moran, president; LeRoy Sargent, vice-president; Reuben Hill, secretary and treasurer. The directors are these officers with Howard E. Adt and Thomas M. Steele. Mr. Moran has been for twenty years associated with the Marlin Firearms and Marlin-Rockwell interests.

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Automotive Engineers Plan Big Session in January

The Society of Automotive Engineers has announced that its annual meeting will be held in New York City, January 10 to 13. This follows the established custom of holding the meeting during National Automobile Show week when interest in the industry centers in the eastern metropolis. The S. A. E. dinner, which has become established as one of the most representative assemblies of automotive men during the year, will be held Thursday, Jan. 12. The celebrated S. A. E. carnival is set for the night preceding the dinner, Jan. 11, and the meetings committee is busy arranging details for both of these events even at this early date.

The plans for the technical session are developing and indications point to the arrangement of a very comprehensive and educational program.

The meetings committee suggests that members desiring to present papers communicate with the society offices at 29 West 39th St., New York, without delay, since it is desirable that the acceptance of all manuscripts be decided by Oct. 1 in order to provide sufficient time for preparation and circulation of the preprints.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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The outstanding feature of the week is a mild revival of speculative confidence and even the conservatives who decry speculation are a little more cheerful because people are becoming normally hopeful again.

The speculative activity has thus far been confined to the cotton market, but there are signs that it is spreading for prices have stopped declining, the bears have been trying to cover and people everywhere are beginning to ask, "What shall I buy?" instead of advising each other to sell.

It is true that in cotton the advance of two or three cents a pound recorded during the week is due to a reported crop disaster that is without precedent, but it is unlikely that the trade demand would have lifted prices so sensationally if the speculative spirit had not been latent and inflammable. In just what quarter it will next manifest itself no one can say. It may be in grain, coffee, sugar or securities. In none of these markets is the position more bearish or the outlook for an advance less encouraging than was the case in cotton a few months ago.

Meantime I observe with some satisfaction that nearly every one is coming to share my persistent optimism in regard to the autumn trade. In a published advertisement the nationally known contractors, J. G. White & Co., say that "A trade revival is indicated by reports received from practically all the principal industrial centers."

A letter from Philadelphia in the *New York Evening Post* says, "For the first time this year consumption exceeds production." The *Credit Guide* says, "For the fifth consecutive week business shows improvement and greater activity on the part of the retailer." A St. Louis bank after an exhaustive canvass of the Middle West by questionnaire reports that there is no ground for pessimism and as yet none for excessive optimism.

Otto H. Kahn, just back from Europe, is quoted as saying that "We shall soon find ourselves within sight of prosperity" and the *Credit Clearing House* is statistically cheerful in reporting that the money value of the wholesale trade for the week ending Aug. 26 was only 2.2 per cent under last year, while the percentage of decline in prices is from 25 to 35 per cent.

There are many other straws which show that the stream of business is flowing with increasing force. Among them is a better demand for coal. Another is a continued improvement in the inquiry for steel and iron. A third is an advance in copper to 12 cents a pound and a fourth is to be found in a report of the Geological Survey which states that the shipments of Portland cement for the first seven months of 1921 are within 4 per cent of last year's record. The Federal Reserve banks and Board are almost alone in doubting the imminence of a trade revival but their dubiousness is to some extent offset by the figures of the department store trade for July in the twelve reserve districts.

These figures show an average decline of but 15.1 per cent in the money value of retail sales throughout the country. Commenting on them the *New York Journal of Commerce* says, "Prices have beyond doubt fallen as much, and it is therefore reasonable to infer that the volume of goods moving over our counters is as great if not greater than last year." From this it is argued with truth that "the current assertions about the number of unemployed and the consequent impairment of the country's purchasing power are gross exaggerations."

As to the alleged unemployment of which so much is heard and so little is seen, at least in and around New York, it is to be noted that President Harding has called a conference to consider it, to be held in Washington in September. It is not clear what such a conference can accomplish unless it recommends that employment be provided at public expense upon public works as is already being done in Racine, Wisconsin, and Detroit, but President Harding is nevertheless to be commended for his promptitude in action and the many efforts he has made and is making to keep industry on the even keel of sustained activity. If Congress would but co-operate with him more heartily by making the promised readjustment in taxes most of the uncertainty by which business is restrained would disappear.

Senator Smoot has given notice that he will introduce a substitute revenue bill as soon as Congress reconvenes. It seems to be a great improvement on the House bill now pending. Briefly, it repeals the present law but re-enacts the existing inheritance and tobacco taxes and provides for an income tax with surtaxes not in excess of 32 per cent, a 10 per cent tax on the net profits of corporations and a 3 per cent manufacturers tax to be imposed only on manufactured articles when they are first sold so that it cannot be passed on by the jobber or retailer. The very simplicity of the proposal makes it attractive and it is to be hoped it will receive serious consideration.

The domestic news relating to business is otherwise unimportant. The stock market has been quiescent and the bond market firm. A loan of $25,000,000 to the Republic of Brazil on an 8.15 per cent basis and another for $7,500,000 to Uruguay offered to yield 8.20 per cent have been well taken. The readiness with which these and other foreign loans have been placed seems to indicate a broadening demand for foreign securities in the United States.

Railroad earnings and car loadings continue to improve. Preliminary figures for July indicate that the net revenue for that month will approximate $75,000,000. This will almost equal the average of the three years ending June 30, 1917, which was the most prosperous period of American railroad history. This is the more remarkable because the high freight rates are diverting much transcontinental traffic to the Panama route. A despatch from Portland, Oregon, says that thirty million bushels of wheat carried by 100 huge steamships will leave there this winter. Much of this grain, formerly carried by rail, will come to the Atlantic Coast.

In the Pacific Coast lumber trade there is a similar diversion of traffic, for during the first half of 1921 there were 93 million feet of lumber shipped by water to the Atlantic Coast as against only a million and a half in 1920. The railroads are endeavoring to meet this competition by reducing transcontinental rates but no reduction has as yet been made in rates to and from inland points where there are no competing steamships to carry the freight. Even Henry Ford has been finally forbidden to reduce rates on his own road, but he has cut the price of his automobile to the basis of $355 for the touring car.

Professor Ripley of Harvard, now associated with the Interstate Commerce Commission has submitted a tentative plan for the remaking of the American railway map which contemplates grouping the various roads in twenty great systems. Thus far the scheme is admittedly academic but in time something of the kind must become a reality and the suggestions made will repay careful study.

The statement of the Federal Reserve Banks shows a further gain of $22,000,000 in the gold held and a reserve ratio of 66.8 per cent as compared with 66.5 the week previous. It is difficult to believe that this constant increase in the gold supply can much longer be without effect upon values as expressed in terms of gold.

All foreign exchanges except marks are higher. The advance is explained by reference to the German reparation payments but no one really understands it. The decline in marks is, however, plainly due to the fact that too many marks have been printed. It may also be in part due to the political unsettlement reported from Germany following the murder of Erzberger. There is, however, nothing to indicate that the political stability of the German Republic is seriously threatened.

The Irish question is still in the air but the rioting in Belfast is not reassuring to those who hope that Ireland will some day be entirely tranquil. Seemingly that is impossible. The East Indian uprising in Malabar is apparently becoming a vary serious affair and the "private war" between Greece and Turkey is still in progress but the London Stock Exchange is unperturbed. Prices are rising, money is easier and the rate for call loans has fallen to 2 per cent. Old John Bull is certainly a phlegmatic character for most people would be hysterical with less than half his worries.

The news from Mexico is highly encouraging The Supreme Court of Mexico has enjoined the Department of Commerce and Industry from "denouncing" or sequestering the rights of the Texas Company to oil under the lands owned or leased by it prior to May 1, 1917. The attempt to make the New Mexican constitution retroactive is thus frustrated and one of the things for which Secretary Hughes was contending is secured. It is predicted that early recognition of the Obregon government by the United States will follow though this seems doubtful.

The decision of the court was curiously synchronous with the arrival of the American oil magnates in the city of Mexico, but it is none the less satisfactory because it justifies my prediction that it would be found that there was a community of interest between Obregon and oil.

There can remain no doubt as to the value of oil as a lubricator, and if through its application the gates of Mexico shall again be swung open to American enterprise it may be that the event will provide a psychological stimulus that will hasten the business revival that seems to be impending in the United States.

Exports of Electrical Machinery Increasing

Official announcement from Washington of the creation of a "Division of Electrical Machinery" in the Department of Commerce calls attention, says the *Trade Record* published by the National City Bank of New York, to the growing demand of the outside world for American equipment for harnessing this latest servant of man—electricity. In the opening year of the war, our fiscal year 1915, our entire exports of the group officially designated as "electrical machinery and appliances" amounted to but $19,772,000 but had advanced to $54.547.000 in its closing year 1918. Then with the world's return to peace and its closer acquaintance with the quality of our manufactures in this line, the total exports of "electrical machinery and appliances" jumped to $80,000,000 in 1919, $87,000,000 in 1920, and $119,221,000 in 1921, the fiscal year just ended.

This increase of $32,000,000 in the exports of this class of merchandise in the fiscal year 1921 is the more remarkable in view of the fact that in the other important classes of machinery the exports of 1921 showed but comparatively slight gains. The exports of electrical machinery increased 37 per cent in value in the fiscal year 1921, while those of all other machinery were increasing but 10 per cent in value.

Electric motors are the biggest single item in the $119,000,000 worth of exports of this character in 1921, amounting to over $18,000,000, dynamos and generators about $7,000,000, and insulating wire and cables over $11,000,000. The 1921 figures showed in each instance a larger total than in 1920, despite the fact that prices per unit of quantity in 1921 were in many instances less than in 1920.

Sugar Machinery in Ecuador

The acreage of all Ecuadorian sugar plantations is increasing. More sugar-making machinery is being installed and modern methods of cane manufacture are being inaugurated with the introduction of American agricultural machinery and implements. The high prices for sugar that have prevailed in Ecuador from the beginning of the war to the present time have given the sugar-mill proprietors the opportunity of introducing important improvements in the way of new machinery for their plantations.

Business Conditions as the Big Banks of the Country See Them

The First National Bank of Boston Comments on General Business

A general betterment of feeling and a somewhat more buoyant attitude toward business is in evidence throughout the country. In New England it is specially marked, due to the fact that several of its principal industries have experienced a distinct increase in activity during the past month. Figures bearing on shoe manufacturing are now available, which show two things: first, that the manufacturers have come through the past year with surprisingly few failures; and second, that they have worked out of the severe depression of recent months to a point where production compares well with the similar periods of 1920 and 1919. Their present position is made more comfortable by very cheap materials and an easier labor situation. The increase in production is conspicuous. In the combined woolen and worsted industry, mills have so increased production that it may fairly be said that a normal percentage of machinery is in operation. The openings of the largest interest were successful at fair prices, with full production up to January 1st allotted. The consumption of wool is therefore nearly normal in amount and raw-material merchants have been able to show reasonable profits for the first half of the year. In cotton manufacturing a stronger demand has appeared, influenced by scant stocks and the short cotton crop, the smallest in a quarter of a century. In this industry the improvement has been both in volume and prices. During the last ten days the prices of print cloths have sharply risen and it is hoped that the mills may soon be able to run at some profit. This will be a welcome relief, as they have, in the main, been running on part time at a loss, to preserve their working forces. The above conditions, coupled with an easier money situation, are chiefly responsible for freer movement of goods, and retail trade, seasonally dull, is continuing at a high level both in units and in dollars. Nevertheless, the general trade depression continues, as witness low bank clearings and idle freight cars. While commodity indices are not registering such sharp declines as in earlier months, Bradstreet's actually scoring in advance in June, the great steel industry is experiencing a sinking spell, production being perhaps at 20 per cent of capacity—virtual stagnation. Price cuts have been drastic and wages are being reduced, the attitude of labor being reported as comparatively acquiescent. The deflation of this basic industry and its many related lines is being observed with the greatest interest as a necessary forerunner to generally better business. The crop situation in this country is reasonably satisfactory and has been made easily on account of plentiful labor and lower wages. It has been estimated that the wheat crop was produced at 35 per cent less cost than last year. The convalescent period which must precede healthy business is apparently to be a long-drawn-out one. Reports of very unsatisfactory conditions in countries abroad confirm this.

A new cotton crop year began Aug. 1. The cotton crop conditions as of July 25, as reported by the Government, was 69.2 per cent, the acreage 26,519,000, which is a decrease of 10,524,000 acres, or 28.4 per cent from last year's figure. The report indicates a yield of 8,433,000 bales, as compared with 13,365,754 last year, 11,420,000 two years ago, and 12,040,532 bales three years ago. In 1914 the yield was 16,134,000 bales. The amount of commercial fertilizer used was about 66 per cent of the average annual amount from 1917 to 1920. The world cotton crop of last year is estimated by the Government at 19,395,000 bales. Cotton consumption for this country, while still under the figures of a year ago, has been showing a steady gain, and is now larger than at any previous time this year. The crop condition on July 25th compares with a ten-year average at this date of 78.8 per cent. Household and cotton dress production has been stimulated by the low prices current, and consumption has been more active in relation to other textiles than has been noted for several years.

Business in iron and steel has been improving gradually in recent weeks, and the hope is growing that July will prove to have marked the low point in output and bookings. While sales have not kept pace with inquiries, orders have been more numerous than previously, although still small. Car repair orders have been perhaps the brightest spot in the markets. The demand for steel sheets has improved perceptibly. Mahoning Valley mills recently attained an operating rate of 52 per cent, as against a rate of less than 30 per cent in recent months. A noticeable enlargement in demand has appeared in nails, wire and pipe from jobbers, who have been moving tonnage at 65 to 75 per cent of the normal rate. Some important sales of basic pig iron, amounting to several thousand tons, have been closed in Philadelphia, the first real activity in this fundamental market in months. Works operations have been extremely low. Steel ingot output in July was at the annual rate of 11,870,000 tons, a rate below the output for any calendar year since 1900. Pig iron output touched new low levels since records first were kept, some fifteen years ago. July iron output was 864,580 tons, or about 28 per cent of the output for July a year ago. The number of furnaces in blast Aug. 1 was 69, out of about 400 standing in this country. The wage reduction movement still is under way. The Cambria Steel Co. recently announced its third cut of the year, amounting to 16⅔ per cent and placing common labor on a basis of 25 cents per hour. The H. C. Frick Co. and the Oliver Iron Mining Co. posted a second cut of 10 per cent, returning to the late 1917 rate. These are subsidiaries of the United States Steel Corporation. The iron and steel industry is pressing for a reduction in freight rates and several conferences between shippers and railroad representatives have been held. A reduction of 20 per cent has been discussed. If such reduction should be effected it would reduce the cost of production about $2.50 to $3 per ton. Independent steel mills adopted new open price schedules July 21, $3 a ton below the scale previously announced by the Steel Corporation. Later the leading interest departed from its custom of maintaining a regular price schedule and has freely met competition for all deliveries. In some cases prices have been cut so low as to indicate some demoralization, but the cutting has stimulated buyers' interest.

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Europe's Gold Reserves Gain

While Europe sent to the United States more than two hundred and fifty million dollars in gold during the first six months of the current year above receipts from this country, nevertheless a slight gain occurred in that period in the total gold reserves of Europe held by central banks or government agents.

Only three of the fourteen chief European gold holding countries showed a diminution in their gold stocks from Jan. 1 to July 1, and these losses were relatively slight, their combined total amounting to less than twelve million dollars. This loss was more than offset by gains among the other eleven countries, the net increase of the fourteen combined amounting to $1,199,000.

Yet between Jan. 1 and July 1, the gold stock held by the Federal reserve banks in the United States increased by $402,601,000, or nearly 20 per cent of the $2,059,330,000 they held the first of the year, almost two-thirds of the increase being made up by the gold from European shipping points, the rest coming from non-European and domestic sources.

An analysis of this gold movement shows that present European gold reserves are not being drained to swell America's holdings, but that the increments to this country's hoard since the first of the year, in so far as shipments from European points are concerned, are chiefly accounted for by three great streams of the metal consisting of newly mined supplies from Africa coming by way of London; of gold yielded up by India, also coming by way of London; and of metal thought to have originated from Russian sources, eventually coming to America through European countries.

Europe's centralized reserves were built up subsequent to the outbreak of the war far above prewar figures, and were further increased since the armistice, by concentrating in them as far as possible all gold privately held. While these reserves by continued government impoundage, have been kept rigidly stabilized at the points attained as a result of those extraordinary war and postwar measures, in the face of the recent tremendous suction toward America, nevertheless the three great streams have flowed through these countries to the United States with little impediment during the last six months. No material effort has been made in Europe to divert the gold from them for the purpose of building up further the reserves there. The gold has served to reduce European indebtedness in America rather than to aid in restoring the gold standard in Europe.

It was stated in the Federal Reserve Bulletin for June, 1921, that the Director of the Swedish Mint had recently estimated that seventy tons of Russian gold were received in Sweden since 1920. He was quoted as saying that after refining it was re-exported, chiefly to the United States, representing an assayed value here of about $40,000,000. The bulletin also said that not less than another $60,000,000 of Russian gold or its equivalent had found its way to the United States through France and other channels.

The movement of gold from Russia to the United States is not definitely traceable. It is thought to have come to this country indirectly through various continental countries in addition to those mentioned above. At the outbreak of the war in 1914 the Russian State Bank held $779,750,000 in gold; by the end of 1917, the date of the last definite statement of gold held in the bank, the stock had dwindled to $633,000,000. It has been reported that this balance has since been largely dispersed and the amount remaining is unknown, but is thought to be small.

It appears therefore that the United States received, between Jan. 1 and July 10, the equivalent of $106,599,000 of African and Indian gold by way of London and the equivalent of more than $100,000,000 of Russian gold by way of Continental Europe. These three chief sources account for the fact that Europe as a whole has been able to make substantial gold payments to the United States.—*National Bank of Commerce.*

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The Farmer as a Factor in the Nation's Prosperity

The plea of the labor leaders against a reduction of wages would be sound if wages were being reduced below the level of prices ruling for the products of labor, or below the general compensation of the great body of workers outside of their own organizations.

The trouble at the present time is that what the labor leaders are protesting against has already happened to more than one-half the workers of this country. The former are trying to maintain the pay of a minority, at the expense of the majority.

The farmers and producers of practically all primary products and raw materials have taken reductions of approximately one-half the value of their products. The prices of their products are back to the pre-war level. They have lost a great proportion of the purchasing power they have been using in recent years, and the market for the services of all the workers who have been supplying them has been curtailed accordingly. This is the fundamental cause of the unemployment which has spread over this country in the last year, since cotton, corn, oats, live stock, rice, wool, hides, dairy products, flax seed, the principal metals and other primary products began to fall. It is true that as factory-workers and others were thus forced out of employment the evil effects have been increased but the original impulse and the main influence comes from this great body of people who extract wealth directly from nature and who are largely dependent upon world markets.

Moreover there is no prospect of a recovery of farm products to the levels of war time. Doubtless they are now unduly depressed and will swing back to a normal level with improvement in general conditions, but any expectation that they will recover to the war level, or to the present general level of wages and manufactured goods, is wholly unwarranted. The sooner war-time prices and wages are forgotten the better. They are not normal in times of peace.—*National City Bank of New York.*

The Swiss Machinery Industry

Special Correspondence

The Association of Swiss machinery manufacturers has just published its annual report from which we gather the following information.

The great difference in the exchange of foreign currency as well as the general international stagnation have largely influenced the Swiss machinery market. The protective policy of a number of foreign countries has been another drawback to the extension of the market. The following figures refer to the years 1913 and 1920.

The imports of steam engines amounted in 1913 to 7,632 metric quintals (a metric quintal equals 50 kilograms, approximately 100 pounds) in 1920 to 3,549 metric quintals; the exports in 1913 to 55,946; and in 1920 to 32,941 quintals. In spite of the general demand for electricity quite a number of orders for steam engines could still be booked. Also for water turbines the foreign demand remained satisfactory. Imports amounted in 1913 to about 4,000 quintals and in 1920 to about the same figure, while exports of water turbines decreased from 49,385 quintals in 1913 to 37,372 in 1920. In combustion power machines the imports in 1902 with 3.261 quintals were double as much as in 1903, while the exports increased from 63,000 quintals in 1913 to 76,675 in 1920. Agricultural machines of all kinds were largely imported from Germany. From 39,397 quintals in 1913 the imports rose to 78,300 in 1920, while the exports decreased from 6,500 quintals in 1913 to 3,369 in 1920. The Federal authorities have now prohibited the importation of this class of machines. Flour mill machinery is scarcely imported while the exports amounted to 69,703 quintals in 1913 as against 58,932 in 1920. As far as textile machinery is concerned business was satisfactory in the case of spinning and twine machines; imports decreased from 15,400 in 1913 to 12,608 in 1920; while exports rose from 12,100 in 1913 to 22,884 quintals in 1920. Weaving machines were chiefly exported to the devastated districts of France and Belgium. The imports of machine tools have largely increased, from 38,670 quintals in 1913 to 111,874 quintals in 1920. Exports increased likewise from 9,785 quintals in 1913 to 81,366 quintals in 1920. Considerable quantities of machine tools are imported from Germany, chiefly on account of the low value of the German mark. Woodworking machines have been imported only to a small extent. and the exports were also very small. In electric machinery, imports decreased from 7,620 quintals in 1913 to 3,696 quintals in 1920, while the exports decreased from 79,000 quintals in 1913 to 66,574 quintals in 1920. The exports of electrical machines are largely influenced by the additional tariff rates levied by various countries, which, for instance, vary in France according to the material used, from 100 to 300 per cent; in Italy they amount to 100 per cent and in Belgium to the threefold of the regular duties. Automobiles were imported to the amount of 120,671 quintals in 1920 as against 10.594 in 1913. Exports however decreased from 21,714 quintals in 1913 to 18,209 in 1920. The locomotive works are chiefly engaged in repair work for foreign countries. On account of the electrification of the Federal Railways and of many private lines the demand for steam locomotives has largely decreased while considerable orders for electric locomotives have recently been placed.

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Smyrna Needs Motor Water Craft

Vice Consul A. Wallace Treat, Smyrna, Asia Minor, in a recent report says that requests have been received at the consulate for information concerning American motor boats and motor launches. Therefore, it is suggested that manufacturers and exporters of these craft forward their catalogs or other material descriptive of their products to the consulate. Such material should preferably be in French and should be accompanied by a price list, but if catalogs and other descriptive materials are not published in French the English edition should be sent.

The harbor of Smyrna is large, landlocked, and offers splendid opportunities for all forms of water transportation, light and otherwise. The actual pleasure-boat season is of about eight months' duration under ordinary conditions.

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Sailed for Europe

J. H. Drury, treasurer of the Union Twist Drill Co., Athol, Mass., sailed last Saturday on the steamship "Olympic" for an extended business trip in Europe.

Dietz Leaves Norton Co. For Presidency of Bridgeport Brass Co.

Carl F. Dietz, vice-president and sales manager of the Norton Company, Worcester, Mass., has resigned to become president and general manager of the Bridgeport Brass Co., Bridgeport, Conn. He will finally sever his connection with the Norton company on Oct. 1, when he will assume his new duties at Bridgeport. He succeeds as president Fred J. Kingsbury, of New Haven, who wishes to be relieved of some of his responsibilities and who now becomes chairman of the board of directors. Mr. Dietz will also be general manager of the brass works. He has been connected with the Norton Company for ten years, first as plant manager, then as assistant sales manager and afterwards as sales manager of the wheel division of the business. Two years ago when the Norton Company and the Norton Grinding Company were consolidated, he was made vice-president and sales manager. He was born in New York, Feb. 12, 1880, and was graduated from Stevens Institute of Technology in 1901, and subsequently took post graduate courses in the Royal Technical College, Berlin, in sciences, metallurgy and mining. Early in his career he was employed for three years at plants of the United States Steel Corporation, largely in blast furnace operation and gas engine installations. In 1905 he engaged in the development of zinc-smelting processes, and later operated a mining lease in Utah, installing a dry method for concentrating lead silver ores. He designed and built modern ore-milling plants for the American Glue Co., as a part of its sandpaper factory at East Walpole, Mass.; Grunelli Chemical Co., Park City, Utah, where the separation of iron and zinc sulphides was the problem; and the Ozark Smelting and Mining Co., Magdalena, N. M., where the zinc ore required concentration for paint making. In 1908 he joined the Minerals Separation, Ltd., of London, as consulting engineer and in the interest of this company developed treatment methods at the Dunderland iron ore deposits in Norway, north of the Arctic Circle, and studied ore treatment methods for properties in Russia, Bolivia, Australia and Africa. He also put into operation the San Francisco del Oro mines in Mexico, yielding complex lead and silver ores. He is a member of the American Society of Mechanical Engineers, the American Institute of Mining and Metallurgical Engineers, and is secretary of the National Machine Tool Builders Association.

CARL F. DIETZ

Vice-president William Le Coste Neilson, foreign sales manager of the Norton Company, with headquarters in London, is now on his way to the United States and will succeed Carl F. Dietz as sales manager of the Norton Company.

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New Steel Process in Japan

A new process by which sand iron, or magnetic sand, may be converted into pig iron and thence into steel, has just been made public by Goro Matsukata and Dr. Asobu Naito of Japan. They claim this will not only revolutionize the steel industry in Japan, but of the world. The process combines sand iron with coke, using hot gas flames and making ferro-coke, from which iron can easily be taken.

The discoverers claim that the new process will make Japan independent of England or the United States in the matter of iron imports.

Car Loadings Increase—Still Behind 1920

An increase of 7,471 in the number of cars loaded with revenue freight during the week which ended on Aug. 30, compared with the previous week, was shown by reports just received by the car service division of the American Railway Association from the railroads of the United States. The total for the week was 816,436 cars. This was a decrease, however, of 151,667 cars compared with the total for the corresponding week last year, and 96,773 cars under that for the corresponding week in 1919.

The principal increase, compared with the week before, was in the loading of merchandise and miscellaneous freight which includes manufactured products, although there was a substantial increase in shipments of live stock. Loadings of both coal and grain and grain products, however, were under the previous week.

The total number of cars loaded with merchandise and miscellaneous freight was 491,922 which was 12,173 more than during the week of Aug. 13. It was, however, 43,000 less than were loaded during the corresponding week one year ago.

Loading of live stock amounted to 29.110 cars or an increase of 2,275 cars over the preceding week and 2,000 cars over the total for the corresponding week in 1920. There was also an increase of 150 cars over the week before in the loading of coke, the total being 4,436.

Coal loadings, which during the week of Aug. 13 went up to 158,260, dropped back to 154,140 or a decrease of 4,120. This was 50,000 under the corresponding week last year. Grain and grain products totaled for the week 59,875 cars or 1,685 under the week before but 18,237 cars in excess of the same week in 1920 and 7,900 more than were loaded during the corresponding week in 1919.

Loading of forest products totaled 44.583 cars or a decrease of 750 cars compared with the previous week while ore decreased 572 cars from the week before to a total of 32,370.

Compared by districts, slight decreases under the week before were reported in the Allegheny, Pocahontas and Southern regions while all the others reported increases. All, however, were under the totals for the corresponding week in 1920.

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Annual Outing of Machinery Club of Chicago

Notice has just been received of the sixth annual outing of the Machinery Club of Chicago, to be held on Saturday, Sept. 10, at Thatchers Woods, River Forest, Chicago.

A lengthy program of entertainment has been arranged which will be varied with athletic games and special attractions for the children. The feature of the day, which has been the big event on other occassions, will be the fried chicken lunch. Each person attending the picnic will receive a lunch box containing a portion of the delectable fowl together with all the usual fixin's. A seven-inning ball game, tug-o-war and other contests between rival companies will also take place.

It is expected that all the machinery and supply houses in the city will close at noon on that day. In case of rain the festivities will be held in the rooms of the Machinery Club.

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National Congress of Engineers at Buenos Aires

The second National Congress of Engineers of Argentina will be held in Buenos Aires from Sept. 23 to Oct. 9, under the auspices of the "Centro Nacional de Inginieros" to commemorate the centennial of the founding of the University of Buenos Aires. The papers presented will cover in a complete manner such subjects as Argentine petroleum, road construction, irrigation, mining, navigation, and labor problems. A list of the subjects, as transmitted by Commercial Attaché Edward F. Feely, is available at the Latin American Division, Bureau of Foreign and Domestic Commerce.

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X-ite, a Heat-Resisting Alloy

The General Alloy Co. of New York and Chicago, announces a low-priced heat-resisting alloy to be known as X-ite. It is claimed that this alloy has about four times the life of steel and that containers made from it retain their shape at high temperature. The company states that X-ite is a development from eleven years of research and experiment and that over thirty tons of experimental castings were made and tested before the material was marketed.

Washington Notes

BY PAUL WOOTON

Washington Correspondent

Further legislation probably will be required before the War Department will settle the Bethlehem wage claim which involves nearly $1,500,000. This amount is claimed by employees of the Bethlehem Steel Co. under an award made by the former National War Labor Board. Of the amount claimed $900,000 is apportioned to machine shop workers.

The award was made July 31, 1918. It was a result of a demand made by the employees of the Bethlehem Steel Co. at a critical period during the war for an increase in wages. The company did not put the award into complete effect except in the case of the electricians, because of its inability to secure from the Government an agreement to reimburse the company for the difference in the labor cost on Government contracts.

The War Department admits that the Government is under some moral obligations to make this payment. It is pointed out, however, that it is not entirely a War Department matter as the Bethlehem company was engaged at the same time on contracts for the Navy Department and for the Shipping Board. Since the War Department does not feel that it has the legal authority to make this payment, it is believed that the entire matter will be turned over to Congress, although the International Association of Machinists has made an application to the Secretary of War for a rehearing. It is the contention of the machinists' association that the War Department has the power to make the payment and it objects to the delay which necessarily must ensue if payment must await the passage of additional legislation.

Test Motor Carriages

A number of motor carriages for 155-mm. guns are being subjected to gruelling tests at Camp Jackson, South Carolina. The carriages are being made to cross trench systems, wire entanglements, shell holes and such conditions of terrain as might be met in a battle area. The carriages being tested were designed and built by Walter Christie of the Front Drive Motor Co. While the tests have not been completed it has been demonstrated that they are able to maneuver successfully over very difficult ground. The carriage is a combined wheel and track-laying vehicle which can be operated on its rubber tired wheels at a maximum speed of 15 miles an hour when good roads are available. When it is necessary to use the tracks, they are disposed over the same wheels.

Would Reduce Noise

If tanks are to be used in warfare with the maximum of success, means must be found for reducing the noise so characteristic of the tank used in the late war So as to enable tanks to make use of the element of surprise, the Ordnance Department of the Army is making extensive studies looking to its elimination. Most of the noise has its origin in the caterpillar tracks. The steel track rollers also produce noise. In the experiments looking to the reduction of noise, rubber cord track rollers are being employed. Rubber and fabric are being used on the track-driving sprocket and on the Idler sprocket, where the track shoes come into contact with those surfaces. Rubber pads are being applied to the wearing surfaces of the track shoes themselves.

Proposed Subway and Tunnel for Havana, Cuba

Plans for the subway system and tunnel proposed for the city of Havana have been exhibited to a representative of the American consulate general at Havana, Cuba. Consul General Carlton Bailey Hurst's representative was shown documents indicating that the necessary concessions for the work had been approved by the Cuban Railroad Commission, and that the Cuba North & South Railroad Co., organized to promote this project, had been completed in accordance with Cuban laws governing the organization of companies for railroad construction. A representative of the firm of engineers in charge (Sr. Serafin Sanchez Govin, No. 62 Villegas Street, Habana), holding a full power of attorney to act for the Cuba North & South Railroad Co., declared his intention of going to New York in October or November to arrange for the necessary capital and expressed a desire to receive correspondence from persons in the United States who may be interested in either the structural or the investment possibilities of the project.

Proposed Officers for Purchasing Agents

The nominating committee of the National Association of Purchasing Agents has submitted the following names for the election which will be held at Indianapolis, Ind., in conjunction with the annual meeting of the organization, Oct. 10 to 13. For president, W. L. Chandler, Dodge Sales and Engineering Co.; first vice-president, A. H. Reinhardt; second vice-president, T. P. Webster; third vice-president, A. V. Howland; fourth vice-president, S. F. Woodbury; fifth vice-president, D. E. Ferguson; treasurer, W. J. Gamble; secretary, L. F. Boffey.

Business Items

The engineering department of the Willys-Overland plant at Elyria, Ohio, will be transferred to Toledo, on Nov. 1. The shift in the engineering department will make no change in the production plan at the Elyria plant. Under the new plan the Elyria factory will be managed directly from the Toledo headquarters.

A $250,000 fire practically destroyed the plant of the Vulcan Iron Works, Jersey City, N. J., on Aug. 22.

The Metals Casting Co. of America, manufacturer and distributor of the Schoop metal spraying process, is now in full operation at its new plant in Philadelphia, Pa.

The O'Neil Engineering Co., incorporated for $5,000, will operate a plant in Toledo, Ohio, for the manufacture of special machinery. Frank O'Neil and Frank R. Smith are the incorporators.

The Raybestos Company, of Bridgeport, Conn., with factories in Bridgeport and Stratford, Conn., recently increased the capital stock of the company from $3,000,000 to $8,000,000, to be used for the purchase of the General Raybestos and Rubber Co., of Charleston, S. C., plants, at Charleston, S. C.

Sales records of passenger automobiles during second quarter of 1921, are reported as 177,885 cars exclusive of sales of Ford plants. It is estimated that sales represent a 57 per cent of capacity production for factories covered.

Production of pig iron during the first six months of 1921 showed a reduction of nearly 50 per cent in comparison with production for the same period of 1920; of basic pig iron production was 4,504,431 tons in 1921 six months period as compared with 8,287,028 tons in corresponding period of 1920.

The Woodward Wrench Co., of Springfield, Mass., has recently been incorporated under the laws of Massachusetts to manufacture wrenches, tools, etc. The capital stock of the new company is $500,000, divided into five thousand shares of $100 each. William S. Thompson, Springfield, is the president; Benjamin W. Woodward is vice-president, and Charles M. Comins, of Longmeadow, Mass., treasurer.

The Efficiency Engineering Corporation has been organized at Orlando, Fla., to manufacture and sell driving mechanisms, etc. Officers are N. O. Overstreet, president; Benjamin Drew, vice-president; P. L. Billingsley, secretary.

H. L. Seaman Supply Co., Jacksonville, Fla., has been incorporated with $20,000 capital stock. Steel, iron and machinery will be a part of the business. Officers are H. L. Seaman, president; E. L. Seaman, vice-president; J. H. Lawrence, secretary; H. L. Seaman, treasurer.

The Olson Machine Works, Portland, Ore., has been organized to do engineering and designing of machinery and machine plants. J. A. Olson is general manager.

The Automatic Radiator Corporation of Chicago has started operations in temporary quarters in Toluca, pending the erection of a factory of its own. P. A. Sperry is president of the corporation.

The Biblex Products Co. has been incorporated under the laws of the State of Delaware with a capital stock of $500,000. Automobile bumpers will be manufactured. Directors are F. B. Block, H. H. Phillips and C. J. Horn.

The Pitt Tractor Co., Wilmington, Del., has been incorporated to manufacture steel tractors. M. M. Lucey, M. P. Lynch and L. S. Dorsey are the directors.

The Betts Machine Co., Inc., Rochester, N. Y., has opened a district sales office at 1915 Oliver Bldg., Pittsburgh, Pa.

The Penn Machine Co., Johnston, Pa., has been organized and incorporated with $100,000 capital stock. The officers of the new company are: President, John Gibson; vice-president, Thomas Houlton; secretary, George W. Smith. Additional directors are Thurston Wright and Frank Baldwin.

The Ringless Piston Replacement Corporation has been incorporated at Dover, Del.; capital stock $3,000,000. Directors are T. L. Croteau, M. A. Bruce and S. E. Dill.

Faurot-Scope Corporation, Wilmington, Del., has been incorporated to manufacture a device to prevent the theft of automobiles. Capital stock is $1,000,000. Incorporators are N. L. Rogers, L. A. Irwin and W. G. Singer.

For the purpose of manufacturing refrigerating machinery, the Artic Corporation has been formed at Michigan City, Mich., with a capital stock of $200,000. S. W. Wilhelm, E. E. Mikesell and R. L. Henry organized the company.

The Whipp Machine Tool Co., Sidney, Ohio, has redesigned and is developing the open-side combination shaper and planer which it purchased some months ago from the Lynd-Farquhar Co., of Boston, Mass.

The Stoughton Nipple Manufacturing Co. has been incorporated at Stoughton, Mass. Directors are F. C. Philips, C. L. Pratt and J. D. Sillen.

Robert J. Metzler, Inc., Newark, N. J., has been incorporated with $100,000 capital, to deal in machinery. R. J. Metzler, S. Kaufman and A. MacMillan, all of New Jersey, are the incorporators.

The Frostholm-Treiber Company, Rochester, N. Y., has been incorporated with a capital of $24,000 by C. C. and J. H. Frostholm and W. C. Treiber to manufacture tools, piston rings and kindred products. It is represented by Melvin & Melvin, First Trust & Deposit Bldg., Syracuse, N. Y.

Henry Owens & Co., Inc., Providence, R. I., has been incorporated to deal in tools, etc. The incorporators are Henry Owens, Ernest Owens and Charles H. Fallows.

The Prest Machine Works Co., Oklahoma City, Okla., has increased its capital stock from $6,000 to $40,000 with $34,000 paid up. John B. Prest is president.

The Auto Collapsible Rim Manufacturing Co., has been organized at Hart, Mich., and capitalized at $100,000. The capital has been subscribed and paid up and a plant will be secured where from fifty to 100 persons will be employed, it is said.

The Loop Lock Corporation, New York, N. Y., has been incorporated with $50,000 capital stock by L. Herold, T. Resnik and M. Schenkman, to manufacture locks, etc.

Bear Tractors, Inc., New York, N. Y., motors and engines, has been incorporated with $500,000 capital stock, by W. J. Greacen, P. Sawyer and E. Conway.

The Welded Products Co., Birmingham, Ala., is reported planning to increase its capital stock from $50,000 to $100,000.

Personals

James A. Brakes, Jr., has resigned his position as head of the department of mechanical engineering at Ohio Northern University, Ada, Ohio, and is now structural engineer for the Chateaugay Ore & Iron Co., Lyon Mountain, N. Y.

O. L. McIntyre has been placed in charge of the Chicago office of the Fuller Lehigh and Fuller Engineering Co.

Philip S. Van Wyck has resigned from the Chicago Great Western Railroad and is now with the Mesabi Iron Company Babbitt, Minn.

W. C. Brumble, formerly resident mechanical engineer, Muncie Products Division, General Motors Corporation, is now equipment engineer for Durant Motors, Inc., Long Island City, N. Y.

M. C. Gillett has been transferred from manager of the Philadelphia branch office to plant manager of the Standard Heater Co., at Williamsport, Pa.

Graham L. Montgomery has recently organized the firm of Montgomery & Fishkind, consulting engineers, New York, which will handle consulting work of a mechanical and structural nature. He has also become a partner in the firm of Vreeland, Fishkind & Co., industrial engineers and architects, of New York.

J. E. Woods has recently joined the general sales division of the Pacific coast organization of the Gilbert & Barker Manufacturing Co., of West Springfield, Mass. Mr. Woods will work out from San Francisco.

George W. Hocking, secretary of the Wheeling Steel Corporation, Wheeling, W. Va., since its organization a year ago, has tendered his resignation to the board of directors. Mr. Hocking has been connected with the Whitaker-Glessner Co., a subsidiary of the Wheeling Steel Corporation, for upwards of 20 years, serving with that company as secretary until the organization of the Wheeling Steel Corporation.

Frank Welsh, who at one time was connected with the sales department of the Republic Iron and Steel Co., Youngstown, Ohio, has returned to that company, succeeding W. W. Hall as assistant manager of sales in the Pittsburgh district. Mr. Hall succeeds Charles S. McKinley as assistant manager of sales at Youngstown. Mr. Welsh resigned from the Republic company Dec. 1, 1917, and after engaging in the export business in New York, became manager of the New York office of Hickman, Williams & Co. For several months past he has represented the Detroit Graphite Co. in Pittsburgh.

Secretary Hoover and Assistant Secretary of Commerce Huston have recommended to President Harding the appointment of D. B. Carson, of Tennessee, as Commissioner of Navigation, succeeding Eugene Chamberlain, who had served 28 years in that office and will be made an expert on the staff of the Bureau of Foreign and Domestic Commerce. Mr. Carson has been for 30 years general manager of the Nashville, Chattanooga & St. Louis Railroad.

Harwell C. Booth has been appointed district manager of sales in the New York office of the Columbia Steel and Shafting Co., Pittsburgh, Pa. Mr. Booth succeeds Edward T. Corbus, who has assumed more important duties in another field.

Victor M. Johnson has resigned as secretary and manager of the Free Sewing Machine Co., Rockford, Ill. To fill his place Frank J. Kelley was elected secretary and A. E. Johnson manager.

J. H. Edwards, manager of the Elyria (Ohio) plant of the Willys-Overland Co., has resigned.

J. P. Oliveau has been appointed chief engineer of the Mercer Motors Co., Trenton, N. J. Mr. Oliveau is a French engineer and was formerly connected with the Panhard, Delahaye and Peugsot cars.

H. L. Gardner, general sales representative at Bakersfield, Cal., for the Gilbert & Barker Manufacturing Co., Springfield, Mass., sailed recently for Rotterdam, Holland, with his family. Mr. Gardner has been granted a leave of absence by the company.

Elmer H. Havens, president of the Hunter & Havens Co., steel merchants, of Bridgeport, Conn., has been chosen president of the Locomobile Company of America, Bridgeport, Conn., maker of Locomobile automobiles and Riker trucks.

D. J. Mahoney, of the general sales department of the Gilbert & Barker Manufacturing Co., Springfield, Mass., has recently been transferred to Butte, Mont., where he will represent the interests of the company with the Continental Oil Co.

B. G. Dann, for the past four years with the engineering department of the Tuscon Steel Co., Youngstown, Ohio, has resigned to become manager of the New York office of the Hendrick Manufacturing Co., Carbondale, Pa., manufacturer of perforated metal and general sheet and light structural iron work.

Guy P. Miller, treasurer and general manager of the Bridgeport Brass Co., Bridgeport, Conn., has severed his connections with that company. Mr. Miller has been with the Bridgeport Brass Company for the past twenty-one years.

Frederick J. Kingsbury, president of the Bridgeport Brass Co., Bridgeport, Conn., has resigned his position as president of the company, and will assume the combined duties of chairman of the board of directors and treasurer from now on.

Trade Catalogs

Thermalloy. The Electric Alloys Co., 1692 Glenmount Rd., Cleveland, Ohio. A six-page bulletin describing the properties, production and uses of a high chromium alloy know as "Thermalloy." A table showing the physical properties of the metal is given, also two line drawings showing rate of oxidation and comparative heating efficiency of thermalloy, steel and cast iron.

Rego Welding and Cutting Apparatus. The Bastian-Blessing Co., 125 West Austin Ave., Chicago, Ill. Catalog No. 23 describing and illustrating "Rego" welding and cutting torches, soldering torches, regulators, complete welding and cutting outfits, and the fittings for use with this equipment.

Die Heads. Geometric Tool Co., New Haven, Conn., Catalog describing a line of self-opening and adjustable die heads, chaser grinders, threading machines, chucks and collets.

Twist Drills. Rockford Twist Drill Co., Rockford, Ill. Catalog No. 10, giving full descriptions, with illustrations, of a line of high-speed and carbon twist drills. Specifications and price lists are included for each type.

Universal Piston Vise. The Manley Manufacturing Co., York, Pa. Catalog No. 350 describing the Manley universal piston vise for use in garages and repair shops.

Nazel Air Hammer. Nazel Engineering and Machine Works, Philadelphia, Pa. A 24-page catalog illustrating and describing power hammers. It is a very complete catalog on this type of machine.

Standard Punch and Die Sets. Diamont Tool & Mfg. Co., Inc., 91-97 Runyon St., Newark, N. J. A 4-page pamphlet setting forth the advantages of using standard punch and die sets as produced in quantity by this firm. Diagrams are included showing the dimensions of the punch and die sets.

Greenfield Taps and Dies. The GTD Corporation, Greenfield, Mass., is now distributing a new catalog describing the small tools and pipe tools which comprise the greater part of its product. There are about seventy pages of tables and other information at the back of the book of interest to the user and designer of tools and machinery. The tools described include screw plates, taps, dies, drills, reamers, milling cutters, bits, arbors, countersinks, hobs, tap and drill kits, mandrels, sleeves, sockets, stocks, tap wrenches, pipe vises and pipe wrenches.

Pamphlets Received

Selection of Fuels: W. S. Rockwell Co., furnace engineers and contractors, New York City, N. Y. One of a series of papers relating to the selection and use of fuels and equipment for industrial heating operations. Several charts are provided which show the comparative costs and rates of efficiency of various heating elements.

Real Production Tools: Goddard & Goddard Co., Detroit, Mich. A four page pamphlet, number one of a series, largely educational, in the interest of better production. This number deals with the half side mill.

Training for Foreign Exploration: School of Mines and Metallurgy, University of Missouri, Rolla, Mo. A reprint of the annual commencement address of H. Foster Bain, dealing with the qualifications of the mining engineer, especially for research work.

The Coal Problem: Senator James A. Reed, of Missouri. The full text of Senator Reed's speech, delivered before the Senate on June 28, when that body had under consideration Bill 1806, "A bill to further amend the interstate commerce act, as amended, to provide for seasonal rates for the transportation of coal," and Bill 1807, "A bill to aid in stabilizing the coal industry." Printed in the government printing office, Washington, D. C. Copies may be had on request.

Crop and Business Conditions for 1921: Continental and Commercial National Bank of Chicago. A forty-page pamphlet giving some valuable facts concerning the distribution of crops over the United States. Maps and charts showing annual production and prices of the principal crops are included.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A manufacturing company in Ireland desires to purchase cigarette-making machines for use in factory. Quotations should be given f. o. b. New York or c. i. f. Irish port. Terms: Cash against documents on delivery. Reference, No. 3537.

A merchant in Norway desires to purchase and secure an agency for the sale of iron, steel, and metals. Quotations should be given c. i. f. Norwegian port. Payment to be made through banks in Norway and in New York. Reference, No. 35378.

A mercantile firm in Spain, having facilities for the marketing of merchandise all over Spain, desires to be placed in touch with manufacturers of motors, electrical machinery, telephones, ventilators, counting machines, adding machines, all kinds of lighting fixtures, accessories and installations, scales, and other weighing devices, turbines, dynamos, insulated materials, covered cables, drills, wire, etc. It is the desire of this house to secure exclusive representation of these products. Reference, No. 35385.

A commercial agent in South Africa desires to secure an agency for the sale of wire, bolts and nuts, hardware, etc. Quotations should be given c. i. f. South African ports. Reference, No. 35386.

A commercial agent in South Africa desires to secure the representation of firms for the sale of machinery, including mining, coal-mining, and general industrial equipment. Reference, No. 35372.

A firm of engineers in Colombia desires to be placed in correspondence with manufacturers of machinery for making cellulose and paper, and machinery for making chemicals, such as caustic soda, as well as cyanide of natrium. Reference, No. 35369.

An engineer in Scotland desires to have manufactured by an American firm a ship heating and ventilating plant. The inquirer holds United States patents. Reference, No. 35370.

Forthcoming Meetings

The second International Cost Conference will be held at Cleveland, Ohio, on Sept. 14, 15 and 16, under the auspices of the National Association of Cost Accountants.

The third annual convention and exhibition of the American Society for Steel Treating will be held in the Manufacturers Building, State Fair Grounds, Indianapolis, Ind., during the week of September 19 to 24 inclusive.

The annual congress of the National Safety Council will be held at Boston, Mass., during the week of September 26. C. W. Price, 168 North Michigan Ave., Chicago, Ill., is general manager.

The twelfth annual convention of the American Manufacturers Export Association will be held in the Waldorf-Astoria Hotel, New York City, on October 5 and 6. A. W. Willmann is secretary.

The fifth annual convention of the Society of Industrial Engineers will be held at Springfield, Mass., Oct. 5, 6 and 7.

A joint meeting of the American Society of Mechanical Engineers, the Society of Automotive Engineers and the Army Ordnance Association will be held at Aberdeen, Md., Friday, October 7.

The annual meeting of the National Association of Purchasing Agents will meet in the Claypool Hotel, Indianapolis, Ind., on Oct. 10 to 13, inclusive. L. F. Boffey, 19 Park Place, New York City, is secretary.

The American Gear Manufacturers Association will hold its semi-annual meeting at Rochester, N. Y., October 13, 14 and 15. F. D. Hamlin, 4401 Germantown Ave., Philadelphia, Pa. is secretary.

The National Machine Tool Builders' Association will hold its fall meeting at the Hotel Astor, New York City, October 18, 19 and 20.

NEW *and* ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

N. J., Jersey City—The National Carbon Co., Inc., 580 Henderson St.—one No. 3 Arbor press without stand.

N. J., Jersey City—The Vulcar Iron Wks.—motor driven shear for cutting off round iron up to 1¼ in. diameter and arranged for 440 volt, 2 phase, a.c., or 110 volt, 1 phase a.c.

N. Y., Buffalo—The Hugh Co., Sheet Metal Wks., 163 Adams St., J. M. Brendel, Purch. Agt.—Burr beading machine and small turner.

N. Y., Long Island City—Harold Motor Car Co., Jackson Ave. — small bench grinder, electrically driven with 8 in. wheels.

N. Y., New York—J. F. Oberle, 238 East 42d St., plumbing supplies—power press, grinder with wheelguards and combined punch and shear, all complete, also a bench drill and a high speed power hack saw.

N. Y., New York—The Pennsylvania Co.. Co., 50 Church St.—one 48 in. motor driven vertual single head metal boring and turning mill complete with all equipment.

Pa., Phila.—City—C. E. Davis, City Hall, engr.; general machine tools and electric crane for Shawmut pump station.

Va., Ashland—Oliver & Rawlings, G. Rawlings, Purch. Agt.—auto agency and repair shop—complete mechanical equipment.

La., New Orleans—The Auto Service & Sales Co., 936-40 Howard St., L. G. Knight, V. Pres.—repair shop equipment, including drill press, electric motor (4 hp.), crane equipment for wrecker, new and used automobile repairing equipment.

La., New Orleans — The New Orleans Auto Supply Co., Inc., Drydes St., R. E. Zerlin, Pres.—auto repair equipment.

La., New Orleans—The Schayer & Sons, Inc., 1039 Dryades St. and 514-536 Julia St.—small sander for sanding panels; also a machine or tool that can bore and mortise, for general wagon work (new or used).

Mich., Detroit — F. J. Lamb Co., 1938 Franklin St.—one No. 4 or No. 5 Michigan (or similiar make) power punch press with knockout.

O., Cincinnati—The Economy Mch. Co., 428 East Pearl St., J. H. Flynn, Purch. Agt.—one 18 in. Bliss press, one geared punch s, end 12 in. with throat 1¼ in. and 1 in. throw, one bench lathe with 11 in. swing, one 24 in. oil burning furnace with blower attached, and bolt cutter releasing dies ¼ to ½ in.

Kan., Lawrence—The Bd. Educ., c/o I. C. Stevenson—manual training equipment for proposed high school.

Minn., Minneapolis — H. Cleveland, 205 South 7th St.—bench lathes, grinder, buffer, drill press, furnace for case-hardening, etc., 1½ hp. electric motor, 220 d.c.

Ont., Manitowaning — Hinds Garage—complete equipment for auto repair shop.

N. Y., Buffalo—The Buffalo Mill Supply Co., 210 Main St., G. Y. Braun, Purch. Agt.—conveying machinery for unloading salt from box car to crusher.

D. C., Washington—Dept. of the Interior—dairy equipment for St. Elizabeths Hospital.

La., New Orleans—The Washington Ice Co., P. J. Wingerter, Ch. Engr., 611 Louisiana Ave.—internal combustion engines, modern draw water ice plant machinery, etc., for proposed plant.

Wis., Racine — The Harvey Spring & Forge Co.—machinery for the manufacture of springs, etc.

Wis., Sauk City—The Sauk City Canning Co.—canning and conveying machinery.

Wis., Sheboygan—The Lake Mills Condensed Milk Co.—C. A. Bauman, Pres.—canning and milk machinery.

Wis., Tomahawk—The Tomahawk Steel & Iron Co., W. Drever, Pres.—crane.

Cal., Los Angeles—The Western Chemicals Co., 503 Merchants Bk. Bldg.—screening machines, crushers and dryers, for proposed factory.

Ont., Windsor—The Essex Provision Co., Ltd., 1120 McDougal St.—cold storage equipment for proposed plant.

Metal Working Shops

NEW ENGLAND STATES

Pa., Philadelphia—S. W. Evans Co., 4623 Paul St., has awarded the contract for the construction of additions to present factory, on Paul St., for the manufacture of umbrella frames, etc. Estimated cost, $125,000.

Pa., Pittsburgh—The Cunningham Sales Co. is receiving bids for the construction of a 2 story, 85 x 100 ft. garage and sales, on Aspen and Liberty Aves. Estimated cost, $100,000. F. C. Fisher & Co., 419 Oliver Ave., Archt.

MIDDLE WEST STATES

Ill., Chicago—The Yellow Cab Co., 57 East 21st St., has awarded the contract for the construction of a 1 story, 140 x 250 ft. garage, on Flournoy and Lavergne Aves. Estimated cost, $85,000. Noted Aug. 18.

Ill., Rock Island—J. Ryan Fdry. Co., 506 41st St., plans to build a 2 story factory. Estimated cost, $50,000. Architect not selected.

Mich., Detroit—Dept. Motor Transportation, c/o W. Helmboldt, Supt., City Hall, plans to build a 3 story, about 200 x 350 ft garage and office building, on Russell and Alfred Sts. Estimated cost, $400,000. Architect and engineer not selected.

O., Columbus—The Columbus Forge & Iron Co., West 1st Ave., will soon award the contract for the construction of a 1 story, 70 x 200 ft., and a 1 story, 110 x 123 ft. factory buildings. Estimated cost, $80,000. Noted Aug. 11.

Wis., Racine — The Harvey Spring & Forge Co. plans to build a 3 story, 60 x 120 ft. factory, on Main St., to replace the one which was destroyed by fire. Estimated cost, $45,000. Probably private plans.

Wis., Tomahawk—The Tomahawk Steel & Iron Co. will build a 1 story, 100 x 180 ft. plant, for the manufacture of structural steel. W. Drever, Pres. L. A. DeGuere, Wisconsin Rapids, Enrgr.

WEST OF THE MISSISSIPPI

Ia., Des Moines — G. L. Garton, Secy. School Bd.

Kan., Parsons—The Missouri, Kansas & Texas Ry. Co., c/o H. H. Johntz, Railway Exchange Bldg., will receive bids until Sept. 15 for the construction of a 2 story, 50 x 150 ft. machine shop. Estimated cost, $50,000. A. L. Sparks, care of owner, Archt.

Minn., Minneapolis—G. C. Ryan, 523 3d Ave. N., plans to build a 2 story, 85 x 135 ft. garage and sales, on Lake St. Estimated cost, $65,000. Architect not selected.

WEST OF THE MISSISSIPPI

Mo., Clarence—A. Burnett, c/o Clarence Auto Co., is having plans prepared for the construction of a 1 story, 100 x 140 ft. auto repair shop. Estimated cost, $45,000. Burgher Bros., Hannibal, Archt. Noted Aug. 4.

Mo., St. Louis—The Plymouth Garage Co., 5909 Plymouth St., plans to build a 1 story garage, on Plymouth and Hamilton Sts. Estimated cost, $50,000. Architect not selected.

Mo., St. Louis—The Standard Stamping Co., c/o G. Wiegand, 2000 North Broadway, has awarded the contract for the construction of a 1 story, 107 x 132 ft. enameling plant, on Bway. and Madison St. Estimated cost, $50,000. Noted Aug. 25.

CANADA

Ont., Manitowaning—Hinds Garage plans to build a new garage and auto repair shop to replace the one which was destroyed by fire. Estimated cost, $50,000.

General Manufacturing

NEW ENGLAND STATES

Conn., Hartford—The Fuller Brush Co., Inc., 74 Union Place, is having plans prepared for the construction of a 4 story factory, on Windsor Ave., for the manufacture of brushes. Estimated cost, $250,000. Buck & Sheldon, Inc., 60 Prospect St., Archts. and Engrs.

Mass., Shirley — The State Industrial School has awarded the contract for the construction of a 1 and 2 story, 35 x 140 ft. kitchen and laundry building. Estimated cost, $65,000. Noted Aug. 4.

N. H., Concord—The Rumford Press Co., Railroad St., has awarded the contract for the construction of a 4 story, 81 x 180 ft. factory, on Ferry St. Estimated cost, $175,000.

The Weekly Price Guide

This Week's Market

The recent reduction in Pittsburgh mill quotations, have been reflected in the present warehouse prices on steel sheets. No. 10 blue annealed are now quoted at $3.28 as against $3.53, No. 28 black at $4, a reduction from $4.25 and No. 28 galvanized at $5 per 100 lb., warehouse, as compared with $5.25 formerly. Bars have been quoted as low as $1.60, Pittsburgh; shapes and plates at $1.70@1.75. Mill shipments of shapes and plates sell for $2.13@2.23, with bars at $2.08 per 100 lb. New York warehouse prices on shapes and plates remain unchanged. A reduction of ¼c. per lb. in bar iron is quoted at the mill, making the present price 2¼c. as compared with 2½c. per lb. previously.

The only advance in the New York metal market is in the price of tin, which is quoted at 26¾c. as against 26c. per lb. Lead, copper sheets and brass tubing have all dropped ¼c.; while a decrease of ½c. per lb. is reported in brass sheets and rods.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	*$24.50
Northern Basic	†21.52
Southern Ohio No. 2	†22.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	†30.26
BIRMINGHAM	
No. 2 Foundry	*20.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	†21.76
Virginia No. 2	†28.74
Basic	†20.26
Grey Forge	†22.26
CHICAGO	
No. 2 Foundry local	*20.00
No. 2 Foundry, Southern, sil 2.25@2.75	†26.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	21.96
Basic	19.96
Bessemer	21.96

*F. o. b. furnace. † Delivered.

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.75	3.28	3.25	3.53
No. 12	2.80	3.33	3.30	3.58
No. 14	2.85	3.38	3.35	3.63
No. 16	2.95	3.48	3.45	3.73
Black				
Nos. 17 and 21.	3.40	3.80	3.80	4.45
Nos. 22 and 24.	3.50	3.85	3.85	4.50
Nos. 25 and 26.	3.55	3.90	3.90	4.55
No. 28	3.65	4.00	4.00	4.65
Galvanized				
Nos. 10 and 11.	3.75	4.00	4.00	4.95
Nos. 12 and 14.	3.85	4.10	4.10	5.05
Nos. 17 and 21.	4.15	4.40	4.40	5.35
Nos. 22 and 24.	4.30	4.55	4.55	5.50
No. 26	4.45	4.70	4.70	5.55
No. 28	4.75	5.00	5.00	5.65

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of July 7, 1921:

Steel			Iron		
Inches	Black	Galv.	Inches	Black	Galv.
BUTT WELD					
1 to 3	64½	52	¾ to 1½	39½	24½
LAP WELD					
2	56¼	44	2	34½	20½
2½ to 6	60½	48	2¼ to 4	37½	24½
7 to 12	57½	44	4½ to 6	37½	24½
13 and 14	45	37	7 to 12	35½	22½
15	42½	32			
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	62½	51	1 to 1½	39½	25½
2 to 3	63½	52			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	54½	43	2	35½	22½
2½ to 4	58½	47	2½ to 4	38½	26½
4½ to 6	57½	46	4½ to 6	37½	25½
7 to 8	53½	40	7 to 8	30½	18½
9 to 12	48½	35	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
¾ to 3 in. steel butt welded.	60%	46%	52½%	43½%	62½%	50%
2½ to 6 in. steel lap welded.	51%	37%	55½%	40½%	48½%	46%

Malleable fittings. Classes B and C, Banded, from New York stock sell at plus 6%. Cast iron, standard sizes, 15% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (heavy)	5.00	6.50	8.25
Spring steel (light)	6.00@8.00	6.50	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.03
Hoop steel	3.88	3.29	3.48
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	4.85	2.74	5.23
Cold finished shafting or screw	4.23	3.85	3.85
Cold finished flats, squares	4.73	4.35	4.35
Structural shapes (base)	2.88	2.74	2.88
Soft steel bars (base)	2.78	2.64	2.70
Soft steel bar shapes (base)	2.78	2.64	2.70
Soft steel bands (base)	3.43	....	.....
Tank plates (base)	2.88	2.92½	2.88
Bar iron (mill 2.25)	2.78	3.52	2.78
Drill rod (from list)	55@60%	55%	50%

Electric welding wire.......... New York 3/32, 8½c. per lb. 1/8—7.15c.; 5/32 to 1/4—6.75c. Swedish iron sells at 18½c. per lb. in Chicago

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	12¾@13
Tin, 5-ton lots, New York	26.75
Lead (up to carlots), St. Louis, 4.35; New York	4.50
Zinc (up to carlots), St. Louis, 4.60; New York	5.00

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.00	25@26	30
Antimony (Chinese), ton spot	5.25	6.00	6.00
Copper sheets, base	19.75	20.75@21	20.00
Copper wire (carlots)	15.50	15.50	14.00
Copper bars (ton lots)	18.50	22.00	18.50
Copper tubing (100-lb. lots)	19.50	23.00	20.00
Brass sheets (100-lb. lots)	15.25	18.00	15.75
Brass tubing (100-lb. lots)	18.25	20.00	18.50
Brass rods (1,000-lb. lots)	13.25	15.50	13.75
Zinc sheets (casks), (8% dis. carlots)	11.00	11.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ½), (case lots)	17.75	23.50	17.50
Babbitt metal (best grade)	70.00	35.50	35.00
Babbitt metal (commercial)	30.00	13.50	9.00

—Shop Materials and Supplies

MONEL METAL Base price in cents per pound, f.o.b. Bayonne, N. J.

Shots and blocks	$35.00	Hot rolled rods (base)	42.00
Ingots	38.00	Cold rolled rods (base)	56.00
Sheet bars	40.00	Hot rolled sheets (base)	55.00

Special Nickel and Alloys

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	9.50	9.00	9.50
Copper, heavy, and wire	9.00	9.00	9.00
Copper, light, and bottoms	7.00	7.00	7.00
Lead, heavy	3.25	3.00	3.00
Lead, tea	2.00	2.00	2.00
Brass, heavy	5.00	5.00	7.25
Brass, light	4.00	3.00	4.25
No. 1 yellow brass turnings	4.50	4.00	4.50
Zinc	2.50	2.00	2.50

TIN PLATES—American Charcoal Plates—Bright

	New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:			
IC, 20x28, 112 sheets	21.50	......	....
IX, 20x28, 112 sheets	24.00	......	....
IXX, 20x28, 56 sheets	13.75	......	....
IXXX, 20x28, 56 sheets	15.50	......	....
IXXXX, 20x28, 56 sheets	17.00	......	....
"A" Charcoal Allaways Grade:			
IC, 20x28, 112 sheets	18.50	......	....
IX, 20x28, 112 sheets	21.50	......	....
IXX, 20x28, 56 sheets	12.25	......	....
IXXX, 20x28, 56 sheets	14.00	......	....
IXXXX, 20x28, 56 sheets	15.75	......	....

Coke Plates, Bright

Prime, 20x28 in.:		(Base)	
80-lb, 112 sheets	13.60	......	....
90-lb., 112 sheets	13.80	......	....
100-lb., 112 sheets	14.00	6.50	....
IC, 112 sheets	14.30	6.65	....
IX, 112 sheets	16.30	......	....
IXX, 56 sheets	9.15	......	....
IXXX, 56 sheets	10.15	......	....
IXXXX, 56 sheets	11.15	......	....

Terne Plate

Small lots, 8-lb. Coating:			
100-lb., 14x20	$7.50	5.50	....
IC, 14x20	7.75	5.75	....
IX, 14x20	8.00	6.00	....

SHOP SUPPLIES

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in	—50%	50–10–5%	—60%
$1\frac{1}{8}$ and $1\frac{1}{4}$x3 in. up to 12 in	—40%	60–10–10%	—55%
With cold punched sq. nuts	—30%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	—40%	....	.. ..
Up to 1-in. diameter, with cold punched hex. nuts (plus std. extra of 10%)	—30%	....	.....
Button head bolts, with hex. nuts	—20%	390 base	.....
Hex. head and hex. nut bolts	—20%	....	.....
Lag screws, coach screws	—50–10%	....	.....
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	60%	—55%
Bolt ends, with hot pressed nuts	—50%	....	.....
Tap bolts, hex. heads	—20%	....	.....
Rivets, $\frac{7}{16}$ in. dia. and smaller. *New list*	–50–10%	60–10%	–60–10%
Rivets, tinned	–50–10%	60–10%	—45%
Semi-finished nuts, all sizes	—70%	80%	.....
Case-hardened nuts	—60%	....	.....
Washers, cast iron, $\frac{1}{2}$ in., per 100 lb.	$5.00	$4.50 off	$4.50
Washers, cast iron, $\frac{5}{8}$ in. and larger, per 100 lb	4.25	3.75 off	4.50
Washers, round plate, off list per 100 lb.	3.00	....	.....
Nuts, hot pressed, sq. Off list	2.00	2.25	3.00
Nuts, hot pressed, hex. Off list	2.00	2.25	3.00
Nuts, cold punched, sq. Off list	1.50	2.25	3.00
Nuts, cold punched, hex. Off list	1.50	2.25	3.00
Rivets:			
Button heads $\frac{3}{4}$-in., $\frac{7}{8}$-in., 1x2 in. to 5 in., per 100 lb	$4.40	....	3.68
Cone heads, ditto	4.50	....	3.78
$1\frac{1}{8}$ to $1\frac{7}{8}$-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	....
$\frac{7}{8}$ in. diameter *EXTRA*	0.15	....	....
$\frac{1}{2}$ in. diameter *EXTRA*	0.50	....	....
1 in. long, and shorter *EXTRA*	0.50	....	....
Longer than 5 in. *EXTRA*	0.25	....	....
Less than 200 lb. *EXTRA*	0.50	....	....
Countersunk heads *EXTRA*	0.35	....	....
Copper rivets	50–10%	40–10%	50%
Copper burs	25–10%	15%	50%

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	0.07\frac{1}{2}$@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb.	.055@.09	.09	.10
Wiping cloths per M., $13\frac{3}{4}$x$13\frac{3}{4}$	....	55.00	55.00
Wiping cloths per M., $13\frac{3}{4}$x$20\frac{1}{2}$	....	65.00	65.00
Sal soda, 100 lbs	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb	2.55	3.25	2.75
Linseed oil, per gal., 5 bbl. lots	.78	.83	.80
Fire clay, Ottawa, per 100 lb.	.80	.80	
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Coke, prompt furnace	$2.90@3.00	Connellsville	
Coke, prompt foundry	4.00@4.50	Connellsville	

MIDDLE ATLANTIC STATES

Del., Wilmington—The Atlas Powder Co. has awarded the contract for the construction of a 1 story 60x80 ft. laboratory building. Estimated cost, $20,000.

Md., Baltimore—The Adamantex Brick Co., Arbutus Ave., has awarded the contract for the construction of a 2 story, 162x268 ft. plant. Estimated cost, $150,000.

Md., Baltimore—The Hampden Laundry & Ice Mfg. Co., J. H. McFaul, Jr., Secy., 3648 Hickory Ave., recently incorporated, plans to build a factory for the manufacture of ice and ice cream, also a laundry.

N. J., Secaucus—The Bd. of Freeholders Hudson County, Jersey City, has awarded the contract for the construction of a laundry, including the installation of machinery, at County Alms House, here. Estimated cost, $45,892.

Pa., Philadelphia—C. P. Cochrane & Co., Kensington Ave. and Butler St., have awarded the contract for the construction of a 2 story, 27 x 42 x 47 x 52 ft. addition to factory, on Kensington Ave., for the manufacture of carpets. Estimated cost, $75,000.

Pa., Philadelphia — The Mayer Baking Co., 60th and Hazel Aves., has awarded the contract for the construction of a 3 story, 125 x 130 ft. bakery, on Thomas Ave. Estimated cost $140,000.

Pa., Phila.—The Tazewell Mfg. Co., Tazewell, Va., has awarded the contract for the construction of a 3 story, 60x200 ft. ginger ale bottling plant. Estimated cost, $70,000.

Pa., Pittsburgh—The Natl. Biscuit Co., 201-10th St., has awarded the contract for the construction of a 6 story factory at 409 Liberty Ave. Estimated cost, $75,000.

Pa., Pittsburgh—The North Pole Ice Co., Carson St., is receiving revised bids for the construction of a 6 story, 160 x 192 ft. ice storage plant, at 1218 West Carson St. Estimated cost, between $500,000 and $600,000. W. Griesser, 222 Meyron Ave., Archt. Noted June 2.

Pa., Pittsburgh — The Standard Underground Cable Co., Westinghouse Bldg., has awarded the contract for the construction of a 2 story, 40 x 100 ft. addition to factory on 16th St. Estimated cost, $15,000.

Pa., Pittsburgh — The Union Ice Co., North Side, is receiving bids for the construction of a 2 story, 70 x 163 ft. ice storage plant, on Beaver Ave. Estimated cost, between $90,000 and $100,000. C. G. Gerber, Engr.

Pa., Scranton—The Smith & Clark Co., 516 South Blakely Ave., is receiving bids for the construction of a 3 story, 60 x 100 ft. ice cream plant, on Wyoming and Poplar Sts. McCormick Co., Century Bldg., Pittsburgh, Archts. and Engrs.

Pa., Wilkesbarre—M. F. Fadden & Sons, Inc., will soon receive bids for the construction of a 2 story, 60 x 90 ft. plant on Wyoming St. and along the tracks of the Lehigh Valley R.R., for the manufacture of ice cream. McCormick Co., Century Bldg., Pittsburgh, Archts. and Engrs.

SOUTHERN STATES

Va., Richmond—E. K. Vieter, 1800 Simms Ave., has awarded the contract for the construction of a 2 story plant, for drying tobacco. Estimated cost, $40,000.

W. Va., Altavista—The Altavista Photo Play Co., c/o Meanor & Handlosser, Archts., Robson-Prichard Bldg., Huntington, is having plans prepared for the construction of a 1 and 2 story, 75x125 and 80x90 ft. moving picture plant, here. Estimated cost, $75,000.

La., New Orleans—The Washington Ice Co., 611 Louisiana, plans to build an artificial ice-making manufacturing plant on Cadiz and Freret Sts. Estimated cost, between $125,000 and $150,000. P. J. Wingerter, Ch. Engr. Architect not selected.

MIDDLE WEST STATES

Ill., East St. Louis—The Southern Illinois Milk Producers' Assn., Arcade Bldg., plans to build a 1 story factory. Estimated cost, $50,000. Architect not selected.

Ill., Joliet—The Coal Products Mfg. Co., Lockport Township, has awarded the contract for the construction of a 2 story, 64 x 67 ft. factory. Estimated cost, $25,000.

Ill., Chicago—The Cuneo Henneberry Co., J. F. Cuneo, Pres., 455 East 22nd St., has awarded the contract for the construction of a 6 story, 100x221 ft. printing plant at 2242-54 Cottage Grove Ave. Estimated cost, $750,000.

O., Cleveland—The Cleveland Society for the Blind, 2275 East 55th St., has awarded the contract for the construction of a 2 story, 40 x 80 ft. factory, on East 55th St., for the manufacture of brooms. Estimated cost, $40,000. Noted Jan. 20.

O., Cleveland—Steve Hovanec, United Bank Bldg., will build a 2 story 40 x 105 ft. paint shop on West 50th St. and Lorain Ave. Estimated cost, $20,000.

O., Cleveland — S. H. Vehicle Co., 3291 East 65th St., has had plans prepared for the construction of a 1 story, 40 x 90 ft. factory, on East 65th St., for the manufacture of wagon repairs. Estimated cost, $15,000. Private plans.

O., Dayton—The Cream Fried Cake Co. has awarded the contract for the construction of a 1 story, 74x100 ft. bakery on Troy and Chapel Sts. Estimated cost, $45,000.

Wis., Barksdale—The Farm & Labor Assn., c/o E. Huff, Pres., is having plans prepared for the construction of a 2 story, 29x96 ft. factory for the manufacture of cheese, etc. Estimated cost, $30,000. Private plans.

Wis., Green Bay—The Amer. Lumber & Mfg. Co., South Pearl St., is receiving bids for the construction of a 2 story, 150x160 ft. factory and warehouse, on Pearl St. Estimated cost, $50,000. Private plans. Noted Aug. 25.

Wis., Hartford—The Portz Bros. Malt & Grain Co. has awarded the contract for the construction of a 4 story, 64x120 ft. condensory and pasteurizing plant. Estimated cost, $150,000.

Wis., Kenosha—P. Pirsch & Co., Fairfield Ave., will soon award the contract for the construction of a 1 story, 100x100 ft. addition to its factory to be used for an assembling plant. Estimated cost, $50,000. C. O. Augustine, Archt.

Wis., Menasha—The United Paper Corp., c/o J. S. Frankland, Pres., is having preliminary plans prepared for the construction of a 4 story, 60x110 ft. factory, (2nd unit) for the manufacture of paper. Estimated cost, $100,000. Private plans.

Wis., Milwaukee—The Best Block Co., 1228 Humboldt Ave., has awarded the contract for the construction of a 1 story, 50x60 ft. factory, (1st unit), on Keefe Ave. Total estimated cost, $40,000. Noted Aug. 18.

Wis., Milwaukee—H. C. Hengels, Archt., 425 East Water St., will soon award the contract for the construction of a 2 story 50x63 ft. addition to knitting factory, on Wells and 18th Sts., for C. Koeffler. Estimated cost, $25,000.

Wis., Nenah—E. A. Wettengel, 578 Pierce Ave., Appleton, is having plans prepared for the construction of a 1 and 2 story, 80 x 555 ft. paper mill, on Blair Spring site. Estimated cost, $800,000. Architect not announced.

Wis., North Milwaukee—J. Greenbaum Tanning Co. is receiving bids for the construction of a 2 story, 50x70 ft. tannery building. Estimated cost, $70,000. Private plans.

Wis., Sauk City—The Sauk City Canning Co. is having plans prepared for the construction of a 1 and 2 story cannery. Estimated cost, between $75,000 and $80,000. J. Dresen, Sauk City. Archt.

Wis., Shawano—The United Fruit Packing Co., c/o H. Opgenorth Pres., Sheboygan, is having plans prepared for the construction of a 2 story, 32x136 ft. factory for the manufacture of fruit boxes, etc. Estimated cost, $35,000. Private plans.

WEST OF THE MISSISSIPPI

Ia., Des Moines—G. L. Garton, Secy. School Bd., will receive bids until Sept. 27 for the construction of a 2 story, 240 x 360 ft. high school, including a boiler plant and manual training shop on South West 9th and Loomis Sts. Estimated cost, $700,000. Proudfoot, Bird & Rawson, 810 Hubbell Bldg., Archts.

Minn., Minneapolis—The Bd. of Park Comrs., J. A. Ridway Secy., City Hall, plans to build a 2 or 3 story storage building and laundry on Lyndale and Farmstead Sts. Estimated cost, $175,000. Architect not announced.

Mo., Joplin—Joplin Center Cord Tire & Rubber Co., 815 Main St., will remodel and build addition to its plant including equipment for the manufacture of tires. Estimated cost, $20,000. J. L. Courvoisier, Treas.

Mo., Rockville—The Keystone Products Co. plans to build a factory for the manufacture of soap. Estimated cost, $25,000. Architect not selected.

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Volume 55 NEW YORK, SEPTEMBER 15, 1921 Number 11

Effect of Heat-Treatment on Steel Castings and Drop Forgings

Results of Tests at Different Stages in Heat-Treatment — Chemical Analyses and Their Results — Interesting and Instructive Information Obtained

BY A. A. BLUE
Metallurgist, the Duff Manufacturing Co.

IN the present day of increasing demands of quality and service upon practically every manufactured article, with all manner of searching tests, such as impact, drop, fatigue, abrasion, etc., former standards are daily going by the boards. The man charged with the responsibility of designing and specifying materials often has little practical data upon which to rely, as, all too frequently, published figures are made on the basis of specially selected materials for various tests. With the purpose of obtaining figures of practical value for use in every-day manufacture, the present series of tests has been made on the comparative heat-treatments of drop forgings and steel castings, as heat-treatment is a necessary operation in the development of steel to withstand the demands of the present day.

The heat-treatment of steel, as is well known, is a process of solution in the solid form of its various constituents, and the redepositing of these ingredients in a more refined state. This solution, as just stated, takes place in the solid state and it is obvious, therefore, that the original size and condition of the constituents of the steel will play a large part in the readiness with which they will respond to this procedure. Fig. 1 shows the structure of a typical steel casting just as the metal solidifies. This form is typical of all crystalline materials after solidification and can be closely compared to the frosting on a window in the winter time. It is the purpose of heat-treatment to break this structure up and to equalize the ingredients throughout the entire mass. The first step in this procedure is annealing. Fig. 2 shows a typical annealed structure of a steel casting. Fig. 3 represents the structure of a forging as it comes from the hammer. The effects of heat treatment on these two materials of approximately the same composition were studied and the results noted and tabulated as follows:

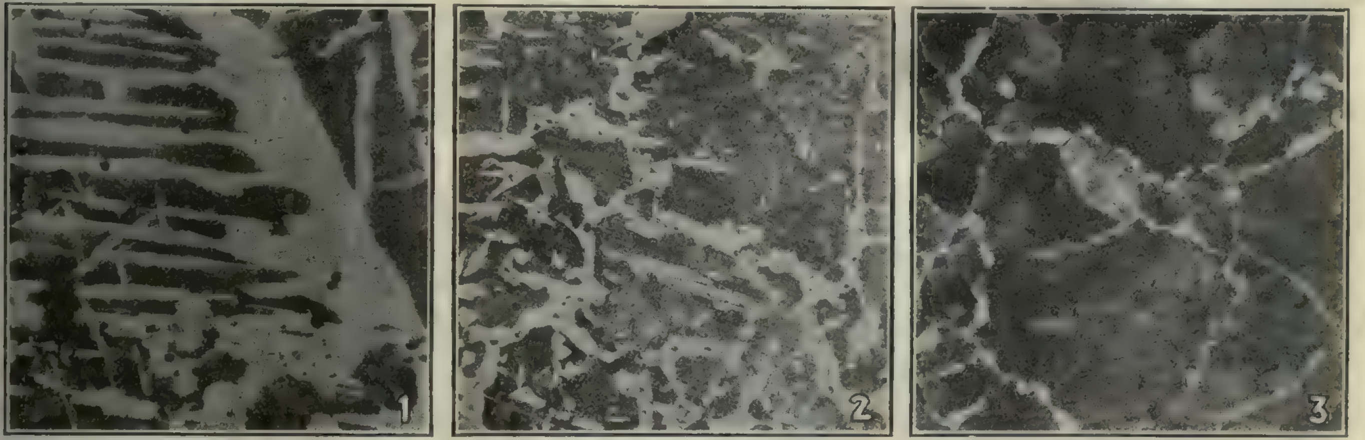
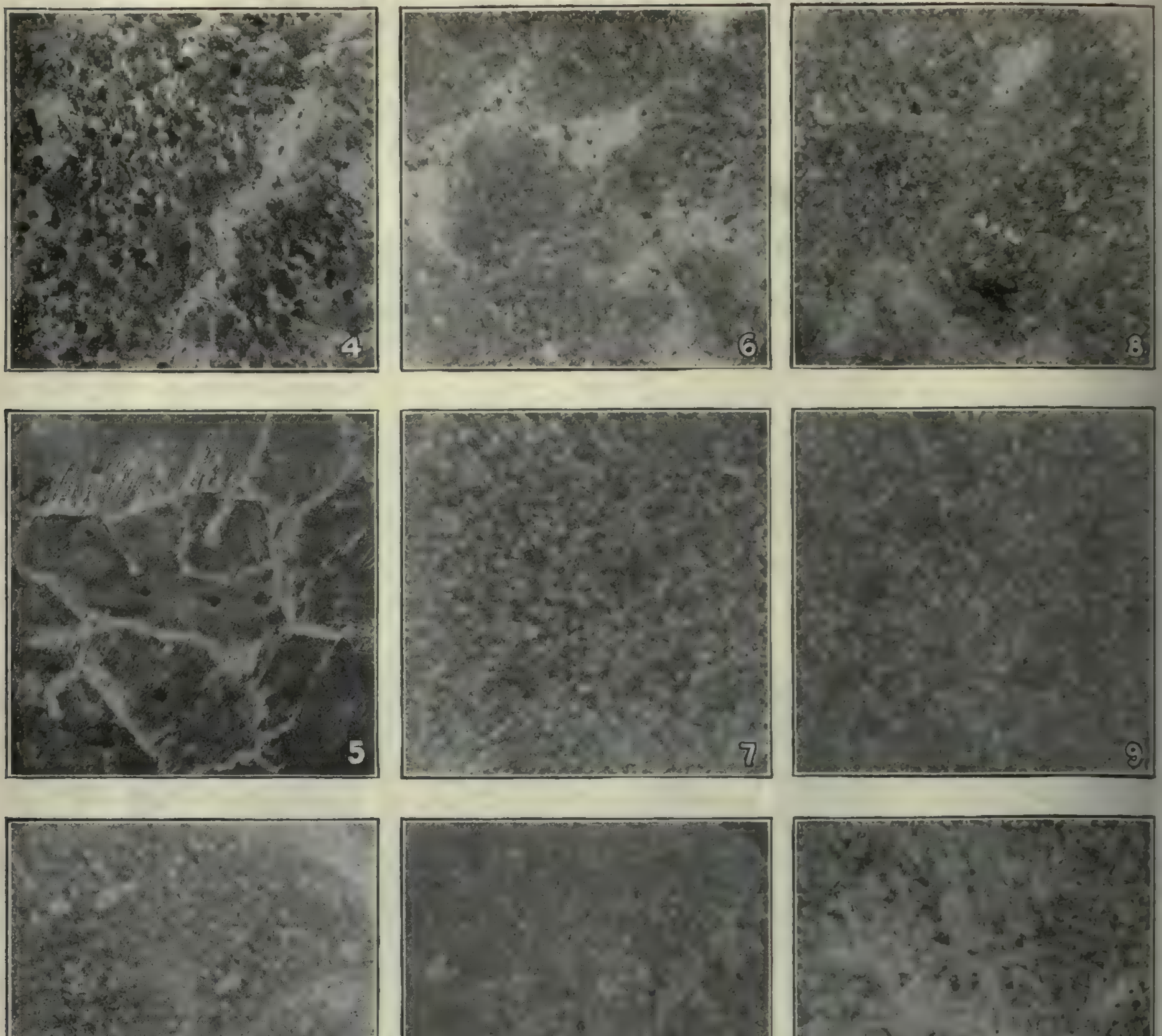


FIG. 1. CROSS-SECTION OF STEEL CASTING (MAGNIFIED 100 DIAMETERS). FIG. 2. CAST-STEEL AFTER ANNEALING. FIG. 3. CROSS-SECTION OF STEEL FORGING

Samples ¾ in. in diameter by 12 in. long were prepared from castings and forgings of nearly the same composition, the material being taken at random from stock-manufactured articles on hand. In each case, the original casting or forging was taken as near as possible the size of the test bar. Thus, the casting was ⅞ in. thick and the forging 1 in. thick. Electric steel castings, annealed, were used and the forgings were unannealed. The compositions were as follows:

	C.	Mn.	P.	S.
Casting	0.45	0.69	0.044	0.040
Forging	0.377	0.62	0.034	0.043

One casting test bar and one forging test bar were then placed side by side in a standard heat-treating furnace, approximately 2½ ft. square by 3½ ft. deep, thoroughly soaked out at 1,550 deg. F. being accurately controlled as to temperature by a Leeds & Northrup recording potentiometer, the thermo-couple being in contact with the bars. The first pair of bars was left in the furnace 5 min. and then quenched in oil. The next pair of bars was then put in the furnace, left for 10 minutes and quenched. Following these, a pair was put in for 15 min. and so on down the list shown in

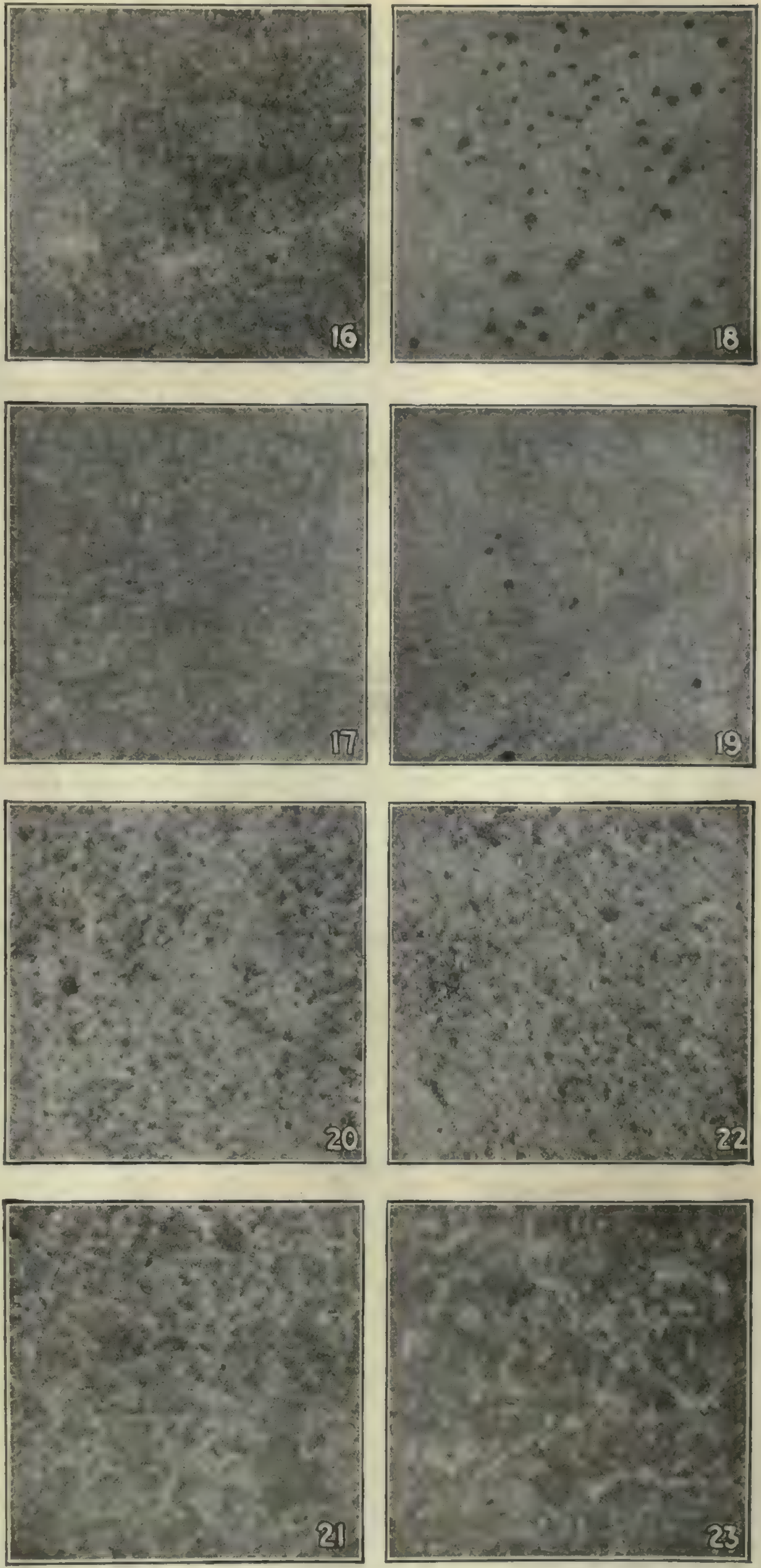


FIGS. 4 TO 15. STRUCTURE OF STEEL CASTINGS AND FORGINGS AT VARIOUS STAGES OF HEAT-TREATMENT

Table 1, up to 5 hr. in the furnace. Specimens from the bars were then examined under a microscope for the results of these treatments.

The bars were cut to standard 0.505-in. tensile test bars and 1 cm. square Charpy impact test bars and tested. A comparison of the photographs, Figs. 4 to 23 inclusive, which were taken of the central portion of each bar, shows more clearly the great difficulty in breaking up the "pine tree" structure formed during solidification of the steel casting, when only heat-treating can be resorted to for this purpose. At the end of 5 min. it is seen that little or no change has occurred in either case. Ten min., however, has proved ample time in which to completely refine the forging structure and to make a slight improvement in the casting. Inreasing the time produces little further effect in the forging up to 45 min., while the casting is seen o be progressively refined. From 45 min. on, the structure of the forging becomes increasingly oarsened while the casting beomes more and more uniform in ts structure.

Summing up, it is thus seen that he forging is refined in 15 min. o a higher degree than the castng is in 5 hr., or in twenty times he length of time. The practical neaning of this is brought out learly in the results of the physcal tests shown in Table I, and vhich have been plotted in curves as shown in Figs. 24, 25 and 26. Although the carbon content of the orging is seven points less than hat of the casting, it is seen hat the physical properties of ensile strength, elastic limit, longation, reduction in area and mpact are higher in nearly every ase for the forging. The Brinel hardness, however, is found o be higher in general for the astings. The very great difference n toughness, as shown by the reuction in area and elongation, is f particular importance. It should e observed that for the forgings, he maximum value in each case s reached after but a short time n the furnace, the later falling ff being due to the increasing rain size, as shown in the photoraphs. This is especially evident n the impact tests. On the other and, further heating is found to mprove the castings to some xtent, due, of course, to the



FIGS. 16 TO 23. STRUCTURE OF STEEL CASTINGS AND FORGINGS AT VARIOUS STAGES OF HEAT-TREATMENT

improvement resulting in the structure by equalizing the various constituents. No attempt has been made to draw a smooth line curve through the values obtained for tensile strength of the castings, as it is felt a curve taking in all of the actual values gives a more accurate idea of what may be expected in practical work from material of this kind, as it is subject to so many defects that uniform results from it are almost impossible to obtain.

TESTS ON GUN PARTS

Additional data upon the resistance of steel castings to heat-treatment are found in a paper recently published by Frederico Giolitti,* describing results obtained during the war by Gio Ansaldo & Co., the "Krupps of Italy," with the treatments found to be necessary on gun parts made of cast steel. The following are two such treatments described:

(1) Heat to 1,600 deg. F., cool slowly, consuming 36 hr.
Reheat to 1,520 deg. F., cool slowly, consuming 10 hr.

Heat to 2,010 deg. F., hold at this temperature 14 hr.; water quench.
(2) Reheat to 1,560 deg. F., hold at this temperature 3 hr.; water quench.
Reheat to 1,200 deg. F., hold at this temperature 2 hr.; water quench.

Figures are given to show that short treatments, such as are made for forgings, were entirely inadequate for castings, one such described being "Heat to 1,650 deg. F., hold 45 min., cool slowly." Comparisons made in the work of the Ansaldo company on the relative merits of cast and forged steel of the following compositions:

Carbon 0.21; manganese 0.94; silicon 0.19; phosphorous 0.07; sulphur 0.03; showed as follows:

Casting 77,700 lb. tensile; 53,000 lb. elastic; 27 per cent elongation; 42 per cent reduction in area.
Forging 80,000 lb. tensile; 55,800 lb. elastic; 32 per cent elongation; 60 per cent reduction in area.

The large increase in the reduction in area and elongation are especially important. Charpy impact tests made on the same steels showed a value of 8.13 for the castings and 17.12 for the forging. In other words, Giolitti found that treatments requiring from one to two days, including the heating time, were necessary on steel castings to produce results more or less comparable to those obtained from forgings treated in one to two hours.

Points of especial importance to be noticed are: (1) The great superiority of forgings in resistance to shock, as shown by the Charpy impact values; (2) the much greater ductility found in the forging, as indicated by the elongation and reduction in area; (3) the fact that the Brinnel hardness test is not a reliable indication of these properties in the steel.

In order to understand why this large divergence in the properties of products of approximately the same composition should occur, a brief summary of the methods of manufacture involved in each case is necessary.

Inasmuch as both forms of steel start in the steel furnace, the basic procedure is the same in each case up to a certain point, that is, pig iron and scrap are melted and refined by means of one of the several standard methods, such as open hearth, converter, and electric furnaces. Up to the point of pouring the metal from the ladle, therefore, the procedure is, generally speaking, the same, but from thereon wide differences are brought in.

THE SMALL CASTING

In the case of the small casting, the metal is run into sand molds where it solidifies to the final form of the desired part. This solidification being more or less rapid, depending on the size and shape of the part to be made, various strains are set up in the cooling due to the variation in shrinkage of portions of different sections in the casting. In some cases, especially in larger castings, these strains are sufficient to crack the casting. While running into and filling the mold, the hot metal, at a temperature of some 3,300 deg. F., cuts away portions of the runner and the mold itself, both being of sand. Most of this sand then becomes trapped in the solidifying metal, as it is unable to escape to the risers on account of the rapid freezing of such a small amount of metal, and also being prevented from escaping by being retained by projections of the contour of the mold. Rapid solidification from this point of view is thus a disadvantage, but, on the other hand, it diminishes segregation as the various elements, *i.e.* carbon, sulphur, phosphorous, etc., do not have time to travel to other portions of the molten mass, following a lengthy process of progressive solidification. However, with small castings considerable time is

TABLE I

Fig. No.	Material	Treatment	In Furnace	Brinnel	Tensile, Lb. in 2 In.	Elastic, Lb. in 2 In.	Elong., per Cent	Red. Area, per Cent	Remarks	Charpy Impact Ft.-Lb. in 2 In
	Casting	Annealed	....	179	80,000	36,000	5.5	6.6	Straight fracture	36
	Forging	Untreated	....	174	86,275	42,000	24.5	50.6	½ cup	135
4	Casting	1,550° F.	5	183	90,000	45,000	10.5	10.4	Straight fracture	58
5	Forging	Oil quench.	min.	187	89,150	45,000	26.0	50.3	½ cup	52
6	Casting	1,550° F.	10	302	115,400	60,000	0.03	4.3	Straight across	67
7	Forging	Oil quench.	min.	286	116,125	72,500	22.5	53.5	½ cup	131
8	Casting	1550° F.	15	248	77,250	.....	0.0	4.7	Jagged	80
9	Forging	Oil quench.	min.	269	117,900	55,000	21.5	54.9	½ cup	138
10	Casting	1550° F.	20	286	81,600	62,000	.....	.....	....	75
11	Forging	Oil quench.	min.	269	117,550	57,500	18.5	55.1	¾ cup	68
12	Casting	1550° F.	30	286	73,875	45,000	0.05	3.5	Jagged	62
13	Forging	Oil quench.	min.	286	119,675	70,000	19.0	52.5	Full cup	86
14	Casting	1550° F.	45	286	115,350	68,500	.....	.....	Straight fracture	79
15	Forging	Oil quench.	min.	255	112,230	49,320	18.5	54.05	¾ cup	155
16	Casting	1550° F.	1	269	99,250	77,500	0.02	3.14	Irregular	88
17	Forging	Oil quench.	hr.	255	112,275	69,000	18.0	48.6	½ cup	98
18	Casting	1550° F.	1½	269	56,500	49,000	0.02	4.7	Defective	86
19	Forging	Oil quench.	hr.	255	108,700	70,000	18.5	53.5	½ cup	104
20	Casting	1550° F.	3	269	83,750	75,000	0.02	3.94	Jagged fracture	95
21	Forging	Oil quench.	hr.	255	110,725	60,000	20.0	54.4	½ cup	81
22	Casting	1550° F.	5	255	118,350	51,500	.....	.....	Straight fracture	90
23	Forging	Oil quench.	hr.	255	109,150	55,000	18.5	47.2	½ cup	30

RESULTS OF TESTS AT DIFFERENT STAGES OF HEAT-TREATMENT

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*"Steel Castings of High Strength and Toughness," by Frederico Giolitti, *Chemical and Metallurgical Engineering,* vol. 24, p. 113, Jan. 19, 1921.

necessary to pour a complete heat from the ladle, with the result that segregation occurs in the ladle itself, so that the first and last castings of the same heat will vary in composition to a considerable extent. Occasionally this is reduced by pouring from two ladles simultaneously. During solidification, the steel, as in general of all solidifying materials, assumes the characteristic "pine tree" or dendritic structure illustrated in Fig. 1, which also shows the prevalence of slag particles above referred to.

NECESSITY OF HEAT-TREATMENT

As the steel is now in its final form, no further operation of a mechanical nature can be employed to break up this extremely coarse and brittle structure and, therefore, heat-treatment is the only recouse for refinement and this method must carry the entire burden of fitting the casting for the service it is to be called upon to perform. Steel made for small castings by the electric furnace process is probably the best made at the present time, inasmuch as higher temperatures are obtained, so that a larger degree of impurities are burned out resulting in a more nearly clean and sound steel, and also as the metal is hotter at the time of pouring a somewhat longer length of time is required in solidifying, which allows the entrapped slag and sand a greater opportunity to escape. High temperatures, on the other hand, give rise to larger crystals in solidifying and increase the difficulty in breaking up the structure in the subsequent annealing and heat-treating. Therefore, as electric steel castings are probably better than others, only such castings have been considered in the present examination for physical tests, photographs, etc.

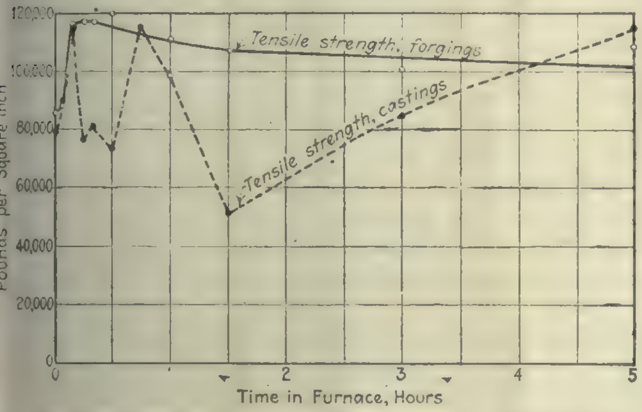


FIG. 24. COMPARISON OF TENSILE STRENGTHS

PROPERTIES OF STEEL INGOTS

Turning now to the procedure involved with drop forgings and taking up the thread where the metal is in the ladle ready to pour, various differences are found which effect, in a great degree, the properties of the final product. Instead of being poured into small sand molds with the undesirable effects of slag and sand inclusions, gas pockets, etc., as described above, the metal is run into large iron ingot molds where it solidifies comparatively slowly, allowing the slag time to rise to the top of the ingot and leaving the ingot body relatively clean. This is further aided in good steel practice by the use of "hot tops" made of fire clay on the top of the mold, as the "top," being a heat insulator, keeps the upper portion of the steel molten for a longer time and allows the slag greater opportunity to escape and also serves as a reservoir of molten metal to fill the cooling ingot, so as to reduce the tendency to form pipes and shrinkage holes. As the metal is thus poured rapidly into large molds, little difference due to segregation will be found between the first and last ingots, as found in the case of the castings. On the other hand, as the metal cools slowly in the large ingots, segregation is found in the ingot itself and the slow cooling also gives rise to the formation of larger crystals in solidifying than in the case of the small, more rapidly-freezing castings.

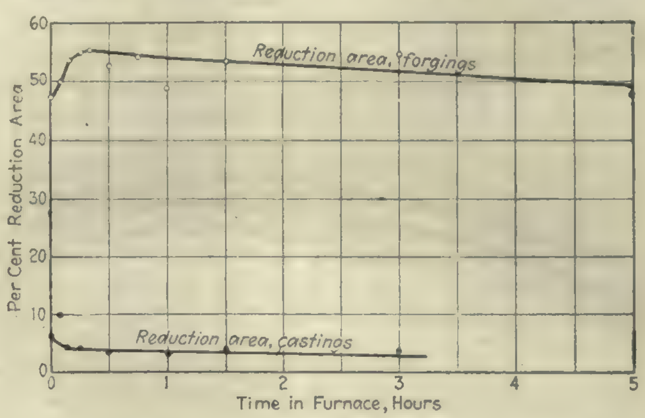


FIG. 25. COMPARISON OF AREA REDUCTION

When cooled sufficiently, the ingot is removed to the "soaking pit" where it is heated evenly throughout and then rolled out into bars of the desired size and shape. This rolling breaks up, in a large measure, the massive crystal forms of the ingot, which is known as "ingotism." The structure produced by the rolls is one in which the crystals are well broken up and elongated. The bars are then cut into billets, reheated to the forging heat and shaped between dies in the drop hammer. This vigorous working of the metal removes the last traces of ingotism, the result being shown in Fig. 3. The steel is now in a condition which readily responds to the simplest heat-treatment. Sometimes a large grain size may be found from overheating during forging, but as this grain is the result of a secondary crystallization, that is, it has not been formed from the primary solidifying of the metal, it is easily broken up on reheating.

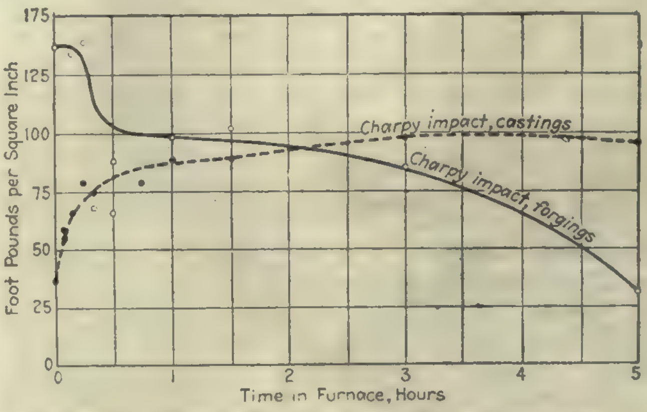


FIG. 26. COMPARISON OF RESULTS OF CHARPY IMPACT TEST

Under the discussion of steel castings, it has been explained that there is a tendency for the inclusion of slag, sand, gases, etc., in the steel while solidifying. As has been mentioned, the use of highly heated electric steel diminishes this difficulty. Another method is by varying the composition of the steel. This thus places the composition of the steel subject to variation of analysis, arising from the size and shaps of the article, disregarding the strength and serviceable qualities desired. Forgings, on the other hand, are made of steel closely guarded as to its chemical composition on a basis of quality only. The compositions generally used at the present are covered by the standard S. A. E. specifications. Thus, for castings, the only specifications given by the S. A. E. are sulphur and phosphorus under 0.05 per cent; for forging stock, however, the carbon and manganese are also closely regulated and a lower limit of 0.045 per cent is given for phosphorus than the 0.05 per cent in the case of the casting. Generally speaking, a steel casting is a "steel casting," but a forging must always be of a definite specified composition. The following analyses have been taken at random from a number of various forgings and castings and in each case from different makers in order to arrive at a general idea of the run of such material.

Castings

	Carbon	Manganese	Phosphorous	Sulphur	Silicon
Converter steel..	0.12	0.41	0.046	0.092	0.32
Electric steel....	0.43	0.59	0.037	0.075	0.30
Open hearth steel	0.14	0.50	0.059	0.117	0.33

Forgings

Carbon	Manganese	Phosphorous	Sulphur
0.14	0.47	0.026	0.031
0.39	0.36	0.013	0.034
0.193	0.48	0.013	0.036
0.184	0.40	0.010	0.038

As stated, each analysis is from a different manufacturer and, as the sources extend all the way from New England to the Middle West, the figures are fairly representative of national practice. An examination shows sulphur and phosphorus, the two worst enemies of good steel, to be on an average twice as high in castings as in forgings.

One of the largest fields in the use of steel forgings includes the use of alloy steels, heat-treated, which makes possible articles of very light weight and small cross-section. The use of alloys in steel carries with it the necessity of heat-treatment, as it is only through heat-treatment that the greatly increased strength produced by the alloys is realized, thus warranting the additional expense of the alloying material. Alloys, however, generally greatly increase the dangers of cracking during treatment, and as castings are more liable to fracture, due to the strains in them and to the very large grain size of the crystals, the benefits to be derived from alloy steels for casting purposes are more limited than in the case of the forging with its thoroughly broken up and well knit structure.

It is thus seen that castings present a very difficult problem indeed in heat-treating to obtain ductility, uniformity and resistance to shock. Forgings, on the other hand, produce these qualities with very simple heat-treatments. Castings are, of course, also less desirable than drop forgings on account of their well known tendency to contain blow holes and sand pits, and to their variance in size and shape. Castings have the distinct advantage of application to practically all designs, whereas forgings are largely limited to simple shapes.

Freight Rates Bother You?

A man from the coast came in to see us yesterday. He says that the Northwest cannot sell its lumber in the East because the freight rate is too high—the door is closed to them.

A man from the South was in last week. He said the South could not profitably ship its products to the West because the freight rate was too heavy—and they weren't shipping.

The area of the United States is over 3,000,000 square miles and the railroad mileage is something over 250,000 miles. The familiar map with its resources carefully marked thereon remains the same. BUT you will have to think of the distribution of those resources in new terms before very long if the present charges for freight remain in force.

Water borne freight from South America can handle grains, hides and similar competitive products into the United States cheaper than the railroads can haul such things across the country. Western fruit is not found in the Eastern market because people cannot afford to pay for it. Temporarily, that is a blessing to the Southern fruits but in the long run some other item will enter in and equalize the gain.

New England can now afford to raise grains for its own use, for the freight rate boosts the price of the fruit of the central western fields up.

Consider what is happening to your own product; are you finding that increased freight rates are making a difference in your distribution? Are you taking any means to express the opinion of yourself and your associates in this matter?—*Helix* (Greenfield Tap and Die Corporation).

Turning V-Grooves

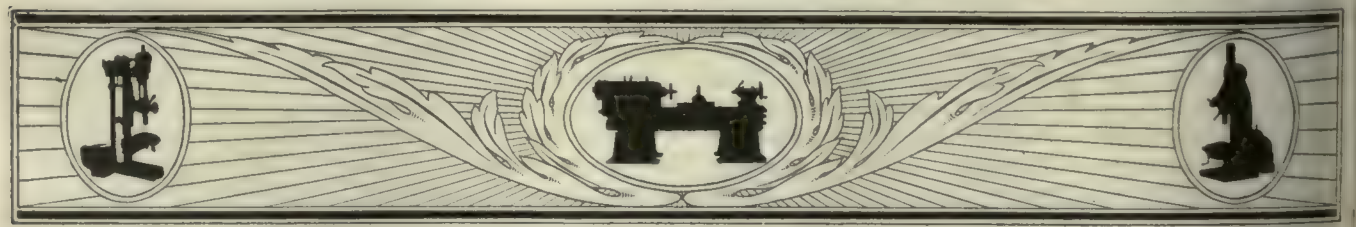
By E. C. Gifford

We had a large number of V-grooved malleable iron fan pulleys to make. Perhaps our experience in machining them may help some reader.

A high-speed tool was forged to form the V-groove and ground with 6-deg. clearance on each side and flat on the top face.

Upon trial, it was found that the cutting edge would not hold up, and the finish obtained on the work was poor. The chips crowded and caused the tool edges to give way.

As an experiment, the tool was hollow ground on top. This gave a keener edge and one which would curl the chips sufficiently to eliminate crowding. The tool life was thus increased many fold and the finish was quite satisfactory in quality.



The Economics of Production

IV. CAUSES OF CHANGES IN DEMAND

BY PROF. D. A. MCCABE, PH.D.

IT HAS BEEN pointed out in previous articles that the kind and quantity of production depends upon demand. Producers are always trying to anticipate the demands of the public in their selection of the kind of goods they produce and to keep the volume of their production from exceeding the quantity that can be sold at a profitable price.

With a stationary demand it might not be too difficult to work out what would be the right quantity of each kind of goods to produce—that is, the right quantity to meet the demand at a reasonably profitable price. But with a changing demand, we have changes in the quantity that bring the reasonably profitable price, and, naturally enough, changes in the quantity produced. Changes in the volume of production may mean so much in the way of changes in profits, in wages, in unemployment, and even in the conditions of human living, that we are all anxious to learn as much as we can of the causes of the changes in demand that bring about these frequent fluctuations in the volume of production.

The fundamental factor affecting the volume of current earnings is the volume of production. We are speaking here of the earnings of all engaged in business. Employers, wage-earners, middlemen, transportation men, farmers, and all others who derive income of any kind from current operations make up the public in this sense. And the volume of earnings of this public as a whole increases when the volume of production increases and decreases when the volume of production falls. If we don't produce and sell we cannot demand; we have too little to demand with. And when we stop demanding from the others they in turn have to cut down their demands, because their production is reduced.

In speaking of a change in demand we may be speaking of a change in the demand for a particular commodity, as for example, automobiles, or of a change in the total volume of demand for commodities, such as we experienced in 1920. Changes in the demand for particular goods are occurring all the time, usually because of some development that affects particularly the commodity in question as apart from commodities generally. Changes in fashion and the introduction of new articles, as for example, a safety razor, that suits the public better than the old one, are continually lowering the demand for one commodity and increasing the demand for another.

Changes of this sort affect very seriously the profits of producers and the employment of men in particular plants. They have not, however, the general consequences that follow from large changes in the demand for commodities in the aggregate. It is to changes of this latter class that we shall devote our attention.

General increases or decreases in the demand for goods proceed as a rule from changes in the amount of money the public is earning. When the public is making more money it ordinarily spends more. It may save more but it also spends more. When it is earning less it, of necessity, reduces its offers for goods. Some people in such times purchase from their savings; nevertheless the total volume of expenditures is reduced. Saving helps somewhat to even up the general demand for goods between the period of good earnings and the period of reduced earnings, but it has not yet been carried far enough to prevent a decline in the general demand for goods when current earnings fall off.

It is true that the public may reduce its purchases when there has been no reduction in its earnings. It may feel that prices for some goods are unreasonably high and resort to a temporary "boycott" or "buyers' strike" in order to force them down. The danger in this is that the reduced demand which begins as a matter of choice may develop into a reduction in demand which is forced by reduced earning power. The reasons for this will appear below. For the moment it is enough to repeat that for the most part the demand for goods in the aggregate rises and falls with the volume of earnings.

The fundamental factor affecting the volume of current earnings is the volume of production. We are speaking here of the earnings of all engaged in business. Employers, wage-earners, middlemen, transportation men, farmers, and all others who derive income of any kind from current operations make up the public in this sense. And the volume of earnings of this public as a whole increases when the volume of production increases and decreases when the volume of production falls. The aggregate money earnings of the public may be increased or decreased independently of the volume of production through an increase or decrease in the amount of money in the country. The increase in money was an important factor from 1916 to 1919, for example. But the most important single factor affecting the total earnings of the public in any one season, and the one subject to the sharpest changes, is the volume of production.

It may seem confusing to say that production depends upon anticipated demand and then to say that demand depends upon production. But it is true. It is one of the perplexing facts of the complicated industrial system under which we work and live. It is due to the fact that we produce for others and demand from others. If each family produced only for its own consumption and therefore consumed only what it produced for itself, it would be quite clear that its consumption would be limited by its own production. Under our present system it is still true that we are both producers and consumers, but our production is for others and our capacity to demand goods from others for *our* consumption depends upon our producing goods that they will buy from us. If we don't produce and sell we cannot demand; we have too little to demand with. And when we stop demanding from the others they in turn have to cut down *their* demands because *their* production is reduced.

Let us assume that the producers in a given line, say automobiles, have to cut down their production. It may be because the manufacturers cannot get the necessary credit. It may be because there has been a big falling off in the foreign demand. It may be because there have been big crop failures and the farmers and all the business people in agricultural sections whose business prosperity depends upon the prosperity of the farmers have to cut down their demands and have begun by cutting down their demand for automobiles. It is clear that all in the automobile industry and accessory industries and all the automobile dealers will have less earnings. They will have to cut down their demands for the goods of others, for tires, for supplies, for machine tools.

All those producers who have been producing to meet the demand of those consumers engaged in the automobile business will now be faced with a decline in the demand for *their* goods. If they meet it by reducing *their* production, employment and earnings will be still further reduced and the demand for goods in general will have to suffer another reduction. And so it goes, each decline in production causing a reduction in demand and this in turn causing another decline in production until a halt is called somewhere by demanders or producers and the wheel is started spinning in the other direction.

A look at the more cheerful side shows the same connection between demand and production. When producers enlarge their operations the prospects are bright for an increase in the demand for goods in general. The increase in employment in those industries and the increase in the volume of business handled by the distributors of those lines adds to the buying capacity of those groups. They accordingly increase their demand for goods and this stimulates other producers to increase *their* production, with the result that still more people are more actively engaged and earning more money with which to increase still further the demand for goods in general. From necessities the increasing demand advances to luxuries and from finished goods to the machinery, tools, supplies and raw materials necessary for their production. It sweeps on from shoes to touring cars and from clothes to looms, and every upward move in production leads to a better market for products until something happens to check the upward swing.

This check may be a sudden falling off in demand, or it may be an enforced stoppage of production. Whether it be the one or the other that drops first, if one goes down the other goes down with it. Demand cannot long hold its place after production is reduced, nor will production maintain its pace unslackened after demand has dropped back.

The adjustment of production to a general decline in demand is a difficult and frequently a tardy process. It involves losses to many and usually it does not take place without much disagreement and much trying to avoid the inevitable. It will be the subject of the next article.

A Thought Along the Right Line

The caption furnishes sufficient comment on the following letter sent out to the trade by J. E. Kelley, general sales manager of the Simonds Manufacturing Co. of Fitchburg, Mass.:

"For the last twelve months we have been liquidating. We have all been wearing out our old shoes, our old clothes, patching up our tools, reducing our stocks and getting along without purchasing, excepting just the various essentials absolutely necessary to carry along our very much depleted business. We have cut out extravagance in so far as purchasing materials is concerned, but statistics prove that we have added another far greater piece of extravagance to our list than any heretofore indulged in, and that is the extravagance of wasted time. We have reduced our energies more in proportion than we have reduced our expenses, and most of us find ourselves today wastefully waiting and watching for the gold nuggets to come to us. In other words, we have stopped hustling.

"It was the writer's personal privilege to visit Japan shortly after the Russian-Japanese War, going as far north as the island of Hokkaido and as far south as Nagasaki, and at that time all Japan had been advised by circular letter from the Emperor to curtail all expenditures possible; to get along with as little as possible. They were certainly doing that. People were without shoes in the coldest part of winter and were using ordinary sacking to wrap their feet in. They were without knives and forks to eat with, without chairs to sit on and with hardly any of the ordinary comforts of life. They were getting along without much of any expense, but they were not producing. They were undergoing hardships to themselves and were not profiting by it. They had allowed the idea of curtailment and penury to supplant action and work.

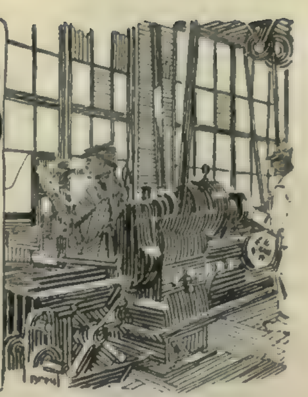
"As I view the last twelve months here, I can see a considerable comparison to that of Japan after the Russian-Japanese War. We can get along on very little if we force ourselves to do so, but what do we gain by it? The world needs products and all kinds of products. In our opinion the best thing for all of us to do is to take our losses and start in to work and build them up again; mark the prices of our goods down and cut the price of labor down, and insist on more hours work from every employee and more active work from all salaried employees. Start booming activity and by the reduction of prices enable those working for a lower wage to procure as much, or nearly as much, as during the war period.

"We have reduced the price of saws, in fact of all the material which we manufacture, to a point which we believe is less than the present cost of manufacture; and we hope by doing this to so stimulate business that the increased demand will let us operate at a profit.

"We ask you if you won't take the idea contained in this letter and send out to your trade something along a similar line creating a chain of thought that will help toward getting busy, for that is the one thing that will change present conditions."

MODERN PRODUCTION METHODS

By
W R. Basset
of
Miller, Franklin, Basset & Co.



XXI. Graphic Methods of Control

When To Use Graphic Charts and When Not To—Proper Use of Charts Saves Time—Master Charts

GRAPHIC charts sometimes affect an executive as does golf, in that, after first scorning the fad, he is in danger of taking it up so enthusiastically hat he finds but little time left for his business.

Charts may or may not be inexpensive, yet valuable ids to managing. It is undoubtedly true that a picture s more effective than a thousand vords of description—to some men. Business facts are sometimes more uickly grasped in the form of graphs han as columns of figures. But that s not always true; I have seen most omplex, hard to read graphs drawn p to present simple and sometimes nimportant facts.

For example, one of my clients etermined to have his expense anal- ses drawn up graphically. Opposite ach item he drew a horizontal line hose length indicated the value of the normal figure. Jnder this a red line was drawn to show the actual mount of that item for the month. At a glance the elative length of the lines showed whether the actual xpenses were greater or less than the normal, and pproximately how much. But the expense analysis hich has been reproduced in this series of articles ives the normal and actual expense in the exact figures. ince they are in parallel columns and require no fur- ner analysis to tell their story they are much easier read than a graph and more accurate. To graph them kes nearly half the time of a clerk.

This is a typical example of the kind of report *not* chart. At the other extreme is the graphic control art used in planning production which is shown in ig. 33, Article VII. Here the problem was to show hours the progress of a large number of different arts from machine to machine. These figures have to changed from day to day to reflect the actual per- rmance of the factory. Even though it might be pos- ble to draw up a form on which the information could shown, the information in other than graphic form ould be unintelligible and the clerical work would be tremendous that the data would be out of date before was compiled; and the mere physical bulk of the ntrol mechanism would be enormous. A single clerk, wever, can keep the charts up to the minute, and the ture plans for, and the present condition of production are easily grasped. For such a purpose the graphical chart is justified. When figures are more easily read than curves, figures should be used. For the borderline cases, careful consideration should precede the decision to use graphs. Ordinarily, I believe that statistics are more easily grasped as figures than as graphs. But graphs are undeniably spectacular and poor ones often find their way into the routine of a business because of a child-like love of pretty figures which most of us have.

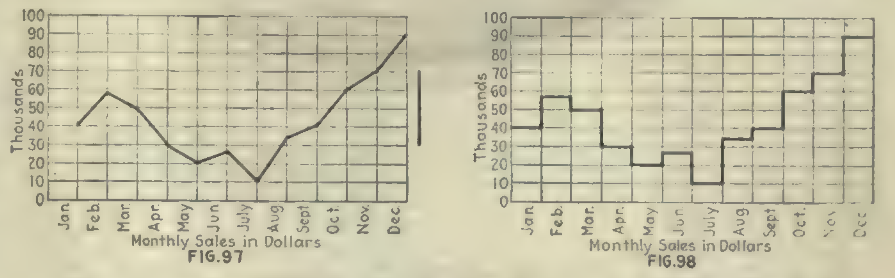


FIG. 97. MISLEADING SALES CHART. FIG. 98. A BETTER CHART FOR MONTHLY SALES

There is a danger inherent in certain types of graphic curves that must be guarded against. Take the chart shown in Fig. 97. To my mind, this information might much better be shown in figures, or in the graphical form shown in Fig. 98. The reason is this: The points which determine the curve are located on the last day of the month and are the total sales for the month. But I find that most men unconsciously fall into the habit of considering that they can determine the sales for intermediate periods from the curve. For instance, they will assume that the sales for the first half of September are $50,000 because the curve on Sept. 15 is at $50,000. Actually on such a chart the month does not cover the vertical space, but simply the vertical line. How ridiculous such a proceeding is, is shown when one tries to interpolate when sales are falling off, for in March it would appear that more goods were sold up to the 15th than for the full month. The temptation to make this error does not exist if the information is presented as in Fig. 98.

Mathematical curves are, of course, drawn so that any intermediate figures may be determined. Most business curves are not mathematical; they are purely statistical.

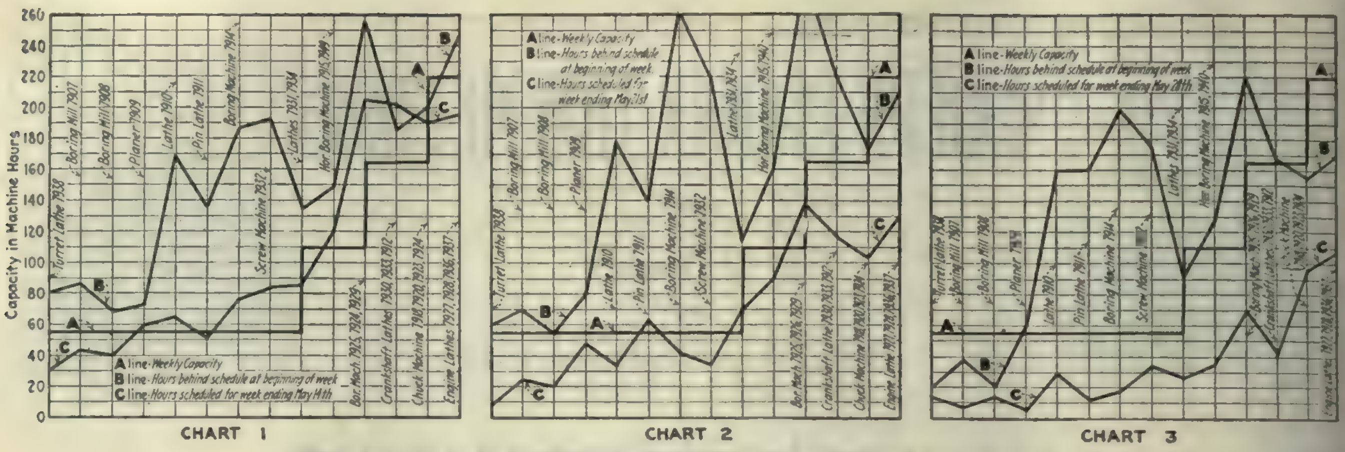


CHART 1

CHART 2

CHART 3

FIG. 99. CHARTS SHOWING ACTIVITY OF MACHINES BY WEEKS

To my mind, the most valuable charts are those which enable the executive to forecast conditions. The three charts shown in Fig. 99 are for consecutive weeks. They show the exact activity of the machines in a department, and give information on which to determine whether or not additional work for those machines is needed or can be taken. In that way, they serve to guide the sales department.

By showing the amount of work ahead, they guide the labor department by making known the need for additional men, or the possibility of dropping a few, weeks ahead. One man keeps these charts up to date in about three hours a week.

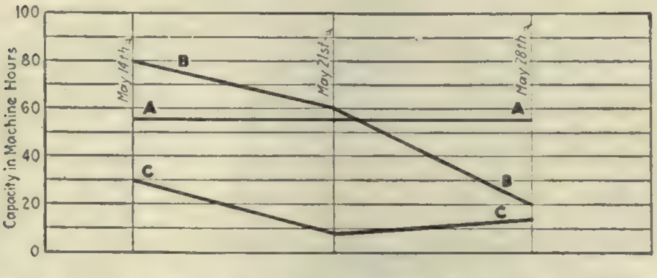


FIG. 100. CHART SHOWING ACTIVITY IN HOURS AHEAD OR BEHIND WEEKLY SCHEDULE

They show the weak spots in unmistakable form, for it should be borne in mind that owing to the balancing of production by the planning department, any machines behind schedule mean that certain parts will be lacking when the assembly floor is reached and consequently some parts will accumulate on the assembly floor waiting for others.

They also show the amount of work scheduled for the shop each week, in advance.

These particular charts show very clearly the decrease in work going into the plant due to the lack of new orders. These conditions were predicted from the charts and on the week following that for which Chart No. 3 was drawn, the working force was reduced and also the week was reduced from 55 to 44 hours.

It may be interesting to follow these charts in a little more detail; for example, Chart No. 1 shows through line "B" that the entire department is behind schedule anywhere from one to three weeks. Line "C" shows a healthy and well-balanced amount of work being sent into the shop.

Chart No. 2 shows a marked increase in some instances of work behind the schedule, notably machine No. 7914. This chart also shows a marked decrease in the amount of work going into the shop.

Chart No. 3 shows a decrease in work behind schedule, due in part to the small amount of new work scheduled for that week and also because machines No. 7914, 7925, 7926 and 7927 were worked overtime in an endeavor to balance production and allow the assembly floor to clean up its work, which resulted in cutting down the working hours of the factory.

These charts may be confusing to some, because the time element does not enter into any single chart, each chart being for a single week. Commonly, charts show time from left to right. Therefore, these charts might well be drawn a chart to a machine as in Fig. 100, plotting the activity in hours vertically and the time in weeks horizontally. The information would be shown as well—perhaps to some minds, better. I mention this alternative simply to show that usually information can be presented in graphs in several ways and it is up to the executive to decide which way he prefers.

A common fault is to draw too many curves on a single chart with the resultant crisscrossing of lines which makes the chart hard to read. If the curves are not related, draw but a single curve to a chart. If they are related and it is desired to see how one set of figures is affected by the movement of another set, it is best to reduce the two sets to a ratio and plot the ratio.

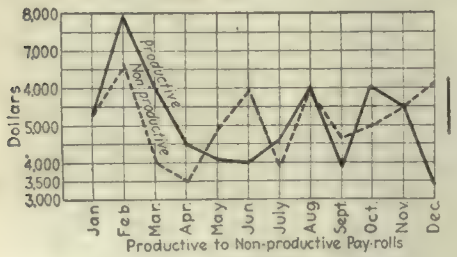


FIG. 101

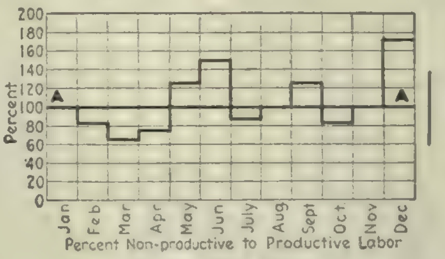


FIG. 102

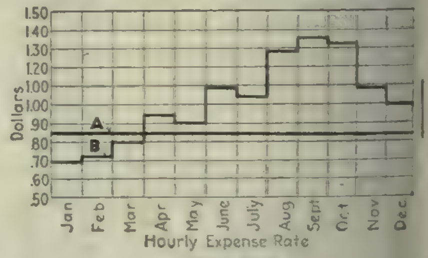


FIG. 103

FIG. 101. CHART OF PRODUCTIVE AND NON-PRODUCTIVE PAY ROLLS. FIG. 102. CHART SHOWING RATIO BETWEEN PAY ROLLS. FIG. 103. CHART OF HOURLY EXPENSE RATE

Take for an example the two charts, Figs. 101 and 102: It is often desirable to watch the amount of non-productive labor, lest it run unduly high for the amount of productive labor. Now, the productive and non-productive payrolls can be plotted month by month, as in Fig. 101, but the chart is hard to read because the lines crisscross. Then it requires what amounts to a mental calculation to determine whether at any time the productive payroll is rising too rapidly considering the amount of the non-productive. The information is given at a glance in Fig. 102 where the dollars and cents of each payroll are reduced to a single curve which is the ratio of the non-productive to the productive expressed in per cent.

Suppose that past experience showed that for this plant a normal ratio based on efficient manufacturing demanded that for each dollar of productive labor, a dollar of non-productive labor was required. The horizontal line *a-a* at the 100 per cent point shows this normal. Then monthly, as shown on this chart, or even weekly or daily, the actual ratio is plotted. So long as the actual ratio approximates the normal, conditions are satisfactory. But if the ratio rises far above 100 per cent, as for May and June, steps will be taken to lay off some of the non-producers.

This condition may be due to the plant activity falling off and failure of the foremen to reduce the non-productive force proportionately, or it may be caused by undue expansion of the non-productive force which nearly always occurs when supervision is lax. In the small plant, it may be sufficient to make one chart cover the entire factory; in larger plants it may be well to make such a chart for each department a main division.

Similar in appearance is the chart shown in Fig. 103, which shows the actual hourly overhead rate of a department as compared with the normal. The data from which the chart is drawn comes from the expense analysis for the department. The line *a-a* is the standard hourly rate—85c.—based on normal activity of the department. During the first three months of the year shown on the chart, the department was operating somewhat above normal activity and the hourly rate was therefore safely below normal. In April, new orders began to fall off, so steps were taken to reduce overhead with the resulting tendency back toward a normal rate as shown for May. Business, however, got steadily slacker, and the curve, by rising promptly, showed the tendency. Had radical cuts in overhead not been made, the curve would very likely have soared off the chart. As it was, it rose considerably until October, when, with new business coming in, the factory increased its activity and the hourly rate approached normal.

Such curves as the last two I have described, both of which show ratios and their tendencies, are to my mind among the most valuable an executive can get.

It is not uncommon to have a chart showing the state of collections from month to month. However, the mere rise and fall of the collection line does not give much of an indication as to how well customers are paying unless it is related to the amount of sales, and inasmuch as few businesses sell for cash, a chart on which there was a line for sales and another line for collections would not mean much. Therefore, it is best to draw a curve representing the ratio between collections and sales. If a business sells on thirty days' time, the business is obviously collecting this month for the sales made last month. Therefore a curve for such a business would consist of a ratio expressed in a per cent of this month's collections to last month's sales. If the terms of sale were sixty days, the ratio would be between this month's collections and month before last's sales. It is not necessary to reproduce a chart of this sort, for it can well be drawn in the same way as that shown in Fig. 103. Then, if the line rose from month to month, it would show that customers were taking more than the proper time which would indicate either laxity on the part of the collection department or a disturbing condition in the trade. In either event, it would indicate to the executive that some steps were necessary and it would not be difficult for him to decide which steps to take. It might even be well to chart a similar curve showing the ratio between the collections that were coming in on the discount date and those which were allowed to run to the full time.

There is one other type of chart different from any that have been discussed which I generally refer to as a master chart. The purpose of a chart of this kind is to provide a means by which the executive can make sure that he is keeping his working capital in balance. The working capital of a business consists of cash, raw materials, goods in process, finished goods and accounts receivable. The rate of capital turnover, and hence to a degree, the profits of the business, depend upon keeping the working capital properly balanced between these various forms. It may seem to many executives that it is unlikely that a business will have more cash on hand than it needs, but that is a condition which is not at all impossible. It is granted, however, that weaknesses in the manipulation of working capital are more apt to come through having too large a goods-in-process account, through over-buying raw materials when the sales department brings in large orders, or through under-buying caused by undue conservatism which may result in delays to production. It is also perfectly apparent that accounts receivable may be allowed to swell to undue proportions. The point is that it is possible in any business to determine the amount of money which should be represented in each of these forms of working capital for any condition of the business. By drawing graphs for each item on a chart with another graph showing unfilled orders on hand, the executive can check up the condition of his plant quickly. For example, he might receive a report showing a million dollars worth of unfilled orders, half a million dollars worth of raw material and three million dollars of goods in process. By referring to the chart which shows the ideal figures, he may find that for this amount of unfilled orders, three hundred thousand dollars worth of raw material and two million dollars worth of goods in process is the standard.

I am not showing a chart of this sort, for one that would do for one business would be nowhere nearly correct for another. Such a chart would have to be drawn after very careful consideration of what the ideal conditions of operation were for the individual business.

My whole purpose in this article has been, not to recommend any particular charts nor even to recommend the use of charts. It has been my purpose rather to suggest charts that may be of value and to indicate some of the wrong methods as well as the right ones in drawing up and using them. Graphic charts, like cost figures, do not in themselves make profits, but they often serve to point the way to wrong conditions. It is then up to the executive to right these conditions.

Characteristics of the Forged Milling Cutter

Methods of Manufacture—Results of Casting and Forging High-Speed Steel—Structure of Metal—Comparison of Bar Stock and Forged Steel

By WILLIAM G. CALKINS
Metallurgist, Detroit Twist Drill Co.

As a result of the rapid strides which have been made in the past few years in increasing shop efficiency and production, a demand has arisen for a superior grade of milling cutter; one which is able to withstand the highest rates of speed and feed without excessive deterioration, thereby removing metal at the lowest possible cost per unit.

The beneficial effect on steel conferred by the proper forging and mechanical working at correct temperatures is well known. It must be borne in mind, however, that the forging of high-speed steel is an operation requiring a high degree of experience and ability and the operation cannot be compared with the ordinary drop forging of low carbon alloy steels similar to those used in automobile construction.

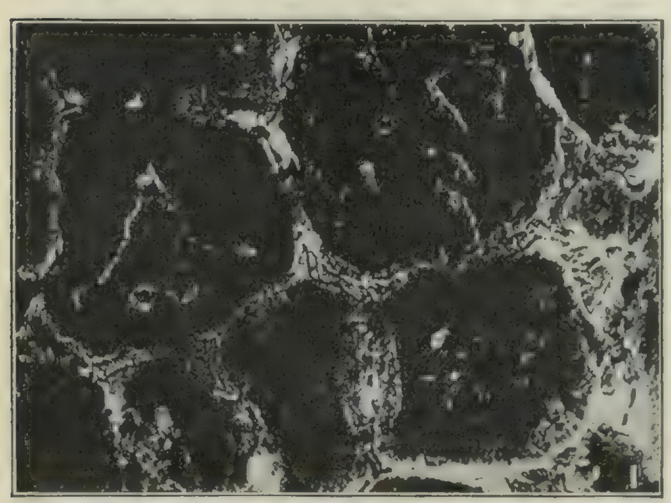


FIG. 1. MICROPHOTOGRAPH OF A HIGH-SPEED STEEL INGOT AS CAST (MAGNIFIED 250 DIAMETERS).

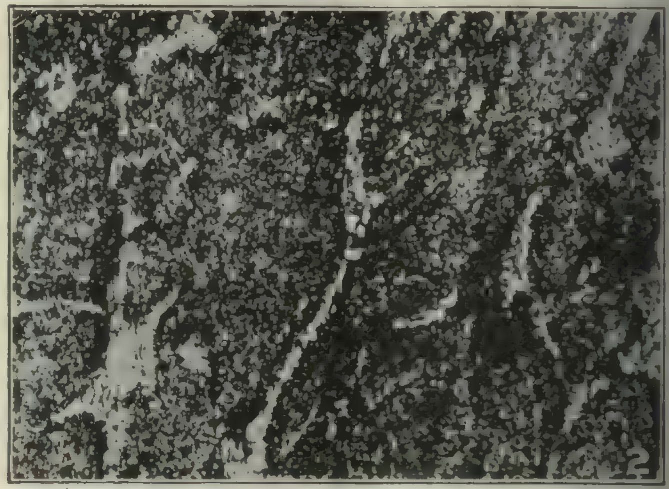


FIG. 2. MICROPHOTOGRAPH OF A HIGH-SPEED STEEL BILLET (MAGNIFIED 250 DIAMETERS)

By the term "high-speed steel" we refer to a steel of the high-tungsten, high-chrome type which has been adopted by a majority of reputable tool manufacturers as the material most suitable for the manufacture of the highest quality of cutting tools. The following are excellent minimum and maximum limits for the principal alloying elements in such a steel:

Carbon	0.65— 0.75 per cent.
Tungsten	17.00—19.00 per cent.
Chromium	3.50— 4.50 per cent.
Vanadium	0.75— 1.50 per cent.

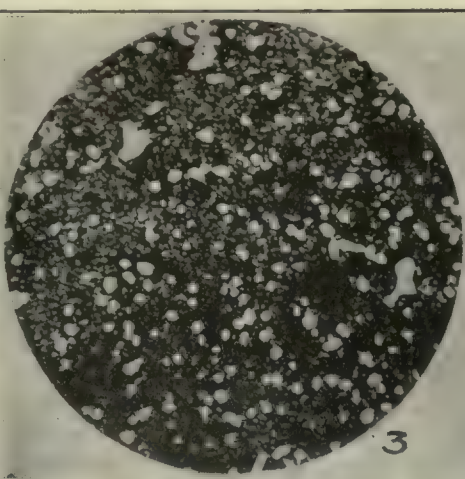
This specification does not preclude the possibility of making tools which will perform satisfactorily from the so called "low" or 14 per cent tungsten steels for certain operations, but where the utmost limits of endurance are required in drilling or milling operations the 18 per cent tungsten steel will invariably prove to be superior. The average performance of all the 14 per cent tungsten steel drills which have been tested in this plant (Detroit Twist Drill Co.) has been from 60 to 75 per cent of the maximum obtainable from drills made from the high-tungsten type. Conditions in planing operations are somewhat different and some of the largest machine shops in the country favor the low-tungsten steels for this type of service.

Two methods of manufacture are to be considered in making high-speed milling cutters: (1) Direct cutting from bar stock; (2) upset or forged method.

Before attempting to outline the advantages of a forged cutter as compared to a cutter made direct from bar stock, some consideration must be given to the process of manufacture of high-speed steel with special reference to the internal structural condition.

High-speed steel whether made by the crucible or electric process is cast in the molten state into iron ingot molds. The size of the ingot will ordinarily vary from 3 to 12 in. square with rounded corners and made slightly tapering. It is essential that the ingot be cast as nearly perfect as possible and special attention must be given to the prevention of excessive pipe, blowholes, segregation of certain constituents, etc. Piping is the term applied to the cavity which forms in the top portion of the ingot due to shrinkage as the ingot cools and solidifies. As the central portion of an ingot is last to solidify, it always contains the least desirable structure, which is more coarsely crystalline than the outer portion and also subject to segregation of impurities, slag, et cetera.

When a section of high-speed steel is polished, etched and observed under the microscope highly magnified, it appears to consist of at least two separate and distinct components, one of which is dark in color and the other light. Fig. 1 illustrates the structural condition in the interior of an ingot as cast. Attention is called to the coarse crystalline condition and so called "carbide envelopes" or cellular structure. Steel showing this structure is not suitable for use in cutting tools. These "carbides" are probably mixed complex tungstides and carbides of iron, chromium and vanadium, concerning which the exact chemical formulas are unknown.



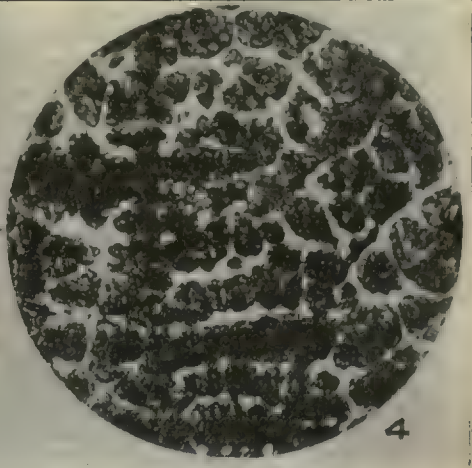


FIG. 3. SECTION OF ⅞-IN. H. S. STEEL BAR STOCK, ANNEALED.
FIG. 4. CENTER OF 6-IN. ROUND

The high-speed ingot is then annealed, primarily to assist in emulsifying the cellular structure and to remove internal strains caused by cooling and contraction; also to enable drillings to be taken for purposes of analysis. The next operation is the removal of surface defects such as checks, blowholes, slag inclusions, etc., by grinding them out with portable grinding machines. The annealed and ground ingot is reheated and hammered or "cogged" under a steam hammer and an amount equal to about 20 per cent of the ingot weight is cut from the head or pipe end, in order to eliminate difficulties due to the shrink cavity being rolled into bars causing hollow centers or seams.

The effect of the hammering and reduction breaks up the coarse structure, refining and distributing the carbide and tungstide particles throughout the mass of the steel. The ingot after cogging and cropping is technically known as a billet. The structure of a high-speed billet is shown in Fig. 2. The billets are then annealed and ground in the same manner as the ingots and delivered to the hammers or rolls as the case may be for final finishing to shape and size. After hammering or rolling, the bars are again annealed and are ready for the market. The microstructure of a piece of properly worked annealed high-speed steel is shown in Fig. 3, which is a cross-section of an annealed ⅞-in. round bar. Here the particles are small, well broken up and uniformly distributed indicative of correct conditions of manufacture and an ample amount of reduction in size from the ingot. This illustrates the desirable structure for high-speed steel. Large rounds, for instance from 4 to 9 in., invariably show a marked lack of uniformity in structure and the central portions frequently retain the raw ingot structure as result of insufficient reduction. The condition existing in the center of a 6-in. round is shown in Fig. 4, in contrast to the internal structural condition existing in the small bar stock where the percentage of reduction has been ample. In this condition alone lies the great advantage in the use of the forged cutter.

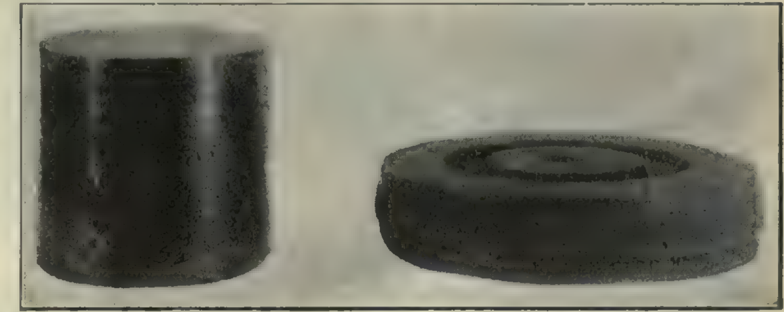


FIG. 5. METHOD OF FORMING A FORGED CUTTER BLANK

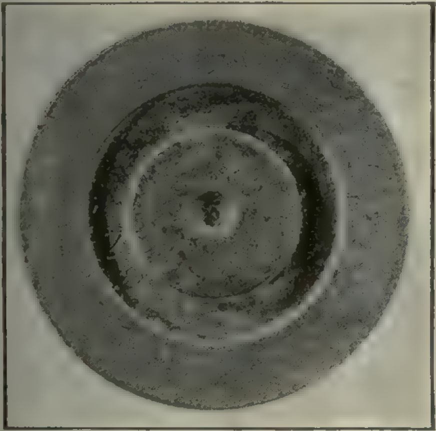


FIG. 6. FINISHED H. S. STEEL MILLING CUTTER BLANK

Little explanation is required to make clear the process of manufacture of cutters from bar stock. The material as received, which is only a small fraction of an inch over the diameter of the finished cutter, is cut to the required length and the operations following are essentially milling the teeth to the required shape, hardening and grinding. Structurally the condition of the steel remains the same and it is very evident from the photographs shown that the internal condition of large high-speed rounds is not desirable.

The method involved in forming a forged cutter blank is illustrated in Fig. 5. The bar stock, which is about half the diameter of the desired cutter, is cut to the length required to furnish the necessary material after upsetting. The direction in which work has been applied, however, has been entirely longitudinal or in a direction parallel to the axis of the bar. This fact is sometimes responsible for failure of cutters made directly from bar stock especially in the larger

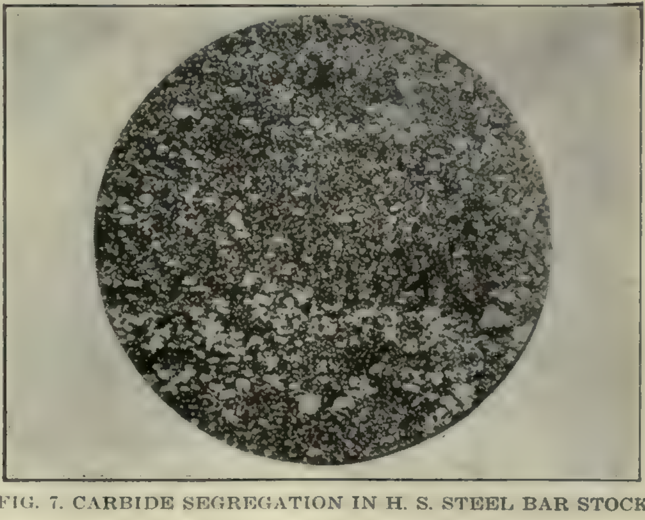


FIG. 7. CARBIDE SEGREGATION IN H. S. STEEL BAR STOCK

sizes, on account of the tendency toward a grain structure which may be described as "woody" or fibrous and which is in a sense analagous to the longitudinal grain in a piece of wood. The tendency toward carbide stringers is shown in Fig. 7 which is a longitudinal section of a piece of high-speed steel from bar stock $\frac{5}{8}$ in. in diameter. Steel showing this effect tends toward planes of weakness along the lines of the segregation, which if present along the cutting edges of the tool may cause flaking off.

It is clear from Fig. 5 that after the cylinder of steel has been cut to length it is hammered and upset in a direction at right-angles to the direction in which work has previously been done. The forging is done at a temperature of approximately 2,000 deg. F. under a steam hammer; the disk being upset to a thickness approximating that of the cutter. It is then reheated and finished in the recessing or forming dies. This procedure squeezes the metal adjacent to the outer circumference into forcible contact with the sides of the die and each blow compresses the metal heavily at the vital points. The excess metal forms a slight flash which is trimmed off later. The extent of the refinement and compression is forcibly brought out in Fig. 8, which is a photograph of the cross-section of a high-speed milling cutter blank in the hardened condition which has been highly polished and then etched to make the structure visible. The microphotographs show the structure magnified fifty diameters corresponding to locations indicated in the photograph of the cutter section. Note the ring of fine grained dense metal extending around the outer edge where the teeth would be cut, and the more open grain in the center. Compare these structures with those of the bar stock cutter in Fig. 9, where the coarse crystalline condition shows the "dendrites" or pine tree crystals, which are indicative of a lack of sufficient reduction and mechanical working of the steel. The magnifications are the same in both cases.

Merely upsetting a bar into a disk or "pancake" between flat-faced hammer dies does not produce the result referred to in compressing the metal heavily at the circumference, as it tends to open up the edges of the disk and the disk is very apt to split radially, as shown in Fig. 10, making the structure porous at the most vital points in the cutter. This difficulty is not encountered in the drop forging process as the metal is forcibly driven into the recess of the dies without the tendency to split.

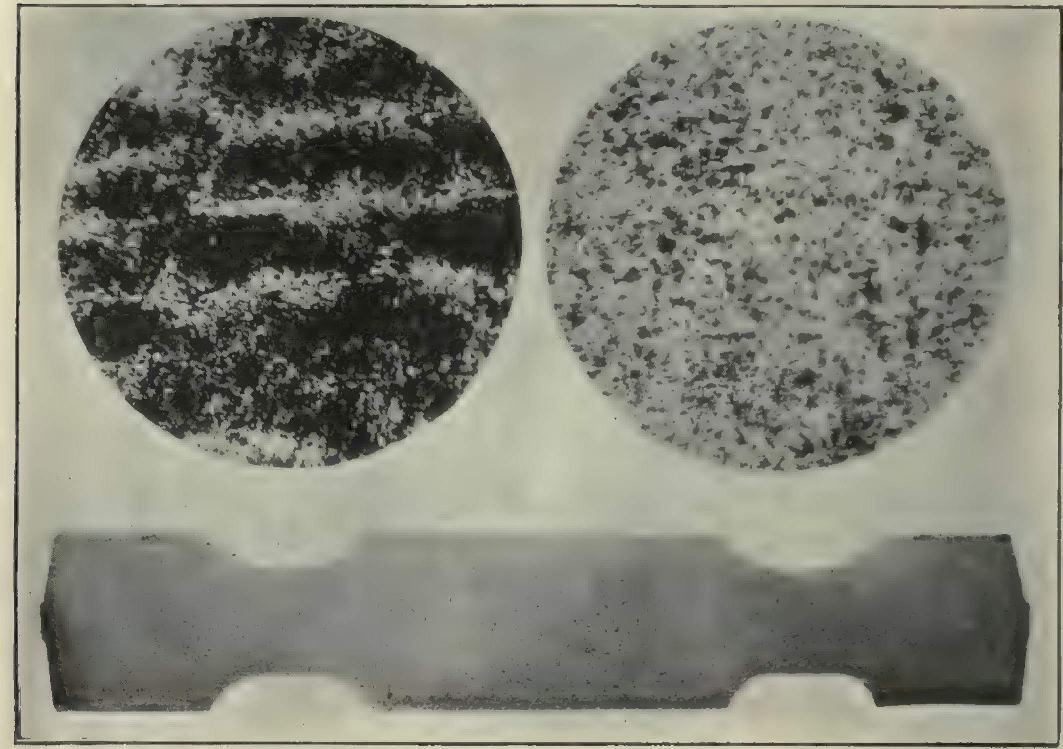


FIG. 8. CROSS-SECTION OF FORGED H. S. STEEL MILLING CUTTER

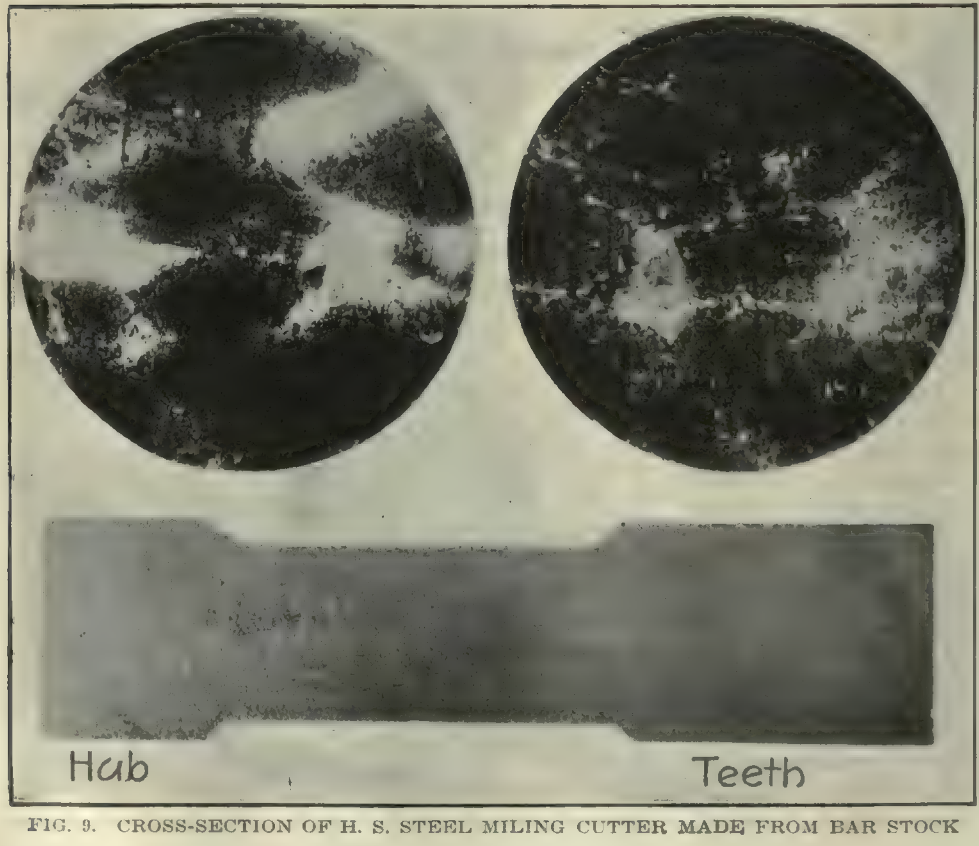


FIG. 9. CROSS-SECTION OF H. S. STEEL MILING CUTTER MADE FROM BAR STOCK

The forging process for manufacture of cutters while more expensive from a manufacturing standpoint possesses advantages which cannot be overlooked by the user of milling cutters and the fact alone that the largest users are now beginning to specify forged cutters is sufficient evident that the claims of increased performance made for the forged cutter are being realized.

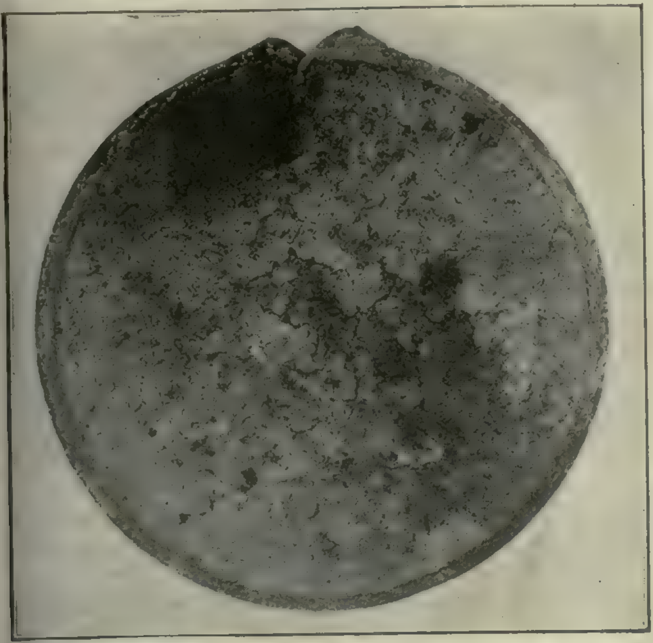


FIG. 10. FORGED H. S. STEEL DISK SHOWING RADIAL CRACK DEVELOPED BY HAMMERING BETWEEN FLAT-FACED DIES

Reminiscences of an Old-School Machinist

BY R. THOMAS HUNTINGTON

After the closing of the Norris Locomotive Works in Philadelphia, which closing also terminated my apprenticeship, I went to the shop of Norris Brothers in Lancaster, Pa., where I served one year under instructions. The machinery at this shop was more up-to-date than that at the older Norris plant, but the work was handled in much the same way. At this shop my work consisted largely of fitting on the straps at the ends of the connecting rods. I also got considerable repair work to do, some of it of the hurry-up order, and one such job still lingers in my memory.

A yard engine belonging to the Pennsylvania railroad was one day run into the shop for a new pump rod and gland. The rod fell to my lot and the gland went to "Jake," a fellow workman on a nearby lathe. We were both given instructions to work as fast as possible, for there was a yardful of cars waiting for the engine and it was only from necessity that she had been run in.

We had no micrometers in those days; only the old reliable bow calipers to be used in conjunction with our trusty two-foot rules of boxwood. For reamers on brass work, we used a tool shaped very much like a blunt-pointed flat drill, and of these we had a fairly complete set, with the sizes plainly stamped on each.

When the foreman had given us the sizes of the required parts we went to work with a will; each striving to get his part done first. Our respective parts finished, we started to assemble the pump and found much to our surprise that the "fit" was worse than before. Being only a cub, I was naturally the first to be suspected, and the boss, to use a now current expression, "lit on me for fair."

Fortunately for me I was able with my rule and caliper to establish a satisfactory defense, whereupon the foreman turned upon the astonished Jake, who promptly produced the "reamer" and showed the figures, which tallied with the boss's instructions.

A little investigation, however, showed that some inconsiderate workman, having wanted a special sized reamer, probably for a hurry-up job, had swaged out the tool a sixteenth or so over-size and forgot to alter the size-mark to correspond.

Great was the wrath of the foreman, who heaped abuse upon poor Jake while he hunted up another casting; but Jake insisted in broken English (he was Pennsylvania Dutch) that "it was not mein fault; it vos de fault of de drill."

I have seen many men since, and they were not all Pennsylvania Dutch by any means, who have similar excuses to put forward when things do not turn out as expected.

APPRENTICESHIP WASTED

When my year was up in Lancaster, I returned to Philadelphia and as a journeyman entered the employ of the Baldwin Locomotive Works, where I found to my sorrow and surprise that the years I had spent learning the trade had been thrown away; for everything in Baldwin's was system and "routine."

I was given a lathe, which stood quite high from the floor, and had a compound slide-rest which was fed by hand. Three jobs were assigned to me, and a certain price was put upon each piece, so that my wages depended entirely upon myself.

One job was to finish from the rough castings the columns, or supports, of the hand rail which ran from the cab of the locomotive to the front of the boiler, so that the fireman could hold on when he was compelled to go forward while on the road. The set of castings comprised two flanges to be fastened to the cab, one on each side of the boiler; six columns about six or eight inches high with a ball on the end of each through which the railing passed; and two acorn-shaped pieces to go in the front end of the pipe rail. All of these parts had to be rough turned, scraped, and polished with oil and emery on a pine stick.

Another job was to turn the tapered end of the bolts which went through the rims of the driving wheels; the points going into correspondingly tapered holes in the steel tire. The tires were pressed on and six holes were drilled and reamed in the tire from the inner side, using the wheel as a drill-jig, in connection with a special drill-press made for that purpose. The holes in the rim of the wheel were threaded, and the bolts came to me, threaded from the rough forging, to be fitted. I had to center them true by the outside diameter of the thread and turn the tapered end to match a sheet metal gage. The turned surface had to be smooth and concentric with the thread.

The third job assigned to that particular lathe, was to lap out, with a wooden lap, the pinhole in the rocker and reverse shaft arms. These arms were about 2½ in. wide by ¾ in. thick and 8 in. long, with bosses forged on each end. The eye where the pin went through was case hardened, very hard, after the hole was machined and then was lapped to size. Great care was taken in welding these arms on to the shaft and rocker, not to heat the bosses hot enough to soften them.

the sector in the middle position, the drills being guided by the small fixed bushings in the sector to be seen at *O* in Fig. 8; in this view the sector is not shown in the corresponding drilling position. Sizing drills and reamers are guided by slip bushings all of which may be seen in the foreground of Figs. 6 and 7, and all of which fit the main bushings, one of which may be seen at *P* in Fig. 8.

It will be noted that the heads of the main bushings (of which there are four, two in the top and two in the bottom of the sector) are rectangular in shape, with a locating notch at one side. This locating notch is an important factor in connection with the drilling of the cut-out holes, the slip bushing for which is indicated at *Q*, Figs. 6 and 7, and will be explained later. The other two slip bushings seen are for the sizing drill and the reamer respectively.

The drilling is done on a multiple-spindle sensitive drill press to be seen in Fig. 9. Four spindles are ordinarily used, but at the time the photographs were taken a lot of gages were going through upon which the rough-drilling had already been done in a previous setting as an experiment in production. The rough-drilling would be done with the sector of the jig in middle position, the jig being located widthwise of the table (for all operations) by pushing it against the long raised bar to be seen at the back of the table.

The location of the various holes is shown in the enlarged sketch, Fig. 10. In Fig. 9 the jig is in position for size drilling one of the anvil holes and the sector is pushed back to its limit, exactly as shown in Fig. 6. The size drill is not, strictly speaking, a drill at all but should be called a helical fluted reamer with a long pilot which passes through a permanent bushing in the middle wing of the sector.

After putting through the sizing drill the jig is moved along to the next spindle, the slip bushing changed and the finishing reamer run through. The finishing reamer is piloted the same as the sizing reamer or drill which it resembles, except that it has straight flutes instead of helical ones. Changing the slip bushing again, the jig is moved under the last spindle where the cut-out hole is drilled.

Every toolmaker who has tried to drill a hole that cuts out for about a third of its diameter into a hole already drilled, knows something about the difficulty to be expected. Plugging the first hole and then driving out the partially drilled plug after the second hole is put through, is the toolmakers method; but it would hardly be consistent with economical production where many thousands of such holes are to be drilled.

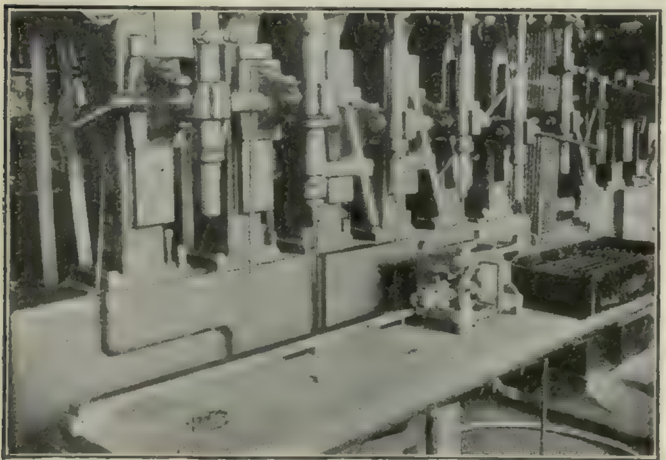


FIG. 9. THE DRILLING OPERATION

There are four of the cut-out holes in every frame, one for each anvil hole, and not only must they be drilled rapidly but they must also be parallel with the anvil hole. The tool for doing the work is shown in Fig. 11.

The lower part *A* of this tool is the guide bushing shown previously at *Q* in Figs. 6 and 7. The upper part *B* is a single piece the function of which is to support the crescent-shaped rod *C* in its proper relation to the drill. The drill itself, marked *D*, is a piece of drill rod with about $\frac{1}{4}$ in. of the lower end milled or filed to form the lips of a flat drill. It is, in fact, exactly what a toolmaker would call a spotting drill, except that the angle of the point is rather flatter than it would ordinarily be made for that purpose. The part *C* is a hardened steel rod of a diameter that closely fits the reamed anvil hole in the frame (and also as a matter of course, the corresponding hole in the guide bushing *A*, through which it passes). One side of this rod has a semicircular groove, running its full length, of the same radius as the drill and of a depth equal to the amount that the drill "cuts out" into the anvil hole of the frame. The hole in the guide bushing *A* is of the same shape—something like a figure 8—as the finished hole in the gage frame. The collar *E*, secured to the drill by a setscrew, supports the part *B* and consequently the crescent-shaped rod *C* so that the lower end of the latter is $\frac{1}{16}$ in. in advance of the cutting lips of the drill; the groove in which the drill lies being relieved slightly for $\frac{1}{4}$ in. so that the cutting edges will not drag on the hardened steel and become dulled.

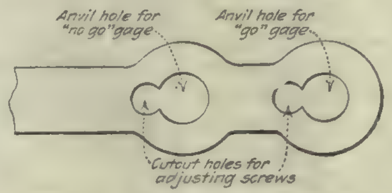

Anvil hole for "no go" gage
Anvil hole for "go" gage
Cutout holes for adjusting screws

FIG. 10. OUTLINE OF HOLES DRILLED

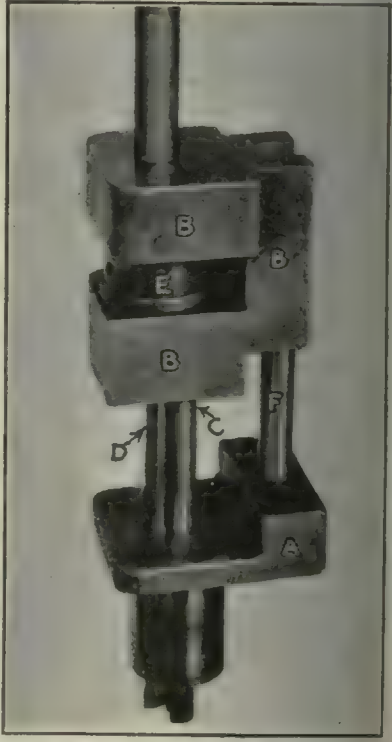


FIG. 11. THE "CUT-OUT" DRILL FOR DRILLING THE OFFSET HOLES

In operation the jig is moved under this spindle, the bushing *A* (*Q* in Figs. 6 and 7) fitted to the bushing of the jig and positioned by a pin on the under side of the head, entering the notch in the head of the die bushing.

The tool is now brought down by means of the feed lever of the machine until the rod *C* and drill *D* enter the hole in the bushing; the guide pin *F* in the bushing at the same time enters the notch in the back of part *A* to keep the latter from revolving. Continuing the downward movement of the spindle the drill cuts through the metal of the frame as readily as if it were cutting through solid metal instead of working a third of its circumference "in air."

The drill is at all times supported by the rod *C* against the tendency to run out into the previously drilled hole, and though the average toolmaker would say without hesitation that such a tool would jam and break before drilling more than a quarter of an inch, it has now been constantly at work for many months and shows no tendency to jam unless the cutting edges are allowed to get dulled.

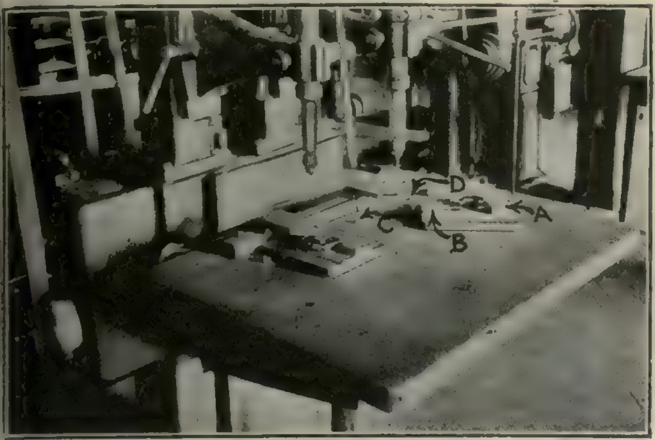


FIG. 12. DRILLING THE STOP-PIN HOLES

Having completed one hole, or rather two holes in one, the jig is moved back to the first spindle, the sector *L* swung forward to the position shown in Fig. 7 and the sequence repeated, thus finishing the two anvil holes and the two offset holes upon one end of the frame. To drill the holes in the other end of the gage frame the other side of the jig is turned up and the sequence twice repeated; completing all of the drilling on the frame at one setting.

THE FINAL OPERATION

The final machine operation on the frames is the drilling of the eight small crossholes for the pins against which the adjusting screws bear. Though this operation is a very simple one, much thought has been given to the jig design for the purpose of simplifying the movements and keeping the production cost to the lowest limit.

The operation is shown in Fig. 12 with two of the jigs upon the table of the drilling machine. A jig is required for each size of frame and the work is supported by plungers entering two of the anvil holes and by a third fixed point upon which the bow of the frame rests.

A frame is placed in the jig by slipping one of the anvil holes over a short fixed stud projecting from the boss *A*, drawing back the spring plunger in boss *B* dropping the frame into place and allowing the spring plunger to come forward, entering the anvil hole at that end of the frame.

No fastening is necessary as the gage is held against sidewise movement by the plungers. The drill bushings are permanently fastened to the drill press table, the jigs being correctly located by pushing it against the back bar and against the stop-pin *C* for one hole and against the stop-pin *D* for the second hole. Turning the jig end for end the sequence is repeated, finishing four stop-pin holes. A distance piece is now placed against the back bar on the machine table and all the movements repeated, drilling the eight holes in little more time than is required to describe the operation.

This completes the frame so far as machine operations are concerned. There are no tapped holes, the adjusting screws bearing in threaded grooves in the stems of the anvils.

There are, however, a number of interesting operations in the making of the anvils, and these will be taken up in detail in another article.

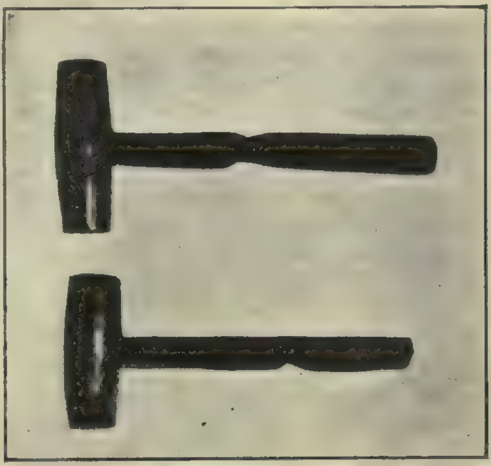
Are Hollows Worn in Hammer Handles?

By F. W. Bach.

L. L. Thwing asks on page 980, Vol. 54, of *American Machinist*, if any one has seen a hammer handle that showed finger prints or other wear from the friction of the hand? He thinks that it would be possible only where the hand was covered with some gritty substance, but I will endeavor to convince him that it is done with the hand oily and smooth.

Several years ago, I worked beside a man who was doing light riveting of typewriter parts. Stubs wire was used for the rivets and great care was needed to make a free moving bearing, so a very small and light flat hammer weighing but a few ounces was needed. The hammer had a hickory handle which was held loosely between the fingers and thumb to get the delicate balance required.

The continuous movement and friction of the oily hands (clock oil was used) day after day for several years had worn such hollows in the handle that the latter eventually broke.


HAMMER HANDLES WORN BY THE FINGERS

Another case in the same shop where not so much delicacy was required, showed the same results where a larger hammer was held loosely in the hand.

Later, while working at the gun business where the gun barrels were straightened with a hammer, one of the old-time barrel straighteners who used the block and hammer to straighten, had the hammer shown in the cut which weighed about 5 lb. As he had for years done only finish straightening and mostly on shot gun barrels, which required a delicate balance of the hammer, he also held his hammer loosely. His hands generally were greasy from the work and were calloused where the handle had moved on them.

On rough straightening the hands are sometimes gritty, but then the hammer is gripped tight and there is not much wear on the handle.

Tool Engineering

By ALBERT A. DOWD AND FRANK W. CURTIS

(Continued from last week's issue.)

SEVERAL examples of keyway broaching are shown in Fig. 191. The ordinary method is illustrated in the example *A*, which is being cut by broach *D*. The work is located on a bushing *B* which is fastened into the faceplate of the machine. This bushing is so made that the broach fits a slot in it at *C*, thereby guiding and supporting it at the same time. This method is generally used for ordinary keyway cutting as the only fixture required is the guide bushing. Standard broaches can also be used, which is obviously economical.

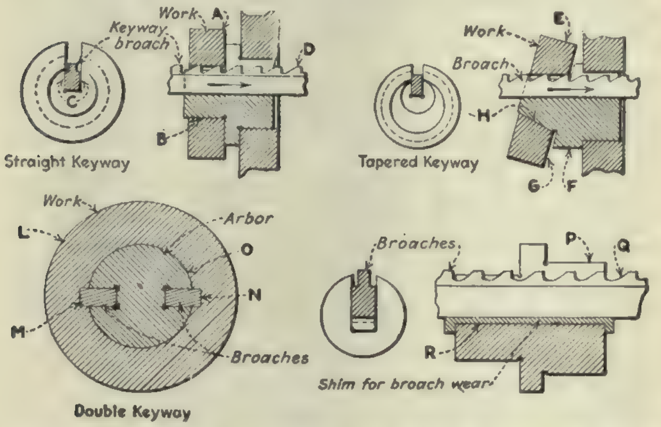


FIG. 191. VARIOUS METHODS OF BROACHING KEYWAYS

When a taper hole has a keyway cut in it as shown at *E*, the method used is the same except that the guide bushing *F* is made to fit the taper and it is also tilted so that the keyway will be parallel to the side of the tapered hole as indicated. Care must be taken by the designer to see that the work fits the tapered portion *H* yet does not strike against the surface *G*. Sufficient clearance must be provided so that there will be no chance for this to happen; $\frac{1}{16}$ or even $\frac{1}{8}$ in. is none too much, depending on the angularity of the taper.

An excellent idea which can be applied to certain kinds of work is shown at *P*. This is a guide bushing in which the broach *Q* is operating. It is evident that as the broach or bushing wears, the keyway will become shallower and eventually will not be deep enough to pass inspection. By providing a shim at *R*, adjustments can be made as desired by placing paper or thin metal between the shim and the body of the bushing, thus raising it up and prolonging its usefulness.

Referring to the work shown at *L*, attention is called to the two keyways at *M* and *N*. In broaching a piece of work like this two methods are possible; a bushing can be made like that at *O* and two separate broaches used at *M* and *N*, in connection with a coupling like the one illustrated in Fig. 196; or a broaching bar can be made up with two inserted broaches in their correct positions, and the work done without resorting to a guide bushing. Either of these methods will produce good work.

In broaching square holes the work must first be prepared for the operation by drilling a hole and facing one side square with the hole. As a general thing the corners are not quite square, as a sharp corner would be hard to keep up and also it might cause trouble in hardening if the work were to be heat-treated. The sides of the hole are also relieved slightly in order to obtain a better bearing on the shaft and likewise to relieve the cut somewhat while broaching. This is clearly shown in the work *A* in Fig. 192. Starting with the hole as at *B*, the work when about half finished would appear like the diagram at *C*. The illustrations at *D* and *E* show the general form of broach used for this kind of work. The method used for setting up the work is the same as those mentioned and shown under the descriptions of broaches which do not require guide bushings.

When a square tapered hole is to be broached the work must be set up so that the taper of the corner of the hole is parallel with the spindle of the machine as shown at *F* in the same illustration. An indexing fixture must be made for work of this kind and the broach itself must be so designed that it is of the form shown at *G*. The cut should extend slightly beyond the center of each side. It is of the greatest importance for the designer to remember that the angle at the corner of a square taper hole is not the same as the angel of the sides. It is a compound angle which is not usually given on the blue print of the part; therefore it must be figured out by trigonometry.

BROACHING FIXTURE FOR CONNECTING ROD

The crank pin and piston pin holes in connecting rods for automobiles are frequently finished by broaching. A fixture for this purpose is shown in Fig. 193. The fixture itself is very simple and yet it is effective and accurate. The two connecting rods *A* and *B* are located on studs at their upper and lower ends, one large end and one small end of each rod being broached at the same time as indicated at *C* and *D*. The locating plugs are correctly located in the faceplate *E* which is positioned by means of the plug *F* against the faceplate on the machine. A large and small broach are used

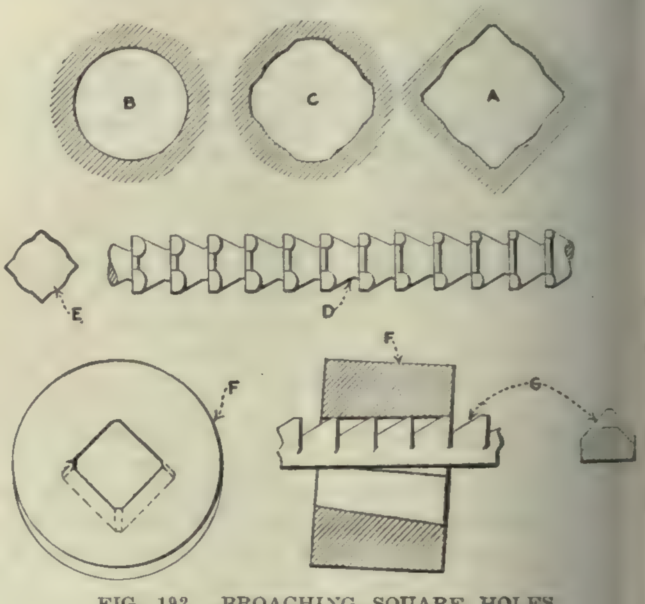


FIG. 192. BROACHING SQUARE HOLES

simultaneously, after which the connecting rods are transposed while the other two holes are broached.

Broaching Fixture for a Ratchet Sector

Fixtures for broaching use many of the devices which have been previously illustrated and the principles of holding and clamping can be applied to this type of fixtures as well as to the others. There are, however, peculiar conditions to be met in the design of fixtures for broaching and these can best be appreciated by citing suitable examples. The matter of removing and eplacing the broach after each operation sometimes akes time which can be avoided by a little thought n the part of the designer. An example of this kind given in Fig. 194, the work *A* being a ratchet sector f which four pieces are to be broached at a time as ndicated. The work is set up in the swinging locater which rests on a lug *O*, and is pivoted at *D* in such way that it can be swung over into the broaching osition when desired and located by a pin at *F* which orresponds to *G* on the faceplate as shown. In the ading position, the clamp is pulled back as shown by e dotted lines at *K* while the work is being placed n the two pins at *X* and *Y*. The clamp is then tightned and the work is ready to be swung into place when e other pieces are finished, While the loading of one roup of pieces is proceeding the other set is being achined, being held in the other swinging member *C* d located by the dowel pin at *H*. The clamp *L* holds e four pieces firmly and the broach *M* cuts the serraons shown. A bracket *N* is mounted on the face of the ate to act as a guide and support for the broach. fter the pieces have been machined the swinging mem-r *C* is turned over until it rests on lug *P* where the eces can be removed and replaced by others.

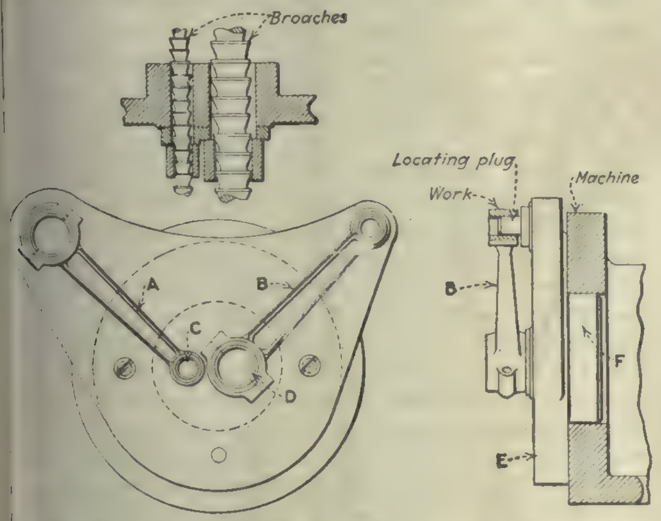


FIG. 193. DOUBLE BROACHING FIXTURE FOR TWO DIFFERENT SIZE HOLES

As the broach used for this operation is a heavy one is advisable to support the outer end on the sliding pport which can be obtained as a part of the broachg machine equipment. With a fixture like the one own, however, it is unnecessary to remove the broach all and consequently the only time lost is in the turn stroke of the broach and the swinging into place a fresh group of pieces. Arrangements of this kind e sometimes possible when work does not have a hole it through which the broach must pass.

Certain kinds of work must be located in a fixed relation to each other when they are installed in the mechanism of which they form a part. It is therefore a decided advantage to take this into consideration when designing tools for these parts. An example of this kind is given in Fig. 195, the work *A* and *B* consisting of two automobile timing gears. A definite relation must be kept between the keyways which are to be broached and the teeth which have been previously cut. In addition to this each gear must be properly marked in a particular place so that when the two gears are assembled in the car the gears can be meshed at these points, thus assuring the correct position of the cams on the camshaft in relation to the throws of the crankshaft.

The work is located on two studs, the locating pins at *C* and *D* being provided to determine the relation of the keyway with a given tooth. The method used is apparent from the illustration. The marking of the teeth is done by the swinging arms *H*, each of these having in it a pointed pin *K* which, when struck with a hammer, makes a mark on the gear. After the marking has been done the arms are swung out of the way so that the gears can be readily removed. The principles illustrated here can be applied in other cases where the location of the keyway must be kept in relation to some other part.

Examples of Index Broaching

Index broaching is of various kinds and the requirements are also varied. In one case accuracy may not be of the greatest importance, while another may require the greatest care to produce it within the necessary limits. These points must be considered when designing fixtures for any kind of an operation. So far as the fixtures are concerned the indexing

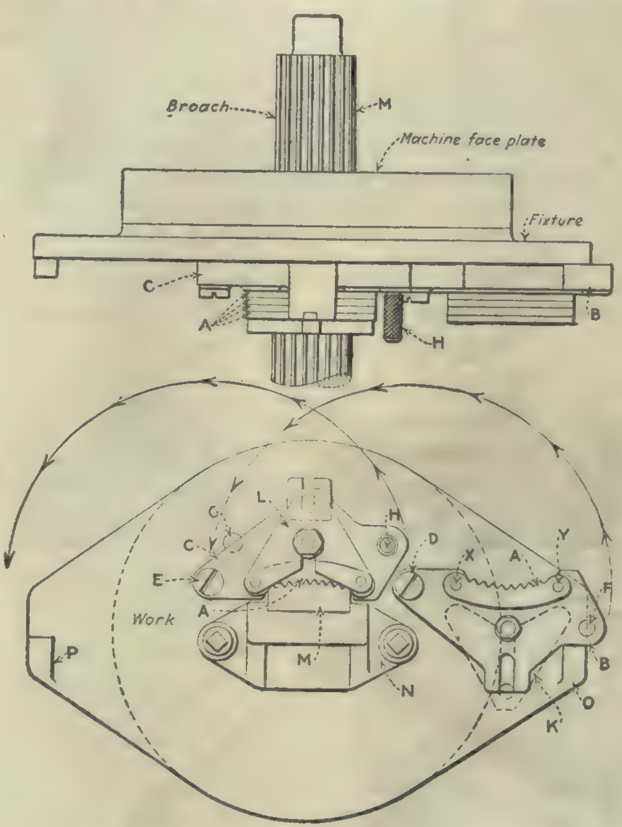


FIG. 194. BROACHING FIXTURE FOR RATCHET SECTOR

devices which have been described in previous articles cover the situation quite thoroughly, so there is no necessity for repetition. Several examples of work which may require an indexing device of some kind are shown in Fig. 196. The work *A*, for example, is of such large diameter that it would hardly be desirable to make up a four spline broach, both on account of its weight and also the expense. It is evident therefore that an indexing device would be of assistance in a case of this kind. A method is illustrated in order to point out the errors into which a tool designer may fall unless he analyzes a situation carefully. Let us assume that the work is set up on a guide bushing so that a broach can be used as at *F*. If then the guide bushing has a slot *G* located at 90 deg. from the one which is used as a guide for the broach, it would appear that the work could be turned around on the bushing to take another position and located with a plug as at *K*. With this plug in place a broach cut could be made as at *H*, and the operation could be repeated to finish the other keyways. If the work *A* is to be machined at *B*, *C*, *D* and *E* it is apparent that any slight error in location of the plug *K* would cause an error which would become more and more as the work is turned around, so that the piece when completed might be valueless. Hence, it is seen that a method of this sort is not good practice and will not produce accurate work.

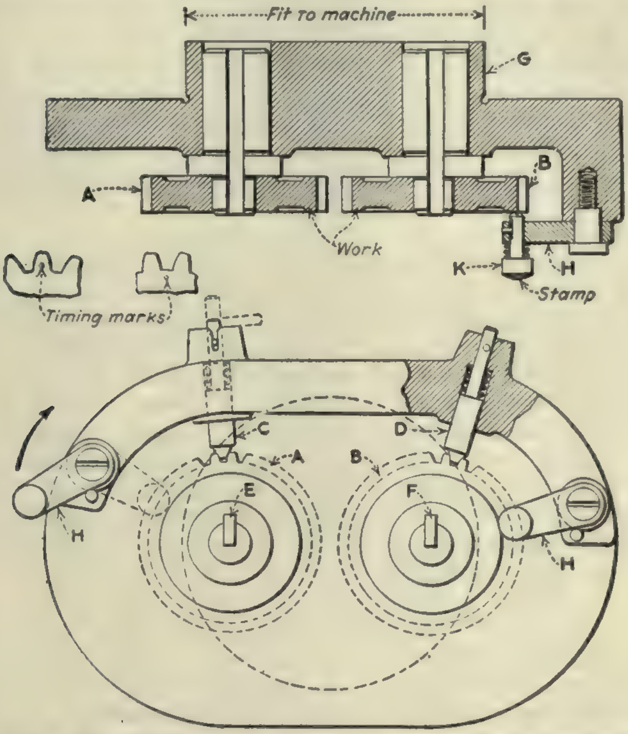
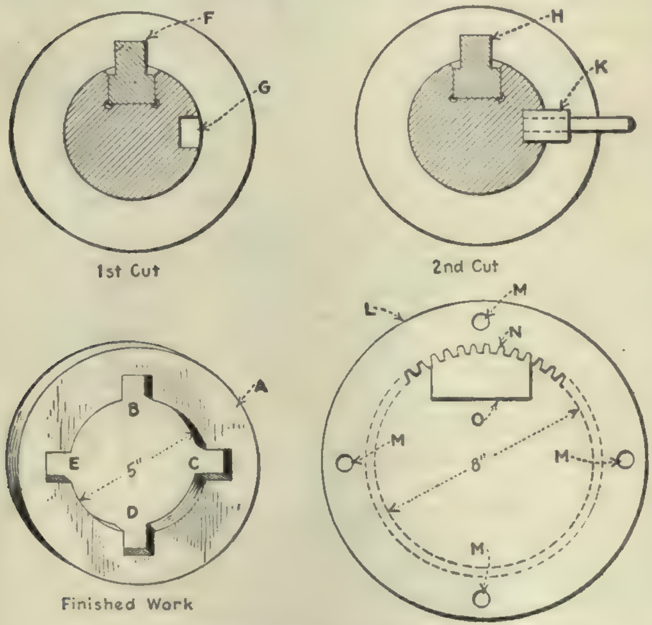


FIG. 195. BROACHING FIXTURE FOR TIMING GEARS



1st Cut

2nd Cut

Finished Work

FIG. 196. EXAMPLES OF INDEX BROACHING

An index fixture of simple design could be used with much more satisfactory results, and although it might be a little more expensive than the method illustrated, the product obtained would pass inspection. Another example of work which requires indexing is shown a *L*, which is an internal gear of large diameter. Th work is to be done by the broach *N* which is s designed that it will cut a number of teeth at one time The work can be located on pins in the holes *M* on simple index plate so that the successive broachin operations will produce a finished gear. Any goo method of indexing can be applied to a piece of wor like this, although it is essential to use a method whic will not multiply the error as in the instance just mer tioned. An indexing fixture should be made up wit the indexing bushings or slots as far away from th center as possible in order to insure accurate work.

When the use of a heavy broach is necessary th weight of the overhanging portion of the broach likely to be a matter of serious moment. It is evide that if it is to be supported at all it must be done some arrangement which will permit it to be align properly, or else the work produced may be inaccura When one hole is to be broached in accurate relation another accurate alignment is also necessary, so that each of these two cases it is well to use the outboa support.

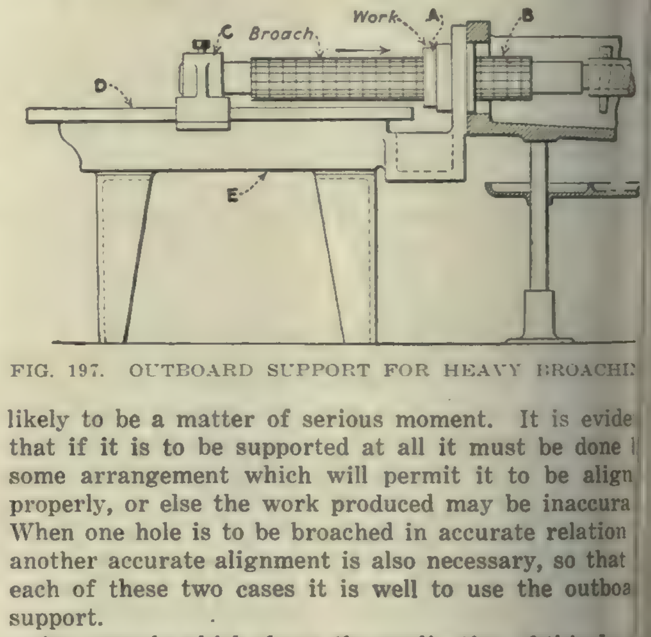


FIG. 197. OUTBOARD SUPPORT FOR HEAVY BROACHI

An example which shows the application of this dev is illustrated in Fig. 197, the work *A* being similar the internal gear shown in the preceding illustrati In this case, however, the broach is so made that of the teeth are cut at the same time, and as a con quence the broach is both large and heavy. The supp *E* is provided with a slide *D* on which is mounted member *C* which holds one end of the broach as ir cated. Provision is made so that proper alignment be obtained without difficulty.

SPIRAL BROACHING

When it is necessary to broach a spiral, two meth are possible; the broach may be arranged so that will revolve while cutting, or the work may rev while the broach is passing through it. In Fig. 198 two examples of spiral work are shown at *A* and *B* and one method of broaching is shown. The work *A* is mounted on the broach *C* so that the pulling action comes against the face of the bushing *E*. This bushing is adjusted by the two check nuts at *G* so that it will revolve freely and all of the thrust is taken on the thrust bearing *F*. The fixture *D* is mounted on the faceplate of the machine and fastened by means of screws.

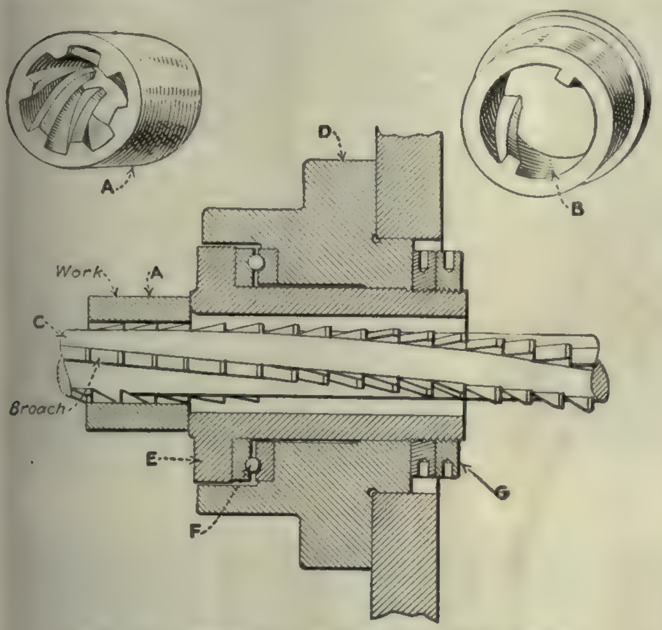


FIG. 198. METHOD OF SPIRAL BROACHING

In operation the angularity of the broach teeth causes the work to revolve so that the spiral is cut without other assistance.

We Pay for Human Energy

By A. N. Goddard

President, Goddard & Goddard

In the ultimate analysis of all industry the one thing we pay for is *human energy*. The three factors usually considered in figuring the cost of a commodity are material, labor and overhead. Overhead involves the expenditure of human energy; mentally in administration, supervision and sales. Labor involves the expenditure of human energy; physically, on the part of the workman, and the raw material of one industry is the finished product of another.

Connection of Raw Materials and Direct Labor

Milady's muslin dress is the finished product of the dressmaker, involving the direct labor of the seamstress and raw material of the muslin. Muslin is the finished product of the cotton mill, involving the direct labor of the operator and the raw material of the cotton field. Cotton is the finished product of the cotton grower, involving the direct labor of cultivation and raw material of seed and soil. This takes us back to Mother Earth, nature's supply, but available for man's use only by the expenditure of human energy.

The watch you carry is a composite of many different raw materials and the direct labor (human energy) of fabricating and assembling. The hair-spring involves the direct labor of the operator and raw material of high-grade spring steel. Spring steel is the finished product of the steel mill, involving the direct labor of the operator and raw material of pig iron. Pig iron is the finished product of the blast furnace, involving the direct labor of the workers and raw material of ore. Ore is the finished product of the mine, the gift of nature's wealth and the expenditure of human energy in the process of mining.

Saving Human Energy a Benefit to All

When human energy is saved, shrinkage in economic waste is brought about, resulting in easier conditions of living. Necessities of life are cheaper, cost of luxuries are brought within the range of a greater number, and happiness is increased.

We as mechanics, fabricators of the world's goods, have a distinct responsibility at all times, and this is greatly increased in the days of rehabilitation before us. It is our duty to study in detail the problems of production that come under our own personal supervision and see to it that we are rendering a worthy account of our stewardship by the saving of human energy through the application of better methods, and the use of better tools.

The Value of Good Tools

Better tools are not necessarily cheaper in dollars and cents of first cost but are actually cheaper, because of longer ultimate life and increased production possible with their use. Many a shop in this country today is trying to manufacture with tools that would actually pay bigger dividends returned to the cupola than on the shop floor. And we are increasing economic waste just so long as we allow them to remain on the shop floor or in the toolcrib.

Let us have the courage to do and do now the thing which down deep in our hearts, we know should be done. Don't let us fool ourselves—the inexorable law of the survival of the fittest will apply with relentless force in the days to come. It lies within our own power to determine whether we will be among the fittest and thus not only survive, but progress; or whether we are content to retrogress and die.

Converting an Old Planer Into a Broaching Machine

By John A. Yungivirth

In visiting a small shop where they were manufacturing quite a few parts requiring internal keyways, I discovered a novel method of cutting keyways and doing light broaching when no broaching machine is available. In this shop they had an old planer that had seen its best days but was still capable of giving further service as a broaching machine. All that is required is an Armstrong planer tool and an angle plate.

The tool clamping stud is removed from the toolholder and the latter is bushed to receive a standard La Pointe broach which is inserted and tightened with a nut. The angle plate is bored to receive the broach guide and is fastened to the planer table.

The broaching is done on the cutting stroke and the table is stopped on the return stroke by arranging a stop on the belt shifter so that the belts shift to the loose pulleys.

In the small shop that cannot afford modern equipment this method works very satisfactorily and certainly beats the old stand of poking out keyways in the shaper.

Machining the Peerless Lower Crankcase and Front Cover

Fixtures That Make Handling Easy for Different Operations — Boring Difficult Holes and the Gages for Inspecting Them

By FRED H. COLVIN
Editor, *American Machinist*

THERE is much less machining on the lower half of the crankcase than on the upper, it being in reality little more than an oil pan with a sump from which lubricating oil can be pumped to the different bearings of the motor. This part is also an aluminum casting and the sequence of operation is as follows:

Operation 1—Mill top side.
Operation 2—Mill ends.
Operation 3—Mill bottom.
Operation 4—Mill slot on top side.
Operation 5—Drill all holes excepting four flanged bolts.
Operation 6—Drill twenty-two holes in flange.
Operation 7—Tap holes.
Operation 8—Bore two lower halves at center in one operation.
Operation 9—Mill at right-hand side.
Operation 10—Bolt two halves together.
Operation 11—Bore and face rear end and face front end.
Operation 12—Drill rear end.
Operation 13—Drill front end.
Operation 14—Tap front and rear ends (the four operations (Nos. 11 to 14) are performed while bolted to the upper half and have been accounted for in the previous article).
Operation 15—Unbolt lower half.
Operation 16—Solder sand and blow holes and file burrs.
Operation 17—Inspection.

Milling the upper side is shown in Fig. 1, which also shows the construction of the holding fixture with its plungers on each side to resist the downward thrust of the milling cutters. These plungers are adjustable by means of the knobs shown and support the cases in a satisfactory manner.

The ends are milled on angular fixtures, similar in design to those used for the upper half of the crankcase. These fixtures are shown in Fig. 2 and need no explanation.

The drilling fixture, which resembles that for the upper half of the case, is shown in Fig. 3. This view also shows the transfer table at *A*, the saddle which carries the drilling bushings at *B* and the tool stand at the right. This setting takes care of drilling twenty-eight holes, some of which are reamed and a few of them tapped.

Next comes the drilling of the bolt holes in the flange, Fig. 4, the fixture being simply rolled over to present the proper bushings to the drilling spindles.

After several holes have been tapped, two of the lower halves are clamped together as shown in Fig. 5 and both bored at one setting in the fixture shown. This is done under an American radial drilling machine in the arched shaped fixture shown, the boring bar being guided in the usual manner.

Although a comparatively small piece there are twenty-two operations on the crankcase front cover, as follows:

Operation 1—Mill rear sides.
Operation 2—Mill pad at crankshaft hole.
Operation 3—Mill pad at fanshaft hole.
Operation 4—Mill pad at water-pump bracket.
Operation 5—Mill tire-pump pad.
Operation 6—Drill and ream 2½-in. dowel holes.
Operation 7—Mill generator pad.
Operation 8—Bore and ream crankshaft and fanshaft holes.
Operation 9—Drill thirty-three holes at various places.
Operation 10—Drill twenty-one holes.
Operation 11—Tap sixteen holes.
Operation 12—Bolt clamps to cover.
Operation 13—Bore, ream and face crossshaft holes.
Operation 14—Drill eight holes at crossshaft holes.
Operation 15—Drill two holes in generator pad.
Operation 16—Drill dowel and oil-holes in water body clamp.
Operation 17—Spot-face eighteen holes on front side.
Operation 18
Operation 19 —Tapping
Operation 20
Operation 21—File off all burrs.
Operation 22—Inspection.

The design and the distribution of metal in the crankcase front-cover make it quite a problem to hold satisfactorily in a fixture, so as to withstand a heavy cut. The design of the fixtures is shown in Fig. 6 which also shows the cover both in and out of place. The light flange around the outside of the cover helps to take the downward thrust of the milling cutter and several of the pads on the castings are utilized in this same way.

The upper hole through which the fanshaft projects is utilized for clamping at *A* while the plungers *B* and *C* support both bosses as can be seen at *D*. Setscrews

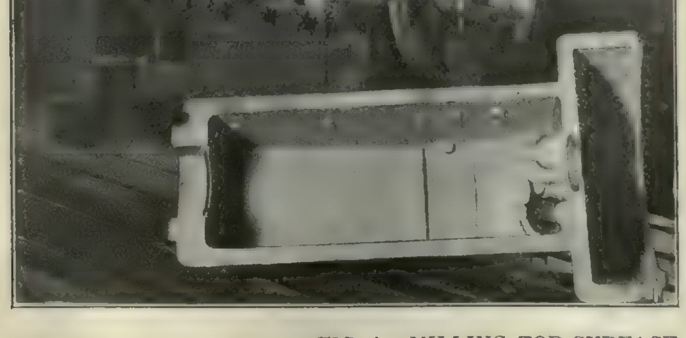


FIG. 1. MILLING TOP SURFACE.

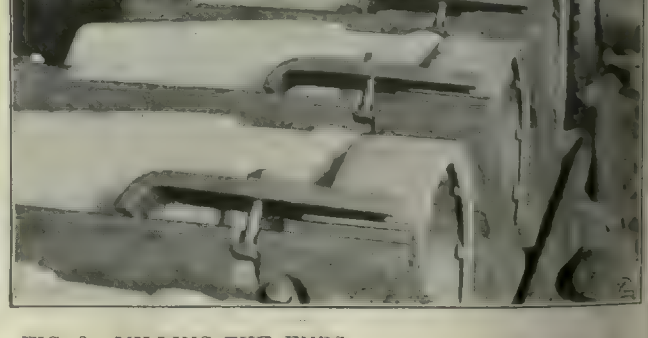
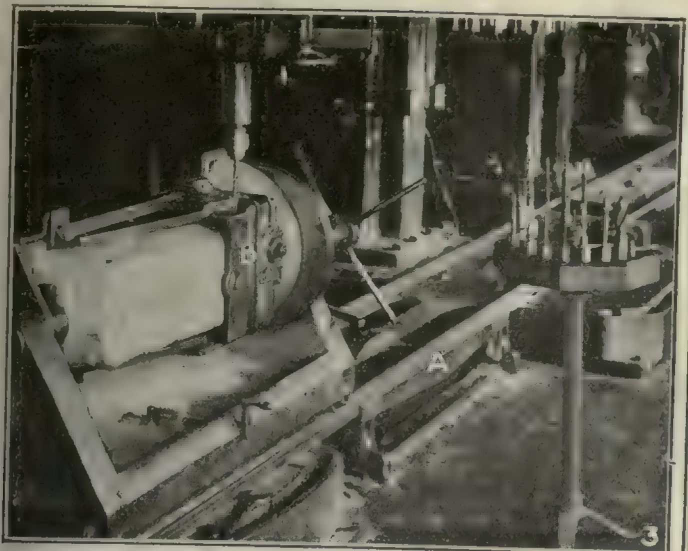


FIG. 2. MILLING THE ENDS



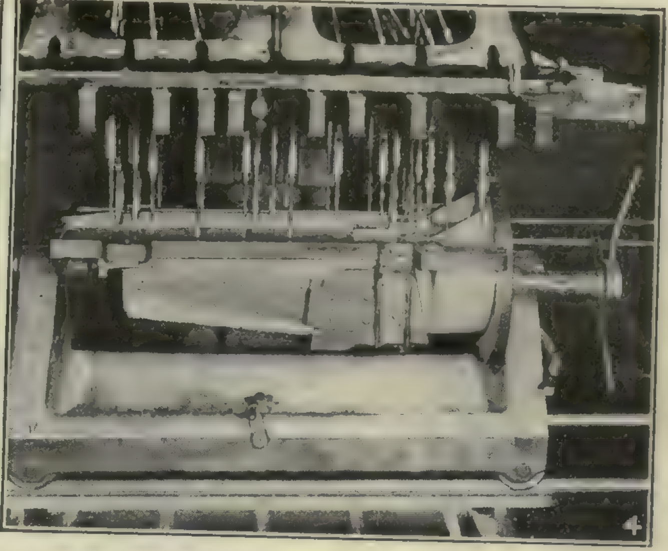
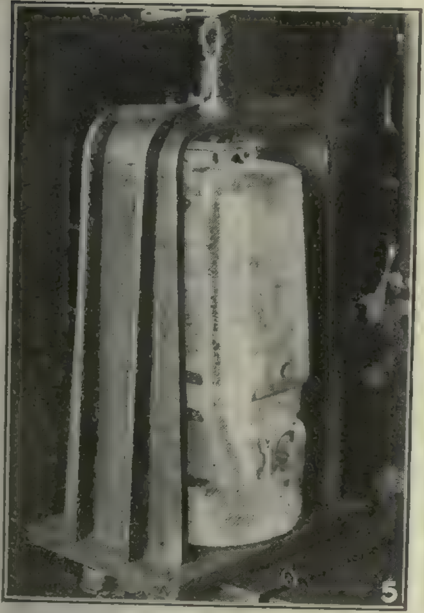


FIG. 3. DRILLING THE SIDE HOLES. FIG. 4. DRILLING THE FLANGE HOLES



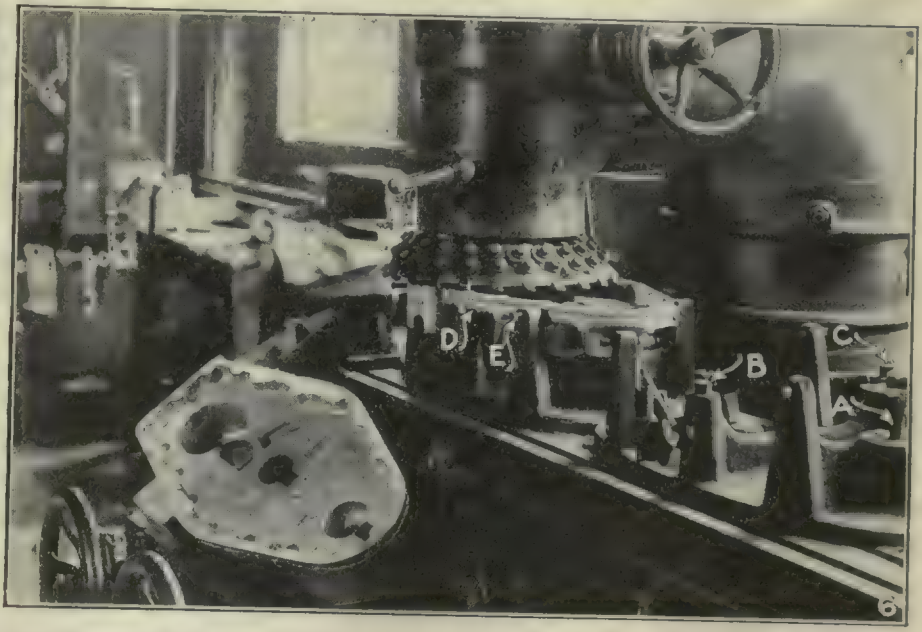
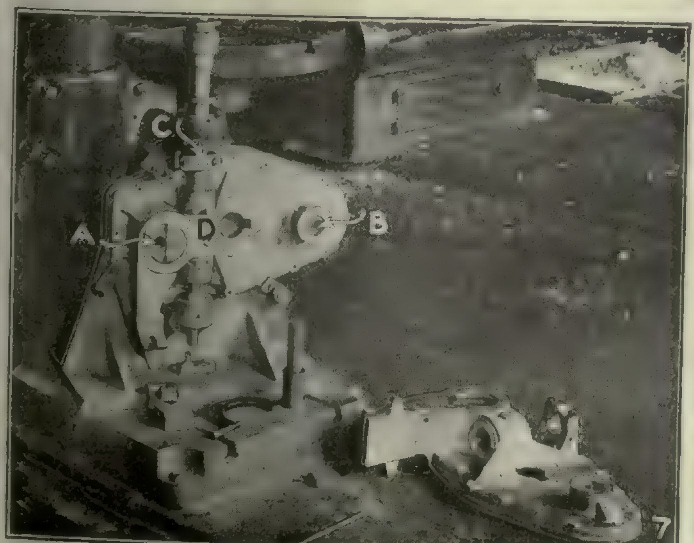


FIG. 5. BORING TWO LOWER CASES AT ONCE. FIG. 6. MILLING FRONT END COVER



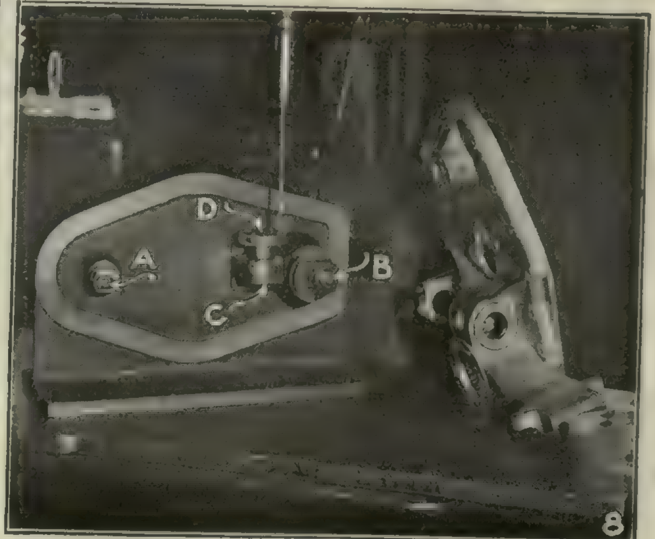


FIG. 7. BORING AND FACING CROSSHOLE. FIG. 8. DRILLING FIXTURE FOR CROSSHOLE FLANGE

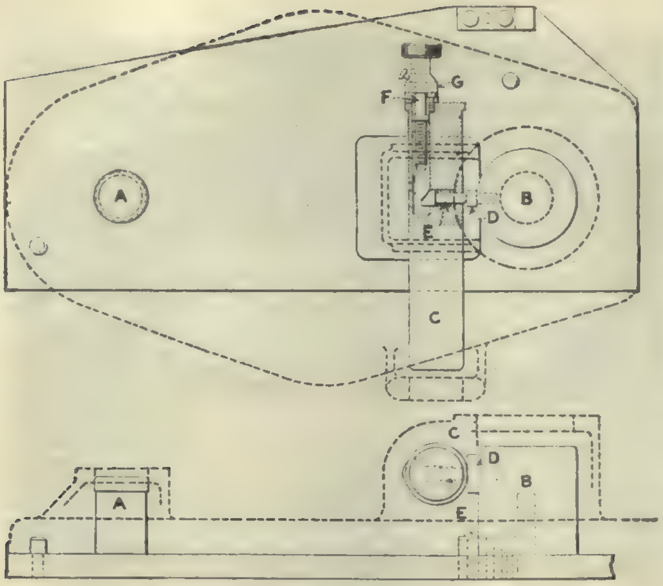


FIG. 9. INSPECTION GAGE FOR FRONT COVER

against the side of the casting as at *E*, hold it against side movement, while the clamp at *A* effectually overcomes any tendency for it to lift out of the fixture.

The boring, reaming and facing of the cross-shaft hole is accomplished in the fixture shown in Fig. 7. The cover plate is located by means of studs which enter the holes *A* and *B*. The bearings *C* and *D* are then bored and faced, the boring bar being guided both top and bottom as can be seen. Right- and left-hand facing cutters *E* and *F* face the ends of the center bearing. A finished cover is shown on the floor.

The drilling of the screw holes around the cross-shaft hole is accomplished on the fixture shown in Fig. 8, the cover itself being removed to show the fixture more clearly. The cover is located and held by studs at *A* and *B* as in Fig. 7. The extension *C* projects inside the casting and locates the plate *D* which carries the four drill bushings. This plate is pushed down through the hole in the front cover after it is in place and guides the drill. There are also four bushings in the extension *C* which guide the drill down to the lower surface and insure the holes in both flanges being in line.

The gage for determining the relations of the holes in the front cover is shown in Fig. 9, the outline of the cover being shown in dotted lines. The upper hole of the cover fits over the stud *A* and the large hole over the stud *B*. The plug *C* is then slipped through the crosshole, to determine its relation to the hole *B*. The piece *D* is inserted in the plug *B* as a measuring point for the plunger *E* which is controlled by the micrometer screw *F*. This device acts, by means of the cone point on *F* and the bevel on *E*, so that the variations can be easily read on the graduated dial at *G*.

Organization and Management of the Small Shop

V. Production Planning and Control—The Necessity and Uses of System—Figuring Shop Capacity—Management of Production—A Simple Method of Cost-Keeping

BY E. W. LEACH

IS THERE a limit to your possibilities? Have you ever said to yourself, "I can do this, but I can't do that, it is impossible"? Or better yet, have you ever seriously asked yourself, "Am I doing all that I can, and is it all my best"? There is a limit to present possibilities of your shop. There is a condition you can reach when your shop will be "running to capacity," and beyond that point you cannot go unless you add more equipment, work longer hours, or devise faster ways of doing things.

But are you running to capacity? Are you doing all that you can with your present equipment? When a shop is not running to capacity something is being wasted. Maybe you have invested in machines which are not kept busy all the time. Maybe you have too many of one kind of machines and not enough of another. Maybe there are times when those machines cannot be kept busy because of lack of materials. Possibly your men themselves are inefficient and are not living up to the requirements of the job. Possibly lack of standard practices results in a lot of scrapped work of certain kinds. Or it may be the sales force is not up to snuff in obtaining sufficient business so that it is good judgment to run to capacity.

There are a hundred and more "maybe's" one could mention that can creep into any business where those in charge do not keep their eyes eternally open to see that they are kept out. But for every "maybe" I have mentioned, and I am sure that for every one you could mention in addition, there is a remedy. And by applying that remedy you will bring your production closer to its maximum. This remedy is to plan your production beforehand, and then control it afterward. That is not merely a remedy for shops that are permitting their production to be governed haphazardly, but it is a preventative against decreased production in shops that are just being organized.

Small shops, it seems, are particularly susceptible to the dangerously expensive practice of "just drifting along," without any system, without any attempt to be methodical and to keep records. Too many small-shop owners say, "Sure I'd like to have a nice cost system and an elaborate method of production control; but I can't afford it." The cost of a system, if it be laid out sensibly and with a view to practicability, should be more than made up a dozen times a year in the savings it effects for you through the information it places at your disposal and through the increased efficiency which it brings into the management of your business. If you are going to look upon the installation of a system as an expense from which there is no return, I cannot hope that this article will be of any value to you whatever. It's something like your advertising—you don't pay for it, the customer doesn't pay for it, it actually *pays for itself*.

If you do not know the capacity of your shop, the time to find it out is *right now*. Maybe you have a small plant from which your shipments are averaging $5,000 a month. Do you know whether you could possibly produce $10,000 worth of goods in a month in that plant? If you don't know, it is very likely you are not realizing all the volume that is yours for the getting.

Or if you find that you cannot possibly produce more than $6,000 worth of goods a month, and yet the increasing demand for them necessitates bringing your production up to $10,000 a month, do you know what to do to raise it to that point? Those are problems which you can solve if your production is properly planned and controlled. I am going to give you a rather unusual definition of production planning and control. Here's what it means to the small-shop owner:

Knowing just where you are,
Knowing just where you're going, and
Knowing just when you should get there.

BILL OF MATERIALS, ECONOMY SKIVER

CASTINGS:
1 Base
1 Frame
1 Top arm
2 Gear blanks
2 Feed rolls
1 Crank
1 Gear guard
1 Leather guide

Cold Rolled Steel Parts:
2 Feed roll pins
1 Blade adjusting screw
1 Hinge pin
1 Spring swivel pin
1 Blade holder
1 Crank handle
1 Blade adjuster nut
1 Short sleeve
1 Long sleeve
1 Upper feed roll shaft
1 Lower feed roll shaft
1 Leather guide screw
1 End washer
1 Blade adjuster bearing
1 Knurled nut
1 Outside blade hanger

Set Screws, Etc.:
2 ⅜ x ⅝-in. hdls. cup point set screws
1 ⅜ x ⅝-in. low head cup pt. set screw
1 ½ x ⅝-in. low head cup pt. set screw
1 $\frac{8}{32}$ x ⅜-in. rd. head machine screw
4 ¾-in. No 10 rd. head blued wood screws
1 $\frac{5}{16}$ x 4½-in. machine bolt
2 $\frac{3}{16}$ x ½-in. rd. head rivets
1 $\frac{5}{16}$-in. cut washer
1 ⅜-in. semi-finished hex. jam nut

Special Parts:
1 Blade
1 ¼-in. extension spring
1 ⅜-in. compression spring

TABLE I. FORM FOR "BILL OF MATERIAL"

Before you can get any production at all in your shop, your men must know exactly how the various jobs are to be done; and that will call for blueprints. If you give a man a job and a blueprint and he makes a mistake, it's clearly "on him." If you gave him the job with only verbal instructions, there are any number of possible alibis he could offer to shift responsibility for a slip-up.

For simplicity of explanation, we will assume that you are making but a single machine or product. For your own information you should have a "Bill of Material" (see Table I) for this machine. This will show all the castings, the steel parts, the screws and bolts, and any other parts, and give the number used on each machine. From this bill of material you can figure your "Requirements per 100," (Table II). This is a good quantity to use as a unit, and knowing your various requirements for that number of machines, if you wish to put through 500 at a time you will know how many castings you must order from the foundry, how many feet of each size and kind of steel you will need, and exactly what quantities of other items.

Your purchase orders should always be written. Telephoned orders should always be confirmed later by a written one. Whether you have your own printed forms or whether you buy a ten-cent blank order book is not so important as the fact that you are putting things down in black and white, eliminating the possibility of duplication and making it easy to place responsibility for mistakes in deliveries. After your materials have been ordered in the proper quantities and you know they will be on hand when needed, your next job is to lay out the work for your men. First you must make a record of the different operations to be performed on each piece, and the machine on which each operation should be performed. In laying out the forms which you will use for orders, requisitions, etc., a good rule to follow is this: do not have any form or any single item on a form that does not serve a real purpose, or that is not actually used. If you will bear that in mind your system will be simple, it will be inexpensive from the standpoints of the printing cost and the time it takes to keep it, and yet it will provide you with the desired information. Any of the illustrations to this article are, at best, only suggestive, for no one can pretend to lay out record forms without knowing the individual problems of the shop where they will be used.

KEEPING TRACK OF PRODUCTION

One form that you should have, even though you may not have as many as half a dozen men on your payroll, is a "Factory Order Card." The one shown in Fig. 1 accomplishes more than one purpose. It helps you to make out the job cards which you will give out to the men as their authority to do certain work. It serves as a progress report to show at any time just how nearly completed the work on a certain batch of parts may be. And it also provides a permanent cost record, giving you on one sheet the costs of each operation and the total cost of the finished piece. One of these cards will be made out for each lot of similar castings that you order machined, one for each batch of steel or other kind of parts, one for each subassembly, and one for the main assembly.

MATERIAL REQUIREMENTS FOR
100 ECONOMY SKIVERS

Castings:
100 Bases
100 Frames
100 Top arms
200 Gear blanks
200 Feed rolls
100 Cranks
100 Gear guards
100 Leather guides

Cold rolled steel:
45 ft. $\frac{5}{16}$-in round
63 ft. ½-in. round
40 ft. ⅜-in. round
12 ft. $\frac{11}{16}$-in. round
102 ft. ¾-in. round
4 ft. ⅞ round
30 ft. ⅛ x ¾-in. flat

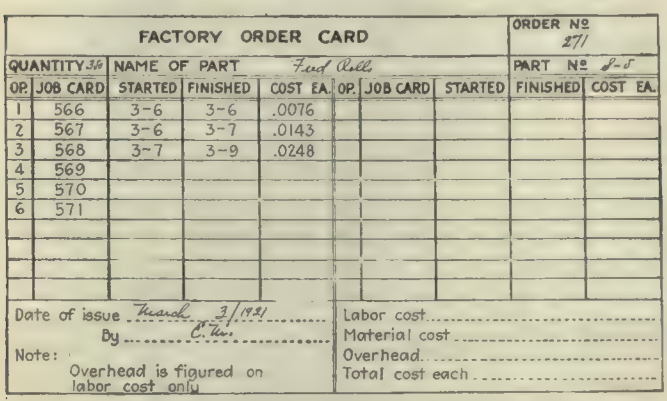
Set Screws, Etc.:
200 ⅜ x ⅜-in. hdls. cup pt. set screws
100 ⅜ x ⅝-in. low hd. cup pt. set screws
100 ½ x ⅝-in. low hd. cup pt. set screws
100 $\frac{8}{32}$ x ⅜-in. rd. head machine screws
400 ¾-in No. 10 rd. head blued wood screws
100 $\frac{5}{16}$ x 4½-in. machine bolts
200 $\frac{3}{16}$ x ½-in. rd. head rivets
100 $\frac{5}{16}$-in. cut washers
100 ⅜-in. semi-fin. hex. jam nuts

Special Parts:
100 Blades
100 ¼-in. extension springs
100 ⅜-in compression springs

TABLE II. FORM FOR "REQUIREMENTS PER 100"

If you want 500 machines started through at one time, you will make out a factory order card for each separate part, noting on each card the name of the part, its number, the quantity, and listing the numbers of the job cards issued under that order. If there are not too many orders going through the shop at once, it is a good plan to keep the cards on hooks on the wall where each one can easily be seen. Then they are in plain sight all the time and any orders which get behind will be quickly noticed. This method will also help to eliminate the danger of orders being overlooked and forgotten as might be the case if you merely kept the order cards in a drawer or a file. For convenience you can arrange all the cards pertaining to one machine in one row, or you may prefer to arrange them according to part numbers without regard to machines.

For each factory order card you will make out as many "Job Cards" as there are operations on the part specified. The job card shown (Fig. 2) is another "combination card," that performs more than one function and is therefore especially adapted to small-shop use. This card is an instruction card for the machinist or assemblyman telling him what is to be done, and it also takes the place of a time-card if you have not enough men to warrant buying a time clock.



FACTORY ORDER CARD

ORDER Nº 271

QUANTITY 350 NAME OF PART Feed Rolls PART Nº 8-5

OP.	JOB CARD	STARTED	FINISHED	COST EA.	OP.	JOB CARD	STARTED	FINISHED	COST EA.
1	566	3-6	3-6	.0076					
2	567	3-6	3-7	.0143					
3	568	3-7	3-9	.0248					
4	569								
5	570								
6	571								

Date of issue March 3/1921

By C. W.

Note: Overhead is figured on labor cost only

Labor cost

Material cost

Overhead

Total cost each

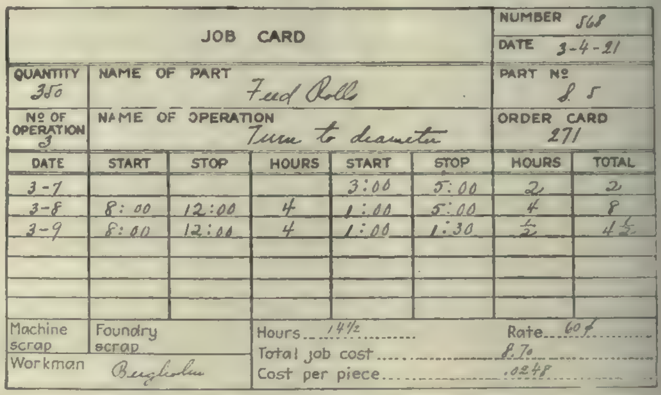
FIG. 1. SAMPLE FORM FOR ORDER CARD

USING A "PRODUCTION BOARD"

Job cards should be sorted out according to the machine on which the operation will be performed. A "production board" can be made with a nail for each machine in the shop, and after the job cards are made out and listed on the factory order cards, they are hung on the proper nails to await their turn. With a definite quantity of work going through the shop you can tell by looking at the milling-machine peg just how many jobs are stacked up for that machine, and by referring to your factory order cards you can arrange the milling-machine jobs in proper sequence so that the most important work will be given first consideration. When a man comes to you for a job you will look at the job cards for his machine and give him the one for the job that should be taken care of first, together with the proper blueprint. The card at this time shows the date and number, the number of the order card under which it was issued, the name and number of the workman, the name and number of the part, the quantity to be machined, and the name and number of the operation.

The workman marks down his time on the job and makes note of any parts that are scrapped, indicating whether they are scrapped through fault of himself or some other workman, or whether the castings as they came from the foundry were defective. This information will be necessary so that you can get proper credit from the foundry for defective castings. The workman also changes the quantity specified if necessary, so that it agrees with the number of parts that he finishes and turns in as O. K. When the job is completed he turns in his card and blueprint. The factory order card should then be checked showing the date this operation was completed. From the time consumed on the job, and knowing the workman's rate per hour, you can figure the cost per piece for that operation. That figure should be put on both the job card and the factory order card, and the job card filed away for future reference.

The cost per piece should be figured promptly, because a job card is much like a street-car transfer—it's no good after it gets old. If the time on a job is a lot more than the average past performance for that job, there will be nothing accomplished by trying a month later to learn the reason for the difference. That sort of information must be gotten without delay if it is to be used effectively to prevent recurrences of unjustified costs.



JOB CARD

NUMBER 568

DATE 3-4-21

QUANTITY 350

NAME OF PART Feed Rolls

PART Nº 8 5

Nº OF OPERATION 3

NAME OF OPERATION Turn to diameter

ORDER CARD 271

DATE	START	STOP	HOURS	START	STOP	HOURS	TOTAL
3-7				3:00	5:00	2	2
3-8	8:00	12:00	4	1:00	5:00	4	8
3-9	8:00	12:00	4	1:00	1:30	½	4½

Machine scrap

Foundry scrap

Workman Bergholm

Hours 14½

Rate 60¢

Total job cost 8.70

Cost per piece .0248

FIG. 2. SAMPLE JOB CARD

A unit of measure that will be valuable in determining production and capacity is the "Man-Hours per 100," and here's how it is derived and how you can use it: On the job card illustrated, it took 14½ hr. to turn 350 rolls. Dividing 14½ × 100 by 350 we get 4.1, and that is the "Man-Hours per 100"; that is, it is the number of hours in which one man would perform that operation on 100 pieces.

DETERMINING CAPACITY OF EQUIPMENT

If you wish to learn how nearly you are running your shop to capacity, or just what the capacity of your shop is and how it can be intelligently increased, figure the man-hours per 100 for every operation on every part, and then sort out these figures so that you know the man-hours per 100 machines for each machine tool in the shop.

We'll assume that your totals work out something like Table III.

Machine Tool	Man Hours per 100
Turret lathe	53
Engine lathe	76
Milling machine	92
Drill press	65
Bench drill press	60
Grinding machine	34
Assembly bench	100
Total hours	480

This means theoretically that one man could make 100 machines complete in 480 hours. Now, then, supposing you are shipping 200 of those machines a month. They net you $12 each, so that your sales or shipments are $2400 a month. You plan to put out some extensive advertising and you believe this will increase the demand for that machine so that you will want to produce 300 a month. Let's see how it will work out:

The milling machine is worked harder than any other in the shop. It works 92 hr. for every 100 machines you produce. That means that if you wished to make 300 machines a month the miller would have to work 276 hr. If you work your shop 48 hr. a week, there is nearly six weeks' work for the milling machine alone. Even by increasing the day to 10 hr. you would still fall short of your schedule. Four weeks of 48 hr. each total 192 hr., and according to your present time records, you could do the milling operations on 209 machines in that time.

Under present arrangements, therefore, 209 machines is your monthly capacity. It is plain that the milling machine must have some relief, so you study your milling work and find there is a great deal of it that could be done on a small shaper. The thing to do, it would seem, is to install a shaper. That will certainly be much less expensive than buying another miller, and it will also enable you to do in your own shop some of the jig work you had been sending outside. After the shaper is installed, you switch some of the boring that you had been doing on the engine lathe over to the turret and your machine-hours per 100 now figures as shown in Table IV.

Machine Tool	Man Hours per 100
Turret lathe	61
Engine lathe	64
Milling machine	44
Shaper	40
Drill press	65
Bench dill press	60
Grinding machine	34
Assembly bench	100
Total hours	468

Now we're most interested in the drill press. In turning out 300 machines there will be 195 hr. of work for the big drill press. Four 48-hr. weeks total 192 hr., and we can very probably find some way to cut our time down 3 hr. and bring it within the limit.

The turret lathe will be busy 183 hr., or 95 per cent of the time. The engine lathe will be busy 192 hr., or all of the time. The milling machine will be busy 132 hr., or 69 per cent of the time. The shaper will be busy 120 hr., or 63 per cent of the time. The bench drill press will be busy 180 hr., or 94 per cent of the time. The grinding machine will be busy 102 hr., or 53 per cent of the time. One man on the assembly bench would be kept busy all the time and another man would be kept busy 108 hr., or 56 per cent of the time. This would necessitate a man on each of the lathes; a man on the miller and one on the shaper (as jig and fixture work would probably take up part of their time), two men at the two drill presses, one man at the bench all the time and one man taking care of the grinding and the balance of the assembly work. Adding another man to take care of all painting, packing and shipping would give you a force of nine men. Figuring an average wage of 60 cents an hour, your payroll (not including yourself) would be $259.20 a week, or $1,036.80 a month of four weeks.

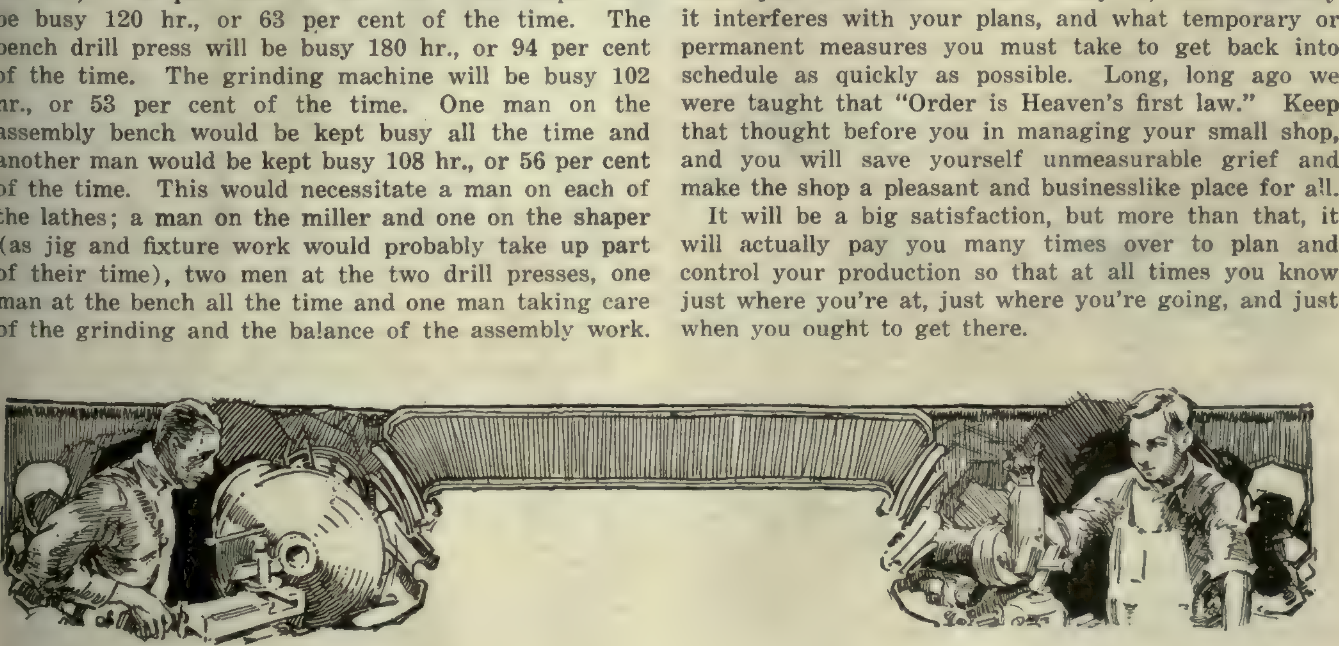
If, in that time you had produced 300 machines, it would seem that your labor cost per machine amounts to $3.46. But according to our schedule there are only 468 man-hours of labor per 100 machines. At 60 cents an hour this would total $280.80, so that really your labor cost on each machine is only $2.81, and the difference between that figure has been spent partly in working on parts for more machines and partly in indirect or non-productive labor such as machining jigs or painting and shipping.

Possibly there is not the slightest similarity between the figures and machines and times given in my suggested problem and those in your shop. But it is the thought behind the thing that I am interested in having you get.

I have told you how one small shop plans and controls its production. It makes several different machines. Some of them sell for $5, some for $200; and so there are variations and elaborations that have been necessary from time to time, but the principles are those which have been explained here. It looks as easy as falling off a log, doesn't it? Well, it really isn't quite as simple as that because it's the unexpected that happens sometimes and throws the best of plans out of gear. No system will ever work out in actual practice exactly as it was arranged on paper. No system is "foolproof," and so you must not look forward to the time when you can come down to the plant at ten o'clock in the morning and leave at about three in the afternoon, trusting to your systematic control of work to insure things running smoothly during your absence. A machine may break down, a workman may quit, the foundry may fall down on deliveries—you know the long list of such possibilities as well as I. And all of those incidents hold up your production and delay the service on shipments.

Without a systematic control of production, such emergencies leave you hopelessly "in the soup." But if you have a clean cut system of record keeping, you know just how serious each delay is, how seriously it interferes with your plans, and what temporary or permanent measures you must take to get back into schedule as quickly as possible. Long, long ago we were taught that "Order is Heaven's first law." Keep that thought before you in managing your small shop, and you will save yourself unmeasurable grief and make the shop a pleasant and businesslike place for all.

It will be a big satisfaction, but more than that, it will actually pay you many times over to plan and control your production so that at all times you know just where you're at, just where you're going, and just when you ought to get there.



Ideas From Practical Men

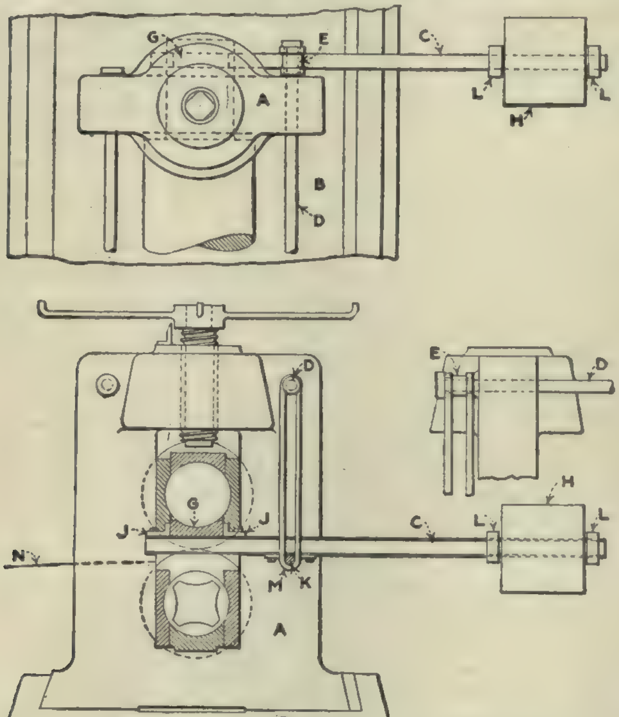
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

A Rather Unusual Job for a Sheet Rolling Mill

By C. F. George

Illustrated herewith is an arrangement for rolling ¼-in. plates from a billet 2 in. in thickness. To do this work on the ordinary sheet mill would have been almost impossible without some such device as shown.

There were two main points that presented themselves: First the lifting of the top roll so as to allow the billet to pass under it and second to counterbalance the top roll so that it would not drop and injure either itself or the bottom roll after the billet had passed through the mill.



HOW THE UPPER ROLL WAS BALANCED

The plan decided upon was to balance the top roll as much as possible and this was accomplished in the following manner: The illustration shows an end view of one of the roll housings *A* which is held securely to the baseplate *B*. The plan view is only a half one, the other half being exactly the same as that shown. Two 5 x 3-in. girders *C* carry the main load and are hung from the back staybolt *D* by forged steel links *E*, two for each girder. Spacer collars *F* were provided between the links *E* so that the staybolt could be tightened up in the usual way. Secured to the ends of the girders were the cast-iron bearings *G* which had to fit the neck of the roll and were held in place by means of the straps *J*. Two 1,500-lb. coupling boxes *H* provided the desired balance at the other ends of the girders and were prevented from coming off by means of the collars L. The girders *C* were fulcrumed at *K*.

The billet was fed through the rolls from the platform *N* and the screws were adjusted at each pass of the billet until the proper thickness was obtained. I may say that over 100 tons of this steel was successfully rolled in this way but it was found advisable after bringing the billets to half their thickness to reheat them to roll to the finished thickness.

Tool for Shortening Valve Stems

By John Lang

The writer recently had a hurry call to shorten, by about 1/16 in. the stems of a number of needle valves for carburetors. These valves were all finished and the assemblers were waiting for them on a rush order.

The stems were about 3½ in. long and 5/32 in. in diameter with a reversed cone on one end that must not be marred.

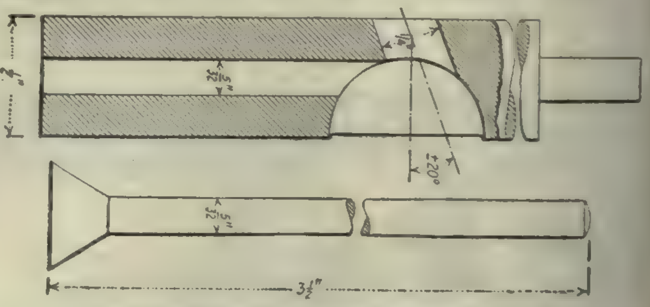
To do the work in the bench lathe without a special chuck would take too long as a wire chuck would have to be taken out on each one; so I took a piece of ½-in. drill rod, drilled a crosshole in it as shown in the sketch at an angle of about 20 deg., chucked it in the bench lathe and drilled a 5/32-in. longitudinal hole to meet the crosshole.

I then roughly ground out a groove as at *A*; grinding to the center and a little way round on each side—altogether a little more than half of the rod. The other end I reduced to go in a drill chuck and then hardened to below the groove.

Holding the stems in a pair of pliers and the tool in a drill press chuck, I inserted the end of the stem in the 5/32-in. hole and pressed down about as hard as if I were drilling a No. 30 hole.

The whole lot of stems were shortened in about 5 seconds each, with a nice radius on the end. No filing of any kind was done on the tool, which took about 15 minutes to make.

[The line cut accompanying this article was unfortunately used in error in last week's issue with an article on drawing gear teeth rapidly. This article will be republished with its proper cut in an early issue.]

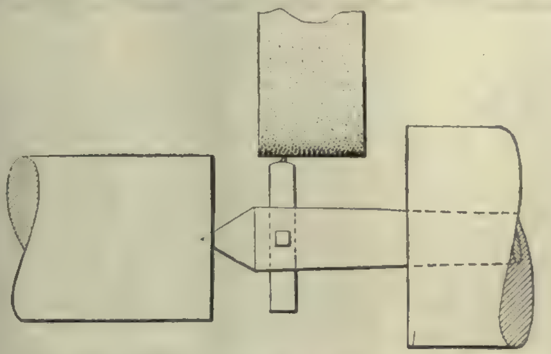


TOOL FOR SHORTENING VALVE STEMS

Method of Truing Grinding Wheel

By Robert J. Thorn

The quickest and most convenient way I have ever found to true a grinding wheel is to provide a tailstock center a little longer than usual, with a transverse hole and setscrew as shown. The holder with the diamond is adjusted through the center with the point about even with or a little back of the surface of the work. To true the wheel it is only necessary to lock the center and with a very short movement of the crossfeed the wheel is brought to the diamond.



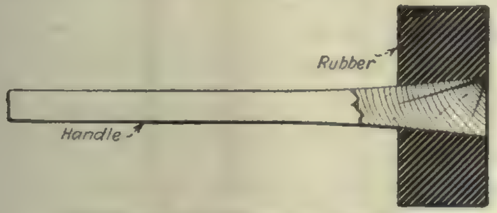
METHOD OF HOLDING THE DIAMOND

Handle for a Rubber Mallet

By W. F. Schaphorst

Rubber mallets or hammers are very useful for hammering delicate metal parts that must not be scratched or battered. Every mechanic should have a rubber hammer handy.

One of the objections to the ordinary rubber hammer, however, is that it easily "flies off the handle." The rubber hammer cannot be wedged like a metal hammer because the wedges simply stretch the head so that it is liable to fly off at any time.



HOW THE HANDLE IS APPLIED

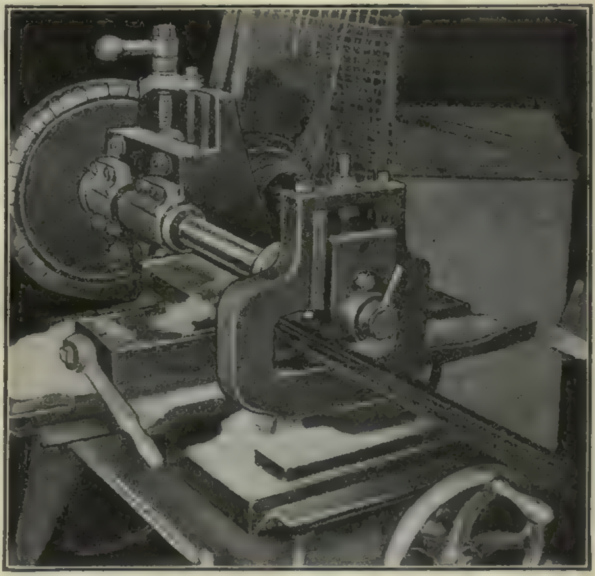
To overcome this objection a friend of mine has hit upon the method of using a handle similar to that used in an earth pick. The handle is large at the head end and is inserted in the head by slipping the handle end in first. In this way the danger of flying off is overcome. The sketch herewith shows how it is accomplished.

Handling Long Bars on a Lincoln Milling Machine

By Donald A. Hampson

There are two or more ways to do every job and what is good practice in one shop is poor in another. Consider parts made from drawn steel and brass bars. Most shops cut them off in saws or in automatic screw machines. The subsequent operations are performed in semi-automatic milling or drilling machines. Where the work is milling only, the method of forging and cutting off complete at one operation has many advantages and would doubtless be given wider consideration but for the fact that the conventional form of manufacturing milling machines has a tailstock or outboard bearing right in the way of the bars, necessitating a transfer of work to other processes.

A milling machine equipped with a special tailstock is shown in the illustration. Three rectangular drawn steel bars constitute a load. A special vise holds the bars which are cut off and notched close to the tailstock by a set of three cutters. The shop turns out a variety of products made from rectangular, hex, round and square bars and almost without exception the work is cut off and formed at one time. Reference to the tailstock will show that it is long in front, providing for safe working space when the table is run out for loading. Its stiffness has been proved by some of the toolings which have gangs of twenty cutters and cutting sections of two square inches in steel.



MILLING MACHINE WITH SPECIAL TAILSTOCK

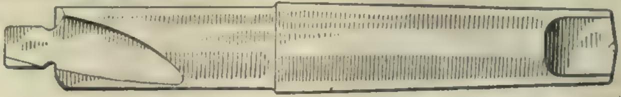
The cutting time on a combined cut-off-and-form-job of this kind is no more than with forming only, but even if the cutting time was much more, it might easily be offset by avoiding second operation work, as has been demonstrated in other forms of shop practice. If a great deal of this work is to be done, it can be put in a department by itself, nesting the machines and placing them on a 20-deg. angle, as in automatic screw machine practice.

An Inexpensive Counterbore

By George H. Barker

The accompanying illustration shows a counterbore made from an old high-speed drill.

We have found this to be a very economical way to secure counterbores for our work as it is easy for the toolroom to make them from discarded drills. A large variety of sizes, both as to outside diameter and the pilot, can be maintained at a very small cost.



COUNTERBORE MADE FROM OLD DRILL

IN THIS ISSUE

THIS issue opens with an article by the metallurgist of the Duff Manufacturing Co., telling of the effect of heat treatment on steel castings and drop forgings. The practical value of this story is indicated by the fact that it is based on the results of an exhaustive series of tests on both castings and forgings. The author tells of the care used in getting truly comparable specimens and in the accurate control to test conditions. Micro-photographs are used to illustrate the changes in structure evident at the various stages of heat-treatment and also by diagrams comparing tensile strengths, area reductions and the results of impact tests. There is also something on chemical specifications.

Coming Features

Complete Articles for the next issue:

The Rolls-Royce Crankshaft—Fred H. Colvin

Piston Work in Motor Repairing—Special Correspondence

Making the Peerless Ring Gear, Spider and Gears—Fred H. Colvin

Series Articles for the next issue:

Economics of Production (V)—Prof. D. A. McCabe

Tools Used in the Manufacture of the P. & W. Adjustable Limit Snap Gage (II)—Ellsworth Sheldon

Metal Cutting Tools (XV)—A. L. DeLeeuw

Tool Engineering (the twentieth part)—A. A. Dowd and F. W. Curtis

Manufacturing with Special Machines vs. Standard Equipment — Col. F. Jenks and H. M. Christopherson.

Another article which is more or less allied in scope to the one we have just discussed is that on the characteristics of the average milling cutter, by the metallurgist of the Detroit Twist Drill Co. While the first article deals with more or less general conditions the latter concerns itself more particularly with the steels used in high-speed twist drills and milling cutters. Here again micro-photographs are used to illustrate different structures of various steels. The article goes on to tell of the treatment of high-speed steel from the ingot stage to final cutter blank in easily understandable language.

Sandwiched between these metallurgical articles are installments of two of our most important series, section IV of Professor McCabe's "Economics of Production" and section XXI of W. R. Basset's "Modern Production Methods." The subject of the economics article in this issue is "Causes of Changes in Demand." If anyone in the metal trades has not been affected by changes in demand in the last year or so we should be very pleased to meet him. It seems to us that he would be the only one who would not have a keen interest in the causes of changes that have been so disastrous to many. Professor McCabe's exposition of this topic is as clear and concise as the way in which he has handled the preceding ones. We are convinced everyone who reads it will have something to think about.

In this day and generation the graphic chart has most certainly come into its own. Its uses are manifold and unfortunately its abuses are too numerous. Rightly used, it is undoubtedly a most efficient tool; wrongly used it is a great consumer of time and energy. Mr. Basset in this installment of "Modern Production Methods" shows both good charts and bad charts and gives valuable hints as to when to use charts and when not to. Sales charts, machine-hour charts, payroll charts, expense charts, and others are all included and described in considerable detail. This section makes a fitting ending to this division of the major subject. It will be followed in a short time by three articles on motion study and rate setting.

On page 428, our New England editor tells in some detail of the methods used by the Pratt & Whitney Co., in large scale production of adjustable limit snap gages. The job is naturally one where extreme accuracy is absolutely essential and one which lends itself to the application of jigs and fixtures. The article is well worth reading.

Next comes the conclusion of part XIX of the Dowd & Curtis series "Tool Engineering." It continues the subject of methods of, and fixtures for broaching of all kinds.

Then on page 436 there is a short article by Fred H. Colvin on the machining of the front cover and crankcase lower half of the Peerless automobile motor. As usual with his work the story is told principally in the pictures. (You would never guess it but he owns up to being an ardent movie fan.) Following Mr. Colvin's article we have the fifth installment of Leach's "Organization and Management of the Small Shop." Here the author tells of planning and control of production in the small shop, and takes up some simple ways of keeping time, cost and production records. Those who have followed Mr. Basset's articles all the way through will no doubt be interested in comparing the methods of the big shop with those of the little one, as told by Mr. Leach.

There are not so many practical letters in this issue but the ones shown are particularly good we think. The letters will be found in about the usual position, the page number this week being 442.

If they do not measure up to your standards why not send us in what you consider to be good ones? You may not know that we are only too glad to get them and to pay for them in real money.

EDITORIALS

Are We Overvaluing Statistics?

N A RECENT address, D. G. Wills, chairman of the Federal Reserve Bank of Cleveland had this to say: "Accurate data intelligently arranged is so far ahead f hunches, guesswork, general results and rule-of-umb that it is as electricity to candle light. Nevereless, its use can be overdone and is being overdone. harts and barometers are fine, but there are two subcts that cannot be charted; they are God Almighty d human nature, and both cut quite a figure. Also should be remarked that it is a person of rare alifications that can analyze and make proper deducons from statistics.

"It is my judgment that a lot of us are getting our ousers shiny sitting at our desks pouring over statiscs, department reports, etc., who could spend our time better advantage learning the people in our organitions and getting a more intimate knowledge of the ewpoint of those with whom we do business."

Mr. Wills is quite right. Statistics of business are considerable value but they have their limitations. hey are no more accurate than the source from which ey are derived and unfortunately there is both inacracy and incompleteness in many of the sources.

In addition there are many of us who do not hold ith the doctrine of fatalism as applied to business. hen we get to the point where we are convinced that an has no control over his business destiny it will time to step aside and let a more progressive race cceed us. Thank Heaven, we are still far from that age.

The Human Side of Wage Cutting

THE efforts of some managers to keep their organizations together have brought out many interesting aracteristics in the personnel. This is particularly ue of the smaller shops where the men and management are more closely related and get together in a ore man-to-man fashion than is often possible in large stitutions.

In one case where the contacts have always been pernal and intimate, the manager held a shop meeting me time ago and laid his cards on the table, face up. e told the men frankly he was up against it for ready sh; that they had good assets, good customers and ood prospects when business came back. But the great b then was to be sure of getting the payroll together ery week. He hadn't cut wages although he had ashed his own salary to the point where it cut out all xuries.

He pointed out that some of the men were getting ore than others, because they earned more, but that cost the men with the lower wage just as much to live s the other—sometimes more, if he had a larger family, s was often the case. He then put it up to the men as whether the higher rate men should stand a larger ut. And here's where the human interest comes in.

The high-priced men voted unanimously to take a cut at brought them down to the low level, the same as with the lower grade men. The good feeling which existed in the shop brought out the best that was in them and the feeling of brotherhood was stronger than selfish desire for personal advantage. And the gratifying part to the manager was that not a word was said about restoring the higher rates to the best men when business came back. The men's knowledge of the manager's fairness made it unnecessary—and they all knew it. Could a manager have a more striking testimonial or recommendation?

Such an arrangement may not bear the scrutiny of an analytical and cold-blooded economist. He could probably point out its weakness from several angles and deplore the abandonment of special reward for individual effort. But most of us will appreciate the human sympathy and the desire to help the other fellow out of a tight place. And the manager who can inspire such confidence in his men has done much to prevent misunderstandings and delays in the days to come.

One Phase of the Airplane Industry

THE successful development of any new industry depends upon having the factors which enter into it on a substantial basis. One of the phases of successful airplane development is that of securing adequate and proper instruments of navigation and other elements which enter into flight under all conditions. Unless such an industry is developed along with aircraft itself, the usefulness of aircraft will suffer.

All recognize the necessity for, and the advantages of, competitive bidding for Government contracts. But as with private enterprise, all circumstances should be carefully considered in awarding contracts. In these days of business dullness many plants are very naturally groping after orders in lines quite apart from their regular field. This is perfectly proper and shows laudable enterprise. But when such competition brings out bids which are so low as to prevent a living profit another factor must be considered.

There are a few firms which are devoting all their time to the development of this field. Others who are now bidding on this work are simply trying to fill in until business in their regular line resumes somewhat normal proportions. Then this source of supply will be closed to aircraft development.

If bids enough are awarded to firms of this sort, the few who have devoted their time, energy and capital in building up a pioneer industry, may be forced out of business. Then, when the airplane development begins in earnest, it will be handicapped by this loss.

Contracts should not be awarded to anyone at exorbitant figures, but neither should unfair bids be accepted to save a few dollars when it endangers the future. Quality of work, reliability of the product and last but not least, the need of maintaining a reliable and permanent source of supply, should be considered, as well as price. As an infant industry it needs consideration, not for itself but for its effect on the development of aircraft in general.

Shop Equipment News

Onsrud Pneumatic Turbine-Type Grinder

The Onsrud Machine Works, Inc., 3908 Palmer St., Chicago, Ill., is placing on the market a high-speed motor driven by compressed air and intended especially for driving grinding wheels. It is said that the motor attains a speed as high as 30,000 r.p.m., the speed of operation being controlled by means of a valve placed at the entrance of the air to the housing. Although the complete unit weighs only 5½ lb., it is said to be capable of producing ¼ hp., giving ample power for the driving of the small wheels for which it is intended.

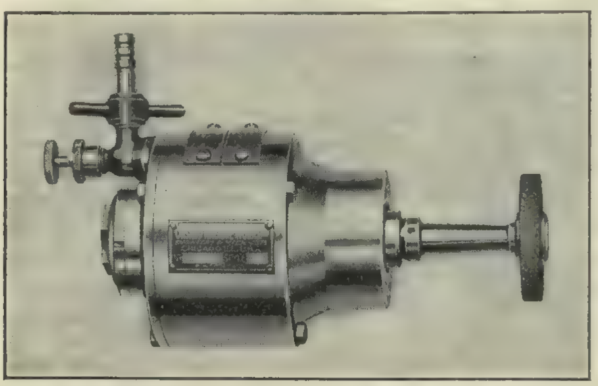


FIG. 1. ONSRUD PNEUMATIC TURBINE GRINDER

The turbine unit, shown in Fig. 1, can be easily held in the hand and operated the same as any portable grinder. However, it is especially intended for attachment to machine tools, and is then held by means of special clamps fastening around the front end of the housing. A heavy shank is provided for holding the grinder on the toolpost of a lathe. A stand for mounting the device on a bench is also made, a toolrest being provided on the stand so that work requiring light grinding, such as tools and cutters, can be easily held in position. For the purpose of grinding center points, a special fixture is provided for holding the grinder spindle at an angle of 30 deg. with the spindle of the headstock of a lathe, so that the proper angle can be ground on the points. This fixture is provided with detachable plugs for insertion into the spindle of the tailstock of the lathe, the use of interchangeable plugs permitting of grinding the centers on either large or small lathes. The grinder can also be mounted on a special bar to permit its use for deep internal grinding where the bore is 5½ in. or larger in diameter, this device being shown in Fig. 2.

The motor of the device is of the three-stage turbine type, operating on the impulse-reaction principle. Stationary vanes between the rotors reverse the direction of motion of the air, so that the impulse on the rotors is in the same direction in each case. The rotors consist of bronze disks with the blades formed in them by milling out the buckets from the solid metal. Thus, sufficient strength is given to the blades, and lightness is also obtained. The rotors are mounted on a heavy spindle, the whole unit being balanced by a special process. The unit makes contact with the other members of the machine only at the ball bearings, which consist of two open-type Norma precision ball bearings of large size, and which are provided with equalizing adjustment and a locknut to give radial and lateral rigidity. There is, thus, no end-play on the spindle, so that grinding can be done with the side, as well as the face of the wheel. It is stated that the balancing is so perfect that vibration is practically eliminated, and that it is scarcely perceptible even though the grinder be held in the hand when running at top speed.

One of the chief advantages of this type of motor is the fact that it operates cold, the ball bearings being kept cool by the passing of the exhaust air over them. The air is then directed from within the turbine casing on to the grinding wheel, so as to blow away dust and grit and aiding in preventing the wheel from becoming loaded. Thus, it is not possible for grit from the wheel to become lodged in the bearings, as it is constantly blown away from the one opening in the housing. In the case of overloading or stalling the spindle, no harm will be done to the motor, as would occur in the case of an electric motor.

The arbors carrying the driving wheels are interchangeable in the spindle of the turbine. Thus, it is possible to leave the abrasive wheel on the arbor with which it is used, and merely change the complete arbor assembly when it is desired to change wheels. Large and small internal arbors, as well as the standard arbor illustrated herewith, can be furnished; and also chucks for holding either cylinders or sticks. The casing of the grinder is made of aluminum, although steel liners are used over the bearings. Lubrication is provided by oil retainers adjacent to both ball bearings.

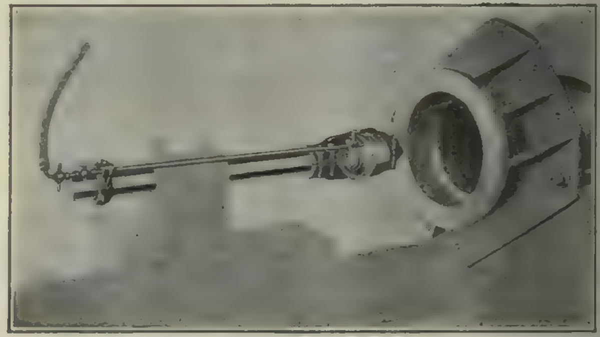


FIG. 2. ONSRUD GRINDER MOUNTED FOR INTERNAL WORK IN DEEP BORES

The grinder is said to require but 10 to 12 cu.ft. of free air per minute at a pressure of 70 to 100 lb. per square inch, although heavier pressures may be used for extremely heavy grinding. The principal feature to which the maker calls attention is the speed of the machine, thus making it possible to eliminate all gearing and such mechanism. The unit is very flexible, because of the fact that the speedy changing of the arbor enables the use of the device for such jobs as buffing as well as grinding, and also because the grinder may be quickly mounted in any of the different styles of fixtures provided for it.

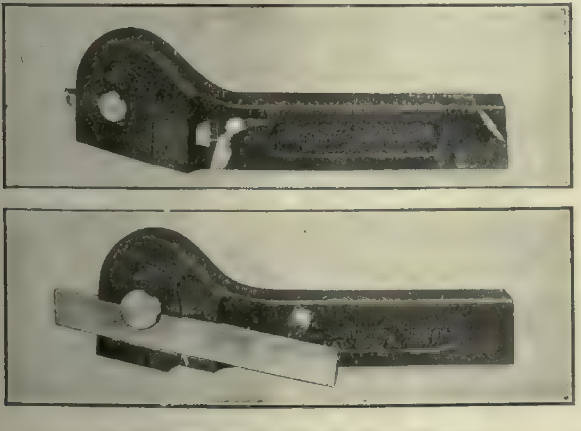
Willard Spring Toolholders

The Willard Tool Co., Inc., 105 East Main St., Stratford, Conn., has recently placed on the market the type of spring toolholder shown in the accompanying illustrations. The holder is made of drop-forged steel, and is hardened to a spring temper. It will be noted that the "goose-neck" is formed by means of a saw-cut through the body of the shank. It is stated that the construction of the toolholder causes the tool to yield or recede in a practically straight line from the work, without causing chatter marks, or endangering the tool when a heavy cut is being taken in tough material.

The device is made in several styles and sizes. At the top of the illustration is shown the regular form of threading and forming toolholder having a right-hand offset. It is said that the tool can work very close to a shoulder, and that it is adaptable both to threading and to the holding of forming tools. The toolbit is carried in a square broached hole, and a non-binding clamping device operated from the side is employed to hold it in place. The action of this clamping device is said to be very rapid and positive. The holder is made in sizes, the No. 3-B holder carrying a toolbit ¼ in. square and being ½ x 1 x 6½ in. in size, while the No. 4-B carries a bit 5/16 in. square and is ½ x 1⅛ x 6¾ in. in size.

At the bottom of the accompanying illustration is shown the cutting-off toolholder of the right-hand offset type. The blade used is beveled on both sides and is clamped in position in the spring end of the holder by means of a special clamping device operated from the side. The blade is provided with clearance in the slot through which it slides on the body of the holder, so that it is free to move somewhat, as the action of it on the work demands. It is claimed that the tool is capable of taking very heavy cuts when supported in this way. The holder is made in two sizes, the No. 3-D holding a cutter 3/32 x ½ x 4½ in. in size and being ½ x 1 x 6½ in. over all, and the No. 4-D being ½ x 1⅛ x 6¾ in. in size and holding a cutting tool ½ x ⅝ x 5½ in. in size.

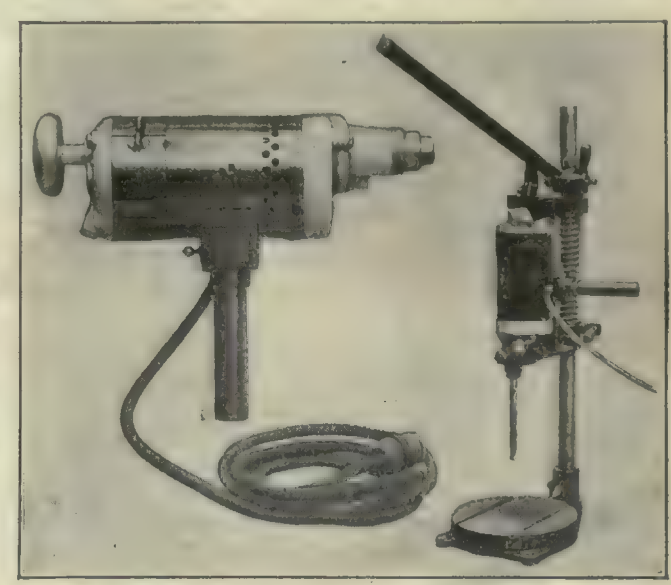
The cutting-off tool is also made in a right-hand straight style, particularly for use on automatic screw machines. The back end of the blade lies in a shank which provides plenty of clearances, so that the tool can tilt when necessary. The device is made in three sizes, the No. 2-C holding a cutter 3/32 x ½ x 4½ in., the No. 3-C and 3-CX a cutter ⅛ x ⅝ x 5⅛ in., the 3-CX being made somewhat heavier than the 3-C.



WILLARD SPRING TOOLHOLDERS

Electro-Magnetic Portable Electric Drill

The Electro-Magnetic Tool Co., 2902 Carroll Ave., Chicago, Ill., is placing on the market the ½-in. portable electric drill shown in the illustration. The tool is intended to meet the requirements of the garage, small machine shop and construction or installation gang. The maker states that the price is its chief feature, as it sells for about half as much as the company's standard drill. A simple and rugged stand, shown at the right, makes the tool into a small drill press and increases its usefulness.



ELECTRO-MAGNETIC PORTABLE DRILL

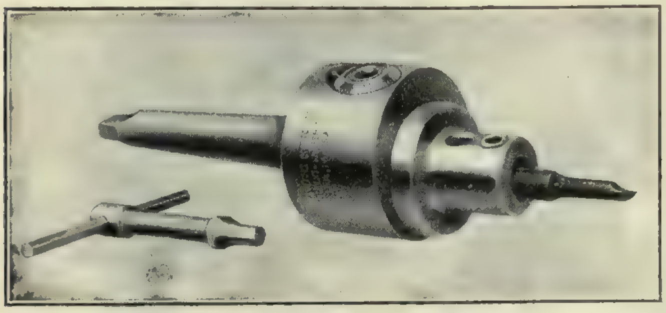
The motor is series wound, has a large commutator, square brushes with pigtails, and an aluminum ventilating fan. The gears are high-grade steel, hardened and ground, and all are removable. The spindle shaft is equipped with ball thrust bearings and runs in special bronze bearings.

A positive switch gives control of the tool at the handle. All connections are made in the switch box, the cover of which is removable and allows for reconnection or changing lead cords without opening the tool. The commutator may be inspected and the brushes removed simply by taking off a cover plate.

Rickert-Shafer Adjustable Boring Head

The Rickert-Shafer Co., Erie, Pa., has recently placed on the market the adjustable boring head shown in the illustration. The device is provided with two hollow-head setscrews for holding the cutting tool in the hollow shank, and can be furnished with the size and style of taper shank required. A micrometer dial, graduated to thousandths of an inch, is used to vary the eccentricity of the toolholding shank. The dial is connected to a cross-screw in the head, and has a friction device to prevent too free turning. The dial can be set to zero for any setting of the tool, so that it is unnecessary when making further adjustments on a piece of work to remember the previous settings or to calculate the required one.

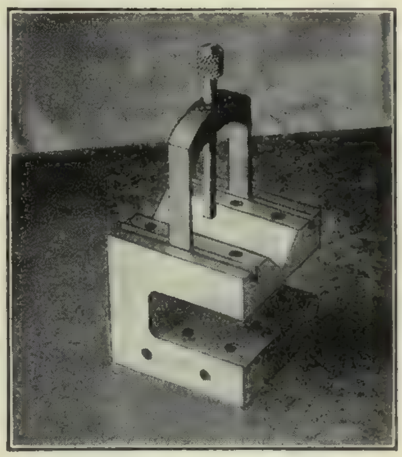
The tool is said to be adapted to the performing of accurate work at high speed. Rigidity and accuracy are claimed for the holder chiefly because of the type of clamp used, this clamp both locking the toolholder in the required position and drawing it rigidly against the head and shank. The clamping screw is placed at right-angles to the adjusting screw. The boring head is adapted to use on machine tools performing drilling, boring and turning, the maker claiming for it the elimination of "cut and try" methods of setting and rigidity nearly equal to that of a solid tool.



R-S ADJUSTABLE BORING HEAD

The head is made in three sizes. The adjustment of the tool each side of center is ¼ in. for the No. 1 size, ½ in. for the No. 2, and ¾ in. for the No. 3; the sizes of the holes in the toolholder are, respectively, ½, ¾, and 1 in.; the outside diameters 2¼, 4 and 5½ in.; and the lengths from the top of the head proper to the bottom of the toolholder 2⅞, 4⅞, and 5⅝ in. A wrench, fitting both the adjusting and the locking screws, is provided.

Toolmaker's Test Block



TOOLMAKER'S TEST BLOCK

A square- and test-block for the use of toolmakers in laying out and testing work upon the bench plate, manufactured by the Art Tool Co., 16 Montgomery St., Bridgeport, Conn., has been placed on the market. The block is of carbon steel, hardened and ground square and true in all planes, and the V-groove is accurately located with respect to the sides. It is claimed to be free from error to 0.0001 inch.

A yoke is furnished with each block to hold round work in the "V," and this yoke, instead of spanning the sides of the block, is held in slots that are milled in the same face as the "V," so that the block will rest squarely upon any one of the other five sides.

Tapped holes are located in convenient places on each of the surfaces to facilitate clamping work to the block by means of screws and straps.

Black & Decker Battery Drill Stand

A special drilling stand has recently been placed on the market by the Black & Decker Manufacturing Co., Baltimore, Md., for the drilling out of terminals of storage batteries. The stand is very similar to that described on page 693, Vol. 53, of the *American Machinist*, but it is able to accomodate a greater height of work.

The stand holds the company's standard ⅜-in. portable electric drill, which has a capacity up to ¾ in. when drilling in lead. It provides a vertical adjustment of the drill of 28 in., the feed motion, imparted by means of a hand lever, being 4½ in. The drill bit can be swung entirely around the column, being 7 in. from it. The extreme height is 46 inches.

Rewards for Suggestions

By C. J. Morrison

The question of rewards for suggestions has been troublesome with many concerns while others have had no trouble and have received many valuable suggestions. The successful concerns have, as far as known, handled the question of rewards on a square deal basis. They have endeavored to pay in proportion to the value of each suggestion and to convince the employees that the rewards were just. Naturally the sums paid varied from a few dollars to very substantial amounts. In one case, the award was so great that it was paid as a royalty extending over a number of years.

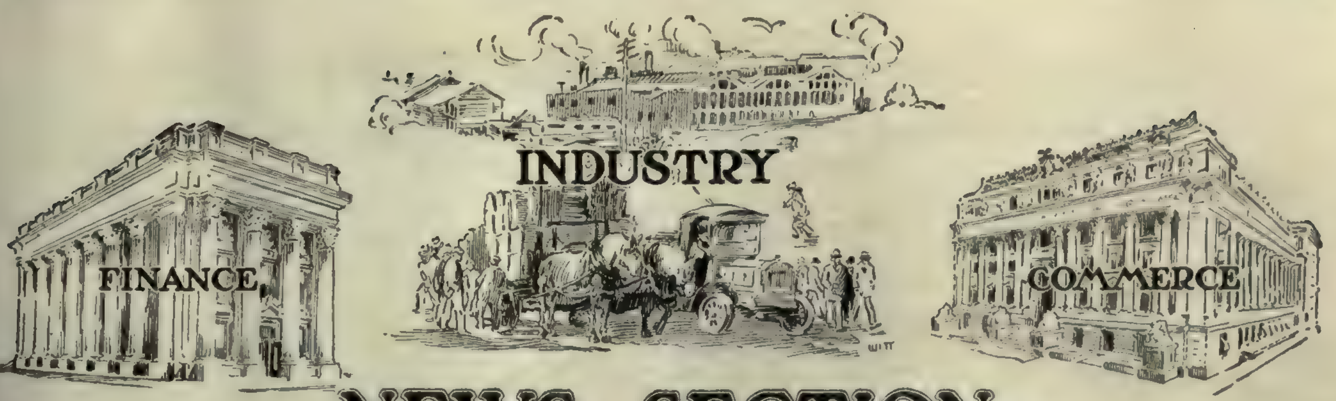
The idea was so simple that the management would not believe it would work, and here is where the spirit of the square deal made many thousands of dollars for the company and gave the employee a small fortune. The demonstration was undertaken to convince the employee that his suggestion was valueless. After the suggestion had proved its value, the employee stated that he had conceived the idea several years before, but had not presented it as the policy of the company at that time was to pay from one to ten dollars for suggestions.

Right there is the crux of the whole matter. A reputation for square dealing must be established and the employees must be convinced that the rewards are fair, and when a suggestion is rejected they must be convinced that this action was also fair.

The suggestions can probably be handled best by a committee composed of members who are thoroughly familiar with the business, but they should in all cases consult with the employees making the suggestions and these consultations should be made in a friendly, mutually helpful spirit.

A concern was struggling with a problem of conveying material from one process to another without handling. Various methods had been tried without success and so-called experts gave nothing of value in return for their fee. One day a helper stopped a member of the suggestion committee and said, "Youse wise guys is still carrying that stuff." Asked if he knew any other way he replied, "Yes I know how, but can't write and can't explain. Bring up your committee and I'll show you." The committee was soon shown how to transport the material without handling. The value of the suggestion could not be determined immediately as time would be required to make drawings and construct the device. Moreover there was the possibility that it might not work. But it did not seem best to keep the employee uncertain as to his reward. Consequently he was given a substantial check and told that more would follow when his suggestion had demonstrated its value. Ultimately he received a very handsome reward.

No idea should be scoffed at and thrown aside, but each should be given careful consideration and rejections should be carefully and tactfully explained.



NEWS SECTION

Steel Treaters Convene at Indianapolis Next Week

The American Society for Steel Treating will convene in Indianapolis, Ind., for its third annual convention, on September 19. The meeting will mark the first anniversary of the amalgamation into one great society of two societies devoted to the heat-treatment of steel, the formal proceeding of which took place in Philadelphia on Sept. 14, 1920. From every standpoint, the uniting of forces has been an advantage and the society has been able to exert an influence greater than would have been possible by two organizations having the same purpose.

The sessions will be spread over six days and will include the exhibition of heat-treating apparatus in the Manufacturers' Building, State Fair Grounds.

A. E. White, national president of the society will preside. The annual banquet will be held Thursday evening, the twenty-second.

◆

Schwep Before Senate Committee on Tariff Bill

Testifying before the Finance Committee of the Senate, C. F. Schwep, of the Ingersoll-Rand Co., asked that the present tariff rate of 8 per cent on hollow drill steel be allowed to remain in effect, instead of the higher rates prescribed by the Fordney bill. He pointed out to the committee that the old type of percussion drilling differs widely in principle from hammer drilling. The hammer drill, he said, uses hollow steel and instead of lifting the steel in the chuck up and down the drill is tapped on the end. Due to the fact that the tool receives blows at the rate of 2,000 per minute, it must possess qualities which enable it to withstand this shock and vibration. Mr. Schwep declared that his company has found that there is something inherent in the Swedish steel, which is not revealed by analysis, which makes that steel much better adapted for the modern drill than is American steel. To place a prohibitive tariff on this article would interfere with the efficiency of operations which use this type of drill.

◆

File Makers Ask More Duty on Imports

Application has been made to the Finance Committee of the Senate to increase materially the duty on files. Domestic manufacturers of files, which include some thirty makers of machine-cut files, suggest the necessity of levying a duty of 40 cents a dozen on files two and one-half inches in length and under; 75 cents a dozen on files over two and one-half inches, and under four and one-half inches in length; $1 on files over four and one-half inches and under seven inches in length; and $1.20 on files seven inches in length and over.

The tariff bill which passed the House prescribes rates of 25 cents, 47½ cents, 62½ cents and 77½ cents per dozen for each of the above groups respectively. It was stated that much keener competition from abroad may be expected since a vast amount of additional capital is being invested in the file industry in England, while the war had the effect of developing materially the industry in Sweden. Since nearly 90 per cent of the total cost of files is represented by labor, the United States is in no position with its high wage scale to compete with foreign manufacturers, it was said, unless adequate duties are provided.

Automotive Engineers To Visit Aberdeen Proving Ground

The Washington, Pennsylvania and Metropolitan sections of the Society of Automotive Engineers, together with members of the parent organization will visit Aberdeen Proving Ground on Oct. 7 at the invitation of Major-General C. C. Williams, U. S. A., Chief of Ordnance. Members of the American Society of Mechanical Engineers and the Army Ordnance Association will also participate in the visit and the latter organization will hold its annual convention at the Proving Ground on that date.

The Proving Ground is, in the opinion of engineering experts, the most complete establishment of its kind in the world and during the war a plant for the manufacture of guns and the loading of gas shells was constructed and put into operation there.

The invitation of General Williams provides an unusual opportunity to note the progress that has been made recently in the development of guns, projectiles, armor plate, bombs, aircraft and mobile mounts.

The meeting will begin early in the morning and will last through the entire day. Among the features of the program will be: (1) Firing of small arms, including tracer bullets from machine guns; (2) firing of mobile guns; (3) firing of major caliber guns from 12- to 16-in.; (4) demonstration of tanks, tractors and trailers; (5) demonstration of bomb-dropping from balloons and airplanes.

According to War Department regulations, admission will be limited to citizens of the United States with the exception of those manufacturing munitions for a foreign government which is at war.

◆

Experts To Study Drill Steel

In the hope that they will serve as a consulting committee to study breakage and heat-treatment of drill steel, a joint invitation has been extended by the Bureau of Mines and the Bureau of Standards to the following engineers: B. F. Tillson, New Jersey Zinc Co.; F. W. Denton, Copper Range Co.; Dr. Van. H. Manning, American Petroleum Institute; Dr. J. A. Matthews, Crucible Steel Co.; W. L. Saunders, Ingersoll-Rand Co.

The Bureau of Mines, during the past year, has been doing some research work on drill steel. This has been conducted at the Rolla, Mo., station and at the Minneapolis station. It is recognized that improvements in drill steel have not kept pace with the improvement in drills. The Bureau of Mines, because of lack of appropriations, has not been able to give this problem the attention which it is recognized it should have. It is hoped that, through the co-operation of this committee and the Bureau of Standards, it will be possible to give this matter the attention it deserves.

◆

German Competition in Latin-America

Cable advices to the Department of Commerce indicate that German firms are sending machinery to Latin-America on consignment. payment to be made when the sale is consummated. Even on that basis, little business is being done, it is reported. American machinery is reported as holding its own, despite the lower prices being quoted by the Germans. These prices are said to be from 10 to 25 per cent under the American prices. Better quality and packing and quicker delivery are offsetting the lower prices.

Society of Industrial Engineers at Springfield, Mass.

One of the most important industrial meetings of the year will be the fifth annual convention of the Society of Industrial Engineers, to be held in Springfield, Mass., Oct. 5, 6 and 7.

In the membership of this national organization are business executives and industrial engineers from almost every line of industry, which naturally tends to add interest to the national meetings.

Industrial Stability will be the main theme for discussion, the topics on the program covering four of the major functions of industry—production, finance and accounting, sales and industrial relations. All the speakers will be men of broad practical experience and national reputation.

Afternoon and evening sessions will be held on each of the three days, the mornings being devoted to visiting some of the most progressive plants in the Springfield district.

◆

Metric System Hearings by Senate Sub-Committee

Hearings on a bill, providing for the compulsory adoption after ten years of the metric system of weights and measures, are to be conducted by a sub-committee of the Senate Committee on Manufactures, composed as follows: Senator McNary, Oregon, chairman; Senator Weller, Maryland; Senator Jones, New Mexico.

The sub-committee was appointed by Senator LaFollette, of Wisconsin, chairman of the Committee on Manufactures, at the request of Senator Ladd, of North Dakota, author of the metric bill introduced in the Senate at this session.

This bill provides among other things, that after a waiting period of 10 years no person shall sell any goods, wares or merchandise (except for export) nor charge or collect for carriage or transportation in or according to any other system than the metric system of weights and measures.

All trade, therefore, wholesale or retail, must then be carried on in a system now strange to our people. All postage, excises, duties and customs charged and collected by the Government will also have to be based on the metric system, the units of which bear no simple or easily remembered relation to the weights and measures now in use.

Under this proposed law the American people would be compelled to discontinue the use of the mile, the yard, the foot, the inch, the pound, the ton, the gallon and use the kilometer, the hectometer, the dekameter, the centimeter, the millimeter, the kilogram, the hectogram, the dekagram, the gram, the liter, the dekaliter, the hectoliter, etc., etc.

◆

Asbestos Mining in Movies

The Bureau of Mines, Washington, D. C. has recently completed a motion picture film showing the asbestos mines of the Johns-Manville Co. and the various factories and processes in the mining, refining and manufacture of asbestos into its numerous products, such as roofings, insulations, packings, brake linings, asbestos textiles, papers and asbestos woods and other products.

The picture is in four reels and runs a little less than an hour. It is available for presentation by clubs, engineering societies, Y. M. C. A.'s, etc. Application should be made to the advertising manager, Johns-Manville, Inc., Madison Ave., at 41st St., New York City.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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"Happily there is a short crop of cotton this year," says Secretary Hoover, and although all economists know that he states a paradox, nearly every one will agree with him; for King Cotton, temporarily dethroned, has again regained his sceptre and under his leadership business is marching cheerfully toward prosperity.

The fact that a curtailment in the supply of one of the world's most necessary staples could work such a transformation in public sentiment is proof that conditions were sound and that all that was needed to reawaken constructive energy was some development that could be favorably construed. In reality a crop failure like a conflagration means a reduction in the world's wealth, but the San Francisco fire proved to be a blessing in disguise because it stirred men to action and provided work for everyone.

For a slightly different reason the cotton shortage promises to have the same effect. It has revived the spirit of adventure without which progress is impossible. In time, of course, this spirit will make some people the victims of their own enthusiasm, but that time is still distant and meanwhile it is only necessary to note that in nearly all the markets the light of a better demand is to be seen.

This is conspicuously true of wheat, which has advanced sharply. The reason assigned is that we have already shipped a third of our exportable surplus, estimated at 160,000,000 bushels, but the truth is that people have become courageous enough to anticipate the future.

The same thing is true of steel and iron. There is more buying and production is being correspondingly increased. The increase though slight as yet promises to be cumulative. Copper is also higher. So are building materials. Lath and lumber, cement and brick and glass and plaster are all being more freely bought. There is also a better demand for gasoline and tires, and the automobile people seem more cheerful although many of them are following Ford's lead in reducing prices. Hides and leather are likewise higher. At the wool sales in London and Australia an eager demand at an advance of from 10 to 15 per cent is reported and a large carpet auction in New York was a great success. In cotton textiles business has been halted somewhat by the violent advance in the raw material but it seems probable that cotton as well as its manufactured products will shortly become stabilized on a basis of about 20 cents for the former. The farmers seem disposed to sell at that figure and while no cotton famine is possible this season the producer is in command and cannot be expected to forego his hard won advantage.

Railroad traffic continues to gain. The net revenue for July promises to exceed $75,000,000 and August earnings may be still larger. It is suggested that by selling the $380,000,000 of equipment trust certificates which it owns the Government may be able to advance that sum to the roads without Congressional action and the executives show a repressed cheerfulness at the prospect.

The statement of the Federal Reserve Banks shows a further gain of $15,000,000 in the gold supply but this is at last commencing to have some effect upon loans and circulation which show an aggregate increase of $60,000,000 with the result that the reserve ratio has fallen from 66.8 to 66.2 per cent. The money market is easier at 5½ per cent for time loans and 5¾ per cent for commercial paper.

The stock and bond markets as a whole have been firm and higher. The stocks of railways which traverse the cotton states and of the companies that sell fertilizers have been helped by the advance in cotton and the securities that smell of Mexican oil are also higher upon the belief that the oil magnates now returning from Mexico City have arranged a *modus vivendi* with Obregon. Meantime Judge Gary of the Steel Corporation, not to be outdone by his fellow captains of industry, is on his way to the Mexican capitol and there are some who expect that our Government will recognize President Obregon now that the great corporations have condescended to call upon him. At all events Mexican bonds are higher and in Wall Street it is believed that the "ticker talks."

Noting all these evidences of the improvement I have so long predicted even the pessimists are becoming cheerful and a veritable chorus of optimism is to be heard from coast to coast and from the Rio Grande to the Great Lakes. By his letter to Senator McCormick recounting the achievements of his administration and describing the many good things yet to come President Harding has made himself the leader of this chorus while the tenor of Will Hays is to be heard as he sings that "every one knows that there is ahead the greatest era of expansion and prosperity the world has ever seen."

A building boom is reported from Chicago. Bradstreets and Duns agree that business is improving. The chief statistician of the American Telephone Co. says that the trade passing is 80 per cent of normal and that "it is becoming plain that depression breeds prosperity." Knoxville and a great many other towns report incipient booms. The editor of the *News Signal* of Middletown, Ohio, has published a 66-page paper proclaiming that "business is better" and the newspapers from one end of the country to the other seem agreed that good times have come again.

It is true that the antiphony of the unemployed is occasionally to be heard but most people think that their numbers have been exaggerated and are decreasing and that there will be work for every one who really wants it before the winter sets in. This view is in my judgment sustained by the facts and the thing most to be feared is that the underproduction in many lines from coal to canned goods will be manifest in great scarcity and high prices as the season advances.

The news from England is reassuring. De Valera seems to have talked too much, and the report that some of his Sinn Fein associates are now calling attention to the fact that he was born in America the son of a Spanish father and an Irish mother would indicate that sentiment is turning against him. This leads me to venture the prediction that through the patient diplomacy of Lloyd George the Irish question will be settled and the London Stock Exchange appears to agree with this view for it is strong and cheerful.

The only other European news that bears directly upon American business is the closing of the Berlin Stock Exchange, where trading has been suspended all week because of the decline in marks which sold in New York at 0.0099¾ cents each on Thursday last. This means that 10,000 marks worth about $2,400 before the war could have been bought for $99.75. It means also the ultimate demonetization of paper in Germany with all the pitiful distress that accompanies precipitate deflation. Without a currency that her people will accept Germany's ability to compete with the rest of the world will be temporarily at an end and while this will be in a sense reassuring to those who have feared the ghost of German competition its social and political consequences may be disturbing.

Other foreign exchanges have been remarkably steady when the break in marks is considered and for the present at least France and England appear to be prepared against the impending debacle in Germany. Whether they and the rest of the world can remain unaffected by the utter impoverishment of the German people is a question that the future must answer. Political economy and history suggest a negative reply.

◆

To Reduce Pay of Navy Yard Workers

The Navy Wage Board has concluded extended hearings on the general subjects of the rates of pay and general policy affecting Navy Yard employees under the reduced appropriations. Representatives of machinists and all other classes of Navy Yard employees were heard. Judging from questions asked and statements made by members of the board during the hearing, it seems probable that a reduction of wages will be recommended. A general reduction of at least 5 per cent applied to all classes of Navy Yard employees is expected. At the same time, it apparently is the attitude of the board not to recommend a reduction to the level of outside industry just at a time when the rate of pay is particularly low in some establishments. There also is evidence that the board will not recommend the continuance of part-time work. The board evidently has no fault to find with the five-day week plan, as a temporary provision to prevent the throwing of a large number of men on the labor market at one time, but it was indicated clearly that this plan is not to continue long. The more efficient employees are to be retained and they are to be given an opportunity to work full time.

◆

Army and Navy Contracts To Stand

Every effort is to be made by the Navy and War Departments to avoid cancellations of contracts as a result of the greatly reduced appropriations which will be available to these departments during the current fiscal year. High officials in each of these departments believe that cancellations can be avoided by slowing up the work and extending it over a much greater period than originally had been contemplated. At the Navy Department it was stated that manufacturers had displayed a most considerate attitude in meeting the situation and that there is every reason to think that an amicable understanding will be reached in a great majority of cases where the department will not be able to carry out its obligations in the exact manner in which it had been planned.

◆

More Planes for Air Mail Service

The Air Mail Service of the Federal Government will soon place in operation six remodeled airplanes of the DH type on the transcontinental air mail route between New York and San Francisco. These planes are army planes and by changing the wing and body capacity they will carry double the amount of mail now carried in the Air Mail Service by this type of plane. Eight hundred pounds of mail or 32,000 letters will be carried on the remodeled plane with the same amount of fuel and the same man power, one pilot.

◆

Fight Increased Tax on Motorcycles

Representatives of the motorcycle industry appeared before the Finance Committee of the Senate to urge a reduction in the duty provided in the Fordney tariff bill for motorcycles. In the bill as it passed the House, motorcycles are protected by a duty of 30 per cent ad valorem. The manufacturers asked that this be reduced to 15 per cent ad valorem. Under the Payne-Aldrich bill motorcycles were dutiable at 45 per cent ad valorem. This was reduced to 25 per cent in the Underwood Act. It was pointed out to the committee that American motorcycles have become very popular abroad and that the expansion of the export business is likely to be hindered by retaliatory duties if high rates are prescribed.

Business Conditions as the Big Banks of the Country See Them

The National City Bank of Chicago Sees Many Signs of Improvement

There are distinct signs that fundamental conditions are improving and that the basis is being laid for genuine business revival. Buyers are still cautious, and while some manufacturers are complaining at the dearth of orders compared with this season in other years, the conservatism in making new commitments is natural in view of the lack of confidence in future values. There is developing, however, a better undertone to general trade, and while the situation is still abnormal, yet the outlook is suggestive of sustained improvement in various lines. The extraordinary movement of grain to market has had a good effect. This influence is likely to go further as a consequence of the cuts in freight rates ordered by the Interstate Commerce Commission upon export shipments of grain and grain products as well as on flour. This action gives interest to the assertion by Secretary Wallace that the decline in the purchasing power of farm products below the average of other commodities has created a situation where the production of farm products is seriously threatened. The Secretary has pointed out that in Iowa the purchasing power of oats is just about 48 per cent of what it was from 1909 to 1914. This situation is very interesting and will be given serious consideration by railroad officials as there is much to be said for the theory that the prosperity of the railroads is largely dependent upon the prosperity of the farmers.

One of the most reassuring changes in the financial situation has been the continued strengthening of the country's bank position. Compared with conditions existing one year ago, the reduction (taking the figures of Aug. 17) in circulation has amounted to $671,000,000, the contraction from the high level of the war period being $901,000,000. Nothing perhaps better illustrates the changes in the credit situation than the decrease in notes during the first three weeks of last month of $30,000,000, as against an expansion during the corresponding period last year of $44,000,000. With the reserve ratio of the Federal Reserve system at the year's highest figure and the gold inflow from all quarters continuing, the bank position shows splendid strength. It is significant also that the great foreign banks are making headway in deflating their currency, which in the case of the Bank of England amounts to 10 per cent for the year, and the outstanding circulation of the Bank of France shows a decline from high point of last year of 2.651,000,000 francs. These gains are highly encouraging, but they must not be taken to mean that the credit strain has ended or that the credit situation is normal again. It is far from it, owing to the immense volume of frozen credits based on unsold stocks of cotton, wheat, sugar, rubber, wool and other material and merchandise. There is still a worldwide demand for credit accommodation to reckon with in connection with the continued demoralization of the foreign exchanges and consequent pressure upon the banks for long term credits to enable foreign buyers to take out produce and merchandise on a deferred settlement basis.

Reduced Exports

Recent developments in the foreign trade situation show that a point has been reached where it will be necessary hereafter for this country to compete actively for world trade. The government compilations show that July exports were 322,000,000, compared with $651,000,000 in that month last year, while imports amounted to $178,000,000, compared with 37,000,000 a year ago. It is interesting to note that of the $144,000,000 export balance shown last July, nearly half of it, or 0,534,000 was settled for by the net inflow of gold that month. The complete figures given out by the Commerce Department indicate a falling off of 23.8 per cent in the country's gross foreign trade for the year ended June 30, the total commerce having declined from $13,347,000,000 in 1920 to $10,171,000,000 in 1921. The total imports for the year of $3,654,000,000 showed a loss of 32.2 per cent, while exports of $6,516,000,000 within twelve months declined 19.6 per cent. Fully two-thirds of this decline was in raw materials due to the heavily decreased production of American factories as a result of shutdowns and part time operation. The principal causes for the falling off in export trade the Commerce Department summarizes thus: "With exchange rates on foreign currencies depreciated to a point which made prices in dollars prohibitive, with imports declining, with the impracticability of settling in gold the balances already due the United States, with the difficulty of arranging further credit facilities, with cancellations of orders, rejection of goods already shipped, and collection drafts dishonored, it was impossible for exports to continue at the rate of $500,000,000 or $600,000,000 a month, to which they had grown during the war."

Railroad Gains

There has been such an improvement in the railroad situation as to provide excellent basis for the prediction of Thomas DeWitt Cuyler, chairman of the Association of Railway Executives, that the industry has "turned the corner." The roads showed net operating revenue in June of $51,778,000. This was an advance of nearly $15,000,000 for the month, and compares with a net operating deficit of $14,612,000 in June, 1920. That the roads are reducing their abnormally high expense ratio is indicated by the fact that in June last 82.34 cents out of every dollar of revenue went for expenses, compared with 85.43 cents in May and 96.84 cents in June, 1920. These figures are very striking and indicate clearly that the roads are making consistent progress in getting the better of their unfavorable expense account and in fortifying their financial position. The surprising thing is that the railroads have done as well as they have, when it is recalled that net earnings declined from about $934,000,000 in 1917 to $62,000,000 in 1920. Almost any other industry would have been bankrupted by such a showing. There are definite indications, however, that the railroads are going ahead and that they will be able to retrieve much of what they lost during the interval when every gallery playing politician did his best to nag them and make it difficult for them to get along.

Immediate Problems

One of the biggest problems before the country has to do with providing employment for the great body of idle men and women. The unemployed class has been estimated at 5,500,000, which, reckoning on the usual basis of one breadwinner to sustain five people, means that 27,500,000 people of this country are temporarily without means of support except as they have recourse to savings accounts. This situation will be relieved, however, as the harvest progresses and the railroads give out large orders for supplies and equipment, which they will be able to do as soon as they receive from the government the $400,000,000 or $500,000,000 tentatively promised.

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The Steel Market as a Guide

There is no better guide to the future of general business than the course of the steel market in the past. In the last twenty years there have been five distinct reactionary movements, and, what is interesting to note, the length of these movements has tended to shorten, which reflects the better stabilization of trade. The first of these reactions within the period mentioned occurred in 1904, which accompanied the financial troubles of that year. In 1903 the net earnings of the Steel Corporation were nearly $65,500,000. In 1904 they fell to less than $31,500,000. The cause was monetary stringency, which so contracted the financial credit of the larger consumers of steel and other products that projected improvements were abandoned. Two years later, when credit conditions improved, these plans were revived and the earnings of the Steel Corporation increased to more than $98,000,000. The second reaction occurred in 1908, when earnings fell to $45,634,000, against $105,247,000 in 1907. Enormous decrease in foreign trade, heavy gold exports, and the insolvencies of 24 of our railroads, were the prominent features of 1908.

A third reaction in the steel trade occurred in 1911-12, when the Steel Corporation's earnings averaged less than $55,000,000 a year. The causes of this reaction were widespread and fundamental. Europe heavily liquidated its holdings of American securities; diplomatic tension between France and Germany over the Morocco occupation threatened to embroil England; French capital loaned in Germany was recalled, producing a financial panic in Berlin; the hoarding of cash by the French people (an unusual development) reached unprecedented proportions, and despite a foreign trade balance in our favor in the fiscal year 1912, we exported more than $57,000,000 gold. The recovery from this reaction began in the latter part of 1912, and in 1913 U. S. Steel's profits were $82,000,000.

The slump during the last half of 1914, as everybody knows, was due to the outbreak of the World War. The subsequent recovery in 1915-16 was without parallel. It was based upon our immunity from participation in the war, the enormous increase in our export trade, and the freedom with which we extended financial credits to the belligerents, both as regards advances by the Federal Government and by individuals. The sharp and short reaction which occurred during the first half of 1919 was based on the mistaken belief that speedy readjustment to a peace basis would follow the signing of the Armistice. The recovery during the first half of 1920 was a genuine "flash in the pan" and the subsequent reaction during the last half of 1920 and the first half of the present year was one of the severest ever experienced by the trade.

This brief sketch of the course of our basic industry during the past score of years is made with the object of facilitating a study of the immediate future. The retrospect shows that invariably there were fundamental causes for each slump. The chief of these in the earlier reactions was our clumsy banking system, which was directly responsible for periodic currency panics. That cause has been eliminated by the operations of the Federal Reserve System. While this system lasts there will not be another currency panic in this country. In many of the reactions the cause was closely connected with foreign affairs, the United States being largely dependent upon foreign credits for trade expansion and upon foreign assistance in tiding us over our financial crises. European political troubles were invariably followed by a tightening of the money market and by a withdrawal of credits from this country. Conditions surrounding international finance have been completely reversed as a result of the war, and the kind of troubles experienced in the past are not likely to reappear.

At the present time underlying conditions of world trade are probably more complicated than ever before. The problems of public finance are most formidable, and are inextricably involved in world politics. Private enterprise cannot escape the influence. However, only the confirmed pessimist will despair of ultimate solution, and even he must admit that the United States is in better economic position to solve the problems of the future than ever before in our history.

Certainly we shall retain our pre-war volume of foreign trade and something in addition. It is within the possibilities that we shall have to write off some of the obligations of foreign governments to our government, but that event would not increase our fiscal burdens as a nation today; it would merely delay relief otherwise available if foreign governments would promptly pay interest and principal of debts due our government. In the meantime our domestic trade will increase. An enormous volume of this domestic trade has been backing up, and the situation as regards some of it is that buying for repairs, for replenishing exhausted stocks, and for new construction cannot be longer deferred. Recovery in volume will come more from innumerable rivulets of trade than from a sudden flood of business from an absolutely new source. The stream may rise almost imperceptibly, as during the past two months, rather than with a booming floodtide, but it will certainly rise.—*Peoples National Bank, Pittsburgh, Pa.*

Denver To Have Million-Dollar Iron Works

Within a year Denver, Col., is to have the largest iron works and machine shop west of Chicago. Articles of incorporation have been signed by four Denver iron and machine companies to erect a $1,000,000 plant to be known as the General Iron Works.

The new plant will consist of machine shop, foundry, boiler shop, pattern shop, forge works, storage and assembly rooms. The incorporators are T. B. Stearns, president of the Stearns-Roger Manufacturing Co.; T. A. Dickson, vice-president and general manager of the Colorado Iron Works Co.; Frank Shepard, president of the Denver Engineering Works; and Albert Cordingly, president of the Queen City Foundry Co.

The Queen City foundry will continue to operate its steel foundry and railroad casting works. The plant of the Denver Engineering Works and that of the Stearns-Roger Manufacturing Co., formerly of Pueblo, have been permanenty closed. All work of those organizations will be handled through a general plant in Denver.

The organization of the new corporation does not dissolve the four separate firms, and they will continue to maintain offices and clerical forces as before.

The board of directors of the new company includes: Thomas B. Stearns, president; T. A. Dickson, first vice-president; Frank E. Shepard, second vice-president; Albert Cordingly, third vice-president; R. W. Gordon, treasurer; C. L. Dean, secretary. Two other directors are A. B. Kennedy, first vice-president, and J. R. Henderson, second vice-president of the Stearns-Roger Co.

R. W. Gordon, general manager of the Stearns-Roger Co., and treasurer of the new organization stated that the purpose of the consolidation is to cut down overhead expenses and boost production to a point where Colorado firms can compete with Eastern manufacturing concerns on a scale never before attempted in the West. The new arrangement will obviate the necessity of sending a great number of orders to the East. Hereafter they will be turned out right in Denver.

Pending the completion of the new plant, the new consolidated concern will manufacture articles at the old plant of the Colorado Iron Works.

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The Italian Shipbuilding Industry

Before Italy took possession of the new provinces there were ninety more or less important shipbuilding yards in the country. Today, there are 130 such establishments. Forty of them are almost without orders and about to shut down. The Venetian yards are working only four days per week. In Liguria more drastic measures have been taken a large percentage of the laborers having been discharged. The government is about to appropriate 250 million lire for the construction of merchant vessels, in order to keep at least a part of the yards occupied. But the Italian shipbuilding yards are seriously suffering from foreign competition, as every pound of coal and iron used in this industry has to be imported from abroad. In the Italian yards a ton of new buildings costs at least 2.000 lire, while the cost on the international market is but 600 lire. The largest Italian yards (Ansaldo Co. at Genoa and Sampierdarena, capitalized at 500 million lire) announce a reduction in wages of 50 per cent. It is feared that most of the other yards will have to follow these steps or to reduce the working time considerably.

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Independent Steel Makers Protest Tariff

The rates of duty prescribed on iron and steel products in the tariff bill which has passed the House are inadequate, according to representations made to the Finance Committee of the Senate by the Independent Steel Manufacturers. This is particularly true because of the duties placed on raw materials. The bill is acceptable only, it was declared, because it contains American valuation, anti-dumping and bounty clauses. A plea was made for a return to the policy of free raw materials. By placing high duties on such materials as ferro-silicon, fluorspar, manganese, magnesite, pig tin and zinc, the cost of raw materials of the steel industry will be increased $24,000,000 per year, it was stated. Everything should be done to stimulate lower costs in the steel industry, it was declared, since the present capacity of the country is 20 per cent in excess of the home requirements.

W. L. Fenn, Machinery Builder, Dead at Hartford

Wilson L. Fenn, president of the Fenn Manufacturing Co., Hartford, Conn., died on July 26. He was one of the original incorporators of the Taylor-Fenn Co., and had been prominently associated with the manufacture of special machinery for a number of years

WILSON L. FENN

Mr. Fenn received his early training in the shops of the Pratt & Whitney Co., in Hartford, and he later organized the Taylor-Fenn Co., a combination of the Fenn and the Phoenix Iron Works. In 1915 he formed a partnership with his son which was known as the Fenn Manufacturing Co., of which he was president at the time of his death.

He is survived by a son, Wilson A. Fenn, who is general manager of the Fenn company.

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The Austrian Magnesite Industry

(From the *Neue Freie Presse*. Transmitted by Carol H. Foster, American Mission, Vienna.)

A concentrating tendency in the Austrian magnesite industry has made progress lately. The Veitsch magnesite works have acquired a Tyrol deposit and the magnesite works of Kraubarth have gone over to the Alpine Montan concern. It is remarkable that such great quantities of raw magnesite are exported abroad. This is probably due to the fact that part of the newly established magnesite plants of Austria have as yet no foundries, and are therefore obliged to dispose of their raw magnesite.

Nine-tenths of the magnesite production is exported. While before the war the United States was the principal market for Austrian magnesite, the greater part of the export now goes to Germany. In 1920 the exported raw magnesite amounted to 99,710 metric quintals (1 metric quintal = 220.4 pounds). Of these 74,417 went to Germany, 12,448 to France, 480 to Italy, 146 to Sweden, 7,343 to Switzerland, 1,071 to Jugoslavia, and 3,794 to Czechoslovakia. The export of burned magnesite amounted to 525,596 quintals, of which quantity Germany also got the greater part, receiving 216,174 quintals; France, 29,970; England, 32,861; Italy, 12,685; Poland, 1,359; Rumania, 2,129 Jugoslavia, 1,138 Czechoslovakia, 510; and the United States, 195,025.

America last year purchased considerable quantities of Austrian magnesite, though its own output of magnesite has been nearly doubled over that of 1919. The output of magnesite in the states of California and Washington in 1920 attained 303,767 tons. In spite of this the import of burned magnesite in 1920 still amounted to 43,154 tons, and was thus three times as great as in 1919. Still the imports constituted only 15 per cent of the pre-war imports. These figures show that America can still be considered a great consumer of Austrian magnesite.

Austrian magnesite exports greatly increased in the first three months of 1921, amounting in that period to 213,000 quintals, which is 130,000 quintals more than in the previous year. Recently the great demand for magnesite has somewhat diminished. This is due no doubt to reduction of work in foreign steel and iron industries.

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Fire, on Aug. 13, virtually destroyed the branch of the Ford Motor Co. at Issy-les-Moulineaux, a suburb of Paris. More than a hundred automobiles were in the building when the fire occurred, and the property loss is estimated at from 6,000,000 to 7,000,000 francs.

Improved Tendency in American Iron and Steel Trade

The sentiment in steel-trade circles is more cheerful than it was only a few weeks ago. There is a general tendency toward the belief that the worst has been passed, both in domestic and in foreign markets for steel, and that improvements may now be expected. In most quarters, however, no rapid or extensive improvement is looked for at an early date.

Low Point Probably Passed

Increased activities reported from blast furnaces and from rolling mills indicate some revival of buying to meet pressing current needs, to replenish diminished stocks, or to supply export demand. If this movement, which began about the first of August, is sustained as is expected, July will prove to have been the turning point of the most severe depression in the recent history of the steel industry in the United States. The increase scale of operations at some plants has been reported to be substantially above the previous low levels, but for the industry as a whole it does not appear likely that the August figures of production will show anything more than a moderate move upward from the abnormally low record reached in July. Any upward tendency, however, is a welcom change from the uninterrupted downwar course of the steel business during the las eight months.

There has been a good deal of discussio whether the steel industry is still a goo barometer of general business condition because last year the steel trade was muc slower than most others to show any pronounced effects of deflation of prices an approaching depression. Without attempting to settle this interesting question, i nevertheless is probably true that unmistakable evidence of revival in the ste industry will be regarded as an encouraging sign not only in steel-trade circle but also rather generally by other busine interests. For this reason the customar indices of domestic conditions—pig iro production, ingot output, and unfilled orders on the books of the United Stat Steel Corporation, for August—are await with considerable curiosity.

Export Market Quiet

The export markets for steel continue t be very quiet when compared with cond tions of last year, and there are still man reports of an unbridged gap between pric quoted by Germany and Belgian produce and those which would leave no profit American exporters. There is a growi tendency, however, to hold that a consid able element of artificiality is involved the present form of German competitio and that comparatively slight changes fro existing conditions would largely remo the difficulties which have been experienc on account of German offerings at absurd low prices. Already, it is said, furth downward revision of American prices, rise in German prices, and some appreci tion of the exchange value of the mar have bettered the chances of United Stat exporters meeting German competition certain lines of steel, and especially where quality or delivery date is an i portant consideration.

Inquiries and firm orders for exports steel are reported as more numerous th they were earlier in the year, although mo of the buying is in relatively small lo apparently to satisfy immediate nee The only exceptions appear in railw material, and in pipe orders for oil-prod ing countries.

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Airplane Service Between Rev and Stockholm

(Consul Charles H. Albrecht, Reval, thonia, July 18, 1921.)

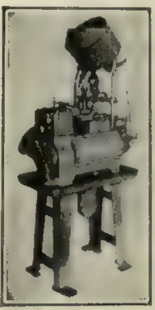
The Svenska Lufttrafik has establis an airplane service between Stockholm a Reval. Two trips per week each way w be made, the trip to take three hours. M from Sweden and passengers both w will be carried, there being accommo tions for five passengers on each trip. subsidy for carrying the mail is recei from the Swedish government, and it expected that the Esthonian governm will also grant a subsidy to provide carrying mail from Esthonia to Sweden.

A hydroplane with a motor of 185 ho power and speed of 180 kilometers hour will be used for the trips, leav Stockholm on Mondays and Fridays 12 m. (Swedish time) and leaving Re on Tuesdays and Saturdays at 3:30 (Reval time—one hour later than Swe time). The price of passenger tickets 250 Swedish crowns ($52.50 at the aver exchange rate of $0.21 for the Swe crown, July 15-18).

Condensed-Clipping Index of Equipment

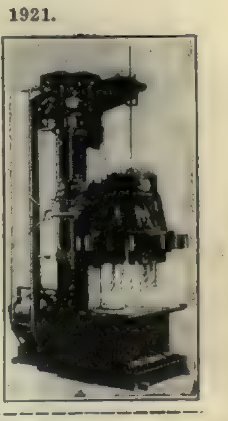
Patented Aug. 20, 1918

Tapping Machine, Nut, Automatic, Double-Spindle
Anderson Die Machine Co., Iranistan Ave., Bridgeport, Conn.
"American Machinist," June 2, 1921.



This machine incorporates new features in the reversing type of machine in that it is entirely automatic and has no clutches. Square or hexagon nuts ranging in size from 3/16 in. to 5/8 in. across the flats, from 3/16 to 5/16 in. in thickness, and having any size of hole up to 10-24 may be tapped at a rate of production of from 112 to 136 pieces per minute. The work is dumped into the hopper and by means of an agitator is fed through the curved chutes, the lower ends of which are fitted with shutters that hold the nuts, one at a time in each chute, in tapping positions. The machine is driven by a ¼-hp. motor, the drive being through a worm and wormwheel. The net weight of the machine is 500 lb., and it occupies a floor space of 18 x 24 in. The height to the center of the spindle is 43½ in., and the total height 66 inches.

Drilling Machine, Upright, Multiple-Spindle, D-32
Fox Machine Company, Jackson, Mich.
"American Machinist," June 2, 1921.

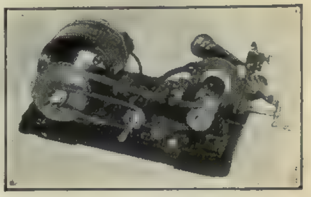


Provision is made for lowering and raising the spindle head by power, using an Ingersoll-Rand four-cylinder air motor mounted on the head. The machine is shown with a 20-in. round head having twelve spindles, each 2 in. in diameter. However, it can be furnished with any one of a variety of heads. The head has been mounted on a saddle in order to obtain a longer bearing on the column ways. Sliding gear transmissions are used for feed and speed changes, the shafts being mounted on Hyatt roller bearings. The machine can be equipped with an automatic tapping attachment so built that it is possible to reverse the spindles at any time during the tapping operation. Rotary tables can be furnished for the machine, so that loading can be done at the same time that drilling is progressing under the head. The machine weighs from 9,000 to 12,000 lb., depending upon the equipment.

Lathe, Triple-Geared, Heavy, 60-in., H. S. & G.
Houston, Stanwood & Gamble Co., Cincinnati, O.
"American Machinist," June 2, 1921.

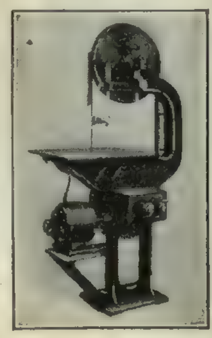
The bed of the lathe, which is 42 ft. long, is made in one section. The large steadyrest shown at the end of the lathe has a capacity of 23 to 37 in. and the smaller steadyrest has a capacity of 2 to 23 in. The carriage is equipped with a rapid power traverse. The lathe shown is equipped with a 35-hp., Westinghouse Type SK, d.c., 220-volt, variable-speed motor. Lubrication of the headstock is accomplished by means of a pump mounted at the rear of the lathe where it will be accessible for repairs. The apron is made with front and back walls to prevent bearings from shifting out of alignment. At the right-hand side of the apron are the motor controller bracket and dial by which the starting, stopping and reversing of the main motor are controlled. At the extreme right can be seen a recently patented support for the lead screw and controller roll. Net weight, 80,000 lb.

Grinding Machine, Portable, Automobile, Repair-Shop
Franklin Machine and Tool Co., Springfield, Mass.
"American Machinist," June 2, 1921.



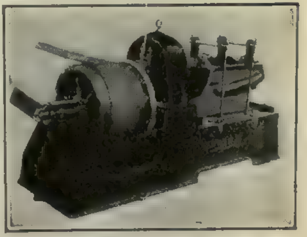
The machine is known as the Model "B" repair-shop unit, and is intended chiefly for grinding valves, sharpening reseating cutters and reamers, and for driving wheels, wire brushes or drills on the end of a flexible shaft. It consists of a flat base, on which is mounted a ¼-hp. motor, a grinding wheel running in bronze bearings and driven by a belt from the motor, an idler being provided to keep the proper belt tension. In the illustration, a double-ended valve-reseating tool is shown in position for grinding, this tool being used for machining the valve seats on the cylinder castings. Since the valve itself can be mounted in the same head for grinding, the same angularity can be obtained on the valve and on its seat. The machine can be adapted to other uses. When used with a flexible shaft directly connected to the end of the motor shaft, different types of tools can be driven.

Saw, Band, Metal-Cutting
Clark Machine Works, Belmont, N. Y.
"American Machinist," June 2, 1921.



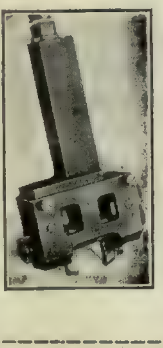
This machine is a compact sprue-cutting saw for use in brass foundries and shops having to cut brass, bronze, aluminum or any of the softer metals which can be fed up to the saw by hand. The machine is ball bearing throughout, the bearings being so designed that they require no oiling. The drive is direct through a worm gear running in a special lubricant, the motor being controlled by a snap switch conveniently located on the under side of the table. It has a sliding-gear speed change operated by a handle on the outside of the gear-box, all gears running in an oil bath.

Burning-in and Running-in Machine, Automotive Bearing
Phoenix Manufacturing Co., Eau Claire, Wis.
"American Machinist," June 2, 1921.



The machine was designed to burn-in and run-in the main bearings on all makes of motor cars, trucks and tractors. The power is transmitted through a three-to-one gear reduction. The burning-in operation is done at a speed of 200 r.p.m., and the running in at 600 r.p.m. An especial feature is the solid Fibroid cone self-adjusting clutch, said to be especially adapted to the severe strains existing during the burning-in operations. The machine is of heavy construction, being ribbed and reinforced. Ford and Fordson fixtures are furnished, and other fixtures for different types of motors can be supplied. The machine weighs 2,200 lb. Height, 34½ in. Floor space occupied, 29 in. x 78 in.

Tool, Planing, Duplex, Dusenbury
Waltham Machine Works, Waltham, Mass.
"American Machinist," June 2, 1921.



The tool cuts in either direction, thus making it possible to take advantage of the ordinary idle stroke of a planer table. The cage seen at the lower part of the tool in the illustration, swivels upon the long bolt which passes lengthwise through the shank, and can be clamped in any desired position by the nut. The amount of the swiveling movement can be regulated and adjusted by means of four small screws. Within the cage are two "clapper blocks," so mounted as to swing toward each other, thus bringing the two cutting points fairly close together and avoiding the necessity for a long over run at the end of each table stroke. The tool may be used in any position, being intended for surfacing, for planing down the side, or for undercutting at an angle. The swiveling feature enables the operator to divide the amount of cut equally between the two cutting points, one for roughing and the other for finishing.

Chuck, Drill, Self-Tightening
Knebel Manufacturing Co., Middletown, Conn.
"American Machinist," June 2, 1921.

A spider, mounted on ball bearings, turns freely upon the central portion of the chuck, and the three jaws are attached to this spider by means of toggle joints. The shell is in two parts, the upper part being threaded to the central part or hub by a square thread, by means of which the chuck is tightened on a drill. The lower part of the shell is screwed to the upper part by a fine-pitch V-thread. The three holes for the jaws in the lower parts of the shell are round, and they cause the jaws to close in as the shell is turned back on the large square thread. The chuck may readily be taken apart for cleaning, and there are no loose parts to be mislaid or to be wrongly assembled. The chuck is made in two sizes to hold 0 to 3/8 in., and 0 to 17/32 in. drills, respectively.

Clip, paste on 3 x 5-in. cards and file as desired

Evolution of an "American Machinist" Article

[VII]

Without illustrations it would be impossible to describe things mechanical; therefore a paper like the *American Machinist* must give considerable attention to that phase of its work. It is a duty of the editor to decide the size of a cut; this decision usually rests on the amount of detail that is necessary to be shown. He also decides on the advisability of using a headpiece. If reference letters are deemed necessary to make a description clear they are marked on tissue paper which is pasted over all photographs. This tissue paper serves to protect the photo and acts as a guide for the editor in checking it up after it is retouched and lettered. If it is a drawing that is being lettered the editor marks his letters directly on the drawing. After an article is edited it is sent to the illustration department, together with the illustrations. Here it is decided what size a line-cut drawing should be, in order to get the proper reduction. The left-hand view shows the making of a line-cut drawing; these are generally made on tracing cloth, while cartoons are made on drawing paper. The right-hand view shows the retouching of a photograph. Here, important lines are made to stand out and, if specified, backgrounds are painted out by hand or by air-brush, or both. While most illustrations are sent in by contributors or are taken by editors on the road, there is considerable work done around our home district. This, together with much advertising work, keeps the company's field photo service department continually on the jump. Our last view shows a flashlight of the dark room, giving a good idea of the equipment carried.

THREE VIEWS OF ILLUSTRATION DEPARTMENT

Tractor Troubles in South Africa

There is a certain loss of power in internal combustion engines, due to the high altitudes met with in South Africa. This is to some extent modified by the lower average temperature at higher altitudes, but nevertheless the difference is considerable, approximately 10 per cent at 4,000 ft. and well worth consideration from the designer's point of view.

Engines should be sturdily built and able to give their full rated power at less than 1,000 r.p.m. It would be better if their general rate were nearer 600. The reduced speed of an engine working under these conditions leads to a very great increase in the working life of the engine and makes it a sweeter engine to run.

The South African soil after a drought becomes very hard, and even in what is considered easy soil hard patches are met with. Very little easily broken soil is found in the country. Under certain conditions clouds of dust are raised in the operation of plowing, and this is of a particularly fine penetrating type. The effect of dust on the engine can be readily imagined. The farmers of South Africa in considering the merits of plows usually insist on land being plowed in its hardest condition, for the reason that it would have to be plowed by oxen under similar conditions, and if a tractor will not do it the tractor is of no use to them.

The South African farmer does not usually employ a skilled mechanic ready to tune the engine to suit the varying temperatures. A machine that requires nursing is not desirable. The machine that is required is one capable of being overdriven and overworked in order to get the work done, and as soon as the machine has proved its worth the cheapest kind of labor will be employed to be put in charge of the tractor. Furthermore a cheap lubricating oil is likely to be used regardless of the possible effect on the tractor. There are, of course, certain farm owners who are more enlightened, but the tractor to be sold in South Africa must be capable of doing well under the worst conditions.

◆

Machinery Exports in July

Oil-well machinery valued at $708,923 was exported during July, 1921, according to figures just made public by the Bureau of Foreign and Domestic Commerce. This compares with $458,704 in July of 1920. Exports of all other types of mining machinery during July, 1921, were valued at $482,677, as compared with $676,336 in July, 1920. Exports of pumps and pumping machinery in July, 1921, were valued at $513,749. This compares with $936,560 in July, 1920.

Business Items

The Porter-Cable Machine Co., Syracuse, N. Y., has taken over the production and sales of the Woodall-Basch drill and reamer holder, described in the *American Machinist* for March 24.

The Utica Drop Forge and Tool Co., manufacturer of nippers and pliers, has recently undergone a reorganization and is now doing business with R. B. Billings as president and J. S. Frazer as secretary and treasurer.

Commerce Reports, the official publication of the Bureau of Foreign and Domestic Commerce, Wash., D. C., will hereafter be issued as a weekly publication. All information and data will be classified on a commodity and geographical basis. The bureau is planning another method of distributing rush news as soon as received.

The Jones Auto-Drive Co., has been incorporated at Dover, Del., to manufacture a one-piece or solid rear axle drive. Capital stock reported as $500,000.

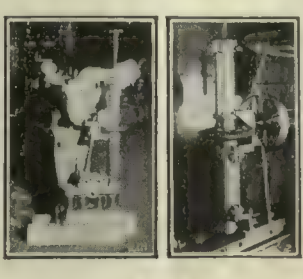
The Reliance Machine and Specialty Co., of Boston, Mass., has been combined with the Union Machine Co., of Fitchburg, Mass. The Jamaica plant of the former company will be moved to Fitchburg where it will be established in the Union Works in that city. The manufacture of self-lubricating bushings and bearings will be continued under the new arrangement.

The Salem Die Co., Salem, Mass., has recently been purchased with its entire equipment, by the Joseph E. Knox & Co., diemakers, of Lynn, Mass.

Condensed-Clipping Index of Equipment

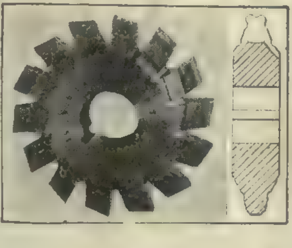
Patented Aug. 20, 1918

Boring Machine, (Re-), Cylinder, Motor
Phoenix Mfg. Co., Eau Claire, Wis.
"American Machinist," June 9, 1921.



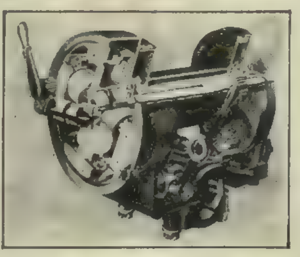
The machine is intended for reboring gas engine cylinders. By the use of the attachments which are supplied the machine can be used either as a hand machine, as shown in Fig. 1, or with power, as shown in Fig. 2. Cylinders can also be rebored without removing them from the chassis. The boring bar operates in an adjustable bearing, 13½ in. long. The cutter head is adjustable from 3⅜ to 4¼ in., and with an extra set of blades will bore cylinders up to 5 in. in diameter. The machine weighs 160 lb.

Milling Cutter, Gear, "High-Production"
Bonaffous, Bozonnet & Co., St. Ouen, near Paris, France.
"American Machinist," June 9, 1921.



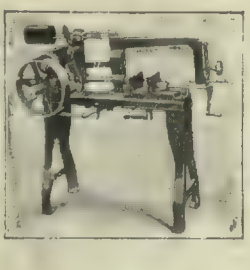
The cutter is intended for production work in the cutting of gear teeth. It looks at first sight like a roughing cutter, but it is stated that it is not, as a very smooth finish can be obtained, as well as a correct profile. The cutter is relieved on a special milling machine. As can be seen by the view on the left, the relieving is straight instead of curved, as is the case in the ordinary gear cutter. The cutter is not ground with the tooth faces radial, but in such a way that the tooth face is kept parallel to a certain diameter line through the tooth. The teeth of the cutter are nicked alternately in the manner shown by the top and bottom portions of the sketch at the right of the illustration. These nicks, or chip breakers, are intended to prevent chatter and to allow each tooth to remove a certain amount of metal.

Hoist, Air-Operated, "Waughoist," Model 250
Denver Rock Drill Mfg. Co., 39th Ave. and Williams St., Denver, Col.
"American Machinist," June 9, 1921.



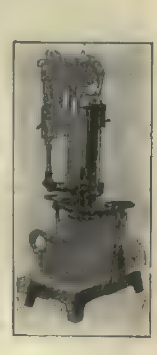
The hoist is designed on the principle of a rotary engine, and the whole engine revolves within the motor housing, which is an oil and air-tight casing. A clutch pinion is mounted on the small end of the spider shaft, so that the cable drum gearing can be disconnected from the engine and the drum permitted to run free when desired. The hoist can be reversed instantly. Brake horsepower, 5 at 100 lb. air-pressure. Hoisting capacity. 500 to 1,000 lb. hoisted vertically at the rate of 68 to 143 ft. per minute. Drum capacity, 775 cu.in. of rope space, accommodating 1,000 ft. of ⅜-in. rope. Weight, 335 lb.

Saw, Hack, Power
Frontier Machine Tool Co., Inc., 128 Lakeview Ave., Buffalo, N. Y.
"American Machinist," June 9, 1921.



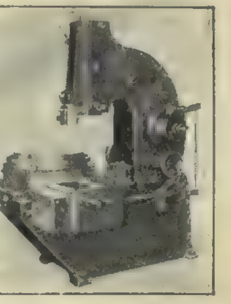
The saw is belt-driven and provided with an automatic stop and a positive clutch in the driving mechanism. A speed reduction of two to one is made in the gearing, the normal speed being 65 strokes per minute. Length of blade, 8 to 14 in. Stroke, 6 in. Cutting capacity, 5½ x 6 in. Vise: opening, 5½ in.; jaws, 4½ x 3 in. Pulley, 11 x 2⅜ in. Floor space, 36 x 18 in. Weight, net, 215 lb.; crated, 235 lb.

Boring Machine, (Re-), Cylinder, Type M
Storm Mfg. Co., Minneapolis, Minn.
"American Machinist," June 9, 1921.



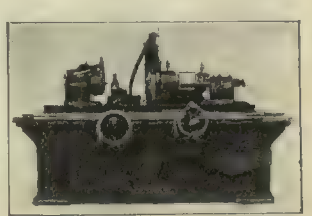
The body of the machine is a casting which supports the boring bar and feeding and driving mechanism. The boring bar is of hollow carbon steel and is carried by two heavy adjustable bearings. It has a travel of 14 in. The cutter heads are of the six-cutter type, having universal adjustment by means of a central control. The machine is regularly furnished with a connection for a drilling machine, but can also be furnished with a belt pulley or with motor drive. The total capacity of the machine is from 2⅝ to 6½ in., and the weight approximately 300 lb.

Slotting and Shaping Machine, Vertical
Jones Machine Tool Works, Philadelphia, Pa.
"American Machinist," June 9, 1921.



The machine is made in two sizes, with 6- or 10-in. stroke, and can be furnished equipped for either belt or motor drive. Power is transmitted through a friction clutch and a set of sliding gears, which allow three speed changes for the 6-in. machine and four for the 10-in. machine. The machine is equipped with the McCord quick-return mechanism, which is flood-lubricated, as are also the change gears. Power feeds for the saddle, cross-slide and rotary table are of the intermittent ratchet-fed type. The rotary table has an indexing plate with spring stop for accurate spacing. Quick indexing is a feature of the table, which can be rotated ½, ⅓, ¼, 1/16 or 1/12 of a circle. The 10-in. machine is equipped with quick power traverse to the saddle, cross-slide and table.

Grinding Machine, (Re-), Autopart
The Norton Co., Worcester, Mass.
"American Machinist," June 9, 1921.



The machine is so arranged that the various set-ups can be easily and quickly made, making it adaptable for the regrinding of crankshafts, as well as the grinding of pistons, pins, valves, etc. It has a swing of 18 in. and is 55 in. between centers. With the twelve work speeds provided, grinding can be performed on work of small as well as large diameter. The wheel slide weighs about 900 lb. and is equipped with a 26-in. diameter grinding wheel. The standard wheel feed mechanism is used. The movement of the feed index pin one space advances the slide one-eighth of a thousandth of an inch. A combined center and valve-face grinding attachment is furnished with the machine. Net weight, 7,600 pounds.

Hammers, Power, Compact Motor Drive for
C. C. Bradley & Son, Inc., Syracuse, N. Y.
"American Machinist," June 9, 1921.

The hammers built by the concern can now be furnished with electric motor drives. The drives are not direct, but through belts. On the compact hammer shown the motor is mounted on a bracket attached to the upright. This can be done with the upright types of machine. The application of motors and belts is clearly shown. Motors for alternating or direct current and with various voltages, phases and cycles can be furnished.

Clip, paste on 3 x 5-in. cards and file as desired

For the purpose of manufacturing automobile tool supplies, the South Bend Wrench and Tool Co., has been incorporated at South Bend, Ind., with a capital stock of $10,000. The organizers of the company are J. C. Romanie, B. V. Romanie and Emmet S. Webster.

British Furnaces, Ltd., Millbank House, London, S. W., England, has been organized for the purpose of manufacturing and selling surface combustion apparatus, as agents of the Surface Combustion Co., Inc., of New York. John H. Bartlett, Jr., foreign representative of the Surface Combustion company, had charge of the arrangements.

The Rex Manufacturing Co., has been organized and incorporated at Sheboygan, Wis., to manufacture all kinds of machinery, machine tools and factory equipment. Charles Voight, George Buchanan and R. Wesendorf are named as incorporators.

George L. Logan, manager of the Philippine district office of the Department of Commerce, announces that temporary quarters for that district have been established in the Ayuntamiento, executive building of the Insular Government.

The Moline Plow Co., Moline, Ill., has taken over the stock and plant of the East Moline Engine Co., and the work of moving the machinery and equipment into the former's plant is now progressing. The East Moline Co., builds engines for the Saxon automobiles, and for Universal tractors, Stevens cars and Moline trucks and tractors.

The Detroit Machine Products Co., has been incorporated under the state law of Delaware with a capital stock of $200,000. The new company will manufacture tools and machine parts.

The open air exhibition and demonstration of farm machinery has been added to the program of the Savannah Tri-State Exposition, to be held in October. Gratz Dent will have charge of this feature of the fair.

The Bunnell-Stevens Co., has been incorporated at Dover, Del., to manufacture engines and machinery.

Articles of incorporation have been filed for the Harrisburg Machine and Electric Welding Co., Harrisburg, Pa. John F. Weiss and Elmer E. Erb are mentioned as directors.

Announcement has just been made of the consolidation of the Rex File Co., the Vixen Tool Co., and the Heller Brothers Co., all of Newark, N. J.

The Henry & Wright Manufacturing Co., Hartford, Conn., has been reorganized through the efforts of Mrs. Daniel M. Wright, widow of the founder of the company. Charles J. Sorrells has been elected president; J. O. Hoover, vice-president; T. B. Owens, treasurer; and Mrs. Wright, secretary. Frank M. Rogers is general manager of the plant and W. G. Allen will be superintendent. Production of the Wright dieing machine will be continued.

The Middlesex Machine Co., of Middletown, Conn., builders of universal grinding machines, has been consolidated with the New Haven Sherardizing Co., of Hartford, Conn. The combination will move to a new plant at 868 Windsor St., Hartford, Conn., where it will be known as the Middlesex Machine Division of the New Haven Sherardizing Co. The company will continue to manufacture its line of grinding machines and will design and build special machinery and equipment. F. A. Brassill will continue as chief engineer.

The Mora Pump Co. has been organized at Ashland, Oregon, to manufacture and sell pumps and pumping machinery. The capital stock is $100,000. T. R. Kelly, H. E. Patton and James Caven are the incorporators.

The Vacuumeter Manufacturing Co. has been organized at Columbus, Ga., and incorporated under the state laws of Delaware. Capital stock is $500,000; directors are J. H. Farish, B. Crawford Jenkins and J. J. Albright.

The Universal Flying Machine Corporation has been organized at Philadelphia, Pa., with a capital stock of $50,000. The board of directors includes M. B. Pupp, Emil Sitte and Charles Pampe.

The Columbia Metal Stamping and Die Co., Cleveland, Ohio, has been incorporated with $10,000 capital stock. James M. McSweeney, M. E. Hurd, W. W. White, R. G. McCreary and G. M. Breen form the directorate.

The C. T. Dunkle Motors Co., Columbus, Ohio, has been incorporated. Directors include C. T. Dunkle, T. S. Hoff, C. A. Augustine and C. F. Shockler.

Personals

C. B. Cole, formerly president of the Tool Sales and Engineering Co., Chicago, Ill., has opened offices at 546 W. Washington Blvd., Chicago, Ill., as a consulting engineer, specializing on tools, gages and manufacturing systems.

Reuben Hill, formerly with the Yale & Towne Manufacturing Co., the Hudson Motor Co., and the Detroit Lubricating Co., is now secretary-treasurer of the Marlin Firearms Corporation of New Haven, Conn.

F. A. Brassill will continue as chief engineer of the recently combined Middlesex Machine Co., of Middletown, Conn., and the New Haven Sherardizing Co., of Hartford, Conn.

W. J. Drumpelmann has been appointed director of sales of the Saxon Motor Car Corporation, Detroit, Mich. Mr. Drumpelmann was recently with the Hudson Motor Car Co., and at one time was assistant sales manager of the Chalmers Motor Car Co.

R. B. Woodworth, a consulting engineer with the Carnegie Steel Co., Pittsburgh, Pa., has resigned.

Walter D. Craft, secretary-treasurer of the Vixen Tool Co., Newark, N. J., has been appointed domestic sales manager of the recently consolidated Rex-Vixen-Hellers companies.

Frank Johnson, automotive engineer, has joined the engineering staff of the Cadillac Motor Car Co., at Detroit. Mr. Johnson began his automotive career in Detroit in 1900, doing engineering work for a motor plant in that city. From 1901 until 1906 he was a chief draftsman and designer, having supervision over designing work on all parts of the Cadillac automobile and also on the tools for manufacturing the car.

Charles R. Ketteuring, of Defiance, Ohio, has been appointed special representative in the United States for the Chinese government. He will supervise the purchase of machinery to be used in commercial development.

D. D. Lewis, prominently identified with the steel industry and manufacturing plants for many years, has been appointed general manager of the Carroll Foundry and Machine Tool Co., of Bucyrus, Ohio. Mr. Lewis began his career in Johnstown, Pa. He served as general manager of the Southwark Foundry and Machine Co., of Philadelphia and was general manager of the Buckeye Engine Co., Salem, Ohio. Prior to that time he was identified with the Cambria Steel Co., of Johnstown, Pa. Mr. Lewis was affiliated with the late Tom L. Johnson, of Cleveland, when he built the Johnson Company Steel Mill at Lorain, Ohio. W. E. Matthew, who has served as secretary and general manager of the Carroll company for the last year, will devote his time exclusively to the Lamvert boring mill branch of the company's business, and will continue as secretary of the company as well as a member of the executive committee.

W. H. Archer, of Toronto, Canada, has been appointed locomotive foreman at the Grand Trunk shops at Stratford, Ontario, succeeding H. Battley who has left the service.

W. H. Moore, formerly manager of the New York office of the Garford Motor Truck Co., has recently been appointed manager of the Boston branch office.

George M. Wright, who retired some time ago as president of the Wright Wire Co., Worcester, Mass., a branch of the Wickwire-Spencer Steel Corp., has opened offices in the Park Building in Worcester, Mass., to engage in the manufacture of wire drawing machinery and equipment.

Henry C. Hood, of Detroit, Mich., was recently chosen sales manager for the Taylor-Brown Manufacturing Co., brass founders, Worcester, Mass.

E. L. Larson, general works manager of the Locomobile Company of America, Bridgeport, Conn., has resigned his position, effective September first.

Catalogs Wanted

R. Aguilar, B. 3a de las Artes No. 38, Tacubaya, D. F., Mexico, would like to receive catalogs and details of machinery built especially for making wood screws; also for making nails and tacks.

Trade Catalogs

Detroit Service Tools. Detroit Garage Equipment Co., Detroit, Mich. General Catalog No. 2 describing and illustrating tools and equipment for servicing Ford cars and trucks.

Pierce Packless Valves. Pierce, Butler & Pierce Manufacturing Corporation, New York, N. Y. Catalog No. 50 illustrating and describing, with full specifications and price lists, a line of packless valves.

Direct Current Motors. Allis-Chalmers Manufacturing Co., Milwaukee, Wis. Bulletin No. 1106-A, which is a revision of a previous bulletin on the subject of direct current motors and generators. Several new types are described.

Oldham Pneumatic Tools. George Oldham & Son Co., Baltimore, Md. Bulletin No. 10 illustrating and describing the Oldham chipping and calking hammers, riveters, holders-on, scalers and foundry hammers. Specifications for each type and model are included.

Obituary

Charles B. McManus, formerly president of the Interstate Tractor Co., Waterloo, Iowa, died in Chicago, on September first. At the time of his death he was connected with the Lincoln Motor Car Co., Chicago. Heart disease was the cause of his death.

Fred. A. Dexter, founder and president of the Leavitt Machine Co., of Orange Mass., died at his country home, Sunset Terrace, Mass., on Aug. 23. He was 58 years old. Mr. Dexter was prominent in civic and fraternal circles in Massachusetts and a well-known figure in the machine tool industry.

Louis J. Goldman, president and founder of the Goldman-Beckman Company, Cincinnati, Ohio, and president of the Cincinnati Electric Tool Co., died on Aug. 23. He was 71 years old.

Forthcoming Meetings

The second International Cost Conference will be held at Cleveland, Ohio, on Sept. 14, 15 and 16, under the auspices of the National Association of Cost Accountants.

The third annual convention and exhibition of the American Society for Steel Treating will be held in the Manufacturers Building, State Fair Grounds, Indianapolis, Ind., during the week of September 19 to 24 inclusive.

The annual congress of the National Safety Council will be held at Boston, Mass., during the week of September 26. C. W. Price, 168 North Michigan Ave., Chicago, Ill., is general manager.

The twelfth annual convention of the American Manufacturers Export Association will be held in the Waldorf-Astoria Hotel, New York City, on October 5 and 6. A. W. Willmann is secretary.

The fifth annual convention of the Society of Industrial Engineers will be held at Springfield, Mass., Oct. 5, 6 and 7.

A joint meeting of the American Society of Mechanical Engineers, the Society of Automotive Engineers and the Army Ordnance Association will be held at Aberdeen, Md., Friday, October 7.

The annual meeting of the National Association of Purchasing Agents will meet in the Claypool Hotel, Indianapolis, Ind., on Oct. 10 to 13, inclusive. L. F. Boffey, 19 Park Place, New York City, is secretary.

The American Gear Manufacturers Association will hold its semi-annual meeting at Rochester, N. Y., October 13, 14 and 15. F. D. Hamlin, 4401 Germantown Ave., Philadelphia, Pa. is secretary.

The National Machine Tool Builders' Association will hold its fall meeting at the Hotel Astor, New York City, October 18, 19 and 20.

The third annual convention and exhibition of the American Gas Association will be held in the Congress and Auditorium Hotels, Chicago, Ill., on Nov. 7 to 12.

NEW *and* ENLARGED SHOPS

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Conn., East Portchester—The Portchester Pneumatic Tool Co.—screw machine with collet, 2 in. capacity, also surface grinder, Brown & Sharpe Preferred.

Md., Baltimore—The Machinery Clearing House Corp., Pratt St.—motor driven lathes, 6 ft. 6 in. and 8-10 ft. between centers.

N. Y., Batavia—The Ardia Motor Car Corp.—
One 36 in. planer.
One double spindle shaper.
One band saw, 36 in. table.
One jointer, 20 in. minimum.
Cut-off saw.
Oliver or American mortising machino.
One 36 in. turning lathe.
One 10 ft. Cornice brake for power and hand, for 10 gauge steel.
One large and one small power hammer.
One spot welder, 20 in. throw.
One Acetylene welding outfit.

N. Y., Long Island City—Long Island Fdry. Co., 11th and 12th Sts., and Vernon Ave.—one 24 in. x 5 ft. metal spinning lathe for pattern makers use complete.

Ala., Birmingham—The Woodward Iron Co., Coal, coke, pig iron, etc. J. T. Leonard, Purch. Agt,—One single spindle boring mill, two speed, one piece table, vertical, lateral, transwise and angular adjustment, for heavy castings; about 36 in. will be average size of material used.

One direct geared electric grinding wheel for dressing tools, etc.

Two-wheel machine with steady rests, 1200-1500 r.p.m., prefer "Geometric," 36 in. between centers. One 1½, one 3 and one 5 ton monorail overhead electric cranes, 25 cycle, handling pig iron. Bids are not to include rails.

Ala., Overton—The Alabama Fuel and Iron Co., DeBardeleben, Purch. Agt.—machinery for installation of 2 machine shops for mine of 2,500 ton per day.

Tenn., Mooresburg—G. M. Bolinger—one broom handle lathe and one small planer and matcher (used).

Va., Norfolk—The Atlantic Supply Co., Inc., 421 Water St., J. S. Moore, Secy. and Treas.—one 12 to 14 in. four side moulder, (used in good condition).

Va., Richmond—Layne Auto Service Co., th and Leigh Sts., J. R. Layne, Purch. Agt.—small lathe, light power drill and electric test bench.

Va., Richmond—R. Walker, 1639 West Broad St.—regrinding machine, drill press and medium size lathe (new or used).

Ill., Chicago—Woodward Automatic Control Co., 933 Washington Blvd.—No. 3 punch press.

Ill., Rock Island—J. M. Schaab, 1601 4th Ave.—lathe and drill press.

Mich., Detroit—J. Doran, 270 East Milwaukee Ave.—machine shop equipment for proposed shop on Epworth Blvd.

Mich., Flint—The Buick Motor Co.—Portable scrap shear.

O., Cleveland—The Cleveland Plating Co., 3620 Superior Ave., N. E.—eight ft. squaring shears for 14 gage steel.

O., Cleveland—A. E. Kilroy, 9407 Ramona Blvd., builder—punch and shears, drill presses and trolley runways for steel shop to be erected at 13800 Miles Ave.

O., Columbus—The Bd. Educ., High and Town Sts., E. L. McCune, Clk.—manual training equipment including 2 Oliver trimmers, 2 band saws 30 in., and 2 grinders for Taylor Ave. and Linden St. schools.

Wis., Janesville—The Parker Pen Co., East Milwaukee Ave., manufacturer of fountain pens—C. & P. 10x15 in. press with Miller automatic feed attachment.

Wis., Milwaukee—W. Ehmke, 105 5th St.—one 28 in. iron folder.

Wis., Milwaukee—A. E. Kossow, 473 16th Ave.—one engine lathe.

Wis., Milwaukee—M. Wald, 591 12th St.—one 30 in. tinners folder.

Wis., Prairie du Sac — The Wisconsin School Bo.—manual training machinery also forge and blacksmith equipment.

Ia., Des Moines—The Bd. Educ. c/o G. L. Garton, Secy.—manual training equipment for proposed high school.

P. R., San Juan—The Government of Porto Rico, Purch. Agt., 29 Comercio St., also 17 Battery Place, New York City. American speed lathe.

N. J., Camden—N. G. Wilson Motor Co., c/o W. P. Hallin, 530 Market St.—Machinery for proposed auto sales and service station on Haddon Ave. and Whitehorse Pike.

N. J., Trenton—The Star Porcelain Co., Muirhead Ave.—clay working machinery.

N. Y., New York—V. Lowener's New York Office, 114 Liberty St., K. Engelsted, mgr.—Looms for fence wire weaving.

N. Y., Syracuse—Groves Industrial Requirements Co., 227 Palmer St.—one 20 ton, 8-wheeled locomotive crane with 50 ft. boom and 7½ kw. generator, (used).

N. Y., Tonawanda—F. I. Savitz, 340 Main St.—paper ruling machine.

Pa., Altoona—W. N. Becker, Secy. of the School District, 6th Ave. and 15th St., will receive bids until Oct. 3 for mortiser and shaver machines for use in vocational training shops. Estimated cost, $1,200. C. E. Hedden, Supervisor vocational shops.

Fla., Jensen—The Jensen Ice Wks., H. J. Schultz, Secy and Treas.—Complete machinery and equipment for the manufacture of ice.

Ga., Cartersville—Big Tom Barytes Co., W. C. Satterfield, Purch. Agt.—One or two Raymond 4 roller mills with pneumatic separator for ochre and barytes mines and mills.

Ga., Tate—The Georgia Marble Co., H. L. Litchfield, vice-pres. — complete stone working machinery.

Ky., Paducah — The Ohio-Kentucky Fluorspar & Lead Corp., Inc., F. B. Moodie, Vice-Pres. and Treas.—Jigs, rolls, crushers, tables and other machinery for use in mining fluorspar and lead.

N. C., Lexington—The Elk Furniture Co., J. L. Gilmore, Secy.-Treas.—one Mattison No. 57-B automatic turning lathe (used but in first class working condition).

N. C., Mt. Airy—The North Carolina Granite Corp., W. S. Martin, Secy. & Treas.—

One belt-driven band saw with iron tilting table, size 32 in. to 36 in., to be used to saw out felloes, etc., up to 6 in. thick, also to make simple patterns in 1 in. stock and similar work.

One small belt-driven wood planer, single surfacer or Pony type.

One belt-driven iron planer, single post machine would do but prefer one with single top and side head, length of plate from 6 to 7 ft., width 24 in. to 30 in. Give approximate weight and freight rate to Mt. Airy.

S. C., Prosperity—The Prosperity Cotton Oil Mill Co.—flour mill machinery and equipment.

Tenn., Newport—W. A. Nelson, manufacturer of ice—complete machinery and equipment for 10 to 15 ton ice plant.

Tenn., Nashville—The Rocky River Coal & Lumber Co.

Complete tight barrel heading outfit with one turner.

Six joiners, line shafting and pulleys.

Dry kiln equipment, with or without power.

Two complete heading mills, without power, line shafting, pulleys, belting, edger.

Two 58 to 60 in. saws (used if in good condition).

Two low down stave wheel listers, complete with knives.

Va., Milford—W. Wilson—planing mill machinery.

Wis., Haugen—The Haugen Box & Crating Co., J. E. Lee, Purch. Agt.—woodworking machinery, including saws, planers, mortiser, jointer, etc.

Wis., Maribel—The Maribel Strawcutter Co., c/o H. Glover—machinery for proposed factory.

Wis., Owen—W. F. Weaver Co.—planers, punches, sawing machines, vises and special wood-working machinery.

Wis., Portage—The Portage Co-Operative Canning Co., Michel Bldg.—canning and conveying machinery.

Wis., Prairie du Sac—The Wisconsin River Power Co.—machinery for proposed power and machine shop.

Wis., Watertown—W. Hartig, 100 Cady St.—$15,000 worth of machinery for ice cream factory, to include all special ice machinery, coolers, mixers, etc.

Wis., Waukesha—The Manitowoc Church Furniture Co., C. F. Schuetze, Mgr.—woodworking and special furniture machinery.

Wis., Waukesha—C. F. Schuetze, 1214 Lincoln Ave.—wood-working machinery.

Ia., Davenport—The Davenport Ice Co., 1st and Myrtle Sts.—machinery for the manufacture of ice.

Tex., Dallas — Stickle Lumber Corp., 214-19 Dallas County State Bank Bldg., A. W. Stickle, Pres.—Machinery for the manufacture of lumber, etc.

N. B., Moncton—R. C. Tait—$10,000 worth of saw mill equipment.

Ont., Guelph—Flax Spinners, Ltd.—Machinery to replace that which was destroyed by fire. Loss $100,000.

The Weekly Price Guide

This Week's Market

Soft steel bars and bar shapes have been quoted at $1.60@1.70, Pittsburgh; with plates at $1.65@1.70 and steel shapes at $1.75@1.80 per 100 lb. Mill shipments, New York, of structural shapes, are quoted at $2.13@2.23; plates at $2.08@2.13 and bars at $2.03 per 100 lb. Steel warehouse prices have remained firm throughout the week.

New York reports an advance of ½c. in tin, making the present price 27¼c. as against 26¾c. per lb. Copper bars have been reduced from 18½c. to 18c. and brass tubing from 18½c. to 18c. per lb. Solder has advanced from 17¾c. to 19½c. per lb. (case lots).

Chicago metal market shows a reduction of ½c. per lb. on the following metal products: brass sheets, rods and tubing; copper sheets and tubing and aluminum ingots. Copper bars are quoted at 17½c. as against 18½c. per lb. Advances ranging from ½c. to 1c. per lb. are quoted in old metals. Increased discounts are shown on shop supplies and linseed-oil is quoted at 84c. as against 80c. per gal.

Cleveland reports a decrease of ½c. in copper sheets and a rise of 1c. per lb. in babbitt metal (best grade).

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	*$24.50
Northern Basic	†21.52
Southern Ohio No. 2	†22.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	†30.26
BIRMINGHAM	
No. 2 Foundry	*20.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil.	†21.76
Virginia No. 2	†28.74
Basic	19.76
Grey Forge	21.26
CHICAGO	
No. 2 Foundry local	21.00
No. 2 Foundry, Southern, sil 2.25@2.75	†26.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	†22.96
Basic	†21.46
Bessemer	†21.96

*F. o. b. furnace. † Delivered.

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.25	3.28	3.10	3.38
No. 12	2.35	3.33	3.15	3.43
No. 14	2.45	3.38	3.20	3.48
No.16	2.55	3.48	3.30	3.58
Black				
Nos. 17 and 21.	2.60	3.80	3.55	3.95
Nos. 22 and 24.	2.65	3.85	3.60	4.00
Nos. 25 and 26.	2.70	3.90	3.65	4.05
No. 28	2.75	4.00	3.75	4.15
Galvanized				
Nos. 10 and 11.	2.75	4.00	3.75	4.15
Nos. 12 and 14.	2.85	4.10	3.85	4.25
Nos. 17 and 21.	3.15	4.40	4.15	4.55
Nos. 22 and 24.	3.30	4.55	4.30	4.70
No. 26	3.45	4.70	4.55	4.85
No. 28	3.75	5.00	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of July 7, 1921:

Steel			Iron		
Inches	Black	Galv.	Inches	Black	Galv.
BUTT WELD					
1 to 3	64½	52	¾ to 1½	39½	24½
LAP WELD					
2	56¼	44	2	34½	20½
2½ to 6	60½	48	2½ to 4	37½	24½
7 to 12	57½	44	4½ to 6	37½	24½
13 and 14	45	37	7 to 12	35½	22½
15	42½	32			
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	62½	51	1 to 1½	39½	25½
2 to 3	63½	52			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	54½	43	2	35½	22½
2½ to 4	58½	47	2½ to 4	38½	26½
4½ to 6	57½	46	4½ to 6	37½	25½
7 to 8	53½	40	7 to 8	30½	18½
9 to 12	48½	35	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
¾ to 3 in. steel butt welded.	60%	46%	52½%	43½%	62½%	50%
3½ to 6 in. steel lap welded.	51%	37%	55½%	40½%	48½%	46%

Malleable fittings. Classes B and C, Banded, from New York stock sell at plus 6%. Cast iron, standard sizes, 15% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (heavy)	5.00	6.50	8.25
Spring steel (light)	6.00@8.00	6.50	10.50
Coppered Bessemer rods(base)	8.00	8.00	6.03
Hoop steel	3.88	3.29	3.48
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	4.85	2.74	5.23
Cold finished shafting or screw	4.23	3.85	4.00
Cold finished flats, squares	4.73	4.35	4.50
Structural shapes (base)	2.88	2.74	2.88
Soft steel bars (base)	2.78	2.64	2.78
Soft steel bar shapes (base)	2.78	2.64	2.78
Soft steel bands (base)	3.43	....	.....
Tank plates (base)	2.88	2.92½	2.88
Bar iron (mill 2.25)	2.78	3.52	2.78
Drill rod (from list)	55@60%	55%	50%

Electric welding wire.......... New York 3/32, 8½c. per lb. ⅛—7.15c.; 5/32 to ¼—6.75c. Swedish iron sells at 18½c. per lb. in Chicago

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	12¾@13
Tin, 5-ton lots, New York	27.25
Lead (up to carlots), St. Louis, 4.35; New York	4.75
Zinc (up to carlots), St. Louis, 4.60; New York	5.00

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.00	25@26	21.00
Antimony (Chinese), ton spot	5.25	6.00	6.00
Copper sheets, base	19.75	20.50	19.50
Copper wire (carlots)	15.50	15.50	14.00
Copper bars (ton lots)	18.00	22.00	17.50
Copper tubing (100-lb. lots)	19.50	23.00	19.50
Brass sheets (100-lb. lots)	15.25	18.00	15.25
Brass tubing (100-lb. lots)	18.00	20.00	18.00
Brass rods (1,000-lb. lots)	13.25	15.50	13.25
Zinc sheets (casks), (8% dis. carlots)	11.00	11.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ½), (case lots)	19.50	23.50	17.50
Babbitt metal (best grade)	70.00	36.50	35.00
Babbitt metal (commercial)	30.00	13.50	9.00

—Shop Materials and Supplies

MONEL METAL Base price in cents per pound, f.o.b. Bayonne:

Shots and blocks	$35.00	Hot rolled rods (base)	42.00
Ingots	38.00	Cold rolled rods (base)	56.00
Sheet bars	40.00	Hot rolled sheets (base)	55.00

Special Nickel and Alloys

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

OLD METALS—-Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	9.50	9.00	9.50
Copper, heavy, and wire	9.00	9.00	9.00
Copper, light, and bottoms	7.00	7.00	8.00
Lead, heavy	3.25	3.00	3.50
Lead, tea	2.00	2.00	2.75
Brass, heavy	5.00	5.00	7.25
Brass, light	4.00	3.00	4.50
No. 1 yellow brass turnings	4.50	4.00	4.75
Zinc	2.50	2.00	2.50

TIN PLATES—American Charcoal Plates—Bright

			New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:					
IC,	20x28,	112 sheets	21.50	......	....
IX,	20x28,	112 sheets	24.00	......	....
IXX,	20x28,	56 sheets	13.75	......	....
IXXX,	20x28,	56 sheets	15.50	......	....
IXXXX,	20x28,	56 sheets	17.00	......	....
"A" Charcoal Allaways Grade:					
IC,	20x28,	112 sheets	18.50	......	....
IX,	20x28,	112 sheets	21.50	......	....
IXX,	20x28,	56 sheets	12.25	......	....
IXXX,	20x28,	56 sheets	14.00	......	....
IXXXX,	20x28,	56 sheets	15.75	......	....

Coke Plates, Bright

Prime, 20x28 in.:			14x20 in..	
80-lb,	112 sheets	13.60	......	....
90-lb.,	112 sheets	13.80	......	....
100-lb.,	112 sheets	14.00	6.50	....
IC,	112 sheets	14.30	6.65	....
IX,	112 sheets	16.30	......	....
IXX,	56 sheets	9.15	......	....
IXXX,	56 sheets	10.15	......	....
IXXXX,	56 sheets	11.15	......	....

Terne Plate

Small lots, 8-lb. Coating:				
100-lb.,	14x20	$7.50	6.25	6.25
IC,	14x20	7.75	6.50	6.50
IX,	14x20	8.00	7.00	7.00

SHOP SUPPLIES

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	—50%	–60%	—60–5%
1⅛ and 1¼x3 in. up to 12 in.	—40%	60–10–10%	—55%
With cold punched sq. nuts	—30%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	—40%	....	. .
Up to 1-in. diameter, with cold punched hex. nuts (plus std. extra of 10%)	—39%	....	.....
Button head bolts, with hex. nuts	—20%	390 base	.. ..
Hex. head and hex. nut bolts	—20%	....	.....
Lag screws, coach screws	—50–10%	....	.....
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	50–10–10%	50–5%
Bolt ends, with hot pressed nuts	—50%	....	.....
Tap bolts, hex. heads	—20%	....	.....
Rivets, 7/16 in. dia. and smaller. *New list*	–50-10%	60-10-10%	–60-10%
Rivets, tinned	–50-10%	60-10-10%	—45%
Semi-finished nuts, all sizes	—70%	75%	50%
Case-hardened nuts	—60%	....	.....
Washers, cast iron, ½ in., per 100 lb.	$5.00	$4.50 off	$4.50
Washers, cast iron, ⅝ in. and larger, per 100 lb	4.25	3.75 off	4.50
Washers, round plate, off list per 100 lb.	3.00	.. ..	.....
Nuts, hot pressed, sq. Off list	2.00	3.00	3.25
Nuts, hot pressed, hex. Off list	2.00	3.00	3.25
Nuts, cold punched, sq. Off list	1.50	3.00	3.00
Nuts, cold punched, hex. Off list	1.50	3.00	3.00
Rivets:			
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb	$4.40	3.50	3.68
Cone heads, ditto	4.50	3.60	3.78
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	....
⅞ in. diameter *EXTRA*	0.15	....	....
½ in. diameter *EXTRA*	0.50	....	....
1 in. long, and shorter *EXTRA*	0.50	....	....
Longer than 5 in. *EXTRA*	0.25	....	....
Less than 200 lb. *EXTRA*	0.50	....	....
Countersunk heads *EXTRA*	0.35	....	....
Copper rivets	50–10%	40–10%	50%
Copper burs	25–10%	15%	20%

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb.	.055@.09	.09	.10
Wiping cloths per M., 13¼x13¼	....	55.00	55.00
Wiping cloths per M., 13¼x20½	... ...	65.00	65.00
Sal soda, 100 lbs	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb	2.55	3.25	2.75
Linseed oil, per gal., 5 bbl. lots	.78	.83	.84
Fire clay, per 100 lb.	(Ottawa, .80)	.80	
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Coke, prompt furnace	$3.00@3.25	Connellsville	
Coke, prompt foundry	4.00@4.50	Connellsville	

Metal Working Shops

NEW ENGLAND STATES

Conn., Hartford—Dragat & Troubman, 340 Windsor Ave., will soon award the contract for the construction of a 3 story, 95 x 100 ft. garage on Windsor Ave. Estimated cost, $100,000. G. A. Zunner, 182 High St., Archt.

Conn., Hartford—K. B. Noble Co., 249 Pearl St., has awarded the contract for the construction of a 3 story plant on Pearl and South Ann Sts., for the manufacture of contractors equipment. Estimated cost, $30,000.

Mass., Northampton—F. Girard, King St., is having plans prepared for the construction of a 1 story, 100 x 125 ft. garage, etc. on North St. Private plans.

Mass., Somerville—J. H. Atamian, 275 Beacon St., will build a 1 story, 75 x 169 ft. garage, etc. on Beacon St. Private plans.

Mass., Springfield—The Hampden Tool Co., 344 Main St., has awarded the contract for the construction of a 1 story, 40 x 90 ft. tool shop on St. James Ave. Estimated cost, between $10,000 and $12,000.

MIDDLE ATLANTIC STATES

N. J., Camden—The N. G. Wilson Motor Co., c/o W. P. Hallin, 530 Market St., has awarded the contract for the construction of a 1 story, 60 x 200 ft. sales and service station on Haddon Ave. and Whitehorse Pike. Estimated cost, $75,000.

Pa., Philadelphia—S. Alexander, 4210 Otter St., has awarded the contract for the construction of a 2 story, 48 x 132 ft. garage on 4th and Seigel Sts. Estimated cost, $55,000. Noted Aug. 11.

Pa., Philadelphia — The Columbia Steel Equipment Co., 3d and Ansbury Sts., will build a 1 story, 69 x 73 ft. factory for the manufacture of cabinets and office furniture. Estimated cost, $10,000. **Clark & Dudnick**, Drexel Bldg., Archt.

Pa., Philadelphia—L. M. Davis will soon award the contract for the construction of a 2 and 3 story, 60 x 60 ft. addition to his garage at 1616-18 Chancelor St. Estimated cost, $75,000. R. Priest, 1627 Sansom St., Engr. Noted Aug. 1.

Pa., Philadelphia—J. F. McCourt will soon award the contract for the construction of a 1 story, 40 x 156 ft. garage at 3672 Frankford Ave. Estimated cost, $50,000. F. P. Canavan, 7032 Greenway Ave., Archt.

Pa., Philadelphia—S. Ulick, 1904 North 32d St., will build a 4 story, 110 x 120 ft. garage on 33d St. and Columbia Ave. Estimated cost, $150,000. Clarke & Dudnick, Drexel Bldg., Archts.

MIDDLE WEST STATES

Ill., Chicago—A. V. Capraro, Archt., 105 North Clark St., is receiving bids for the construction of a 2 story, 75 x 120 ft. garage at 1918 South Morgan St., for Spingold & Son, 750 Taylor St. Estimated cost, $50,000.

Ill., Rock Island—J. M. Schaab, 1601 4th Ave., plans to build a 1 story, 62 x 150 ft. garage. Estimated cost, $50,000. Architect not selected.

Mich., Cadillac—R. T. Teetor, Muskegon, is having plans prepared for the construction of a 1 story foundry, here. Cost to exceed $50,000. F. D. Chase, 645 North Michigan Ave., Chicago, Archt.

Mich., Detroit—J. Doran, 270 East Milwaukee Ave., is having plans prepared for the construction of a 1 and 2 story, machine shop on Epworth Blvd. Estimated cost, $20,000. I. M. Lewis, 503 Congress Bldg., Archt.

O., Cleveland—Koller Bros., 724 Prospect Ave., have awarded the contract for the construction of a 1 story, 50 x 101 ft. garage at 663 Huron Rd. Estimated cost, $50,000.

Wis., Maribel—The Maribel Strawcutter Co., c/o H. Glover, has had plans prepared for the construction of a 1 and 2 story, 66 x 99 ft. factory on Main St. Estimated cost, $50,000. Private plans.

Wis., Milwaukee—Pauly & Marx, 2530 North Ave., will soon award the contract for the construction of a 1 story, 113 x 130 ft. garage on North Ave. Estimated cost, $60,000. J. Topzant, 307 Grand Ave., Archt.

Wis., Milwaukee—The Van Buren Garage Co., 174 Ogden Ave., will soon award the contract for the construction of a 2 story, 60 x 127 ft. garage on Van Buren St. Estimated cost, $75,000. R. E. Oberst, 307 Grand Ave., Archt. Noted Aug. 11.

Wis., Osseo—C. J. Amundson plans to build a 2 story, 66 x 116 ft. garage and machine shop on Main St. Estimated cost, $50,000. Probably private plans.

Wis., Prairie du Sac — The Wisconsin River Power Co. has awarded the contract for the construction of a 1 story, 60 x 81 ft. power and machine shop on Main St. Estimated cost, $50,000.

WEST OF THE MISSISSIPPI

Mo., Kansas City—Unico Motor Products Co., c/o W. R. Alexander, 1229 West 59th St., has awarded the contract for the construction of a 1 story, 60 x 224 ft. factory on Rochester and Park Aves. Estimated cost, $75,000.

Mo., St. Louis — The Standard Underground Cable Co., Westinghouse Bldg., Pittsburgh, Pa., has awarded the contract for the construction of a 2 story, 300 x 525 ft. manufacturing plant on Kingshighway and Slevin Ave., here. Estimated cost, $1,000,000. Noted June 9.

CANADA

Ont., Preston—The J. G. Brill Car Co., 62d St. and Woodland Ave., Philadelphia, has taken over the Preston Car & Coach Co., here, and will be known as the Canadian Brill Co., Ltd. The new company capitalized at $300,000 plans to install additional equipment.

General Manufacturing

NEW ENGLAND STATES

Mass., Taunton—Whittenton Mfg. Co., 30 Waverly St., manufacturer of dress goods, has awarded the contract for the construction of a 1 story, 80 x 80 ft. addition to its factory. Estimated cost, $30,000.

R. I., Pawtucket—T. Whalen, has awarded the contract for the construction of a 1 story bakery on Japonica St. Estimated cost, $30,000.

MIDDLE ATLANTIC STATES

N. J. Trenton—The Star Porcelain Co., Muirhead Ave., is receiving bids for the construction of a 1 story, 50 x 80 ft. porcelain plant. Estimated cost, $10,000. Private plans.

Pa., Philadelphia—The General Smelting Co., Stock Exch. Bldg., has awarded the contract for the construction of a 1 story, 66 x 100 ft. factory on Bath and Westmoreland Sts.

Pa., Philadelphia—C. Rost, 3814 Lancaster Ave., has awarded the contract for the construction of a 1 story, 20 x 40 ft. addition to his weaving mill at 3608 Lancaster Ave. Estimated cost, $5,000.

SOUTHERN STATES

Va., Roanoke—The Amer. Viscose Co., c/o C. A. Ernest, Marcus Hook, Pa., will build a 1 story mill here, for the manufacture of silk. Estimated cost, $1,000,000.

MIDDLE WEST STATES

Ill., Centralia—V. E. Joy plans to build a 2 story printing plant. Estimated cost, $60,000. Architect not selected.

Ill., East St. Louis—The Southern Illinois Milk Producers Assn., Arcade Bldg., is having plans prepared for the construction of a 1 story factory. Estimated cost, $50,000. R. G. Kirsch, Magnolia and Thurman Sts., St. Louis, Mo., Archts. Noted Sept. 8.

WEST OF THE MISSISSIPPI

S. D., Sioux Falls—The J. Morrell Co. has awarded the contract for the construction of a 3 story, 100 x 140 ft. addition to cooler building. Estimated cost, $150,000.

Tex., Dallas—The Peaslee Gaulbert Co., 413 West Main St., Louisville, Ky., has awarded the contract for the construction of a 1 story, 100x330 ft. factory and warehouse here. Estimated cost, $50,000.

WESTERN STATES

Cal., Los Angeles—Swift & Co., 922 East 1st St., is having plans prepared for the construction of a 1 story addition to packing plant, on East 1st St. Estimated cost, $60,000. J. E. Chatem, 922 East 1st St., Supt. Private plans.

Cal., Los Angeles—The Western Chemicals Co., 503 Merchants Bk. Bldg., is having plans prepared for the construction of a 1 story, 40 x 200 ft. chemical factory, with a 40 x 100 ft. wing, on San Pedro Annex. Estimated cost, $150,000. Private plans.

CANADA

Ont., Ottawa—The Ottawa Dairy Co., Sommerset St., has awarded the contract for the construction of a 2 story addition to dairy, on **Cooper St. Estimated cost**, $75,000.

IN AUGUST we published 147 leads of concerns in the market for machine tools and machinery—not counting the 171 items on new and enlarged shops. All this business-getting information was collected by our regular reportorial service. We can go on publishing a page of machine tool leads every week. We can make it several pages if you will cooperate.

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It pays to help the other fellow

After all, there never has been a happier and more successful policy than "live and let live." If you find this section useful, make it bigger and better by contributing to it. Let us hear from you and write as long a letter as you please to the

Business News Department

American Machinist
Tenth Avenue at 36th Street
New York

American Machinist

Volume 55 NEW YORK, SEPTEMBER 22, 1921 Number 12

The Rolls-Royce Crankshaft

Main Bearings Rough Turned, Crankpins Ground From the Rough—Finishing Completed Unit of Crankshaft, Flywheel and Clutch Ring

BY FRED H. COLVIN
Editor, *American Machinist*

THAT the crankshaft is one of the most important members of a successful motor is indicated by the care taken in the Rolls-Royce plant to have it as perfect as can be secured. To this end, there are sixty-five operations, beginning with the heat-treatment, which must secure a Brinnell test of between 286 and 331. It is then sand-blasted and both the shaft and test piece stamped with a similar identification number. In common with all other forgings, a test piece is forged on the chankshaft, being afterward sawed off and marked out for the Stanton impact test and tested for tensile strength as well. If the tests are satisfactory, the crankshaft is then carefully centered.

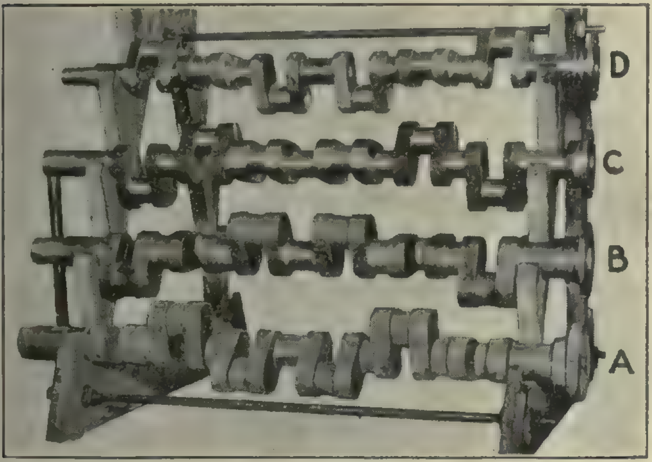


FIG. 1. ROUGH AND FINISHED CRANKSHAFTS

The first machining operation is to spot grind the center bearings, as can be seen in the lower crankshaft *A*, in Fig. 1. The shaft then goes to a Lo-Swing lathe where the cheeks are rough faced, the main bearings turned, the flanges roughed and the other end rough-turned. This stage is shown at *B*. Next comes the rough-grinding of the flange diameter and the two end bearings. Then the six-flange holes are drilled, and three of them are hand-reamed for locating in the future operations. These holes are so spaced that the crankshaft can only be placed in one position in the carrying fixtures, which avoids all chance of error.

THE GRINDING OPERATIONS

The blocks which index the various throws in the Landis grinding machine are then assembled and the crankpin bearings are all spot-ground. Then the cheek faces of the various crankpin throws are turned on the outside, using the crankpin center, after which all of the crankpin bearings are rough-ground. The main bearings are next rough-ground, leaving the crankshaft as shown at *C*.

The outsides of the crank throws are next milled in two cuts, both the inner and outer ends of the throws being machined in the same manner. The test numbers having been eliminated in machining, are then transferred to the shaft once more.

Next comes the drilling of the main bearing, the fixture being shown in Fig. 2, showing the way in which the crankshaft is held. The drills of various lengths are shown on the bench at the left. The work is done in a Foote-Burt machine which has had the column raised by the sub-base in order to bring the spindle to the correct height for the work.

The crankpin bearings are next drilled in the same machine after which both ends are recentered with reference to the main bearings and to eliminate any change which may have taken place owing to the removal of either internal or external stresses by either the drilling or milling operation. All main bearings

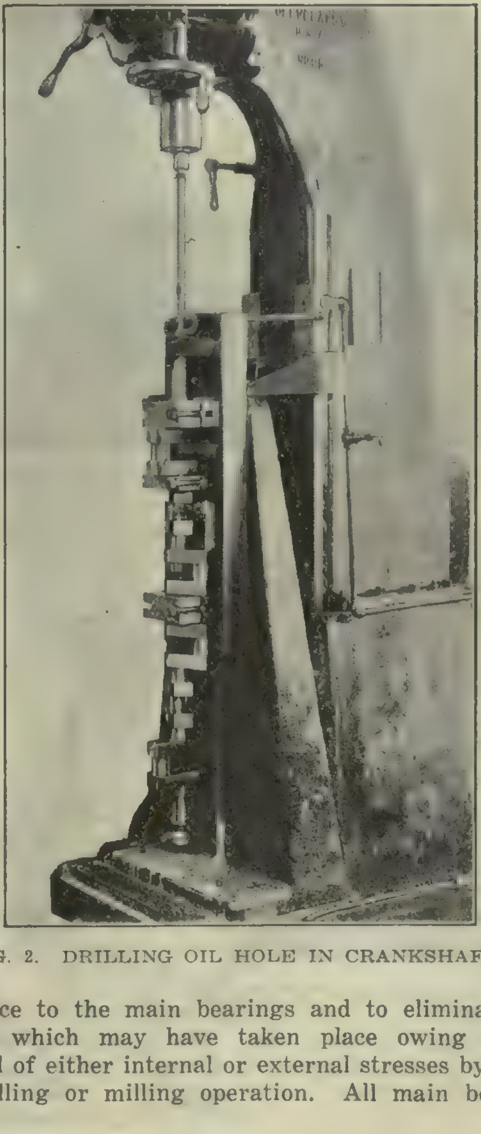


FIG. 2. DRILLING OIL HOLE IN CRANKSHAFTS

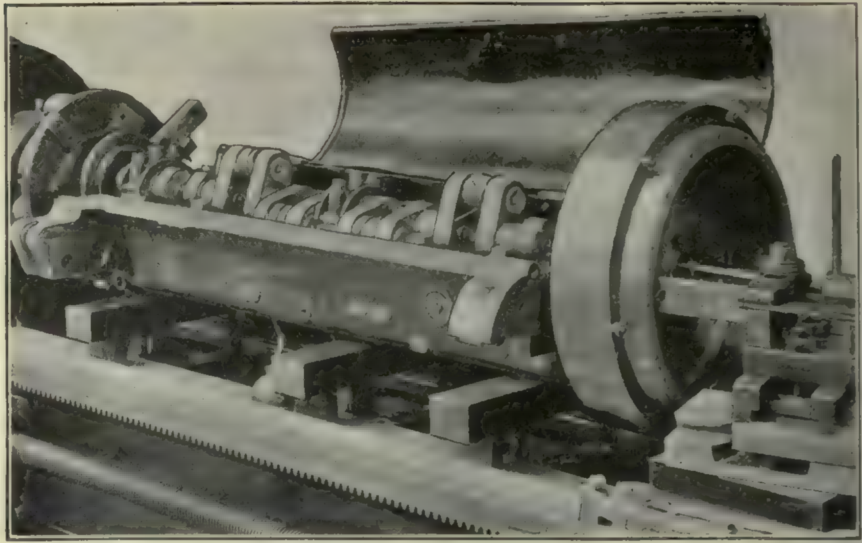


FIG. 4. FINISH BORING CLUTCH RING

and crankpins are then rough-ground for the second time, the faces of all the cheeks of the crank throws are finished and a 0.3-in. radius is bored in the holes of both the main and crankpin bearings. The hole in the flange and gear end is then bored and reamed taper and afterwards tapped at the outer end. Plug centers are then fitted in each end, and the oil collars on the flange are rough- and finish-turned as well as the back face of the flange being finished at the next operation. Then a taper of 1 in 8 is turned on the gear end and the end turned and necked for threading.

A one-inch radius is then milled on the outer end of the throws and a $\frac{1}{8}$-in. radius on the corner and on the throws. Next comes the drilling of the oil holes in the throws, counterboring the oil holes and tapping the ends for the brass plugs which go in them. After milling a keyway and cutting the threads, the next operation is to finish-grind the main bearings, the flange diameter and the sides of the cheeks, as well as the taper on the gear end of the shaft. Then comes the finished-grinding of all crankpin bearings and the other portions. Fig. 3 shows the crankshaft in place for its final grinding.

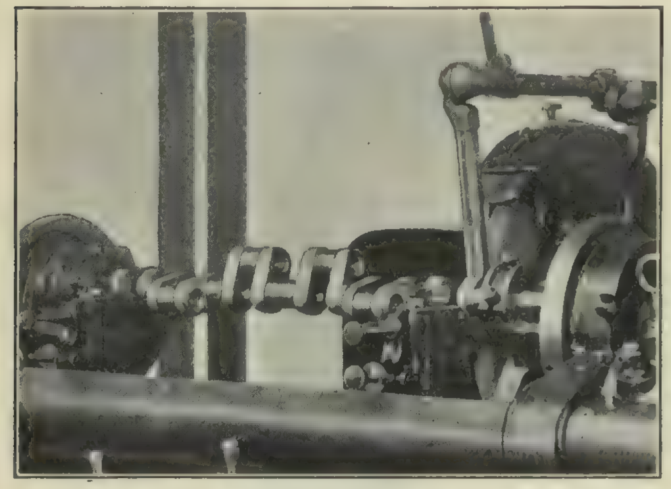


FIG. 3. FINISH GRINDING OF CRANKSHAFTS

After a few minor operations, all the bearings are lapped in a special fixture and the oil lead holes drilled in the bearings. The crankshaft is then balanced and the flywheels and clutch rings fitted to it.

The flywheel is then marked for timing and the complete unit of crankshaft, flywheel and clutch ring is mounted in the lathe, the crankshaft running in its own bearings while the clutch ring is finish-turned and bored so it will be in exact line with the crankshaft. This operation is shown in Fig. 4 and it will be noted that the crankpins are protected from dirt or injury by a felt wrapping secured with wire clips.

All oil holes are then tapped and the completed unit is balanced. The oil plugs are then all fitted and the completed unit given a running balance test. The crankshaft is then tested with oil under pressure so as to be sure there are no leaks, and the final operation, the marking of the part numbers, completes it ready for the assembly. The finished shaft is shown at *D*, in Fig. 1.

It will be noted that except for rough-turning the main bearings all the bearing surfaces are finished on the grinding machine. The crankpins are ground from the rough forgings. It will also be noted that the grinding is divided between a number of operations, the crankshaft going back to the grinding machine for further reductions after practically each machining operation. The total reduction by grinding is approximately $\frac{1}{4}$ in. in diameter, this being divided among quite a number of operations.

This makes considerable handling of the crankshaft from the grinding machine to the lathe and the drilling machine, but when it is considered that the demand is not expected to exceed eight or ten per week, this extra handling can be practically neglected. The removal of such a large amount of metal also removes the small lines which are very apt to occur in forgings. The method has been found very satisfactory in every way. The final finishing of the clutch cone after its assembly on the crankshaft and the balancing of the completed unit all go to make a satisfactory motor.

The Economics of Production

V. PRODUCTION AND REDUCED DEMAND

BY PROF. D. A. MCCABE, PH. D.

WE HAVE now to consider what happens and what action is called for when there is a falling off in demand after a big upward movement. The discussion will turn on prices and costs. Attention will first be given to costs in times of increasing demand.

When demand is increasing it makes its influence on production felt through the offer of increased prices, as was explained in the second article. More goods are demanded at the old price and a higher price is bid for the old quantity. Increased production means increased earnings and a still further bidding up of prices. The higher prices for finished goods lead to bidding for, and so to higher prices for, machinery and supplies of all kinds, for materials and perhaps for labor. For the producers, these are costs. Thus production is put on a new and higher basis of costs. The producers can meet these new costs and keep producing only if the higher prices continue to hold good.

The situation we are describing calls for as great and as speedy a cut in costs of production as can be made. All interested in production should bend every energy to reducing costs as much as possible inside each plant. Whether prices of material or rates of wages or salary are cut much or little, all other elements of cost should be reduced to the lowest limit. This is important at all times in the public interest, but it is particularly necessary in a time of falling demand. Every reduction in cost that is not a reduction in earnings helps to bring about the renewal of demand and production and makes reductions in earnings less necessary.

Unfortunately, after a wholesome increase in demand, demand tends to become rash and extravagant. Producers, also unfortunately, may become careless of costs in the face of a demand that seems careless of price. Both prices and costs become abnormally high.

When demand is suddenly checked in an important quarter after such an upward movement, the producers affected find themselves with high costs of production and facing a demand that will not now pay a price high enough to cover those costs. At least the demanders will not pay that price for anything like the full volume of production. The producers who are first affected usually meet the situation by cutting down production. That, as has been explained, leads to a further reduction in demand and so to a still further reduction in production.

The demanders will not pay the old prices and the producers will not run full at the old costs for the prices they can get. What we have then is a deadlock, with little production and a poor demand. We have idle machinery and many men idle or partially idle and yet wanting the goods that are not being produced. This is the situation we have to consider.

The need, obviously, is for a new price basis on which producers and demanders can agree. The demanders find prices too high and will not resume buying until they think prices have been reduced to a proper point. The producers probably discover that a *small* cut in prices will not induce the demanders to come back into the game. They must cut prices considerably to get results. But they will not cut prices deeply unless costs are cut. Production will be resumed only if a new and lower level of costs can be attained.

It takes the producers some time to adjust themselves to this new condition of demand and to get costs down to a point which enables them to offer their goods at a price at which the demanders will take them in good quantities. The readjustment may be delayed through a belief on the part of some producers that the fall in demand is but momentary. After a big upward movement of demand that generates extravagant prices, it is not likely to be so. Things cannot be started then except on a new level of prices from which all artificial and reckless elements have been pruned.

This pruning does not come about automatically. It involves much disagreement as to who shall submit to the pruning first and much hanging back in the hope of escaping the knife altogether or getting off with a small cut. Men are naturally unwilling to take cuts in their prices or rates before *their* costs, whether of living or of producing goods have been cut by those from whom they buy. The conditions under which goods are marketed, whether they are finished goods ready for consumption or goods for use in producing other goods, are so complicated and so full of differences as between one kind of goods and another, that the reductions in price do not come equally or at the same time for all goods. So, necessary readjustments are held up because other readjustments have not been made. If the whole reducing process could be done at once by general agreement all around, the readjustment would take place much more quickly and production on a new basis of prices and costs could be quickly resumed.

This much is certain. The situation we are describing calls for as great and as speedy a cut in costs of production as can be made. All interested in production, and there are few who are not, should bend every energy to reducing costs as much as possible inside each plant. Whether prices of material or rates of wages or salary are cut much or little, all other elements of cost should be reduced to the lowest limit. This is important at all times in the public interest, but it is particularly necessary in a time of falling demand. Every reduction in cost that is not a reduction in earnings helps to bring about the renewal of demand and production and makes reductions in earnings less necessary.

The burden of making the readjustment to a reduced demand falls upon those engaged in production. This will be true as long as men produce to meet the demand of others. The demanders may be unreasonable in their attitude. It is largely their fault that prices at times reach the unreasonable levels that cause the trouble. But their refusal to pay those prices any longer must be accepted as a fact and the readjustment made. Until they are convinced that prices have been brought down as far as they can be, they will not play, and without them there will be no game.

Tools Used in the Manufacture of the P & W Adjustable Limit Snap-Gage

II. Making the Measuring Anvils—Many Special Jigs and Fixtures Used—Accurate Grinding Operations—An Ingenious Lapping Device

BY ELLSWORTH SHELDON
New England Editor, *American Machinist*

THOUGH the anvils of the Pratt & Whitney snap-gage are apparently very simple pieces to make, there are in fact many more operations upon them than upon the frame of the gage. Each gage carries four anvils, all of which in addition to the hardening and grinding operations, must be grooved and threaded for the adjusting screw; beveled upon one side of the head to facilitate the handling of the gage as a manufacturing tool; and finally the gaging surface must be carefully lapped to a perfectly flat and mirror-like surface, accurately square with the axis of the piece.

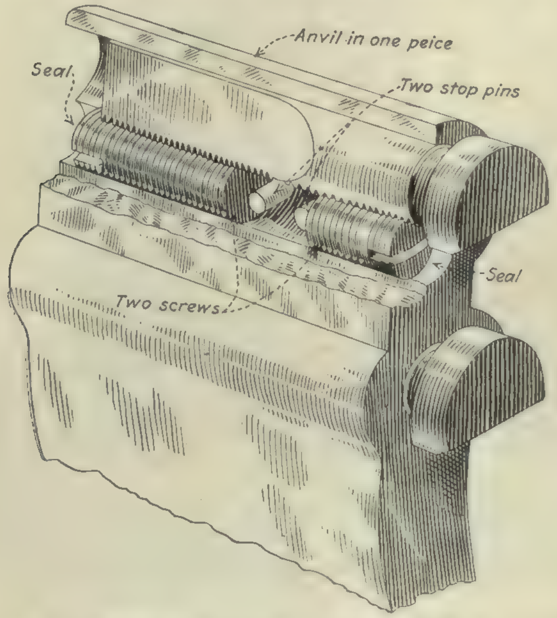


FIG. 13. SECTION THROUGH GAGE, SHOWING ANVILS AND ADJUSTING SCREWS

There are no threads in the frame of the gage. The screws by which the anvils are adjusted to vary the limits or the size of the gage fit closely in the "cut-out" holes previously described as being drilled in the frame; but the threads mesh only with corresponding threads in a groove which is milled lengthwise of the stem of each anvil, this groove being of a size and shape to just complete the periphery of the cut-out hole when the anvils are in place.

There are two adjusting screws to each anvil; and when the latter is in the frame, a screw is run in from each side until it bears upon one of the stop pins placed crosswise of the cut-out hole. Thus the two screws oppose each other and when both are tightened the anvil is locked in place without possibility of the adjustment being altered by accident. Provision is also made for sealing the adjustment so that it cannot be altered by design without leaving evidence of such alteration that may instantly be detected by the foreman or inspector. The perspective view, Fig. 1, shows the construction.

The anvils are made of high carbon steel and are roughed out on the screw machine, no special tools being required. The second operation is the rough-grinding in which the diameter of the stem is reduced to within 0.008 in. of size. The gaging surfaces are then shaved in a Pratt & Whitney shaving-machine.

The first operation with which this article is concerned and for which special tools have been designed is the milling of the thread groove for the adjusting screws. This groove completes the periphery of the cut-out hole in the frame, so that when the screw is in place it bears upon the tops of the thread for its full circumference but meshes with engaging threads only upon that part that is in contact with the stem of the anvil.

The groove, however, is not a part of a true circle. An idea of its contour may be gained from the drawing, Fig. 13, which shows the groove to be cut deeper at the center than the true radius would require, the object being to break up the threaded surface into two sections. This method makes the threading operation much easier to perform because chips from the tap are broken and the deeper portion of the groove provides a channel for the cutting lubricant, lessening the liability to clog.

The milling operation is performed on a Pratt & Whitney semi-automatic milling machine, fitted with a special reversing type of fixture to hold four pieces, two of which are milled at a time. Two form cutters are mounted on the arbor of the machine, and two pieces of work are held by clamping them against opposite sides of a dovetailed piece that is in effect a double V-block with the "V" disposed at an angle to the line of pressure.

The lower sides of the "V" are horizontal, or parallel to the line of pressure of the clamps and thus present a positive locating point directly opposed to the pressure of the cutters. The other side of the "V" stands at an angle of 60 deg. and tends to force the work solidly down on the flat side. The two clamps are drawn together by one bolt passing clear through them and tightened by means of a single cam lever that, at the time the clamping is done, is convenient to the right hand of the operator.

The fixture, shown in Fig. 14, is reversible, so that

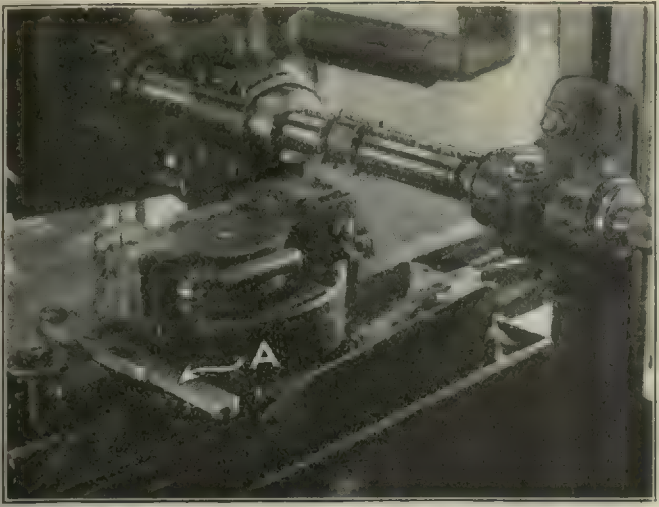


FIG. 14. MILLING THE GROOVES FOR THE THREAD.

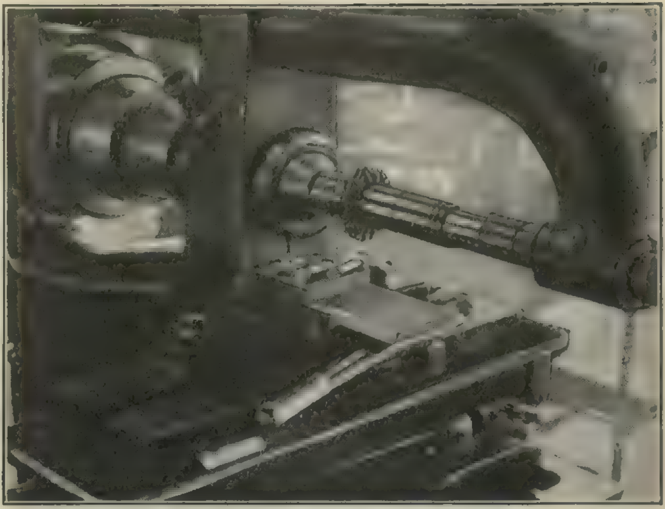


FIG. 15. BEVELLING THE HEADS

the operator may unload, clean out the fixture, and place two pieces of work, while the milling operation is going forward on the other two. When the cut is completed the machine table automatically returns to the starting point and starts forward again, the operator meanwhile unlocking the revolving top of the fixture, turning it 180 deg. and relocking it by means of the lever *A*. In this way the milling operation is practically continuous.

There are five different styles of anvils, including different sizes and shapes of head, which must be milled to conform to the requirements. One such operation is shown in Fig. 15. There are no special fixtures for this operation, which is done in a hand milling machine, except the fitting to the lever operated vise of a special jaw in which there is a groove to match the contour of the stem. The work is thus held in a vertical position and with the longitudinal groove of the stem in correct relation to the line of travel of the machine table.

Two cutters are used on the arbor, a side milling cutter and a bevel cutter placed together with the teeth interlocked so that one side of the circular head is flatted off and the bevel milled at the same time.

Another form of anvil with what is called the offset head is milled on a Pratt & Whitney cam milling machine as shown in Fig. 16. The offset head is used only on the smallest size of the gage and is made in this way because anvils with the regular head could not be assembled in the small frame.

The cutting of the threads in the groove of the stems, which ought to be a difficult operation, is really a very simple one. A small fixture is made to hold two of the anvils at once with the grooves toward each other, so that except for the interruptions caused by the slight distance between the two pieces and that made by the deeper portion at the center of each groove, a circular hole is presented to the tap.

A plate at the top of the jig locates the work by the flat portion of the head so that there is no possibility of getting the pieces in a wrong position. The entire jig is small enough so that the operator may hold it in his left hand while the tap is run through. Two screws are provided, however, in the table of the tapping machine which hold the fixture loosely; allowing it to float under the tap, though preventing it from turning around. A stream of oil is delivered directly upon the top of the work and the tap is therefore flooded with lubricant, washing out the chips as fast as they form and thus preventing snagging and breaking of the taps. This operation is shown in Fig. 17.

The tapping is the final operation before hardening. When the pieces are returned from the hardening room they are as hard as is practical to make them, the tempering being carried only to a degree sufficient to relieve the strains in the steel.

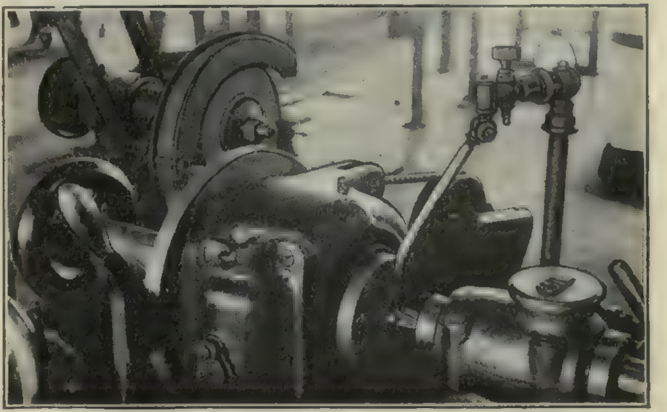


FIG. 16. MILLING THE OFFSET HEADS

The first operation succeeding the hardening is to finish-grind the stems. This is done with a rather wide faced wheel upon the standard Pratt & Whitney cylindrical grinding machine shown in Fig. 18. The limit allowed upon the stems is two "tenths" and the time, including cleaning out one center in each piece, is one minute and fifteen seconds. Only the tail center is used, as the work is driven by the head of the anvil, for which special collets are made. Several minor operations follow the above, such as grinding the rear ends of the stems, an operation performed by hand on

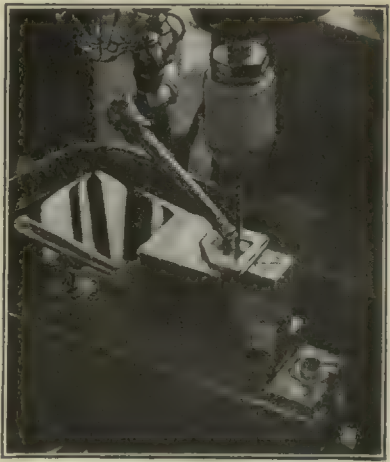


FIG. 17. THE TAPPING OPERATION

a disk wheel; stoning the corners and grinding what is left of the periphery of the head, for which operation the work is held by the stem in a spring collet, a nominal limit only being required.

For grinding the gaging surface, which must be accurately square with the axis of the anvil, a number of pieces are mounted in the jig shown on the P. & W. vertical grinding machine in Fig. 19 and in detail in Fig. 20. This jig is a disk of machinery steel with semi-circular grooves of a depth equal to half the diameter of the stems milled across the periphery. A flexible band of spring steel fits over the outside after the pieces are placed in the jig and drawn tight by means of the clamp that is a part of the band. One or two passes of the work under the wheel serve to bring the heads to the required thickness.

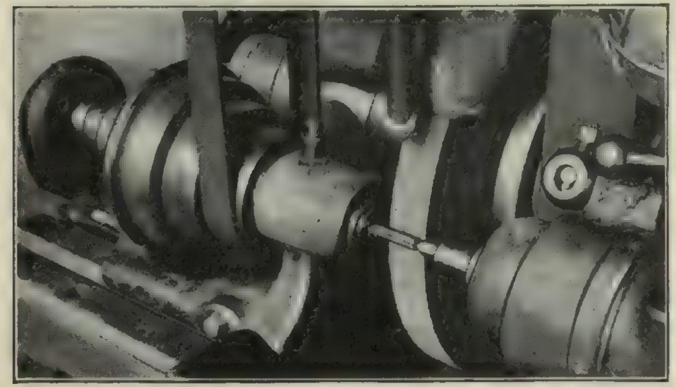


FIG. 18. FINISH-GRINDING THE STEMS.

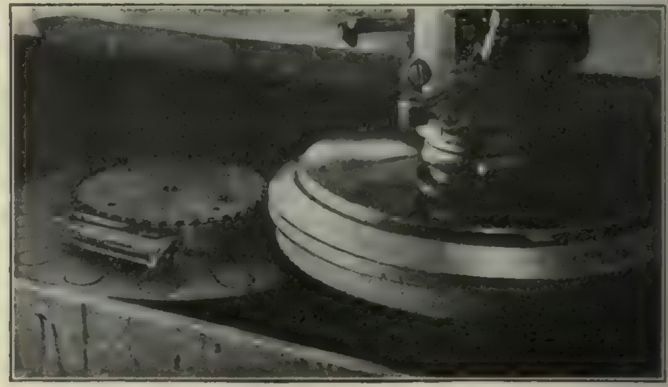


FIG. 19. GRINDING THE HEADS BEFORE LAPPING

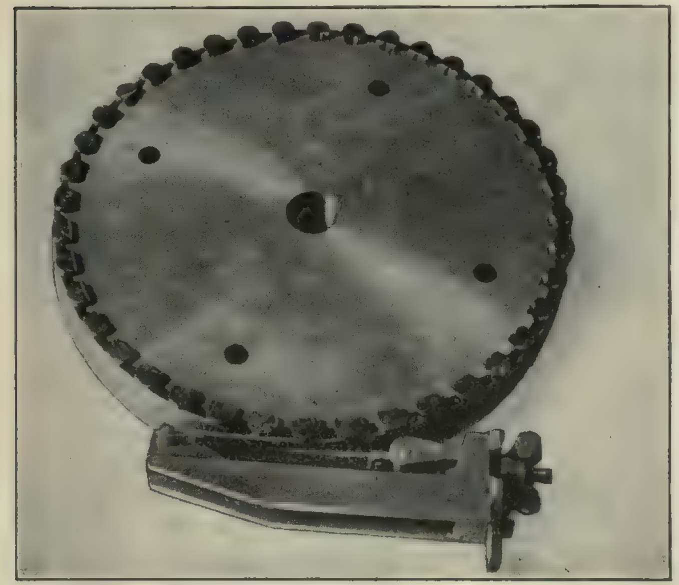


FIG. 20. THE JIG THAT HOLDS THE ANVILS IN THE GRINDING POSITION.

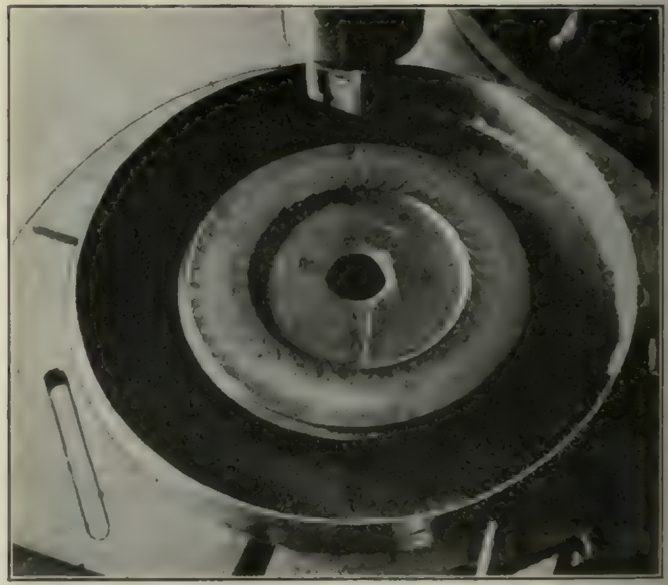


FIG. 22. THE LAP

The holding jig is the same in principle as that used in the lapping operation though it is not the same jig.

As anvils are made in four different sizes to complete the range of the gages from 0 to 12 in. there are necessarily four of the disks *A*, Fig. 20, each disk requiring a band and clamping device of its own. The grooves extending across the periphery of the disk are accurately milled to fit the respective stems and spaced as closely as it is convenient to set the pieces. To load the jig the disk is placed on a surface plate, the band, with the clamp loosened, is placed over the disk, and the grooves filled with the pieces to be ground.

Each piece is pushed down until the under side of the head bears upon the disk, when the band is tightened by turning up the thumbnut of the clamp. Though this jig is very simple, it demands accurate workmanship, for any variation in depth of the grooves or of the size of the stems would leave one or more of the pieces loose to spin around under the wheel and destroy the grinding face.

After grinding the face the bevel is ground on a bench lathe, the set-up being shown in Fig. 21. This work is done by the man who attends the lapping machines, these machines being practically automatic in operation and requiring attention only once an hour or so. As the anvils at this stage are finished to length within very close limits and the spring collet is fitted with an end stop for locating the work, the operation is quite rapid.

The final machining operation, and the most unusual and interesting one, is the lapping of the gaging surfaces. The tools and the set-up are shown in Figs. 22, 23 and 24. The machines used for the operation are standard drill presses, but these are used only because they were convenient. The tools are complete in themselves, requiring only a means of rotating them, and this means is supplied by the drill press.

The lap is shown in Fig. 22, the work having been removed for intermediate inspection. It is of cast iron, with the annular lapping surface of such diameter, both

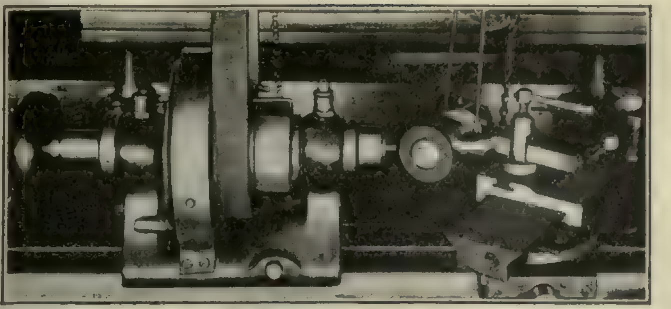


FIG. 21. GRINDING THE BEVELED CORNER

inside and out, that the pieces just pass the edges at the extremes of movement and thus prevent the wearing of ridges. The lapping medium is a special mixture of very fine emery, floated in kerosene. In Fig. 22 the holder and work have just been lifted and the path of the work over the lapping surface is clearly outlined in the lapping mixture.

In Fig. 22 the lap is shown mounted inside a circular pan of galvanized iron the purpose of which is to keep the emery and oil from running down on the table of the drill press. In Fig. 23 one of the devices is seen at work in another drill press upon which no drip pan has yet been placed. Fig. 24 shows the loading plate *A*, several of the disks *B* and two of the clamping bands *C*. As has been stated, the grinding jig shown in Fig. 20 is the same in principle, but in Fig. 24 it will be noted that the disks have ears upon one face while that shown in Fig. 20 is a plain flat disk.

Any surface plate, or even a bench, is all that is required to support the disk in Fig. 20 but for the lapping a special loading plate is necessary, as accurately made as the tools themselves. To load one of the disks for lapping it is placed upon the bench, face up as at *B b*, and the anvils disposed within the clamping band exactly as in the grinding operation. The band is then brought to a bearing by turning the thumbnut of the clamp, but is not clamped tightly.

The disk is then turned over and placed upon the loading plate where the face of the disk bears upon the raised central portion of the plate. It is clamped thereto by the thumbnut on the central stud. With a wooden mallet or a piece of lead the operator now taps the stem of each anvil until he is sure that all of them bear firmly against the corresponding part of the loading plate.

Great care must be exercised in this loading operation to insure that every anvil bears evenly upon the loading plate, for if any one should protrude even slightly beyond the others, and run upon the lap in this position, it would not only wear hollows in the lap but none of the entire loading would be lapped square with the axis.

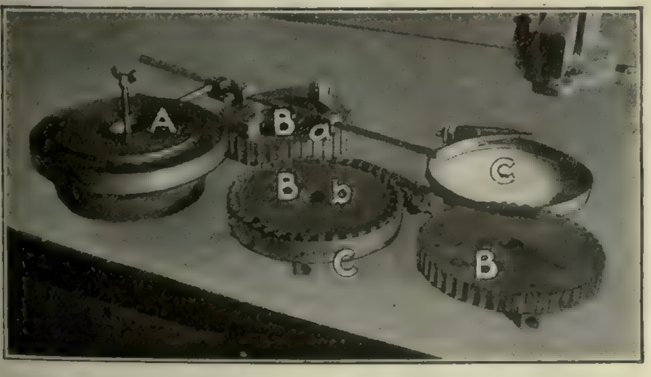


FIG. 24. THE TOOLS USED IN THE LAPPING OPERATION

The band also must be carefully placed, feeler gages being employed between it and the loading plate as the clamp is finally tightened, for if it were tilted with relation to the disk it would encourage the anvils upon the lower side to work away from the lap.

The purpose of the ears upon the back of each disk is made apparent by the view *B a*, where the lifting rod, by means of which the loaded plates are handled, is shown in place. The loaded plate is carefully deposited upon the lap as in Fig. 23 and the spindle of the drill press is brought down until the offset pin in the chuck enters the bronze bushing at the center of the disk.

The pin in the chuck fits very loosely in the bushing, so that any inaccuracy of alignment that may exist in the drill press is not transmitted to the device.

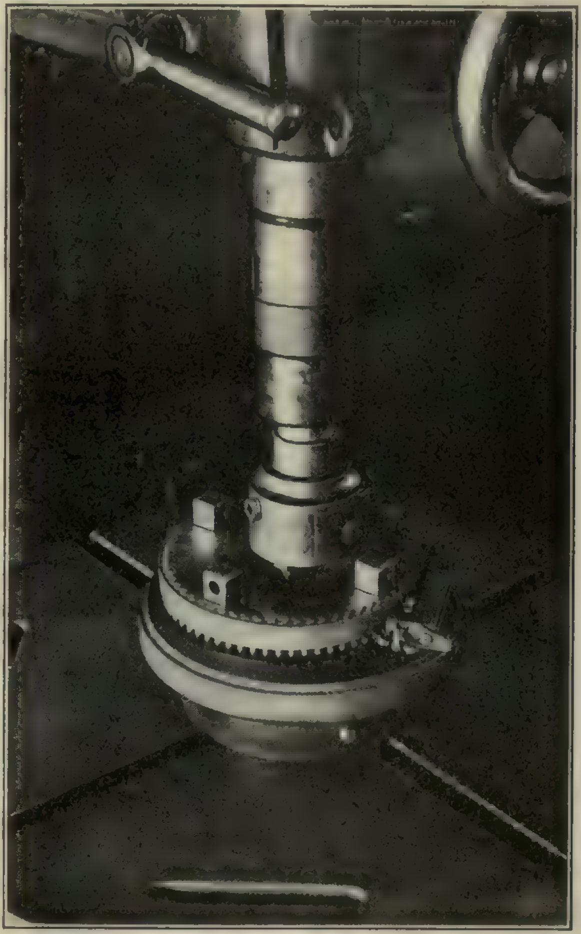


FIG. 23. FINISH-LAPPING THE HEADS

As the drill press spindle slowly revolves it imparts a circular motion to the loaded holding plate, the path of which is clearly indicated in Fig. 22. There seems to be no good reason why the disk with its load of anvils should rotate about its own axis, but as a matter of fact under ideal conditions of the lapping medium it does so rotate slowly, requiring several minutes to complete a revolution, though the relative movement of the drill press spindle, and consequently the circular motion of the disk, is about 60 per minute.

Peculiar as it may seem the direction of this slow rotation does not always coincide with that of the drill press spindle; it not infrequently goes backward, but so long as it rotates evenly no attention is paid to it. When the rotation in either direction takes place intermittently or in a series of jumps it indicates that somewhere in the lap is a particle of abrasive larger than the rest, and this condition requires immediate investigation or the result will be deeply scored work.

Sometimes the disk does not rotate at all and while this condition does not apparently affect the quality of the work, it tends to wear the lap unevenly and either more oil or more abrasive will be added until the floating movement is re-established.

A newly loaded disk is allowed to lap only a few seconds before it is lifted and the work examined with a glass, by which means the operator may determine if all the pieces are bearing evenly. If any discrepancy exists in this respect it is corrected, and the disk returned to the lap for another short period. When the operator is satisfied that each anvil is bearing its proper share of the weight the device may be left to itself while he attends to other duties. A period of from one to two hours is required to complete the lapping.

Qualifications for a Cost Accountant

By L. L. Thwing

Why is it not easier and better to take a bright young man who has had a reasonable amount of shop practice and teach him cost accounting than it is to take an office man for the same purpose. The shop man will bring with him all sorts of pertinent and valuable information that the office man does not know. There is no reason to believe that the shop man will not be able to learn to allocate and pro-rate as well as the office man, although the accountants would have us believe that cost accounting is an obscure and deeply involved science only to be handled by, at least, a correspondence school graduate.

The general complaint about cost systems is that they do not give accurate costs. I do not suppose that this inaccuracy is due to any errors that develop after the figures have left the shop and have been delivered to the cost department. It is reasonable to suppose that the clerical work of collating the shop figures is done correctly. If this is a true assumption, the real trouble is in the figures that are delivered to the cost department, over which the department has no control, but in which they should be able to detect the ear marks of error. For example, I had occasion to go to the cost department of a large machine shop for certain figures, and while there noticed a list of machine-hour costs on the desk. While the information for which I asked was being dug out, I turned over the leaves of the book curiously until I came to the record of one of the departments that I was familiar with. I found that the machine-hour cost for a certain 24-in. drill was $1.70, and for a 48-in. boring mill next to it, $1.85. These figures are quoted from memory, and may be exaggerated, but I was impressed by the fact that the machine-hour rate for a $3,000 machine should be so slightly in excess of that of a $300 machine. To a layman they seem very disproportionate, and I believe that they are. Now, whether or not the cost department figured these rates, it is at least responsible for them, and there should be someone in that department whose training qualifies him to pass on such problems. The foundry cost system in this same shop is operated by the foundry superintendent. He informed me that he was not able to get the figures that he needed from the cost department without wading through too much stuff, and so he pursuaded the front office to let him take it over, and he had operated it with the aid of three clerks for some time to the satisfaction of all concerned. This was in a shop employing 3,000 men, having a large proportion of special work and a cost department of about 50 clerks. I asked the cost accountant if he did not think that there should be at least one man in an organization of that size to represent the shop end of the cost system and to give all his time to checking and following up the cost records made in the shop, and he agreed with me that it would be a good idea.

One of the constructive features of a cost system is to point out unusual or presumably excessive costs. Faults in manufacturing methods can be checked at two points; when the costs are assembled, and when the methods are inspected. The old one-man machine shop depended on the latter method.

Many shops have, in the larger departments, a cost clerk who collects the time and material records for the cost department, in which the clerks are not infrequently girls, or men with an office rather than a shop training. Now, if it were the general practice to employ shop-trained men in these positions, even at an increased cost, there would be certain improvements in shop records, and a possible detection of various errors before it was too late to correct them. For example, if a lathe hand should charge up work on a rectangular piece, an investigation could be made then and there to see if that was a mistake or an exception to the usual shape of lathe work. If 50 per cent more time than usual was charged to a piece of routine work, an investigation at once might bring out the fact that the workman was taken off that particular job for a day, and forgot to deduct it from his regular time.

In brief, it is of little advantage to take incorrect figures to the cost department, as no subsequent manipulation of results can ever correct the errors. The place to catch them is as near the source as possible, and as soon as possible. A shop-trained man is more likely to do this, because there are a thousand and one bits of unwritten shop practice that collect in his head along with the cast-iron dust. You hardly ever see a shop man who reaches out for any sort of office work, but it is not uncommon to see the office assume, either by necessity or presumption, various functions that are best left to the operating end.

Are Hollows Worn in Hammer Handles?

By O. L. Lippert

The article by L. L. Thwing on page 980, Vol. 54, of *American Machinist*, concerning the wear of hammer handles brings to mind a case which I noticed some time ago.

I was using a light hammer on a production job. The hammer had been used by some other man before I took it and I found a slight depression in the handle where the end of the thumb pressed on it. At first, I thought this hole had been ground in but after some three month's constant use, the hole was much larger.

The work was such that it required the operator to lay down and pick up the hammer between 350 and 400 times an hour and was just greasy enough to cause dirt and grit to stick to the hands. My theory is that this grit on the thumb acted as an abrasive and gradually wore a depression in the handle. Why it wore only under the thumb I do not know, unless the pressure of the thumb when gripping the hammer was greater than the rest of the hand.

Metal Cutting Tools

By A.L. DeLeeuw

XV. Generating Tools—Gleason Bevel and Spiral Bevel Gear Planing Tool—Fellows Gear Shaper Cutters—Single and Multiple Thread Hobs

GENERATING tools are tools of definite form which give a piece of work a shape or profile different from the shape of the tool itself by the nature of the relative movements between work and tool. In other words, the shape produced depends on the shape of the tool as well as on the movements made by work and tool. One of the best known examples of this class of tool is the one used in the Gleason bevel gear generator. There the tool itself is of the simplest possible form, but produces a tooth shape of an entirely different outline and differing with the number of teeth of the gear produced. We will not go into the intricacies of generating different shapes, except in so far as certain qualities are required in the tool to make it act properly. In many cases, though not in all, the shape generated is such that a tool of simple shape combined with simple mechanical movements will produce the desired result. Instances of this kind are spur and bevel gears. Such gears can be generated by a tool of which the active edge is a straight line and which requires only straight line and circular movements.

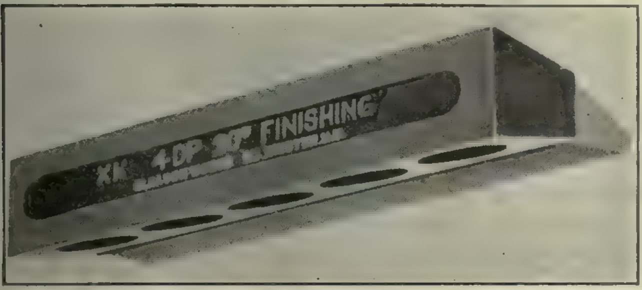


FIG. 231. FINISHING TOOL FOR GLEASON GENERATOR

Fig. 231 shows the tool used on the Gleason generating bevel gear planer and Fig. 232 shows its details. It will be noticed that in cross-section one side of the tool is ground to an angle of 14½ deg. This is the generating angle, and this angle might be anything within the practical limits of the requirements of the gear. Gears cut with this tool will mesh together properly, and so do gears cut with a tool having an angle of 15 or 20 deg. One tool is sufficient for the entire series of gears, provided the generating angle remains the same. Broadly speaking, it would be possible to make a pinion of 12 teeth and of the finest imaginable pitch, or a gear of 180 teeth of the coarsest pitch, both with this same tool. However, as a matter of fact, this is not done. The tool with a narrow enough front to cut the fine pitches would be too delicate for the coarser pitches. Nor would it be practical or economical to try to cut the smallest gears on a large gear planer and, of course, it would not be possible to plane the large gears on a small gear planer. Such practical considerations, then, make it necessary to have a few tool sizes for a given generating angle.

The generating motions are entirely in the machine, and the tool is of the simplest possible section, as is clearly shown in the illustration. Furthermore, the cutting motion is a straight line movement, so that it is possible to grind the front end of the tool to any desired angle suitable for the best cutting action without affecting the shape of the generated gear. In other words, it is possible to give this tool any desired clearance and rake. We have seen, when discussing formed milling cutters, that to grind a given formed cutter with rake changes the shape or contour of the piece made by that cutter, because the piece produced will fit successive radial sections of the cutter as it passes through the work. With the Gleason tool, however, the shape generated does not correspond at all with the shape of the generating tool, and so long as the cross-section of the tool remains the same, the generated gear will not be affected.

It was remarked that all gears generated by the same tool and on the same machine, or rather on the same type of machine, will run together in the proper manner. Of course this statement should be modified somewhat, because in a bevel gear different diameters of the same gear have different pitches. Bevel gears may be imagined as being cut from a sphere and the diameter we refer to here is the diameter of that sphere. The length of face of the gear tooth is part of a radius of that sphere. The movement of the generating tool is along one of the radii. However, the manner in which the tool gets from one end of the gear face to the other is of no importance and

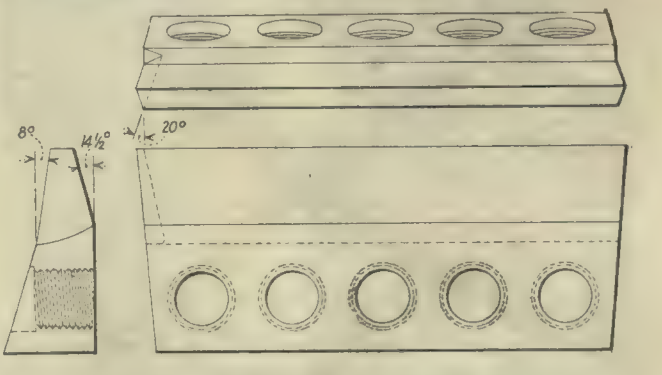


FIG. 232. DETAILS OF GLEASON TOOL

For the author's forthcoming book. All rights reserved.

does not need to be a straight line. If we use the straight line for the path of the generating tool we will obtain bevel gears as we know them. But any other motion might have been used, provided that the same kind of movement is used for all mating bevel gears. We might have gone from one end of the tooth to the other by a broken line, in which case we would have obtained what might be called a "bevel herringbone gear." Or we might have used a snake-line, in which case the gears would run together just as well, provided that we use the same line of movement for all gears generated. Again, we might have used a circular movement for the cutting action of the generating tool, and if we use the same circle of cutting motion for all the gears of a system they will again mesh together properly. Under those conditions we obtain what is called a spiral bevel gear.

If we go from point to point along a tooth of a spiral bevel gear we will get constantly changing conditions of shape and generating angle, etc. But this does not affect the proper running together of two gears. All that is necessary in order to produce again a system of mating gears is to preserve the shape of the generating tool, to have always the same generating movements of the machine and always the same nature of cutting movement of the tool. (The machine itself does not change except by wear, and we are not concerned here with this phase of the matter.) The cutting tool has naturally a tendency to change its shape by wear, and the cutting motion might be changed by placing the cutting tool nearer to or further from the center of the circular movement. Therefore, if we wish to obtain proper results with this kind of tool we must be absolutely sure that we retain the shape of the tool and its distance from the center.

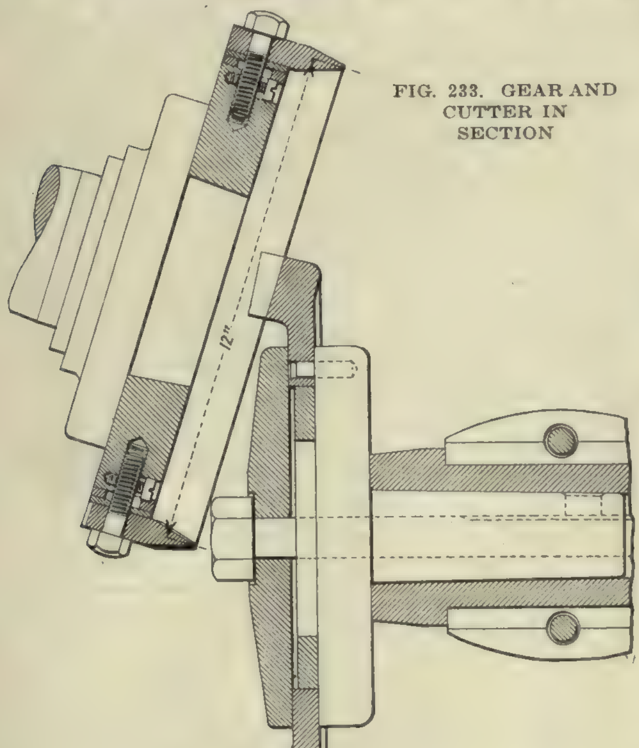


FIG. 233. GEAR AND CUTTER IN SECTION

Fig. 233 shows a gear to be cut and also the cutter in section. The cutter contains two kinds of blades: Some cutting on the outside and some on the inside, for the purpose of generating the two sides of the tooth gap. They are made adjustable in their radial position by means of a tapered wedge and a fine adjusting screw, and they are clamped in position by means of a heavy screw. Fig. 234 shows the construction clearly. The cutter has the general appearance of a face mill. It is made with 20 teeth—10 for outside and 10 for inside cutting. Each individual tooth is made like the teeth of a formed mill, so that they can be ground on the face without losing the proper cross-section. Two of the teeth, marked *A* and *B*—one for inside and one for outside cutting—are non-adjustable and are used for reference when the other teeth are ground and adjusted. In this manner it is possible to maintain the proper relation of the teeth with each other, and therefore the two main elements which must not be disturbed, i.e., the generating angle and the distance from the center, are maintained.

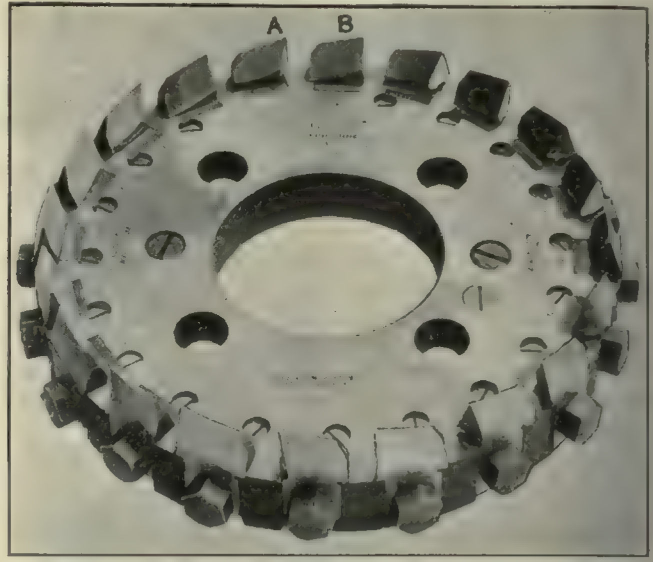


FIG. 234. GLEASON SPIRAL BEVEL GEAR CUTTER

Another tool of simple shape capable of producing an entire system of gears is the Fellows gear cutter. In both the Gleason and the Fellows machines the generating tooth is a rack tooth of which the shape is essentially a straight line. As we have seen in the Gleason machine the rack tooth is a part of a circular rack or, as it is called in that case, a crown gear. In the Fellows gear shaper the base of the generating system is the rack tooth, but in this case the rack tooth is not used for generating the various gears.

In a system such as the involute system of gears, any two gears generated by the same rack will run together properly, and vice versa, any gear generated by the rack can be used to generate any other gear or even the rack itself. Working on this principle, the Fellows system employs a gear as its generating tool and this gear had been generated in its turn by a rack tooth. It is well known how a grinding wheel is employed as the generating rack tooth, thus permitting the finishing of the tool after grinding.

As used in the machine, the generating cutter and the blank to be cut are rotated together as if they were two gears in mesh with each other, and the cutting motion of the tool is merely a motion up and down, such as that of a slotter tool. If the original rack tooth had been used to generate the gear, then this tooth would have to be returned to its original position after a single tooth of the gear had been generated, and then the gear blank would have to be indexed. As one of the chief advantages of the system is the avoidance of inaccuracies by indexing, one of the greatest advantages of this system would be lost if a single rack tooth were used as tool. Even if a section of rack were used instead of a single tooth, the same difficulty would remain. In that case several teeth might be generated before it would be necessary to return the rack to its original position, but in the course of time such a return would become necessary and we would have to index once more.

Fig. 235 shows a Fellows gear cutter. Fig. 236 shows the same cutter in section and the manner in which it is held on its arbor. One face of the cutter is a plane surface and the opposite face is conical.

The purpose of this conical surface is to give rake to the teeth of the cutter. The illustration shows the amount of rake to be 5 deg. However, Fig. 237 shows that this 5-deg. rake only exists in the direction of arrow No. 1. With conditions such as shown in the figure, that is, a tooth occupying almost the entire length of the radius of the cutters, there would also be a certain amount of rake in the direction of arrow No. 2. On the other hand, the amount of rake at arrow No. 3 would be exceedingly small, we might say negligible; and this is even more so when the proportions of length of tooth and diameter of cutter are as they are actually made. Most of the heavy cutting, or roughing, is done at the front of the tooth, while the finishing is done with the side. We see, then, that the cutter as made has some rake where it is most beneficial.

A first glance at a Fellows gear cutter gives the impression that the cutter is made on the same principles as a formed milling cutter; that is to say, it looks somewhat as if it were backed off, but this is not the case. The method of generating the cutter makes the top of each tooth smaller in section than the bottom. We might say that the teeth of the cutter resemble somewhat the teeth of a bevel gear; with this exception, however, that the outline of the tooth remains the same after resharpening, though the thickness of the tooth changes. This, however, does not result in a faulty gear being cut. If the cutter were used in the same manner in which a milling cutter is used, in other words, if the shape of each tooth were reproduced in the work, the gashes cut after successive sharpenings would become gradually narrower. However, this cutter is used as a generating tool and the nature of the generating motion, combined with the nature of the generating curve, is such that the gear cut after successive sharpenings of the cutter will have the same qualities as the gear cut with a new cutter.

There are, then, very few items which must be taken care of in the sharpening of such a cutter. It is only necessary to mount it centrally on a stud which should fit the hole in the cutter, and either to set the cutter or else the grinding wheel to the given angle. The sharpening is preferably done on what is called a ring grinder, though it can be done on any universal grinding machine. If the cutter is not set to the correct angle, the outline of the teeth will be somewhat modified, but a small variation of the angle, such as might occur in practice, would produce so little distortion of the outline that it would not be noticeable in the result.

Fig. 238 shows a Fellows gear cutter used for helical gears. Due to the fact that the teeth of the cutter must be set to the angle of the helix to be cut in order to have clearance, each tooth must have its own cutting surface, as shown in Fig. 238. As a consequence it is no longer possible to sharpen by the method described above, but each tooth must be sharpened separately somewhat like the teeth of a milling cutter. With such a cutter it becomes quite important to have the relation between grinding wheel and cutter right. The spacing also becomes an important item. As ordinary dividing mechanisms used on cutter sharpening machines are usually not made with the same accuracy as the cutter to be sharpened, such devices should not be used. It is better to grind each tooth by a solid tooth rest, grasping around the body of the tooth to be sharpened. A spring tooth rest would not be permissible.

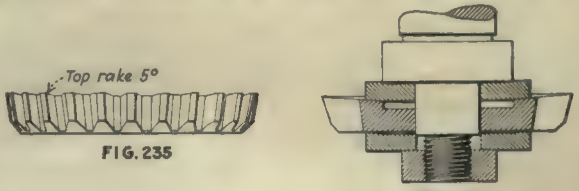


FIG. 235

FIG. 236

FIGS. 235 AND 236. SIDE ELEVATION AND SECTION OF FELLOWS CUTTER

When the Fellows cutter is used for generating spur or helical gears of which the tooth shape is the involute, no inaccuracy is introduced by the fact that the top of the tooth is somewhat narrower than the bottom; but when similar cutters are used for other shapes, such as sprockets or ratchets or any shape different from the involute, this condition no longer prevails, and it becomes necessary to make the cutter along the same principles as the formed milling cutter; in other words, if the cutter is resharpened on a plane parallel to the original plane of cutting edge, the same cross-section of tooth must be produced.

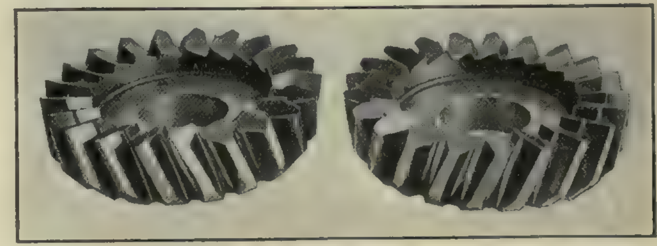


FIG. 238. FELLOWS CUTTER FOR HELICAL GEARS

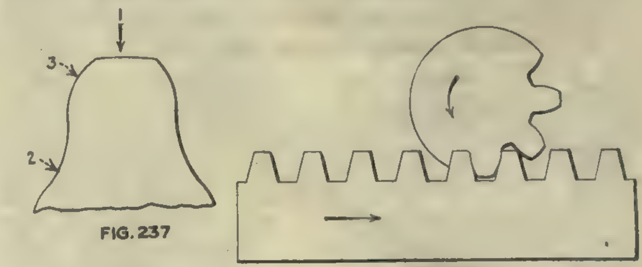


FIG. 237

FIG. 239

FIG. 237. DIAGRAM TO SHOW RAKE LIMITATION OF FELLOWS CUTTER. FIG. 239 USING A RACK AS A GEAR CUTTER

The generating action of a hob depends on the same general principles as that of the Fellows cutter. It was mentioned that the real generating shape used in the Fellows gear shaper is the rack, but that for certain reasons the rack was not used in the gear cutting machine, but was used to generate a cutter which in its turn would generate gears. It was also pointed out that the reason the rack itself was not used lies in the fact that we would need a great length of rack for a gear with a considerable number of teeth, and that the whole procedure would become impractical. Fig. 239 shows the condition we would have if a rack were used to generate a gear. The teeth of the rack are distributed side by side here, just as in an ordinary rack. However, these cutting teeth might be distributed in a different fashion such, for instance, as shown in Fig. 240. In this figure the first tooth A_1 is shown about to enter the gear, and also (but in dotted lines) in the position it would occupy after it had passed through the gear. By this time, the second tooth B is just about ready to enter the gear. Before we make it enter, we will rotate the gear and move the rack sideways as if they had meshed together, bringing the second tooth of the rack above the centerline of the gear. We then stop this motion and proceed with tooth B as we did with tooth A_1. The result would be the same as if we had employed the rack shown in Fig. 235, and again this arrangement would be impractical.

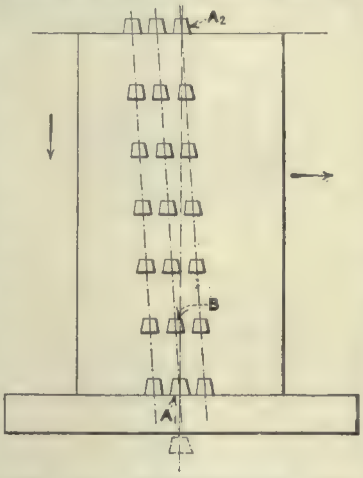


FIG. 240. ELEMENTARY DIAGRAM OF HOB PRINCIPLES

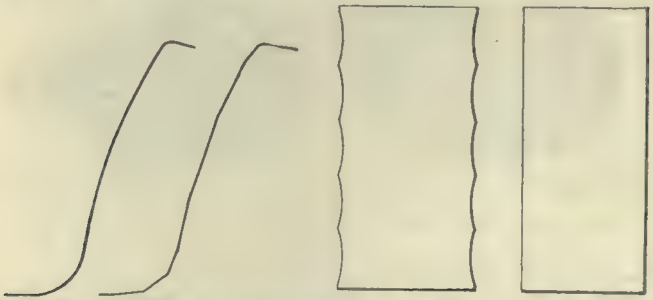


FIG. 241 FIG. 242 FIG. 243 FIG. 244

FIGS. 241 AND 242. DESIRED AND ACTUAL CONTOURS OF HOB-CUT TEETH. FIGS. 243 AND 244. ACTUAL AND THEORETICAL SECTIONS OF HOB-CUT GEAR TEETH

A Possible Theoretical Method

However, it is not necessary that we should first let a tooth of the rack pass through the gear before we rotate the gear and move the rack sideways. If the gears were of infinitesimal thickness we could have brought the cutting teeth of the rack as close together as we might wish to, and then we could have given the rack a downward motion at the same time that the gear rotates and the rack moves sideways. Nor would it have been necessary to have only one rack tooth in each horizontal plane; we might have had two or three or even more. And as long as we do not have so many rack teeth that some of them will fall entirely outside the gear, each tooth would have done some part of the work.

As a matter of fact, we will never have a gear of infinitesimal thickness, and as soon as the thickness is appreciable at all it will take the rack tooth some time to pass through the thickness of the gear. During that time the rack has moved sideways a small amount and consequently all layers of the gear with the exception of the infinitesimal top layer will be acted upon by a tooth which stands off the center.

Practical Method of Gear Cutting

As we mentioned before, such an arrangement would not be practical, but it leads to one of the most practical methods of gear cutting in existence. If tooth A_1 (Fig. 240) is in the center of the gear we will finally get a tooth A_2, which is directly above the center. If there were three teeth in each group of teeth and we started with the central one of the first group, this tooth A_2 will not be the center of its group, but will be the tooth to the right of the center. If we should cut the rack off at this point A_2, as shown by the heavy line, and then roll it into a cylinder, and if then we should rotate the rack instead of moving it downward in a straight line, but giving it otherwise the same movements which the rack had, we will obtain exactly the same result.

The rack rolled into a cylinder is a hob. In order that a hob shall make a perfect gear (we mean here a theoretically perfect gear) it would have to have an infinite number of teeth per revolution and the gear would have to be of infinitesimal thickness. These conditions cannot be fulfilled and as a result a gear cut by a hob is not theoretically perfect. This fact is generally recognized, but many people do not realize how very small the errors are, caused by this departure from ideal conditions.

The fact that we have only a limited number of teeth per turn of the hob causes the shape of the gear teeth to be a compound line made up of a number of short straight lines and not a perfect curve, and whereas the shape should be somewhat as shown in Fig. 241, we will find it to be somewhat as shown in Fig. 242.

Imperfections too Slight to Be Serious

The fact that the thickness of gear cut for one revolution of the gear is not infinitesimal, but may amount to as much as $\frac{1}{16}$ in., causes the section of the gear to appear as shown in Fig. 243 instead of the shape shown in Fig. 244 (which is as it should be). The waves in Fig. 243 are grossly exaggerated; though visible to the naked eye, the depth of the impressions will be a very small fraction of 0.001 in. This depth is not the same all over the profile of the tooth, that is, it may be different at the top of the tooth, at the pitch line, and at the bottom of the tooth, but, even with the coarsest feed which can be used in practice, the depth of the impression will be exceedingly small at any point. Similarly, though the profile of the tooth is actually formed by a number of straight lines, they will appear to the eye and to the sense of feeling as a continuous curve, unless the number of teeth in the hob is unusually small or unless the hob is not long enough to generate a gear tooth completely. We will refer to these conditions more in detail later on.

(To be continued in next week's issue.)

Making the Peerless Ring Gear, Spider and Gears

Methods by Which Accuracy in Boring, Turning and Grinding Are Secured—Chucks for Accurately Locating Pieces of Awkward Shape

By FRED H. COLVIN
Editor, *American Machinist*

THE ring gear for the Peerless car is made of electric furnace steel and is approximately 10⅝ in. outside diameter in the rough. The finished face is 1⅜ in. The sequence of operations is as follows:

Operation 1. Anneal.
Operation 2. Clean off scale.
Operation 3. Rough bore chamfer, face both sides of web and face back side.
Operation 4. Drill eight 31/64-in. holes.
Operation 5. Countersink both sides of holes.
Operation 6. Rough-turn and face outside.
Operation 7. Ream eight ½-in. holes.
Operation 8. Finish-turn all angles.
Operation 9. Inspection.
Operation 10. Rough-cut teeth.
Operation 11. Finish-cut teeth.
Operation 12. Chamfer teeth.
Operation 13. Remove all burrs.
Operation 14. Lap with pinion.
Operation 15. Inspect before hardening.
Operation 16. Heat-treat.
Operation 17. Inspect for hardness.
Operation 18. Grind, bore and face.
Operation 19. Inspection and pairing.

After annealing and sandblasting to clean off the scale, Operation 3 is performed on a 12 x 6-in. Hartness automatic lathe. The total tool set-up is shown as well as possible in Fig. 1, although the compactness of the machine makes it difficult to photograph the tools in place.

The drilling operation is performed by the multiple drilling head shown in Fig. 2, mounted on a Barnes drilling machine. The form of fixtures used can be readily seen. The face of the gear fits over the ring at *A* while the plate *B* drops into the center hole and locates the position of the drill bushing with reference to the finished surfaces of the gear. The gear itself is shown at *C*. The double fixture allows a second gear to be put in place during the drilling of the first and the table is swung from one position to the next without loss of time. The fixture is a simple but effective one for work of this kind.

Turning the Face

The rough-turning of the face and outside is done on a Fay automatic lathe as shown in Fig. 3. An interesting feature is the way in which the gear is held during this operation. The gear is positioned by means of dowel pins, one of which is shown at *A*. Then the plate *B*, which covers about half of the inner flange is slipped over the triangular head *C* of the draw-in bolt that forces the plate *B* into contact with the gear and holds it firmly in position during the turning operation.

The finish turning of the gear is done on a Lodge & Shipley lathe, as shown in Fig. 4, where the arrangement of the tools for turning both the face and the outside bevel can be seen. The gear blank is positioned by the hole in the center and the two studs *A* and *B*, which help to drive it. The clamp *C* fits the inner flange. For quick action this clamp has a hole through the center large enough to slip over the nut and washer on the central stud. The swinging clamp *D* is then put in position under the washer and in this way the gear can be quickly handled both in and out of the lathe. The two compound rests are set to give the proper angles and the job is finished quickly and accurately on this machine.

The chamfering of the outer ends of the teeth is accomplished in a special fixture mounted on a Whitney hand milling machine, Fig. 5. This fixture holds the gear at the proper angle and it will be noted that the method of clamping is identical with that used in Fig. 4. It will also be seen that there are two indexing pins at *A* and *B*.

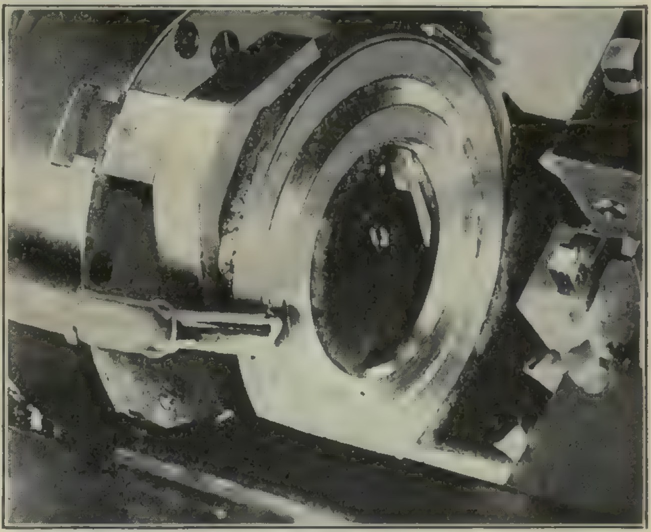


FIG. 1. ROUGH-TURNING AND BORING

After this operation comes the burring, lapping, inspection and heat-treatment, as can be seen from the list of operations.

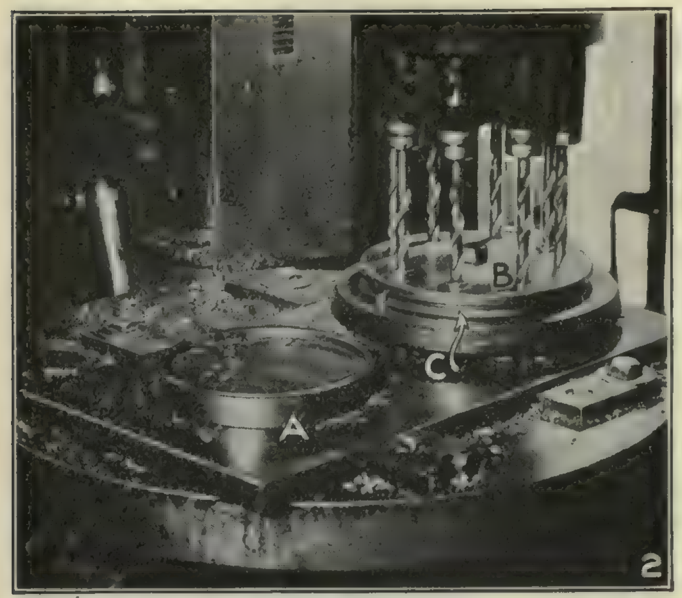
The differential pinion is turned from bar stock and is a screw-machine job except for the drilling, grinding and gear cutting. The tooling, which is a double-forming-tool job, is shown in Fig. 6. The end of the bar is supported by a center in the turret while the two cross-slide tools form and cut off the piece.

The Differential Spider

The differential spider which carries the four small beveled gears is a drop forging in the form of a cross with a large hub in the center. While the machining operations are comparatively simple it is nevertheless something of a problem to have the four arms 90 deg. apart and in the same plane, within high-grade commercial limits. The operations are:

Operation 1. Bore, face and chamfer both sides and turn ends.
Operation 2. Turn legs.
Operation 3. Drill hole.
Operation 4. Mill oil grooves in legs.
Operation 5. Heat-treat.
Operation 6. Grind hole.
Operation 7. Grind legs.
Operation 8. Inspect.

The first operation is performed on a Potter & Johnston machine and is shown in Fig. 7. The spider is held in a special fixture mounted in a three-jawed chuck, the raised part of the fixture holding the spider



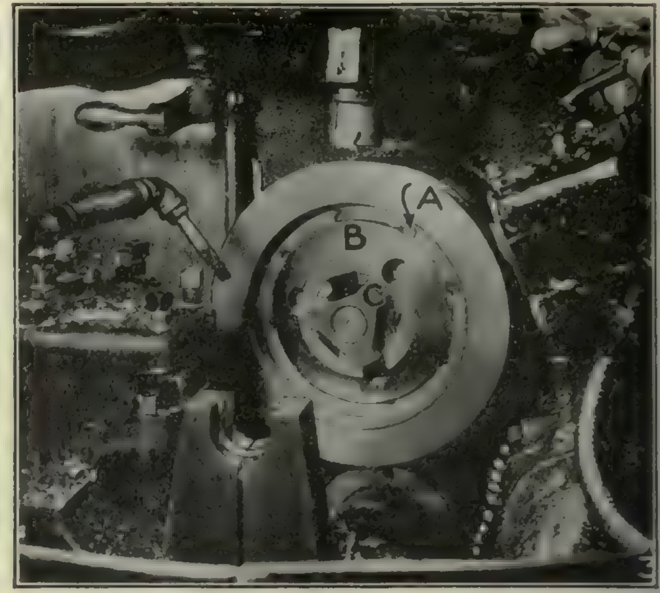
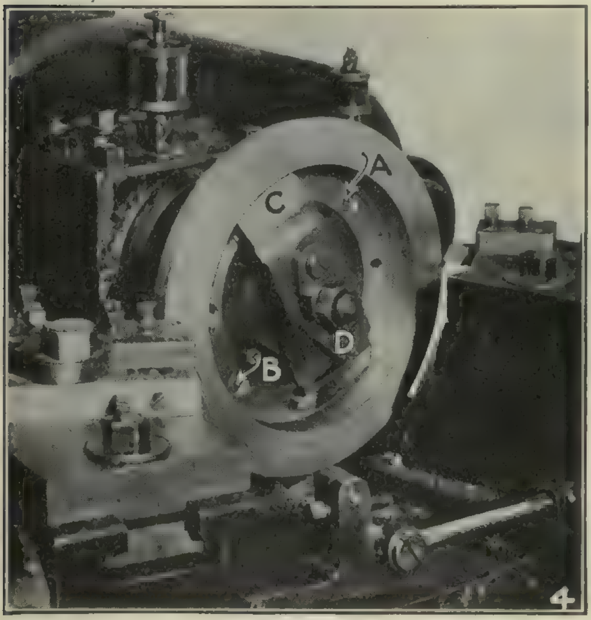


FIG. 2. DRILLING EIGHT HOLES IN DOUBLE FIXTURE. FIG. 3. ROUGH-TURNING OUTSIDE AND FACING



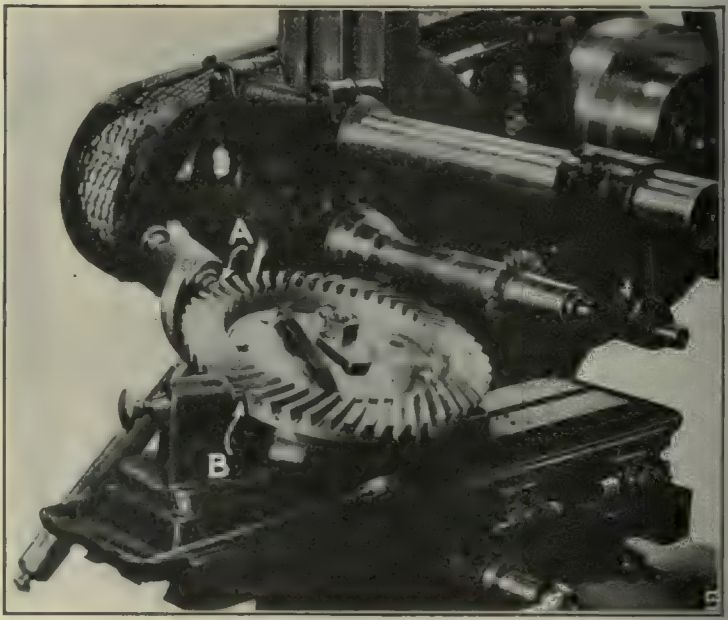
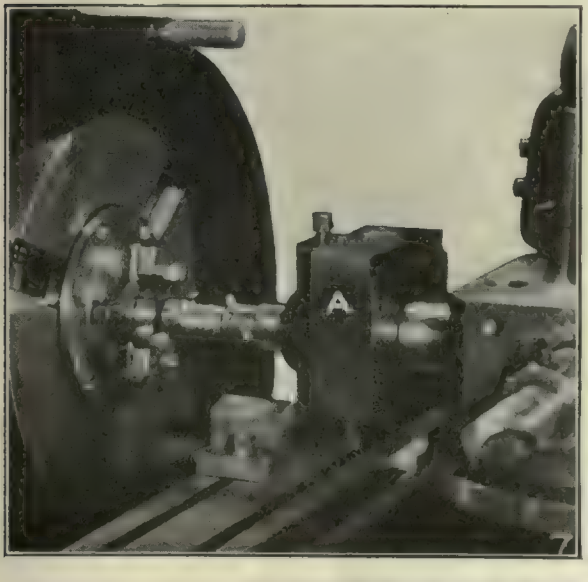


FIG. 4. FINISH TURNING. FIG. 5. CHAMFERING HELICAL TEETH



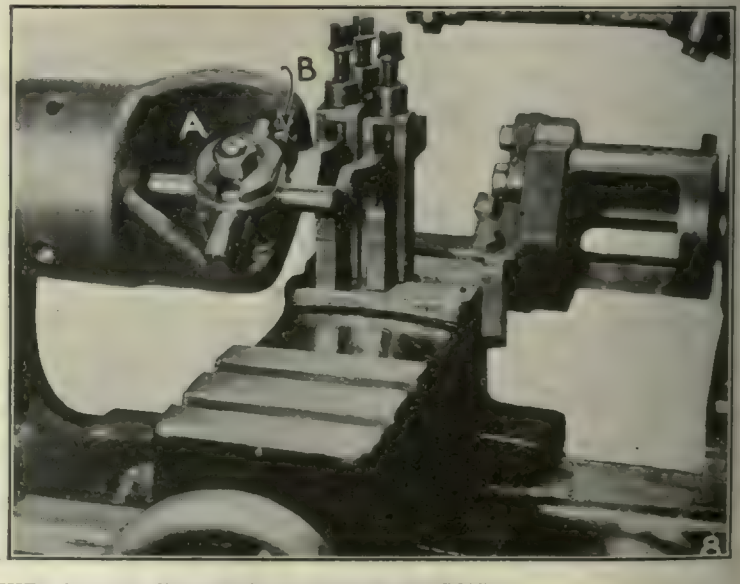


FIG. 7. BORING THE SPIDER HUB. FIG. 8. TURNING THE SPIDER ARMS

so that the hole will be bored square with the arms. The boring bar has inserted cutters and is mounted in an adjustable head *A*. The hole is first drilled and afterward bored to the grinding limit by the bar shown. Both sides of the hub are faced by the double set of cutters shown. The turret is run in to its proper position which is determined by a suitable stop and the facing cutters then fed out by means of the sliding head shown at *A*, facing both sides of the hub at once.

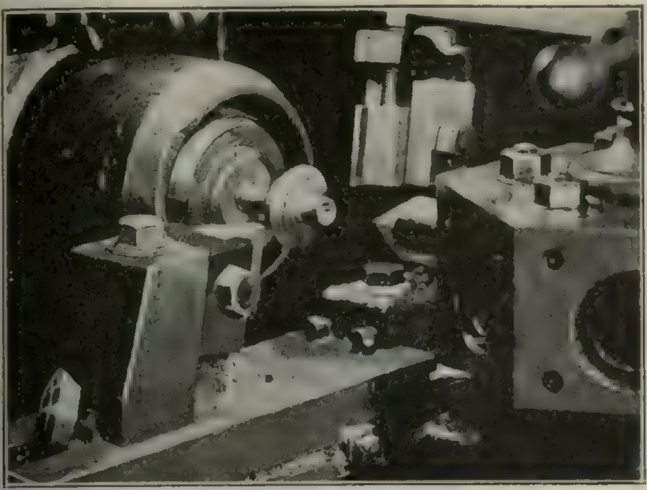


FIG. 6. TURNING THE DIFFERENTIAL GEAR

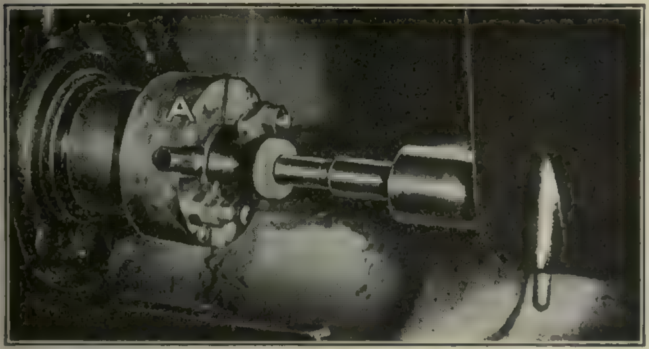


FIG. 9. GRINDING THE CENTRAL HOLE

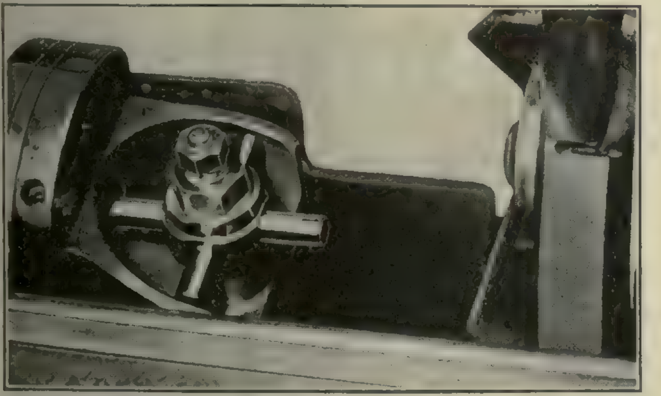


FIG. 10. GRINDING THE SPIDER ARMS

Next comes turning the four arms of the spider. This operation is done in a Warner & Swasey turret lathe with the spider held as at *A* and the position located by means of the stop *B* as in Fig. 8. This method of locating makes it easy to position the spider when turning the different legs. The tools shown in the toolpost face the shoulders and chamfer the ends.

After milling and heat-treating, the hole in the spider is then ground, being held in the fixture shown at *A*, Fig. 9, which locates it by its four arms. The hole is then ground by the wheel shown, the machine used being a Bryant internal grinding machine.

In grinding the arms which comes next, a fixture, Fig. 9, somewhat similar to that shown in Fig. 2 is used. This fixture allows the four legs to be indexed to their proper positions for final grinding. Close inspection of the arms will show the grooves which have been previously milled to assist in lubricating the pinions when in use.

Motor Troubles and Repair

BY R. COWAN

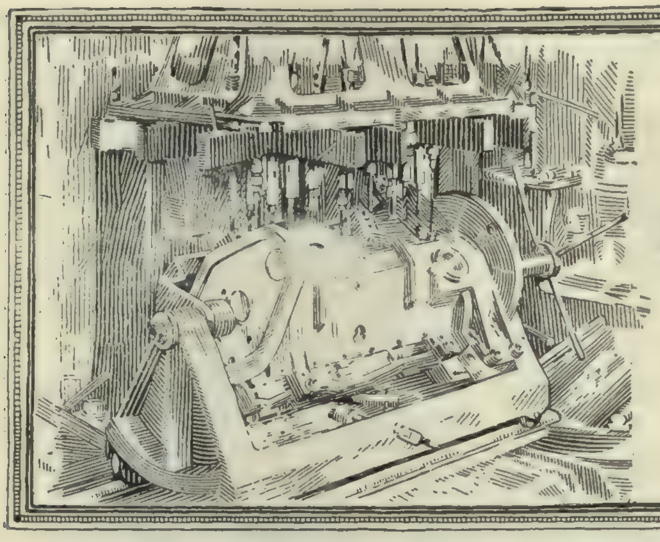
It looks as though I. B. Rich is leaving quite a job for the real mechanic, and while some of the real machine repair shops are going to considerable expense for equipment, there are still quite a few things that require careful personal study. Among these are piston clearance, which seems to be as hard to arrive at as it is to maintain; also carbon on the inside of *one* piston when three more in the same block have none, which lets out both the designer and the oil. Some cases can be cured with correctly fitted pistons and rings and others cannot, which seems to indicate that the water circulation is poor around this cylinder.

One quite noticeable change in design has come with the present vacuum system and some such arrangement as the Holly vaporizer, as used on the Fordson tractor, would seem to be much better than the present attempt to heat the whole volume of gas.

While three and four-ring pistons are common, one automobile rebuilt into a truck is giving good service with only one ring.

I don't understand how they are made but I am sure a good mechanic would hate to use some of the pistons sent out for replacement as the ring grooves are out of true with the skirt as much as 0.01 in. With such pistons it is plain to see why Mr. Rich's friend prefers narrow rings.

Grinding cylinders with a hot wheel is something we try to avoid. Data on results would be interesting and while it would take more time the results may warrant it.



Tool Engineering

By

Albert A. Dowd and Frank W. Curtis

President and Chief Engineer

Albert A. Dowd Engineering Co., New York City

Design of Riveting Fixtures—Riveting Machines—Types of Rivets—Locating and Clamping—Use of Tables—Ring-Staking Tools and Fixtures—Ejectors

THE process of riveting is used extensively in many classes of work, both small and large. For example, adding machines, typewriters, cash registers, etc., have many small parts made up from two or more units, assembled and riveted together to make a single component of the mechanism. Automobile frames, steel girders for buildings, ship plates, bridges and many other forms of structural work depend largely on the process of riveting to locate and hold together the various structural members. Rivets in structural work are usually heated before driving but for small parts cold rivets are used and it is here that riveting fixtures are used to advantage.

Rivets are headed over either by hand or machine. In some cases the rivets are in such a position that it is very difficult to head them over on a machine, necessitating a hand operation. Hand riveting as a rule does not require a fixture.

The machines used for riveting are of two general types, one of which heads the rivet by spinning the metal over to form a head; the other peins the metal by striking successive blows. Both types are extensively used, the selection being dependent upon the kind of work that is to be done.

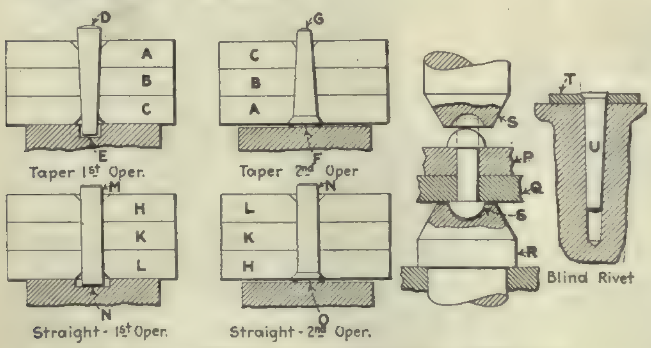


FIG. 199. TYPES OF RIVETS AND RIVETING

Riveting machines are made in several styles, both horizontal and vertical; single, double and multiple spindle; operated mechanically or by pneumatic power. In some machines work is placed on an anvil and the spindle is moved up to it; in others the anvil itself moves toward the spindle. In the reciprocating type of machine the spindle is arranged to hold a pein of suitable form, while in the rivet spinning machine hardened rolls are used. In either machine the action is very rapid and work is produced much more quickly than by hand riveting.

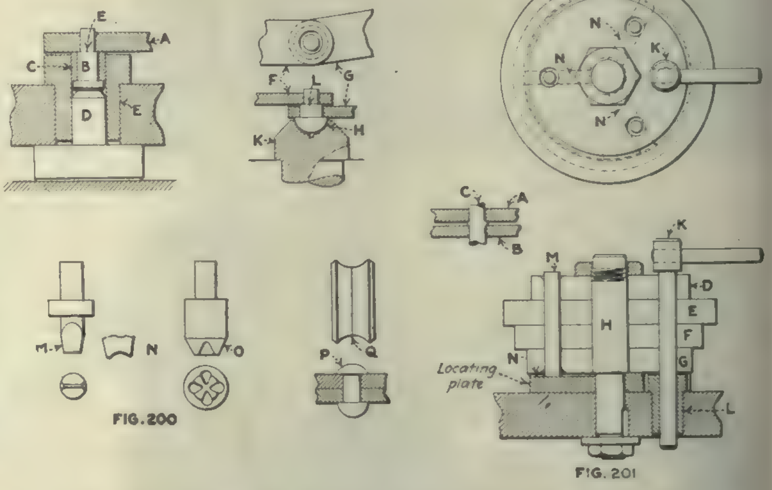


FIG. 200. FORMS OF RIVETING TOOLS. FIG. 201. LOCATING AND CLAMPING FOR RIVETING

Machine riveting produces sharp, quick blows which are rendered elastic by springs or rubber cushions. In the pneumatic type the air acts as a cushion. The force of the blow can be regulated by the operator. The application of riveting fixtures covers such a wide field that it will be understood better by referring to the various examples given in this article. The facility with which work can be handled generally governs the production, as the actual time consumed by the riveting operation is very small.

The kind of work to be riveted affects the shape and form of rivets used. Straight rivets with round heads are often used when the appearance is important and when there is plenty of room in the mechanism so that projecting rivet heads will not interfere with some other

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part. Straight rivets with flat or countersunk heads are also much used for plain work. Taper rivets are valuable when correct relation of several parts to each other is required.

Fig. 199 shows several types of rivets and methods of riveting. Pieces *A*, *B* and *C* are to be riveted together with taper rivets as shown at *D*. Before the riveting operation the parts are reamed in a locating jig and rivets are insertel to act as dowels and keep the parts together. The form of locating jig mentioned has been described under the head of drill jig design.

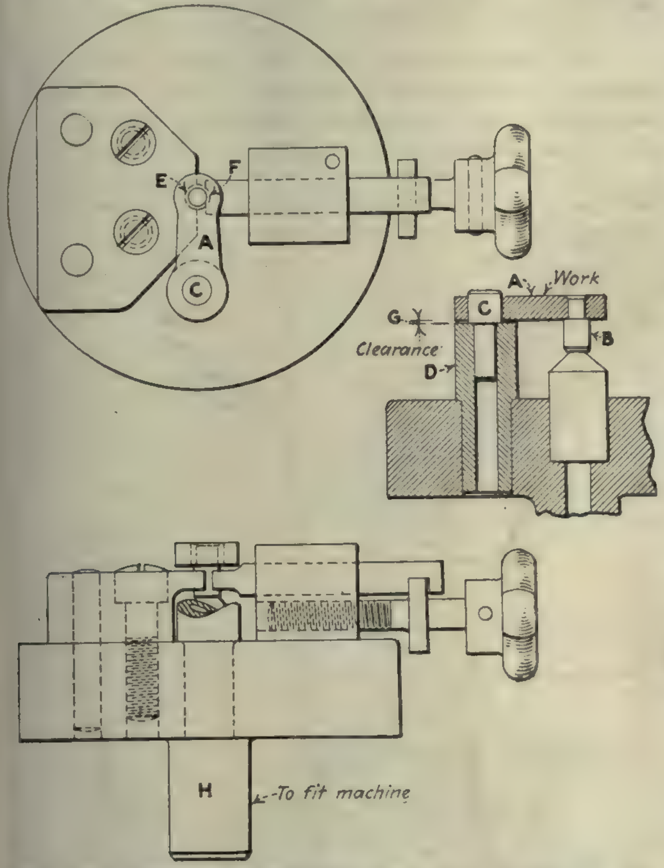

FIG. 202. RIVETING FIXTURE SHOWING METHODS OF LOCATING AND CLAMPING

In riveting these parts together a taper rivet *D* is used. The first operation heads over the large end of the rivet and it is important that clearance should be provided in the riveting fixture at *E* so that the rivet will not bottom. After the large end has been headed the work is turned over so that the small end comes uppermost as at G. The other head of the rivet rests on the anvil at F. Care must be taken to see that work does not rest on the block in this case as the rivet head might be somewhat lower than the surface of the work which would allow it to be forced out during the riveting process. This would cause a loose fitting rivet and inaccurate work. It is important that taper rivets should be made of uniform length and the holes must always be carefully reamed.

STRAIGHT RIVETING

When straight rivets are used in fastening several pieces together as shown at *H*, *K* and *L*, the anvil used must be cut away to allow the end of the rivet to seat itself as shown at *N*. The depth of the recess should be sufficient to allow for a head on this end of the rivet when the work is turned over. After the head *M* has been formed the work is reversed and the head takes the position *O*. The other end *N* can then be riveted taking care that the head *O* rests firmly on the anvil.

ROUND HEAD RIVETS

This is the most common type of riveting, as the rivet is always provided with one head. This head rests in a special anvil *R* which is cupped at *S* deeper than the rivet head and slightly smaller in diameter. This supports the rivet and also prevents it from turning. Riveting of this kind is often done on a punch press as well as a riveting machine and several rivets may be headed at the same time, providing the work is uniform.

BLIND RIVETS

When rivets do not go through the piece of work they are called blind rivets and are generally made in taper form as shown at *U*. When a case of this kind is found, the taper of the hole should be slightly different from that of the rivet in order that a wedging action will be produced due to the difference between the two tapers. This wedging action is sufficient to hold the rivet in place.

METHOD OF RIVETING ROLLERS

If a roller such as that shown at *C* in Fig. 200 is to be held in place in a piece of work *A* by means of the special rivet *B*, provision must be made so that the roller will be free to move on the rivet. Suitable allowance must be made so that the shoulder *E* is slightly longer than the roller. When the rivet is headed on the upper end there will be sufficient clearance to allow the rolls to revolve. In setting up work of this kind a special anvil can be made as at *D*. This anvil is smaller than the rivet head in order to prevent upsetting the head. The bushing *E* serves to locate the rivet and roll.

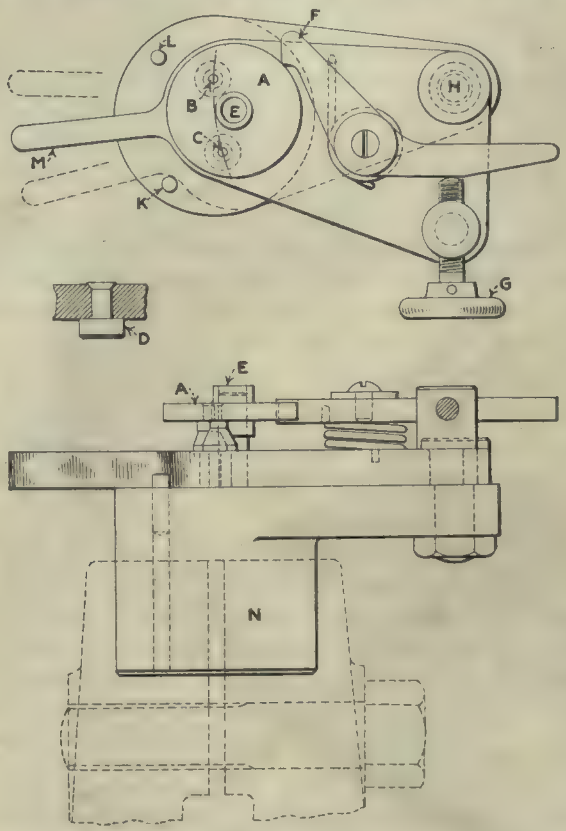

FIG. 203. SWINGING TYPE RIVETING FIXTURE FOR TWO HOLES

The method of riveting a hinge is shown at *F* and *G*. The anvil K is made so that it will hold the round head

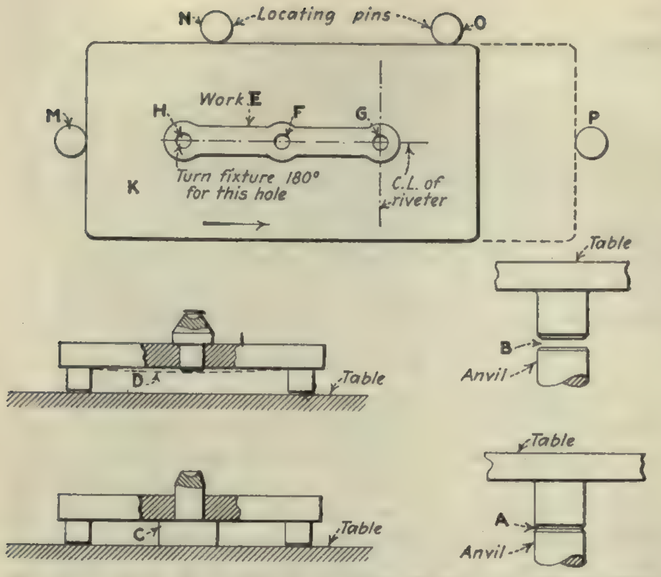

FIG. 204. USE OF SPECIAL TABLE WITH LOCATING PINS

rivet *H*. A shoulder is provided at *L* which gives the proper allowance between the two parts. The operation of riveting can be done in the regular way.

Several forms of peins are shown at *M*, *N*, *O* and *Q*. The form *M* is used for flat and countersunk rivets. *N* is somewhat similar but being cupped slightly has a greater spreading action on the rivet. The form *O* has a series of points which tend to pein the rivet rapidly. In the rivet spinning machine a hardened roll *Q* is used to form a rivet head as indicated at *P*. There are many other forms of peins used in riveting, the shape of these depending on the work to be done and somewhat upon the material of which the rivet is composed.

Rivets often act as dowels in locating several parts with relation to each other when great accuracy is not important. The design of fixtures for this class of work is not at all difficult. Work having a center hole and in which rivets are located radially should be provided with a location hole unless the shape of the piece is such that it can be easily set up in the desired position. For instance, if two washers are to be riveted together so that the center holes will be in alignment, a stud can be used as a locater; whereas if the outside diameters are to be in alignment the work should be nested and located from the outside. In riveting two gears together so that the teeth will bear a certain relation to each other, pins or pawls should be used between the teeth.

The location points for work that is to be riveted should be as near to the outside as possible, in order to obtain maximum accuracy. Clamps are not always required in riveting work together but they are frequently used in order to prevent spreading of the work when the pressure of the hammer is applied. A rivet spread out between two pieces of work is the ordinary result unless clamps are used, the vibration of the machine causing the two pieces to separate. Various types of rivets require special forms of anvils in order to avoid the possibility of bad rivets. Several points in this connection have been brought out in Figs. 199 and 200.

The position and location of the fixture on the riveting table must be so arranged that the rivet will be directly over the anvil and in contact with it. The production required on any riveting proposition does not necessarily affect the design of the fixture as there are not many ways of riveting work. Positive and rapid clamping are important however, and the accuracy of the product is dependent upon the location and the use of proper rivets.

Vibration should always be considered. All loose parts of fixtures should be well screwed down so that the excessive vibration can not loosen them and cause trouble.

In Fig. 201 is illustrated a method for locating and clamping several pieces together for riveting. This is an example which makes plain the importance of proper locating and clamping, in order to prevent trouble due to vibration and also to insure accuracy. Unless the work is held properly it is likely to open up and separate so that the rivet may bulge out as shown at *C* between the plates *A* and *B*. Rivets should not be used as dowels to locate work if great accuracy is required; other means should be provided. In the example shown the four pieces *D*, *E*, *F* and *G* are slipped over the center stud *H* and clamped by means of the nut shown. The locating plug *K* is a loose piece which is pushed through all the pieces and into the bushing *L* which locates it. This is better than a station locating stud similar to the center one, because it is less likely to be sprung out of its true position. The locating plate is slotted in three places to allow for the rivets *N*. For riveting the other side of the work another fixture is necessary.

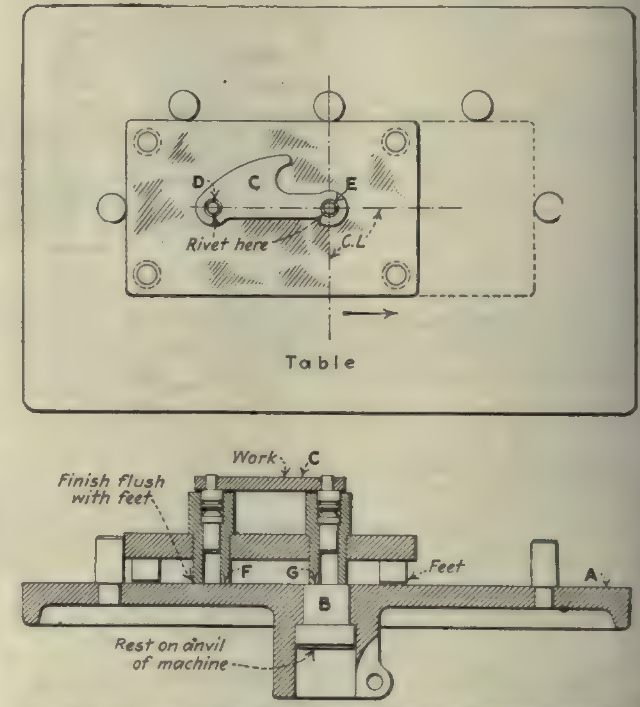

FIG. 205. EXAMPLE OF RIVETING FIXTURE USING SPECIAL TABLE

METHOD OF LOCATING AND CLAMPING

The type of fixture shown in Fig. 202 is very good for a number of kinds of work and it can easily be standardized. In the example given, the work *A* is to be furnished with a pin B which is to be riveted in place. The center distance from *C* to *B* is very important. The work is located on the stud *C* and the riveting is done over the anvil shown. The anvil is directly over the portion *H* which fits the riveting machine. The work is nested between the fixed member E and the movable pin *F*, the latter being arranged so that it does not turn as it is moved by the screw. This clamping arrangement has been previously described.

Attention is called to the location of the pin C in the bushing *D*. This provides for easy replacement of the pin when worn and thus preserves the accuracy. Clearance should be allowed at *G* so that the work will not rest on anything except the rivet.

SWINGING TYPE OF RIVETING FIXTURE

To assist in the rapid handling of work a swinging fixture is often an advantage. An example of this kind is shown in Fig. 203. The work *A* has two rivet studs as indicated at *D*, these being located at *B* and *C* as indicated. As they operate in a face cam in the completed mechanism their location is important and they must be firmly riveted into position. The work locates on a central stud *E* and is held firmly in position by the pawl *F* operated by the thumbscrew *G*. The swinging member of the fixture is pivoted at *H* so that in operation the rivets can be brought into position under the hammer by swinging the lever *M* until it strikes the pins at *K* and *L*. When in the riveting position ample support is given by the fixture at *N*, this portion being clamped in place in the riveting machine. The dotted lines indicate the two positions of the fixture when riveting. This is a clean cut example of a simple riveting fixture involving principles which can be applied to other work of similar character. Tables are often used on riveting machines in order to simplify the location of fixtures which are to be used for several operations. Also when fixtures are large and when rivets are so spaced that they cannot easily be located on an anvil, a table permits easy location and makes the operation of riveting more convenient. A few points in connection with the use of tables are illustrated in Fig. 204. It is important that the table should be so located that the stem *A* will be in positive contact with the anvil on the machine. There must never be a space between them as indicated at *B* as this would not give proper support. The fixture which may have an anvil of its own, must also always be made so that the under side of the anvil is in contact as at *C*. It should never be made as shown at *D* as this would not give good results and would buckle as indicated by the dotted line.

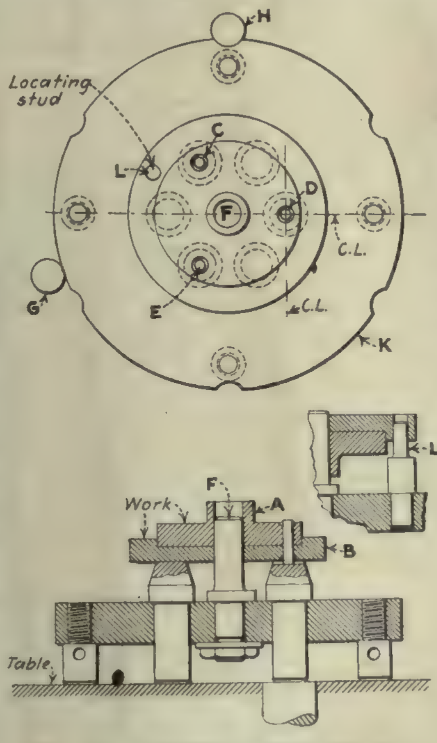

FIG. 206. RIVETING FIXTURE FOR BOTH SIDES

In locating any fixture on the table an arrangement of pins can be provided so that several locations can be easily made. If a number of pieces of a similar kind are to be riveted it is often possible to standardize the tables and the relation of the pins so that fixtures can be built which will all be usable on the same table. The work *E* for example is to be riveted at *F*, *G* and *H* and it is located for the operation on the riveting fixture *K*. Locating pins are provided at *M*, *N*, *O* and *P* so that by moving the fixture along as indicated by the dotted lines, all three rivets can be brought into position over the center line of the riveting machine. Other fixtures for work of similar shape and size can be so made that the same table can be used in each case.

In Fig. 205 is shown another example of a fixture used on a special table *A*. The plug *B* must rest on the anvil of the riveting machine. The work *C* is to have the two pins *D* and *E* riveted in place and the method of location here is the same as that previously described. The ends of the bushings at *F* and *G* must be ground so that they are flush with the feet of the fixture in order that they will be in contact with the plug *B* during the riveting operation. The locating pins on this table are arranged in similar fashion to those previously described.

RIVETING FIXTURE USED FOR BOTH SIDES OF WORK

The designing department can often help in simplifying the design of riveting fixtures by paying attention to the location of rivet holes, and placing them in such positions that the same fixture can be used for riveting both sides of the work. An example which illustrates the advantages of this forethought is shown in Fig. 206. The pieces *A* and *B* are riveted together at three points *C*, *D* and *E*, these points being 120 deg. apart and the same distance from the center. The pieces are assembled on the center plug at *F*, resting on six plugs as indicated. Three of these plugs are cut away to allow for the heads of the rivets, while the other three are plain on the top. For the first riveting operation the slotted pins are used successively; but for the second the plain pins are used, the work being turned over.

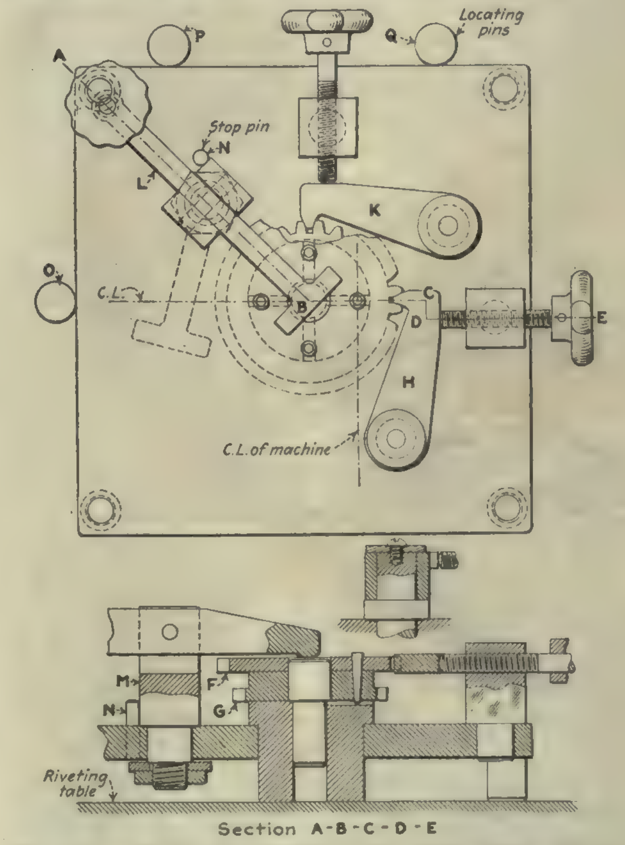

FIG. 207. RIVETING FIXTURE FOR TWO SPUR GEARS

Two pins *G* and *H* are used in the riveting machine table to act as locaters for the fixture. It will be noted that the edge of the fixture is notched in several positions so as to give correct locations for the various rivets. The notch acts as one locater against the pin *H*, while the other location is fixed by a contact of the outside of the fixture with the pin *G*. A pin *L* is placed in the fixture to locate the two pieces and attention is called to the manner in which it is cut away so that it will not interfere with the flange indicated. All of the six studs used for riveting are flush with the legs of the fixture thus assuring proper support when they are brought into position for riveting. This fixture is built high in order to make it easier to turn over; it is dirt proof and easy to clean. The design being so made that both operations can be done in the same fixture cheapens the cost considerably and also expedites the operation.

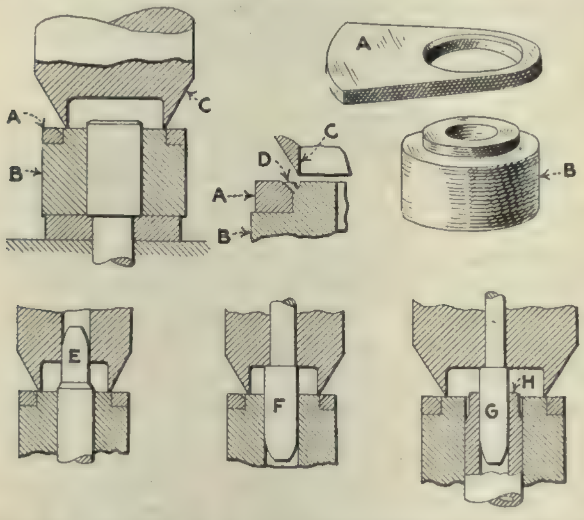

FIG. 208. EXAMPLE OF RING-STAKING AND TYPES OF RING-STAKING TOOLS

When gears are to be riveted together it is often necessary to locate each of them by the teeth in order to preserve the correct relation. Riveting fixtures for this class of work should be carefully designed in order to make sure that no inaccuracies will result from imperfect location. An example of this kind is given in the two pieces *F* and *G* in Fig. 207, in which there are four rivets to be driven as indicated. The rivets used are tapered, therefore provision must be made to prevent the small end of the rivet from bottoming in the slot during the first riveting operation. The work is located on a central stud and the pawl *H* engages with a tooth in the part *F*; the pawl *K* is used similarly with the gear *G*.

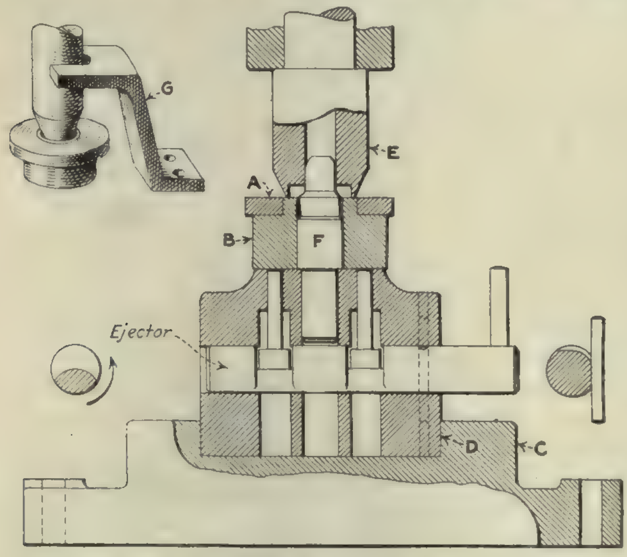

FIG. 209. RING-STAKING FIXTURE WITH EJECTOR

A swinging clamp of special design is used to hold the work as indicated at *L*. This clamp swings on a stud *M* into the position shown by the dotted line so that the work can be easily removed. The stop pin *N* limits the movement. The riveting table has three pins *O*, *P* and *Q*, which serve to locate the riveting fixture in the manner previously described. For certain classes of work fixtures of this kind are very much used and by using a standard plate a number of fixtures can be handled on the same table without difficulty.

RING STAKING OPERATIONS

Ring staking is the process of peining over or swaging two pieces of work together by means of a circular tool having a sharp edge which swages or forces the metal on one piece of work over into a countersunk portion on the other. A ring staking operation is often used when work is to be riveted, as it prevents the parts from coming apart or separating, the rivets serving to keep the pieces from turning in relation to each other. The machine used for ring staking is a punch press.

Fig. 208 shows a few examples of work requiring ring staking, and the tools used for the operation. The cam *A* and the bushing *B* are to be fastened together by staking with the tool *C*. The enlarged sectional view shows at *D* the effect of the staking operation, the metal being upset and forced over into the countersunk portion. Ring staking tools are frequently piloted to assist in preserving accuracy. In the example *E* the locating stud in the fixture is carried up far enough to act as a pilot in the staking tool. The pilot *F* is in the staking tool itself so that it centers the work as it enters the hole. In another example the pilot *G* in the staking tool enters a bushing on which the work locates, the bushing being relieved slightly at *H* so that if the metal is contracted by the staking tool it can still be removed from the bushing without difficulty.

RING STAKING FIXTURE WITH EJECTORS

Fig. 209 shows a complete fixture for ring staking the two parts *A* and *B*. The fixture fits in a shoe *C* on the bed of the punch press, being located and held in place in some approved manner. The counterbored portion of the shoe *D* can be standardized so that a number of fixtures can be used with the same shoe. The staking tool *E* fits the ram of the punch press as indicated. The work locates on a stud *F* which extends above it and acts as a pilot for the tool.

Work of this kind sometimes clings to the tool and rises with it, in which case a stripper like that shown at *G* may be found an advantage. Work may also stick on the locating plug so that it is not easily removed without using an ejector. It is advisable to provide for both contingencies by using both stripper and ejector. The form of ejector used in this instance has been previously described so that further comment is unnecessary. It is important to know the stroke of the press when designing ring staking fixtures, in order that the height of the fixtures may be kept within the required limits.

Piston Work In Motor Repairing

Finishing Semi-Finished Pistons—Fitting Piston Pins and Rings—The Importance of the Crankshaft—How To Assemble the Motor—How To Avoid Scored Cylinders

SPECIAL CORRESPONDENCE

IT IS WELL to remember that in manufacturing pistons a regrinding shop equipped with only a lathe and a drilling machine to do this work cannot hope to compete with a manufacturer who has the proper equipment and up-to-date methods. Probably the only time when it does seem advisable to make pistons complete, is for orphan sizes. Especially is this true if it is a rush job and the regrinding shop is a long way from the piston manufacturer.

Pistons should be of best gray iron, closely grained and sufficiently rigid and reinforced to stand strains and still not be too heavy for high-speed performance. It is possible to make such a piston only with a uniform wall; and to do this, the operations are as follows:

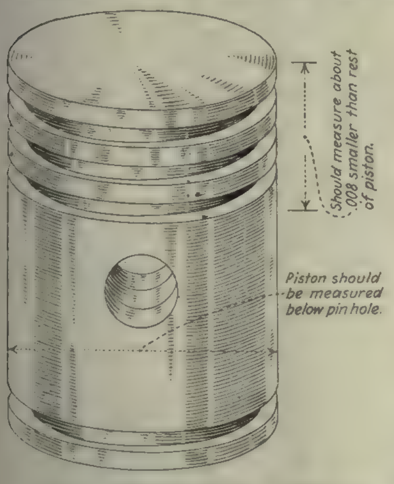
Should measure about .008 smaller than rest of piston.
Piston should be measured below pin hole.

FIG. 1. MEASURING A PISTON

Start by holding the piston on the inside diameter while the center hole is put in the closed end and a roughing cut is taken on the outside. The opposite end can then be chamfered while holding the rough-turned piston in a chuck. By such methods uniform thickness of wall can be obtained. Another particular operation is that of drilling the wristpin hole, which must be at right-angles to the axis of the piston. This operation can be done on a drilling machine using a jig, or on a lathe. There is one operation on pistons that can be nicely taken care of by practically all regrinding concerns, and that is the finishing of the outside diameter. Most manufacturers will furnish pistons either finished or semi-finished. By using a semi-finished piston, which usually comes $\frac{1}{16}$ in. oversize, and grinding it down to fit the bore, not only will it increase production, but it will allow the covering of a larger range of sizes on the same investment.

Finished pistons will change, even when bought from the best of manufacturers, and will frequently be found out of round. A slight tap with a wooden hammer when fitting will generally true them.

In finishing the outside of the pistons a suitable external grinding machine must be obtained. In securing such a machine, it is well to keep in mind two facts: That the length of a piston seldom exceeds 6 or 8 in. and the diameter even on the larger sizes does not ordinarily run over 5 in. Therefore a small-size external grinding machine that will swing 6 or 8 in. with sufficient length between the centers is very satisfactory.

The pin holes on semi-finished pistons come rough-reamed with 0.002 or 0.003 in. left for finish reaming. Any good adjustable hand reamer will take care of this. In finishing the outside diameter, the lands between the rings should be relived and made smaller than the skirt by at least 0.008 or 0.010 in. The excess heat and solid metal cause greater expansion at this point.

Always measure a piston below the wristpin hole and not above it on the head, as shown in Fig. 1.

Piston Pins

While the standard pins can usually be secured from stock in 0.003, 0.005 or 0.010 in. oversize, it sometimes is necessary to order special ones. That there may be no confusion in ordering special sizes, be sure to give oversize above standard, make of car, model, motor, diameter and length, slot or setscrew hole, width and depth of slot, diameter of setscrew hole, distance from center of setscrew hole to end of pin; also state if pin has oil holes or oil grooves. See Fig. 2.

Colors have been generally adopted by oversize piston-pin manufacturers in order to identify the pins so that they can be readily distinguished from one another. The ends are painted different colors as, standard size, no color, 0.003 in. oversize, red; 0.005 in. oversize, yellow; 0.008 in. oversize, white.

Fitting Piston Pins and Rings

Use an accurate reamer in fitting piston pins and be very careful not to remove too much metal. Remember that the clearance between the pin and bearing should be 0.0005 to 0.001 in. A loose-fitting piston pin with too much clearance will cause a piston-pin knock which will eventually mean that the whole motor will have to be pulled down and new pins inserted. On the other hand, if the pin is a wringing fit, it will cause trouble, because there must be room for a film of oil on the pin. A well-fitted pin will last for years.

In fitting rings, first try them in the piston grooves. They should be perfectly free, but without side play. If a little too wide to slip into the grooves, lay a piece of fine abrasive cloth on a flat surface and rub the ring until it just fits. The distance between the end of a gap cut ring should be from 0.0015 to 0.002 in. per one-inch diameter of the cylinder.

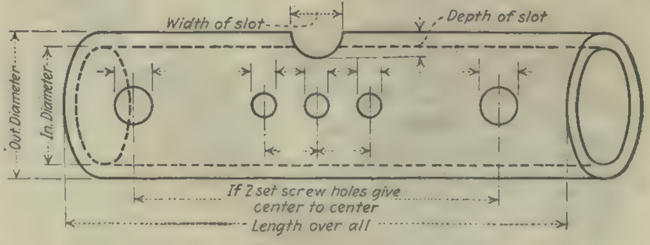

FIG. 2. PISTON-PIN DIMENSIONS

The whole secret of a good ring is that it be perfectly round when in place, and the best results will be obtained if you see that it is so.

No hard and fast rule can be given as to the amount of clearance which should be allowed between the pistons and cylinder walls. There are so many conditions to be taken into consideration, including the construction and speed of the motor, style, and material of the pistons, also the parties who are to drive and the service given the motor after grinding.

Even the manufacturers themselves are divided on this point, each having his own pet theory on what it should be. Some idea of how they vary can be judged from the table of a few of the makers of cars.

As a general rule it is safe to allow 0.001 in. to each inch diameter of the hole on cast-iron pistons. The majority of the regrinding concerns and, as can be seen from the table, the manufacturers themselves, shade the above clearance a little. This can be done, provided the fitting of the piston rings and pins is an A-1 job, and that when assembling the motor every precaution is taken in regard to squaring up the pistons and rods, giving the motor plenty of oil. It is equally necessary that the driver operate the car at moderate speed the first few hundred miles.

MANUFACTURERS' CLEARANCES

Maker	Finish	Diam.	Clearance	Piston Material
Chalmers..........	Grind	3¼″	0.005	Lynite
Chevrolet..........	Ream	3.686″	0.003	C.I.
Continental........	Grind	3¼″	0.001	C.I.
Continental........	Grind	3½″	0.002	C.I.
Continental........	Grind	3¾″	0.002	C.I.
Continental........	Grind	4⅛″	0.002	C.I.
Continental........	Grind	4½″	......	C.I.
Dodge............	Ream	3⅞″	0.003	C.I.
Franklin..........	Grind	3¼″	Taper from 0.003–0.001	Magnalite
Hudson...........	Grind	3½″	0.0035	C.I.
Hupmobile........	Grind	3.248	0.001	C.I.
Kelly-Sp'field......	Grind	3.7460 4.4970	0.003 0.003	C.I. C.I.
Locomobile........	Grind	4½″	0.015 0.003	C.I.
Lycoming.........	Grind	3½″	0.004 0.0065	C.I.
Maxwell...........	Grind	3.622 plus	0.013	C.I.
Mitchell...........	Grind	3¼″	0.0025	C.I.
Oakland...........	Ream	2 11/16″	0.005	Alum.
Oldsmobile........	Ream	2⅞″	0.004	Lynite
Packard...........	Grind	2.998	0.002	C.I.
Pierce.............	Grind	4½″	0.002 0.003	C.I.

If, however, the motor is in a taxicab, race car, or a motor truck, it is well to be generous on this allowance and make it from 0.00125 to 0.0015 in. per inch. The heavy duty of the last two classes causes greater heat expansion than in the ordinary motor. With a taxicab, there is no assurance as to who is to drive it, and therefore it is well to take no chances. Piston manufacturers in many cases, especially on patented construction or alloy material, can best tell what clearance should be left for their particular styles of pistons.

CRANKSHAFT GRINDING

Too much cannot be said about the importance of keeping a crankshaft in perfect condition. The crankshaft, virtually the backbone of the motor, when sprung out of alignment or when its journals are worn out of round, will soon wear the main bearings and connecting-rod bearings which bear directly on the shaft, and consequently will cause the motor to knock.

It is impossible to properly fit a set of bearings to a shaft which is out of round or out of alignment, and the extra time consumed in obtaining even a fair job would more than pay for the regrinding of the shaft.

There has, however, been a great deal of misunderstanding regarding actual crankshaft grinding.

By the old method of filing, lapping, and polishing a shaft, a slow and expensive operation, which is often misconstrued as grinding, it is impossible to obtain accurate results. This work should be done on machines built especially for crankshaft grinding.

Many a perfect regrinding job has been spoiled when the motor is being assembled. If you are in a position to take down and reassemble, then you are more fortunate than many who must trust this final and very important part of the job to someone else.

Great care should be taken to first wash the cylinders, pistons, rings, etc., carefully with gasoline. Be sure every particle of abrasive material and foreign matter is removed.

Make certain the wristpin fits both the rod and piston, and see that it is securely fastened on. Better go over this an extra time and make sure, for a loose pin or screw will ruin the entire job the first time the engine is run. Measure the pistons for roundness after assembling with the connecting rods, to see they have not gone out of shape. A slight tap with a wooden hammer will usually correct any change.

After assembling the pistons on the crankshaft, test them to see if they are absolutely square. Do not take it for granted, because the connecting rods were straight before the motor was pulled down, that they will be straight when you assemble them. There are many chances and reasons why they may have become twisted or out of square. This could happen in taking off the block with the pistons still connected to the crankshaft, when it is an easy matter to bend or twist the rods. Again, in scraping in the connecting-rod bearing or in tightening the caps, a slight variation at this end will increase many times at the piston end.

It is highly important to have the pistons square. If they are not, the cylinders might just as well not have been ground, for the pistons hitting on the sides will give all the troubles of an out of round hole.

Put plenty of oil on all the pistons before assembling in the cylinder. The rest of the assembling is purely a repair-shop job, but every detail should be thoroughly gone into as though it were a brand-new car. In fact, the vital parts are new and with limits usually closer than those allowed by the manufacturer. Therefore, they should demand careful attention.

Be sure the crankcase is well filled with a good light or medium oil and that the oiling system is working perfectly. Run the motor slowly for one-half day, giving it time to cool naturally.

A scored cylinder is caused by one of two reasons. Most pistons are fastened to the connecting rods by means of a piston pin securely anchored to the piston or to the connecting rod. A special-shaped setscrew is used to keep the piston pin from moving. The thousands of little shocks due to the up and down movement of the connecting rods loosen these setscrews which hold the piston pin from moving. The movement of these loosened pins from side to side causes the walls to be scored where the pin touches.

Some pistons are equipped with brass bushings in which the piston pin works. Occasionally these bushings work loose, due to vibration, and score the cylinder walls in the same manner that the piston pin does. In fitting pins, be sure they are locked in tight, as a little carelessness here will ruin the best of regrinding jobs.

Keep a record of every job, including make and model and sizes of parts used. This is not only useful for personal reference, but in renewing pistons, rings, or pins this information is invaluable to the owner. He will appreciate your being able to give him immediate service on duplicate parts if he requires them.

Manufacturing with Special Machines vs. Standard Equipment

V. Lapping the Cylinders — Testing and Assembling—A Completed Recuperator—Comparison of Machining Times at the Otis Works and Watertown Arsenal

BY COL. G. F. JENKS* AND M. H. CHRISTOPHERSON†

OPERATION 47 consisted of drilling the port holes connecting the filling valve with the recuperator cylinder and is shown in Fig. 43. Three air drill holding fixtures were used and the average time of this operation on 280 sleighs was 7 hours.

Operations 41 and 47 were combined in a single operation at the Arsenal and the time given as 13.37 hours.

Fig. 44 shows lapping the finish reamed recuperator and recoil cylinders in operation 48.

Seven horizontal lapping machines were designed and made for this operation. Five of these machines had a reciprocating motion speed of 25 ft. per minute with a slight rotary movement on the forward stroke, the return stroke being parallel to the bore. Two machines were of the rotary type, rotating at a peripheral speed of the lapping shoes of about 850 ft. per minute and a longitudinal feed of 25 ft. per minute.

Two additional reciprocating motion machines were fitted up for temporary use by utilizing type 5 machines. In each of these machines the sleigh was laid on the holding fixtures and a lapping bar was fitted into the head which received its reciprocating motion by means of connecting rods driven by a crank, the crankshaft revolutions being 29 per minute. The average time required in lapping the three cylinders in 280 sleighs was 27¼ hr. The shortest average time lapping three cylinders in 10 sleighs was 10 hr. The first lot of 40 sleighs lapped, averaged 44¾ hr. On the second lot 240 sleighs were lapped and the average time was 24½ hr. The time at the Arsenal was 37.18 hours.

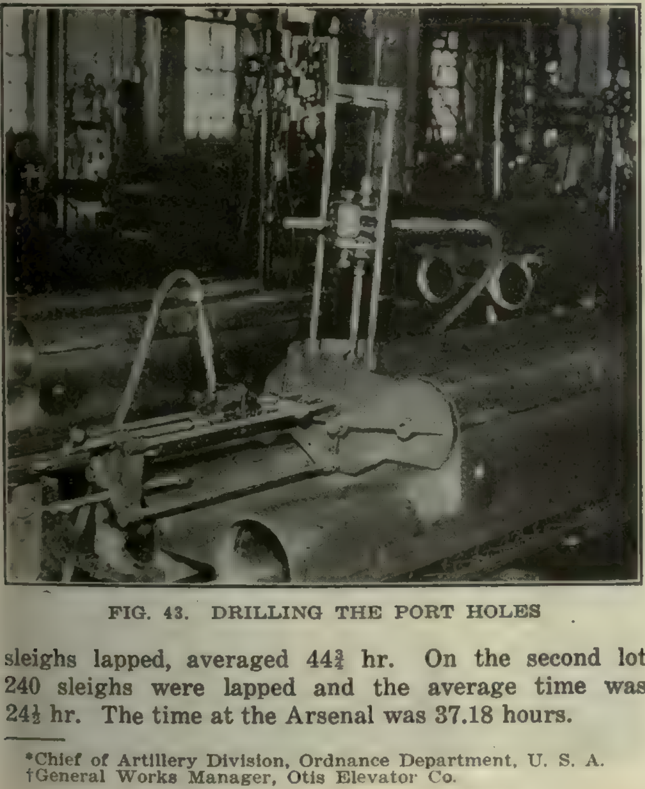

FIG. 43. DRILLING THE PORT HOLES

The bores were reamed quite smooth and true, and the question of amount of lapping required was subject to the inspectors' judgment. The recuperator cylinders were lapped until the surfaces were free from noticeable scratches, leaving a bright and hard surface for the piston packing. The recoil cylinders were lapped to a point of smoothness that would insure long wear of the piston liners.

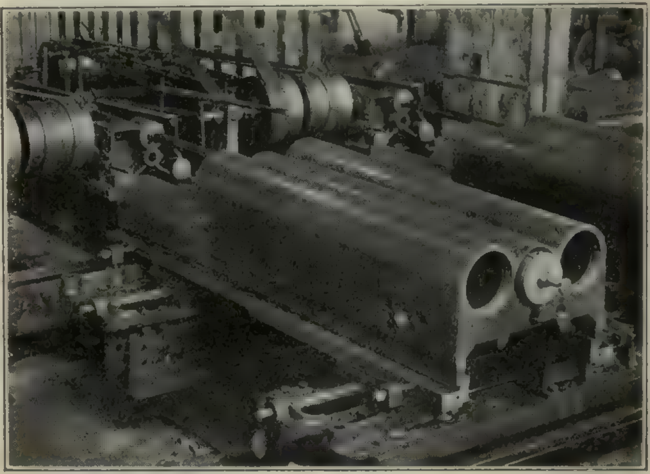

FIG. 44. LAPPING THE CYLINDERS

After considerable experimenting with carborundum shoes and with wood blocks with various grades of grit and oil, we finally determined on the use of wood shoes with ⅜-in. felt covering. Over this was stretched No. 0 and No. 00 emery cloth. The felt provided sufficient resiliency, so springs back of the shoes were dispensed with and the pressure was adjusted by means of taper wedges. A mixture of paraffin and lard oil concentrate was injected into the cylinders with a hand pump.

OPERATION 49

Drilling the 3-in. circulating ports is shown in Fig. 45. Five portable drilling machines with hand feed and driven by shafts with universal joints and specially arranged countershafts were used in this operation.

Average time setting the sleigh and drilling two 1¾-in. holes, which were enlarged to 3 in. diameter with a second cutter, in 280 sleighs was 12½ hr.

Operations 35, 38 and 49 were combined in one operation at the Arsenal and the time given as 18.30 hours.

The portable machines were made on account of difficulty in securing universal radial drilling machines and they proved quite satisfactory. The spindles were set at a predetermined angle in the heads and the heads were designed to fit into the cylinder counterbores so the operator could set and bolt the drill heads without any need for careful adjustment.

OPERATION 50

Fig. 46 shows the application of a hydrostatic test of 4,500-lb. pressure per square inch on each of the recoil

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†General Works Manager, Otis Elevator Co.

cylinders and 2,600 lb. pressure per square inch on the recuperator cylinder and the reservoirs.

Average time required in inserting testing plugs and pipes and in making the test, 4 hr. Arsenal time, 9.78 hours.

This test was made after all operations except fitting wedges and assemblies had been completed. Three sleighs out of 280 that were tested showed slight leakage, two through the cylinder walls and one in the reservoir. Consequently they were rejected.

For convenience in making the tests and also to prevent possible error in pressure, a weighted accumulator with a plunger 1¼ in. in diameter was installed nearby and connected to the test heads with high pressure pipe and fittings. The accumulator weights were raised by means of a triplex chain block with power attachment to the handwheel.

The cylinders to be tested were first filled with raw linseed oil by means of a low pressure well pump, and the required test pressure was then applied by lowering the accumulator weights onto the plunger.

OPERATION 51

Milling two drain channels in the bottom of locking wedge seat along both sides of the walls in the breach and pocket is shown in Fig. 47. One portable milling device was used for this operation and the average time on milling both channels was 1 hr. No Arsenal time for this operation is available.

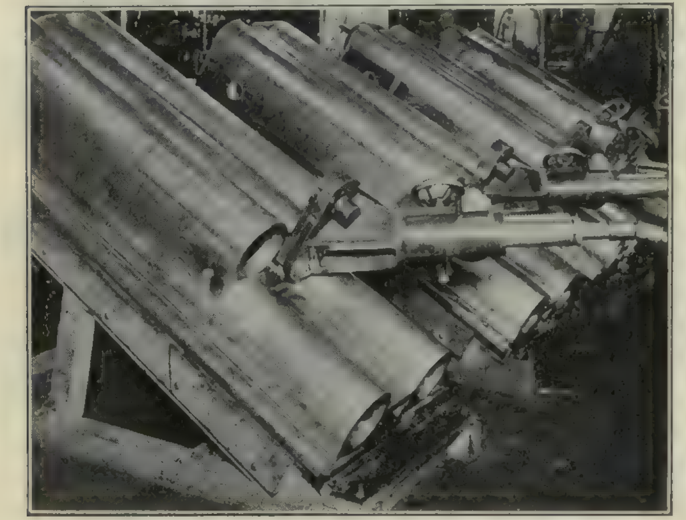


FIG. 45. AN ANGULAR DRILLING FIXTURE

The milling fixture was attached to the slide portion of the sleigh and was used for milling the right- and left-hand sides by reversing the fixture, as both ends of the driving shaft were made so an air drill, from which the power was derived, could readily be attached.

OPERATION 52

Consisted of whatever hand work was necessary to complete the sleigh and in fitting and assembling the locking wedges and in making final inspection.

Average time on this operation on 277 sleighs was 104 hr. Highest average time on 10 sleighs was 132 hr. lowest average time on 10 sleighs was 71 hr. Arsenal time on this operation is given at 38.28 hours.

The fitting floor occupied a space under the crane 38 ft. wide by 120 ft. long. This floor space and crane capacity would have been increased to double the size by the use of adjoining property if the need for assembly of six recuperators daily had continued, as it was the intention to continue this part of the recuperator work with one shift of men working 10 hr. daily.

OPERATION 53

Washing the sleigh and all component recuperator parts and thoroughly cleaning them by hand before assembly. Average time, 5½ hr. No Arsenal time given.

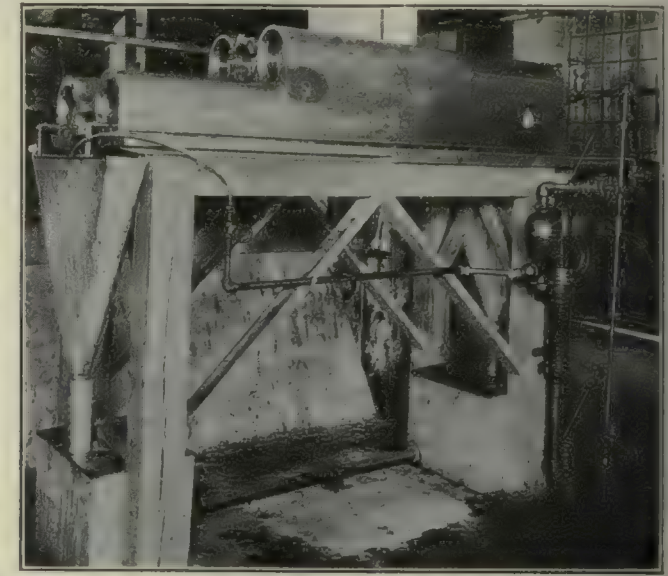


FIG 46. THE HYDROSTATIC TEST

The sleighs and parts were washed in a solution of 2 parts regular Oakite, 1 part Oakite compound and 20 parts water, kept in a wooden tank at a boiling temperature by being circulated through coils in a gas heater.

A very servicable scrubbing machine for cleaning the reservoirs was made from a lapping head, to the end and sides of which were screwed steel prong scrubbing brushes. The head was fastened to the end of a shaft which had an air drill attached to the other end. A few revolutions of the head with cleansing compound being applied insured the removal of all foreign substance.

OPERATION 54

Assembling the recuperator small parts into the sleigh, filling the recoil cylinders with a solution of glycerine and water, and filling the recuperator cylinders and reservoirs with glycerine, water and caustic soda. A hydrostatic test of 3,500 lb. was then applied to the

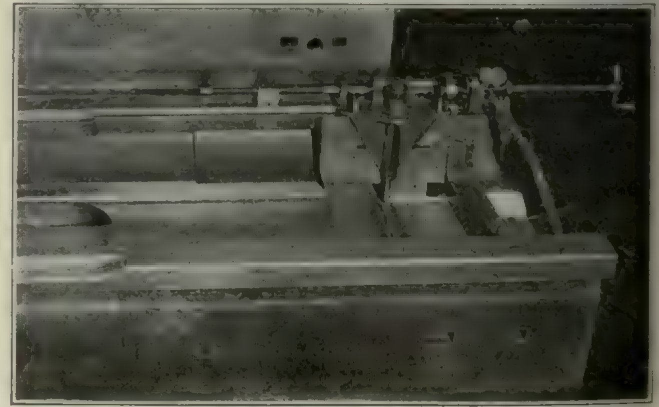


FIG. 47. MILLING OUT A CORNER

recoil cylinder to insure the piston rod packing and heads being tight.

Average time for assembly and test on 277 recuperators, 26 hr. Arsenal time, 41.08 hours.

A space 20 x 64 ft. under the crane runway was fenced in and kept clean to insure the recuperator when assembled and filled being free from any grit. As shown in Fig. 48, in this space there were three cradle fixtures in which the sleighs were held and turned to any angle required for assembly or filling. The liquid after being prepared in required proportions was distributed from Wayne filling tanks.

Fig. 49 shows the finished recuperator ready for final test. This is probably as difficult a piece to produce, and as perfectly machined, as any heavy piece of artillery equipment required for war purposes.

OPERATION 55

"The Gymnasticator Test" in which a gun is mounted on the recuperator or on a special stand. Average time testing 277 recuperators, 2½ hours.

In this test the recuperator was drawn back by power through long screws, a steel crosshead connecting both screws. The forward end of the crosshead has cam-operated releasing hooks which engage a corresponding hook on the sleigh. As the recuperator is drawn back the piston forces the glycerine into the reservoirs which are partly filled with glycerine and nitrogen, thus compressing the nitrogen and building up pressure so that unlatching of the releasing hooks permits the nitrogen to expand and force the recuperator back into battery position. Performance tests of the recoil cylinders, pistons and throttling rods are made by firing the howitzer at the proving grounds.

Now follows, in Fig. 50, the operations on the brake piston rods, some of the tools used being shown in Fig. 51. The rods were drilled and bored in vertical machines built for the purpose. Figs. 52 and 53 show the recuperator piston rod and the throttling rod. Fig. 54 shows the liners for the sleighs and gives all necessary details concerning them.

BRANDS OF HIGH-SPEED STEELS

The high-speed steels adopted were Red Cut—Clarite—L XX—Uranium—Firth-Sterling. For finish boring cutters and reamers, Columbia double special and Vulcan high-carbon steels were generally used. The original supply of smaller sizes of milling cutters was made by the Illinois Tool Works, Chicago, in which Uranium steel was generally used. The larger size plain and formed cutters were made in the Otis Ordnance Works toolroom, where all sizes of milling cutters were reground and replenished.

On the cutting tools a mixture of 1 part solcut to 15 parts water was used. The solution was circulated in two pumping systems, one at 5-lb. pressure for milling cutters and planer tools, and the other at 85-lb. pressure for rough boring where it was necessary to force the chips out of the bore past the drill head.

Experience as the work progressed confirmed the belief that it was most economical to reduce to a minimum the number of operations each man should perform and particularly in milling the pocket in the breech end of the sleigh, to move the work to several machines, so as to give each operator only a portion of the work to do, as in that way he became most proficient and his work was less subject to spoilage.

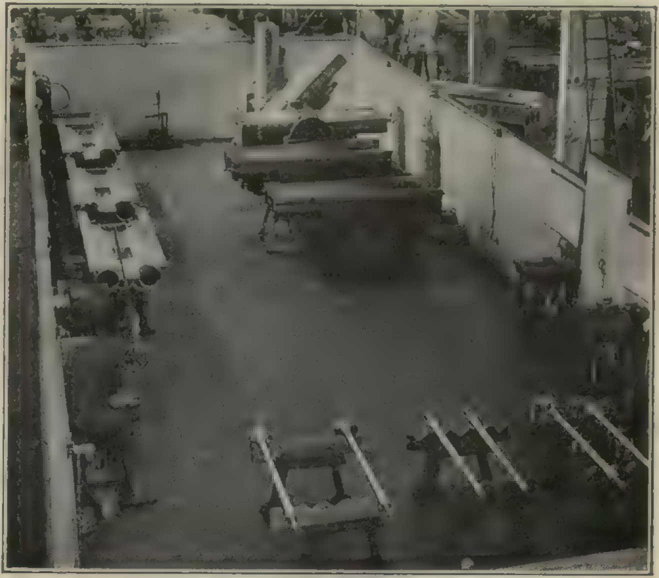


FIG. 48. ASSEMBLING FLOOR

In place of planers, the use of heavy face and slab milling machines with well designed cutters and with cutting speeds and feeds definitely established showed up remarkably well by comparison.

At the commencement of the recuperator contract the productive hours of labor to fully complete all operations on the sleigh and to assemble the parts into it, but not including the labor of producing the component parts, was estimated at approximately 1,000 hr.

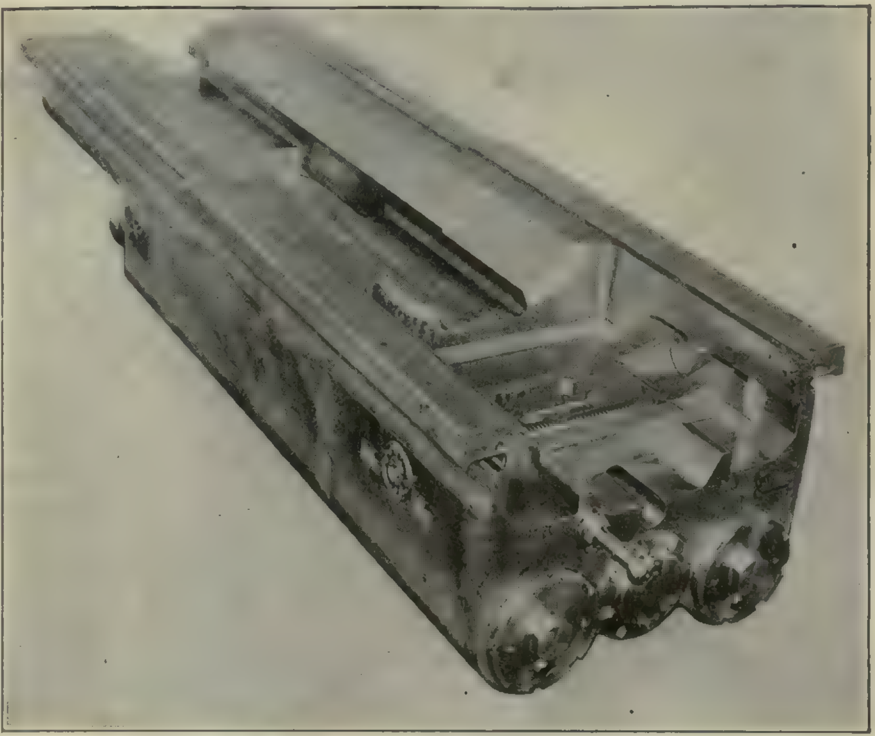


FIG. 49. A COMPLETED RECUPERATOR

on the basis of making 814 recuperators which was the quantity specified in the first order. The number required was reduced to 280 and this quantity having been completed, it may be of interest to note the actual average productive time consumed in producing the reduced quantity and the progress that was being made through improved methods and increased skill in the reduction of the average hours.

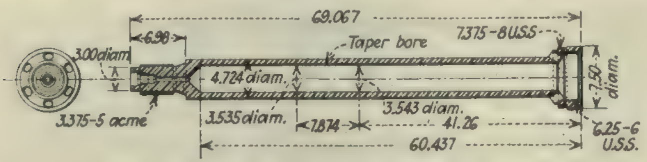


FIG. 50. THE BRAKE PISTON ROD

Sequence	Operation	Hours	Min.	Machine Tool Used
1	Spot turn and center	2	0	24 in. lathe
2	Rough bore	8	0	24 in. Libby turret lathe
3	Bore and ream	8	0	Stecher vertical boring mill
4	Spot turn and line up	1	30	18 in. lathe
5	Re-center, face and turn	1	0	20 in. lathe
6	Turn thread clearance and large diameter	1	0	20 in. lathe
7	Cut internal thread	2	0	Lees Bradner thread milling machine
8	Rough and finish turn outside diameter	5	30	20 in. lathe
9	Cut Acme thread on small end	1	0	Lees Bradner thread milling machine
10	Drill 6—1 $\frac{1}{16}$-in. holes	1	0	30 in. upright drilling machine
11	Finish grind all outside diameters	2	30	Cincinnati grinding machine
12	Finish turn all grooves, bevels and shoulders	1	45	20 in. lathe
13	Cut external thread on large end	1	45	Lees Bradner thread milling machine
14	Drill, ream, counterbore and tap small end	2	0	Barnes horizontal drilling machine
15	Assemble and finish turn piston liners	1	30	20 in. lathe

Hydrostatic test—4380 lb. per square inch—Time each, 1 hour, 30 minutes.
Elongation test—71.65 tons—Time each, 30 minutes.
Average time, each set, 81 hours.

SUMMARY OF TIME

A summary taken of the hours after the final tests were made, commencing with the first lot of 40 that was completed and continuing to average each lot of 40 until all were finished, we have the following results:

On the first lot of 40, average time 1,330 hr.
On the second lot of 40, average time 1,057 hr.
On the third lot of 40, average time 934 hr.
On the fourth lot of 40, average time 777 hr.
On the fifth lot of 40, average time 743 hr.
On the sixth lot of 40, average time 709 hr.
On the seventh lot of 40, average time 705 hr.

No effort had been made in the above to select for earlier assembly the sleighs that had been least efficiently machined nor were the operations on each sleigh made in sequence, and some of those in the later lots to be assembled doubtless had some individual operations completed at the commencement of the assembly when there was necessarily more or less experimental work going on. The accompanying table gives a comparison of the times on the principal parts at the Otis works and Watertown Arsenal.

The payroll showed that 312,000 productive hours were paid for in producing the sleighs and for assembly and testing, this being about 24 per cent more than the total time represented in completed recuperators. This difference is attributed to the work that was done on sleigh forgings and laid aside at the signing of the Armistice as not being required, also in the time spent on forgings that proved defective or were spoiled and in time lost in waiting for forging changes at the end of machining operations.

The following illustration will give a clearer idea of what was accomplished by improved methods in machining and the benefit derived from tabulating the daily operations, thereby being prepared with each succeeding day to do a little better.

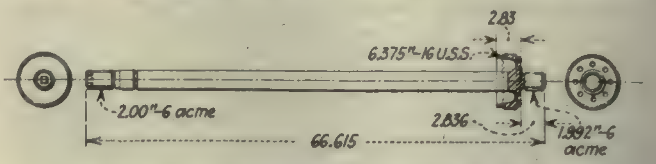


FIG. 52. RECUPERATOR PISTON ROD

Sequence	Operation	Hours	Min.	Machine Tool Used
1	Cut off	1	30	18 in. lathe
2	Center	0	30	18 in. lathe
3	Rough out piston	3	15	18 in. lathe
4	Spot turn	3	0	18 in. lathe
4-B	Finish all outside dia. for grinding	3	0	20 in. lathe
5	Finish grind all outside diameters	2	15	Cincinnati grinding machine
6	Finish grooves and taper inside piston	5	45	20 in. lathe
7-A-B	Cut Acme thread	1	30	Lees Bradner thread milling machine
8	Mill thread outside of piston	0	45	20 in. lathe
9	Drill and counterbore for square hole in end	0	15	20 in. lathe
10	Broach square hole	0	45	....
11	Drill and assemble	2	30	24 in. upright drilling machine

One rod required. Total time, 25 hours

The greatest time on each operation, selected in ten instances from the time sheets on 280 completed recuperators, showed a total of 1,446 hr. to complete the series of operations, while the time sheets in ten other in-

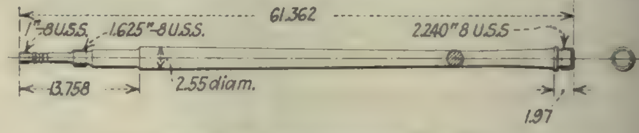


FIG. 53. THROTTLING ROD

Sequence	Operation	Hours	Min.	Machine Tool Used
1	Cut off to length and center both ends	1	30	18 in. lathe
2	Rough and spot turn	3	0	18 in. lathe
3	Rough turn all over to +.060 size	1	0	Fitchburg 3½ in. lathe
4	Rough turn throttling curve	2	30	Fitchburg 3½ in. lathe
5	Finish turn all straight diameter for grinding	0	45	18 in. lathe
6	Finish grind all straight diameters	0	45	Cincinnati grinding machine
7	Finish turn all shoulders, fillets, etc.	2	30	18 in. lathe
8	Cut all threads	1	0	Lees Bradner thread milling machine
9	Assemble with 38253-4	0	15	
10	Drill and ream $\frac{5}{16}$ in. hole for pin	0	15	24 in. upright drilling machine
11	Finish turn throttling curve	1	30	18 in. lathe
12	File throttling curve	2	0	18 in. latne
13	Mill flats for wrench	[illegible]	30	Bristol milling machine
14	Assemble with 32253	0	15	
15	Drill and ream ¼ in. hole	0	15	24 in. upright drilling machine
16	Grind valves	0	30	Cincinnati grinding machine

Average time, each set, 37 hours

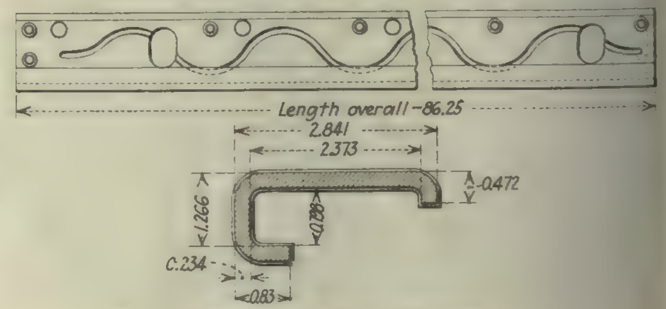


FIG. 54. SLIDE LINERS

Two extruded bronze liners required for each sleigh. The liners were drawn to $\frac{1}{32}$ in. of finished dimensions and were planed on the outside. Average planing time, each set, 3 hours. Milling five oil recesses in each liner, time each set, 1 hour. Drilling rivet holes, time each set, 1 hour. The inside of slide liners were machined in milling operation, No. 45. The oil grooves were machined in operation No. 46.

Total machine time, each set, 12 hours.

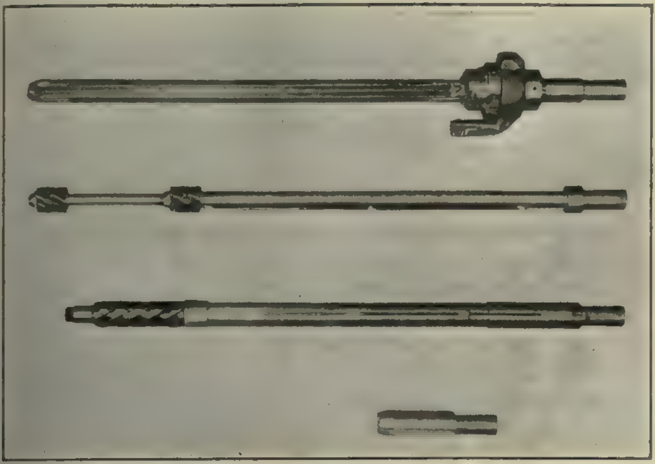


FIG. 51. BORING AND REAMING TOOLS

stances showed that the least number of hours on each operation totaled 552½ hr. and this time could readily have been maintained by securing the co-operation of the workmen and in continuing the machining operations that were finally adopted.

COMPARATIVE SUMMARY OF MACHINE AND FLOOR WORK HOURS COMBINING VARIOUS PRINCIPAL OPERATIONS ON THE SLEIGH, INCLUDING THE ASSEMBLY OF COMPONENT SMALL PARTS INTO THE SLEIGH.

	Watertown Arsenal:	Otis Elevator Co.:
Average time on all roughing and finishing machine operations on top of sleigh, including the gun seats and for looking blocks	271.16	205.86
Average time on all roughing and finishing machine operations on the bottom of sleigh except that portion which is beneath the reservoirs	29.12	53.39
Average time on all roughing and finishing machine operations required for machining the ends of the sleigh and underneath the reservoirs	64.99	31.54
Average time on rough and finish machining both sides to angle	29.61	16.66
Average time on all rough and finish machine operations required to form the seats for slide runners and for machining the inside of liners	75.83	29.90
Average time in drilling and finish reaming the cylinders and reservoirs and in lapping the cylinders, includes counterbores and threading	153.70	175.31
Average time on drilling and tapping all holes —(Not cylinders or reservoirs)	54.71	56.34
Average time on all floor work	172.43	146.06
Total hours	851.55	715.06

Rewards for Suggestions

BY RICHARD J. JACKER

I was employed in a large factory in Chicago as a mechanical draftsman and machine designer. In a number of places in the plant were suggestion boxes stating that the management would reward employees for suggestions which resulted in a benefit. I noticed that several men in a certain department were in the habit of playing pranks on others and carried the matter far beyond reason, even destroying personal property of some of the men. There was a general antagonistic feeling among the men of the department which interfered greatly with the men getting out the normal amount of work.

I placed a suggestion in one of the boxes saying that the antagonistic spirit among the men of that department was interfering with their efficiency and suggested that something be done to cultivate a friendly and helpful feeling among the men. The next day the foreman of the department laid my written suggestion before me and asked if I wrote it. I replied yes. He then repeated a very sarcastic remark regarding the same which he told me was made by one of the officials of the company who has charge of the suggestion boxes, and added some uncalled for remarks by himself, which dampened my ardor for making suggestions in the future.

It seems to me that the cultivation of good fellowship and a helpful spirit among the men is as important as the saving of unnecessary steps or operations in a large factory where efficiency is desirable. It may be that my suggestion would have gone a different course if more than one person had passed on it.

[Suggestions should be considered by a committee that is familiar with the practical conditions in the shop. There are few cases where one man is capable of dealing with them all to the best interests of all concerned.—EDITOR.]

The Use of Grindstones in Axe Manufacturing

BY CHARLES HEATERS

Brades Steel Works, England

On page 1,001, vol. 54, of *American Machinist*, appeared an article on wet grinding. I have had the privilege of witnessing the operation of grinding axes by grindstones in the U. S. A. at various times, and have considered it the most injurious occupation I have ever seen, especially the grinding of the heads and edges of the axes, which is done almost dry, and consequently produces a great amount of dust.

The report of the U. S. Public Health Service does not appear to draw attention to the particular reason for the injurious nature of this dust, which is due to the grindstones being composed mainly of silica, and which is liable to cause a special disease of the lungs called silico-fibrosis or "grinders' phthisis." The same disease occurs with the workers in ganister (another silicia) grinding mills, and in silicia brick manufacture.

We understand that the principal manufacturers of axes and similar tools in the United States have abandoned the use of grindstones in favor of artificial wheels. My firm makes over 1,000 axes and hatchets per day, all of which are ground in the same way. Incidentially the artificial wheels cost considerably less, per hundred axes ground, than the sandstones.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Chart for Determining Belt Lengths

By David Turcott

The chart accompanying this article was designed for the purpose of simplifying calculations of belt lengths. By means of this chart the length of a belt can be found with sufficient accuracy, and in less time than is possible by any of the belt formulas. The chart is also useful for finding the distance between the centers of the pulleys when only the vertical and horizontal distances between them are given.

The following formulas served as a basis for the design of the chart:

$$L = 2\sqrt{C^2 + \left(\frac{D-d}{2}\right)^2} + \frac{\pi(D+d)}{2}$$

= *Length of Open Belt;*

$$L = 2\sqrt{C^2 + \left(\frac{D+d}{2}\right)^2} + \frac{\pi(d+d)}{2}$$

= *Length of Crossed Belt;*

when,
L = Length of belt in inches;
C = Center distance between the pulleys in inches;
D = Diameter of large pulley in inches;
d = Diameter of small pulley in inches.

There is a small error introduced in the above formulas, as compared with the theoretically correct formula. To compensate for this error, 3.16 was substituted for the value of π. The above formula then can be expressed as follows:

$$L = \sqrt{(2C)^2 + (D-d)^2} + 1.58(D+d)$$

= *Length of Open Belt;*

$$L = \sqrt{(2C)^2 + (D-d)^2} + 1.58(D+d)$$

= *Length of Crossed Belt.*

These formulas are easily solved by aligning various lines on the chart, as explained in the following example:

Let it be required to find the length of an open belt to pass over two pulleys 28 and 6½ in. in diameter

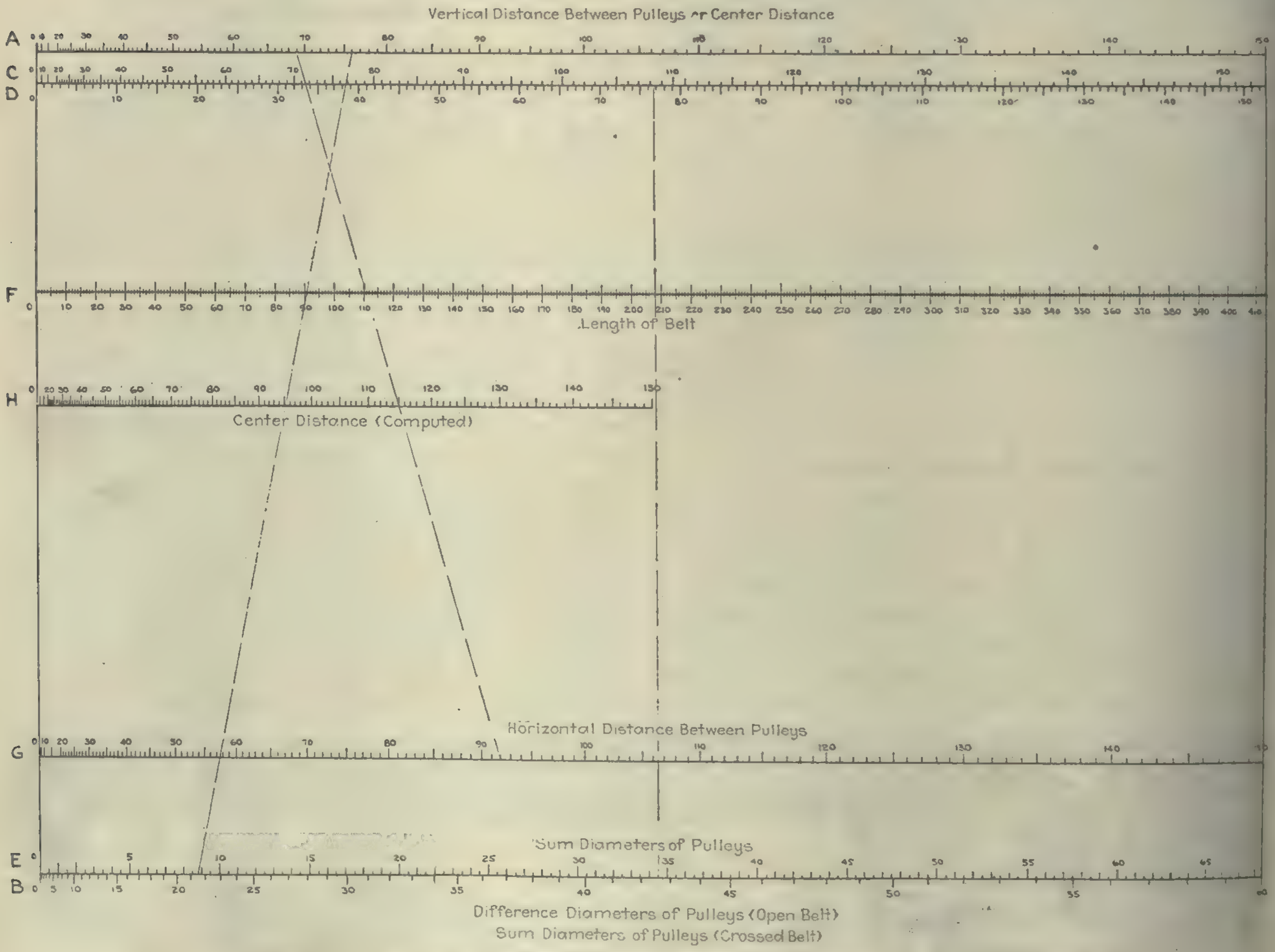


CHART FOR CALCULATING THE LENGTHS OF EITHER OPEN OR CROSSED BELTS with a center distance of 76 in. Read the center distance 76 on scale *A* and the difference between the pulley diameters or 21.5 on *B*, and lay a straight-edge across these two points as indicated by the broken line. The straight-edge will cut 76.8 on scale *C*.

Now read 76.8 on scale *D* and align this point with the sum of the diameters (34.5) on scale *E*. The straight-edge will then cut out 208 on the line representing the length of the belt, scale *F*, as shown by the broken line. Therefore, the length of the belt is 208 in. The procedure for finding the length of a crossed belt is the same, except that on the scale *B* the sum of the diameters of the pulleys must be read, instead of the difference.

In the above example the center distance was given, but it frequently occurs in practice that the drawing gives only the vertical and the horizontal distances between the pulleys. In this case the center distance can be found with the aid of scales *A*, *G* and *H*. Let it be required to find the center distance between two pulleys when the vertical distance between them equals 69 in. and the horizontal distance 92 in. Read 69 on scale *A* and 92 on scale *G*, and align these points with the straight-edge. The point through which the straight-edge will pass on scale *H* will represent the center distance. In this example the center distance equals 115 in., which distance can now be used for finding the length of the belt in the manner already explained.

In order to show just how the length of a belt, as determined by means of the chart, varies from the theoretical length, the accompanying table was prepared. The theoretical length was calculated with the aid of a six-place table of logarithms.

TABLE COMPARING CALCULATED RESULTS WITH THOSE OBTAINED FROM CHART

D in Inches	d in Inches	C in Inches	Theoretical Length, in Inches	Length from Chart, in Inches
		OPEN BELTS		
32	18	112	302.977	303.0
20	5	20	82.114	82.2
28	6½	76	207.709	208.0
		CROSSED BELTS		
9.44	4.69	110	242.659	243.0
15	10	108	256.715	257.0

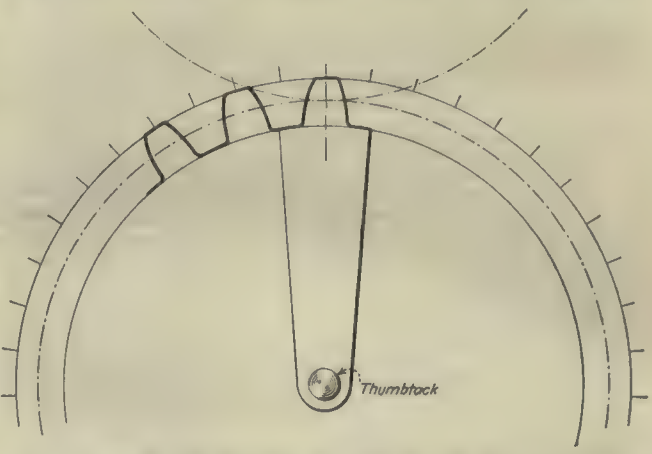
The chart was designed for center distances not exceeding 150 in. When the center distance is longer, divide all given dimensions by 2 and find the length, as usual. The result will represent only one-half of the actual length and, therefore, must be multiplied by 2. In this manner the same chart can be used for center distances up to 25 ft. For accurate results, an allowance can be made for the thickness of the belt by adding the thickness of the belt to the diameter of each pulley. If, for instance, the diameters are 18 and 5¼ in., and the belt is ¼ in. thick, figure the belt length as for 18.25- and 5.5-in. pulleys.

Drawing Gear Teeth Rapidly

By Homer S. Trecartin

The work of laying out gear teeth should not be shirked on a finished assembly view, as it adds greatly to the good appearance and clearness of a drawing to have the gear teeth detailed. I applied a little time-saving idea to this work, which proved better than anything I know of for rapid detailing.

I laid out one gear tooth accurately on a piece of stiff paper. Then I carefully cut this out for a template, including in the piece the center point of the gear circle. I drew in pencil on the drawing, the circles for the outside diameters of the gears, and spaced them off for the proper number of teeth. On the center line of my template I pricked a small hole at the proper radius from the original line and fastened it over the gear center with a thumbtack, as shown by the accompanying illustration.



USING TEMPLATE IN DETAILING GEARS

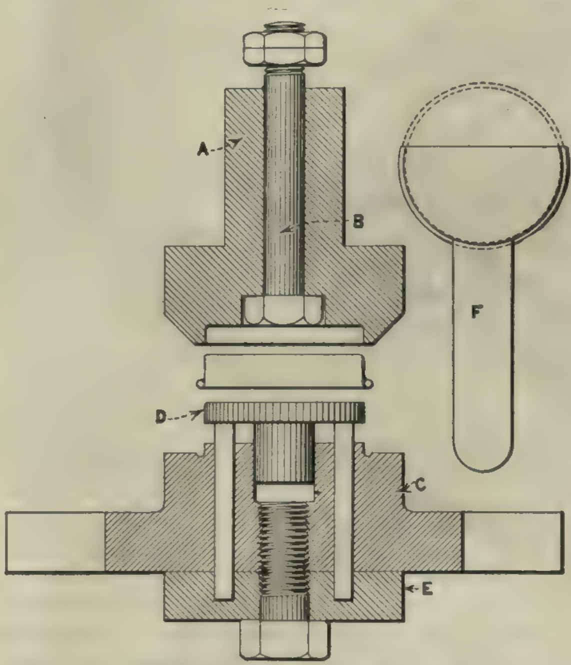
It was easy to locate this template for each tooth, by indexing its center line to the spacing marks on the circle. The outline of the gear was thus quickly drawn, either with a pencil or with a drawing pen.

A Cover Curling Die

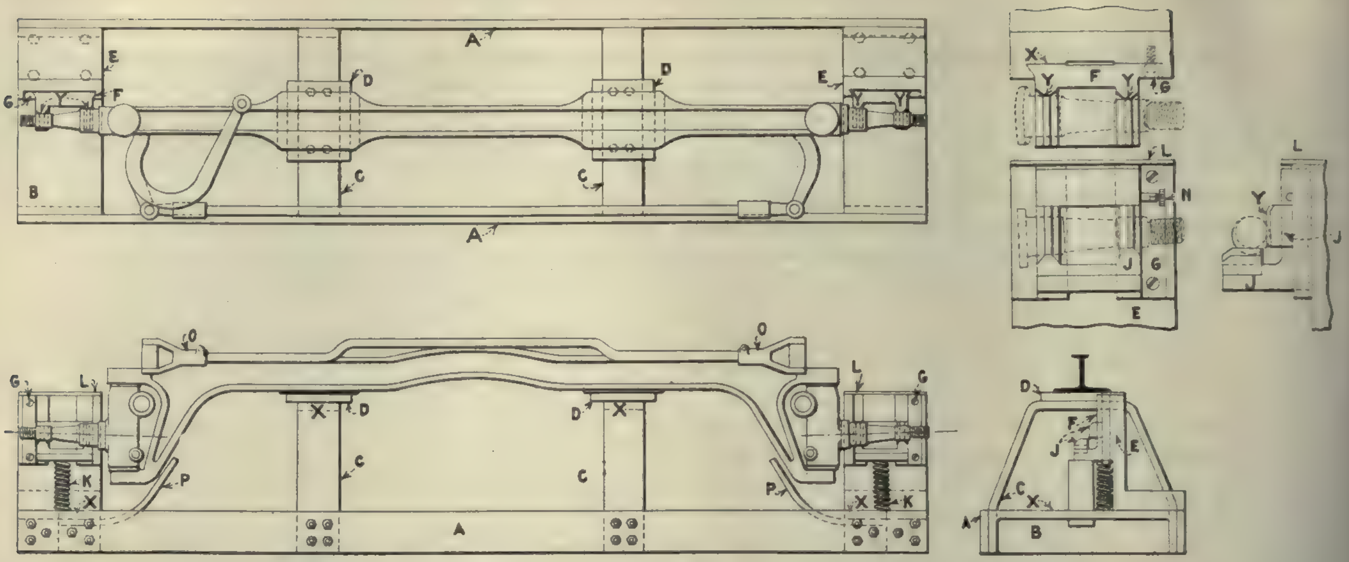
By S. A. McDonald

We received an order for 25,000 curled covers which were wanted in a hurry and, as there was no likelihood of a repeat order, it was necessary to get out the dies as cheaply as possible. The cover had originally been made without the curl, so it was only necessary to make the curling die.

The punch and die as shown in Fig. 1 were made as follows: An old drawing punch *A* was rescued from the



A CURLING DIE QUICKLY MADE



FIXTURE FOR TESTING ALIGNMENT OF AUTOMOBILE FRONT AXLES

scrap bin, and the cutting edge turned off. A recess was then made to fit the cover, and the inside of the punch was bored to take the head of a ½-in. capscrew *B*, which acted as a knockout. Next, an old shoe *C* was found that could be turned off and used. It was set up in a lathe and the groove formed and the hole bored to take the cold-rolled steel die center *D*.

The cast-iron washer *E* was then bolted to the shoe, a ⅝-in. capscrew being used for the purpose. Holes for the four pressure pins were drilled through the shoe and into the washer; the washer then being removed and a larger size drill run through the shoe to give clearance for the pins. The pins were made a drive fit into the washer and filed off to length. The usual stem, rubber pad, lower washer, and nut were used.

As the size of the order did not warrant a feed chute or guard, a pick was made by soldering a piece of steel to a part of a cover as shown at *F*, thus making it unnecessary for the operator to put her fingers under the punch.

While I would not recommend using cast iron for a curling die as general practice, for this size of order it proved perfectly satisfactory and showed little signs of wear at the completion of the order.

The direct labor cost for the die including setting up was: Diemakers—8 hr. at 65c. per hour = $5.20; Operator—15 hr. at 30c. per hour = $4.50; total, $9.70.

What we got for the job I am ashamed to say, but the customer was as pleased with the price as he was with the speed with which the order was filled.

Fixture for Testing Alignment of Automobile Front Axles

By C. F. George

The illustration shows an inexpensive fixture for testing the alignment of front axles. This framework can be made very quickly, and eliminates the use of a main casting which, of course, would need patterns and perhaps coreboxes. Another point in its favor and which is a big factor is the weight saved. If made from a casting it would be about five times as heavy as the one here described.

The frame is made from 2½-in. x ½-in. steel and consists of two main base pieces *A* to which are bolted the platform pieces *B* and the housing pieces *C*. The framework is machined at the places marked *X*. Two hardened-steel machined pieces *D* are bolted to the housings *C*, which locate the axle spring pads.

The actual testing parts of the fixture can be readily seen and consist of angle brackets *E* which can either be made from castings or forgings as desired. They are machined to take the slides *F* which are held in position by the machined gibs *G*.

Screwed to the slides *F* are hardened-steel locating pieces *J* which can be renewed when necessary. The slides are operated by the coiled springs *K* and are prevented from sliding out by the plate retainers *L*. Two locating pieces *P* are bolted to the framework to locate the axle endwise.

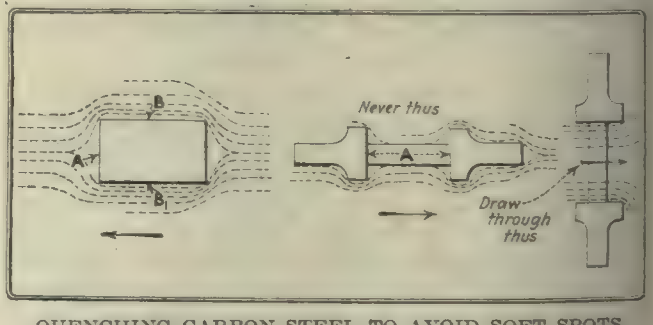
The operation of the fixture is simplicity itself. The axles come from the assemblers and are placed on the fixture as illustrated. The indicators *N* on each end at once show the difference between the height of the axle spring pads and the wheel spindles. The alignment is seen immediately by looking at either end of the fixture and if the spindles do not touch all four points marked *Y*, the necessary adjustment can be made by resetting the threaded parts *O* backward or forward as desired.

Quenching Carbon Steel to Avoid Soft Spots

By W. C. Betz

Some of the readers may recall times when a piece of water-hardened tool steel would have soft spots while the surrounding metal was glass hard.

The writer has had this experience on small embossing dies and the pads of gages and has found the cause in the method of quenching. If a piece is drawn through the quenching solution, as shown in the sketch, the



QUENCHING CARBON STEEL TO AVOID SOFT SPOTS section *A* in the direction of travel will invariably be found soft and the sides *B* and *B* will be uniformly hard. This can only be accounted for by the fact that an air pocket is formed in the center of the piece being quenched as it is drawn through the water, and as the water passes each edge of the center it cools the metal quicker near the edge and the sides *B* and *B*. On oil quenching steel this phenomena does not seem to appear.

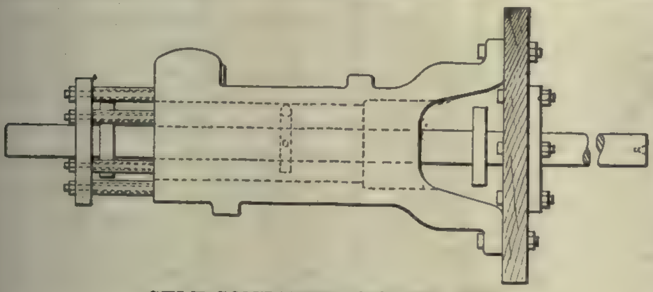
Boring a Gas Engine Cylinder

By R. McHenry

Some years ago we were required to rebore an unweildy gas engine cylinder, removing as little metal as possible from the bore and doing the job in the least possible time, as it would not warrant the expenditure of any great amount of money.

The engine in question was of a heavy vertical type, about 6-in. bore and with a long stroke. From the upper end of the cylinder there protruded six long studs for holding the cylinder head. The lower end of the casting terminated in what may be termed "feet" where it joined the open crankcase.

The boss was soon convinced that the cylinder would not swing in our old 20-in. lathe and for various reasons neither could it be strapped to the carriage for boring with a bar on centers. It was generally agreed among the "hands" that the "Old Man" had "bit off more than he could chew."



SELF-CONTAINED BORING RIG

A long boring bar was made by cutting off a smooth straight piece of 3$\frac{7}{16}$-in. shafting and fitting it with a cutting tool and setscrew near the center of its length. Four disks or plates of cast iron, approximately 1 in. thick, were next procured and a 3$\frac{7}{16}$-in. hole bored through each to a nice sliding fit on the bar.

As the travel of the piston did not include the entire length of the bore the inside of the cylinder was smooth and true for a short distance at each end. Two of the disks were therefore turned on the outside (concentric with the hole) to a snug fit in these ends.

The other two disks were some 3 or 4 in. larger in diameter and were faced off on one side square with the hole. One of them was laid out for six holes, corresponding to the studs of the cylinder but drilled to $\frac{1}{16}$ in. larger. The other had four $\frac{5}{8}$-in. bolt holes drilled on the quarters and near the outer edge.

Next, six pieces of $\frac{3}{4}$-in. pipe were carefully squared in the lathe to equal length, which was 2 in. less than that of the studs. About 2 ft. of hardwood plank having a 4-in. hole cut in the center and a few iron bolts completed the "tooling up" for the job.

One of the smaller disks was entered part way in the cylinder at the crankcase end. The plank was then bolted across the "feet" so that the 4-in. hole was in line with the bore of the cylinder. Next, the bar was slipped through both plank and disk until it protruded from the opposite end of the cylinder. The other small disk was then put on this end of the bar and entered in the open end of the bore.

After placing the pieces of pipe over the studs, the disk with the six holes was brought up and slid along both bar and studs until its faced side rested against the pipes. The stud nuts were then applied and screwed home. The remaining disk was put on the other end of the shaft and its faced side brought up to a bearing on the plank, to which it was bolted through the four bolt holes.

With the chuck on the lathe, the tailstock at the lower end of the bed, the center rest set for 3$\frac{7}{16}$ in. and clamped farther up, and the carriage next in line, it was short work to set in the rig.

The head end of the bar was gripped in the chuck jaws, the other end running freely in the center-rest, while the plank was close to the cross-slide.

The small disks which, as will be seen, served only to locate the bar while clamping to the outer disks, were then slid back a few inches. The bar was free to turn centrally within the cylinder and the latter easily rode along the bar. Openings between the studs and the feet allowed for setting the tool and inspecting the boring so all that remained was to connect the piece of plank loosely to the carriage which supplied the feed movement.

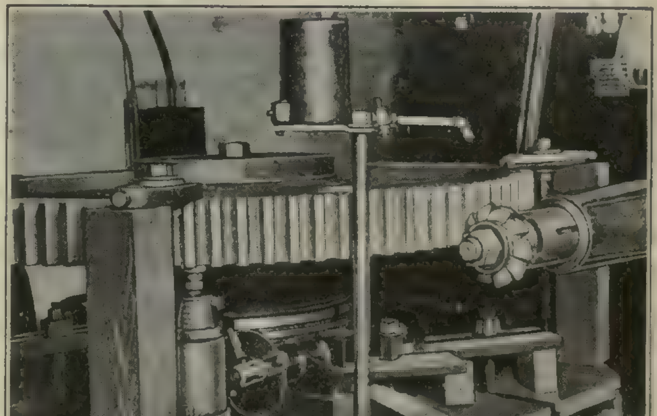
Cutting a Large Gear on a Boring Machine

Special Correspondence

The illustration shows how the Stevenson Gear Co., Indianapolis, Ind., used a Gidding & Lewis boring machine as a gear cutter for a large job. The gear is 48 in. in diameter, 4-in. face and 3 diametrical pitch.

A Milwaukee dividing head was procured, which was guaranteed accurate within 0.001 in. at 10-in. radius; it was rigged up on the table as shown.

The gear was mounted on a mandrel turned by the dividing head. The outer edge of the gear was supported by blocking and screw jacks at several points, and held down by the straps as shown. The clamps were of course, released for indexing.



CUTTING A LARGE GEAR ON A BORING MACHINE

In spite of the overhang of the cutter, due to the extension necessary to reach the center, the gear was smoothly cut and proved satisfactory in every way.

IN THIS ISSUE

AS ANNOUNCED on this page last week the leading article in this issue describes the manufacture of the crankshaft used in the Rolls-Royce automobile. The description concerns only the heat-treating, machining and testing operations performed on the shaft after it has reached the Springfield plant. The number of grinding operations performed is significant of the quality of the work done and consequently of the product turned out. It may be noted in this connection that there is also a large amount of skill employed in the forging operations performed at another plant before the shaft gets to Rolls-Royce. We hope to have something for you on this forging practice in the near future.

The fifth section of Prof. McCabe's "Economics of Production" gives the elementary theory underlying the present situation of business. He begins, "We have now considered what happens and what action is called for when there is a falling off in demand after a big forward movement. The discussion will turn on prices and costs." If anything could be more timely than this we can't imagine what it might be. Further on he says, "Every reduction in cost that is not a reduction in earnings helps to bring about the renewal of demand and production and makes reduction in earnings less necessary." This is excellent theory under present conditions, but isn't it equally logical at any time?

Page 456 sees the beginning of the concluding article on the tools used in the manufacture of the Pratt & Whitney adjustable limit snap-gages. Mr. Sheldon has gone thoroughly into the details of this exceptionally accurate production work and a study of his illustrations and description is well worth while. Most of the current installment is devoted to grinding and lapping fixtures and methods.

Part XV of "Metal Cutting Tools" discusses gear cutting tools of the generating type. The action and design of the Fellows and Gleason cutters are analyzed, and the author then proceeds to the theory of hob action. This part was too long for one number and will be continued next week.

Following Mr. DeLeeuw's article is another by Editor Colvin on automobile part making in the Peerless shops. Several differential gear parts are described.

Dowd & Curtis' "Tool Engineering" begins on page 468. The design of riveting fixtures is the general heading under which the authors take up riveting machines, types of rivets, ring staking tools and fixtures, ejectors and various other matters connected with riveting practice. There is so much of interest in this article that we find it difficult to pick out any one feature to which to call your attention. The whole thing is invaluable.

The recent article on automobile cylinder regrinding has caused so much favorable comment that we are following it up this week with one on piston work in motor repairing. See page 473. This article is prepared particularly for men engaged in the more elaborate automobile engine repair work and contains boiled down directions for handling pistons and piston pins. A table showing manufacturers' clearances in several makes of cars is included and there is also something on crankshaft grinding. The article concludes with some general directions telling how to get best results in motor overhauling.

Incidentally, the cylinder grinding article brought out quite a broadside of criticism from the re-boring and reaming people as was to be expected. We do not intend to carry on a controversy between the exponents of the various refinishing methods in these pages but we will certainly give all sides a chance to be heard. We shall endeavor to get the various views into print at an early date as there is considerable activity in automobile repair stations at the present time. Many an old car is being doctored up to last another season.

The final section in the series on "Manufacturing with Special Machines vs. Standard Equipment" follows the piston article just mentioned. It tells of the lapping operations on the recuperator cylinders and the assembling and testing of the complete recuperator. The series is concluded with a summary of the time taken for the various lots in the two different shops and a general résumé of the whole subject.

Among the practical letters this week are several which stand out from the ordinary run. On page 480 David Turcott has a chart for simplifying the calculations involved in determining belt lengths.

Coming Features

The maintenance of our nine million or so automobile passenger cars and trucks is beginning to provide profitable business for many a large and small jobbing machine shop. The machining problems presented to the job shop manager by this kind of work are quite distinct from those of the automobile factory man. Perhaps the biggest field opened up in this direction is that of manufacturing repair pistons. The methods employed in a New England shop engaged in this work are described in our next issue.

The grinding of holes of irregular shape also presents unusual problems. How it is done on a well-known machine forms the basis for another article next week.

Part XXII of "Modern Production Methods" is devoted to the fundamentals of correct time study. The evils of careless or inaccurate time analysis are pointed out and general rules for the observer are laid down.

Other management articles will be found in the sixth installment of "Organization and Management of the Small Shop," and the sixth part of "Economics of Production."

EDITORIALS

On the Up Grade

THE recent wordy skirmish at a Washington banquet one for many months. During the days of inflated prosperity when he predicted the inevitable reaction the scoffers called him a calamity howler, or worse. In the end, however, he was vindicated by the worst industrial depression for years.

When he recovered a little spirit he mildly suggested that a resumption of business was due in the spring of 1921. But by this time the average man had concluded that the bottom had dropped out of everything and refused to be comforted. What was worse he sat back and waited for something to happen instead of digging in with every bit of strength and grit he could summon. Under this treatment the incipient boom struggled feebly but soon strangled to death under the oppressive weight of pessimism.

The next date set for the revival of business was Labor Day. Many were still unconverted but the more thoughtful realized that consumption was proceeding at almost normal rate and that before long surplus stocks would be gone. This condition has come sooner than was expected in some lines.

It is perhaps a little soon after Labor Day to tell whether or not a real revival is in progress, but all the surface signs point that way. Railroad earnings have increased and freight car loadings have done likewise. The position of the banking system is constantly gaining in strength and money rates are consequently decreasing. Textile and leather people are running nearly full time and automobile plants are doing more. Stock and bond prices are stiffening.

Even iron and steel markets are showing signs of life and that is most welcome news for men in the metal trades for there seems to be a definite relation between pig iron production and machinery sales. When iron is going strong there must be machine tools to convert it into marketable products and machine tools wear out or become obsolete in time.

Climbing up the business hill is harder work than sliding down, but the view from the top is far better than that from the bottom. We are just starting up. Let's keep going.

What About Spare Parts?

AN experience we have just had with an automobile service station leads us to do some more wondering on an old subject—the making of repair parts in dull times. Business has been so bad that we feel constrained to run our ancient car one more year although it has fully earned a rest. As a result certain replacements must be made.

We have taken it for granted for so long a time that during slack times manufacturers built up their reserves of repair parts so that a supply would be on hand when the factory was running full on production, that we were astounded to discover that not one of three commonly failing parts was available. The stock clerk complained that he had in orders for thousands of one of the parts in question but didn't know when he would get any.

The company making the car we drive ranks among the first five in volume of output and has not been running full time all summer but is now behind on orders. Evidently there is to be further delay in taking care of old customers.

We would be the last to advocate the manufacture of excessive quantities of spare parts with materials and wages both at high figures but there is certainly a happy medium between such a procedure and that of allowing parts reserves to be seriously depleted. It should not be a difficult matter to determine the rate at which various parts wear out and must be renewed, and from this to estimate the necessary stock to carry.

Perhaps this is only an isolated case and other manufacturers are in better shape. We hope so, but we have our doubts. Our experience certainly substantiates the findings of Mr. Hoover's committee on waste—that management is responsible for a goodly share of industrial inefficiency.

The End of Excess Profits Taxes

AS THIS is written it appears that the Senate will accept the House provision in the new revenue act which repeals the excess profits levy as of Jan. 1, 1922. To many business men it will make little difference whether the date when the appeal takes effect is that chosen by Congress or that recommended by Secretary Mellon. But few of them saw anything that looked even remotely like a profit during 1921.

The fact remains, however, that once more very definite campaign pledges have been ignored and the utter folly of believing anything promised by a politician has been demonstrated beyond question of doubt. The heads of the present administration should not be included in the general condemnation for they seem to have done their best to fulfill their pledges. They at least are far-sighted enough to see that such an unwise restriction of business as the excess profits tax has turned out to be in peace times should be removed at the earliest possible moment for the good of the country.

The Plain Unvarnished Truth

THE recent wordy skirmish at a Washington banquet between General Pershing and Samuel Gompers filled many an American citizen with silent joy. In view of the undisputed record of strikes called by organized labor leaders during the period of the war, it is rather galling to be reminded continually of the great share labor had in winning the war. General Pershing's remarks can hardly be discredited on the ground that he represents the capitalistic attitude antagonistic to labor. In fact, a more disinterested individual can hardly be named.

The labor profiteers were probably no worse than any of the other breeds produced by the war, but the others at least have not the hardihood to claim a large share in the ultimate victory.

Shop Equipment News

Pawling & Harnischfeger Boring, Drilling and Milling Machine

The illustration, Fig. 1, shows a horizontal boring, drilling and milling machine that has recently been developed by the Pawling & Harnischfeger Co., 38th and National Aves., Milwaukee, Wis. The machine is made in several sizes, the one illustrated being the No. 4-F, the smallest of the series. It is designed to drive high-speed steel tools to the limit of their capacity. The machine is intended chiefly for heavy milling and large boring operations, and can be used either as a single-purpose or as a general machine shop tool. The principal features in the machine to which the maker calls attention are the narrow guiding surfaces, the feed screws operating in tension, the provision for taking up wear on all sliding parts, and the centralized control.

The saddle carrying the spindle is of box section. It contains the drive mechanism for the spindle, the feed-change mechanism and the feed distributing mechanism. It is stated that the complete unit can be lifted and supported at any point when fully assembled, without fear of distortion. The drive gearing and shaft bearings are bronze bushed, and the main spindle sleeve bushing is of phosphor bronze, scraped to a slight taper to permit of taking up wear. The saddle is guided upon the column by a narrow guide placed at the front so as to be near the cutting tool. The feed screw is in tension and is placed in the center of the guide. The saddle is fully counter-balanced, the weight being located on the inside of the column. It is raised lowered on the column by means of a bronze wormwhe actuated by a quick-pitch worm an running on a steel screw, the oper tion being performed either by han by power feed or by the quick travers

The column is of box constructi and has two sides straight and t sides tapered, a wide base being ca integral with it. It is guided by na row guides on the front of the be the screw for feeding it being in te sion and placed near the guide. T entire column can be traversed either direction from the saddle either the handwheel, power feed rapid traverse. The bed or runw on which the column is mounted also made of heavy box section.

The power is applied to the spin at its front end, and the feed moti at its rear end through a rack a pinion. This construction provid for the spindle large bearings on bo the front and rear. All feed chang are made by spur gears and positi clutches. The drive is delivered the spindle from the gears in t saddle through either a small facepl having a wide-faced spur gear through a large faceplate having internal gear.

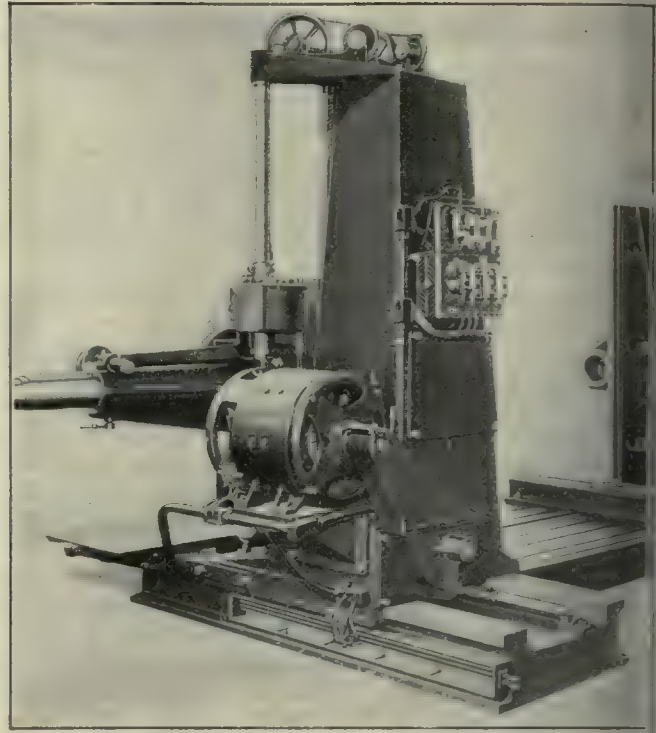


FIG. 2. REAR VIEW, SHOWING MOTOR DRIVE ON P. & H. BORING MACHINE

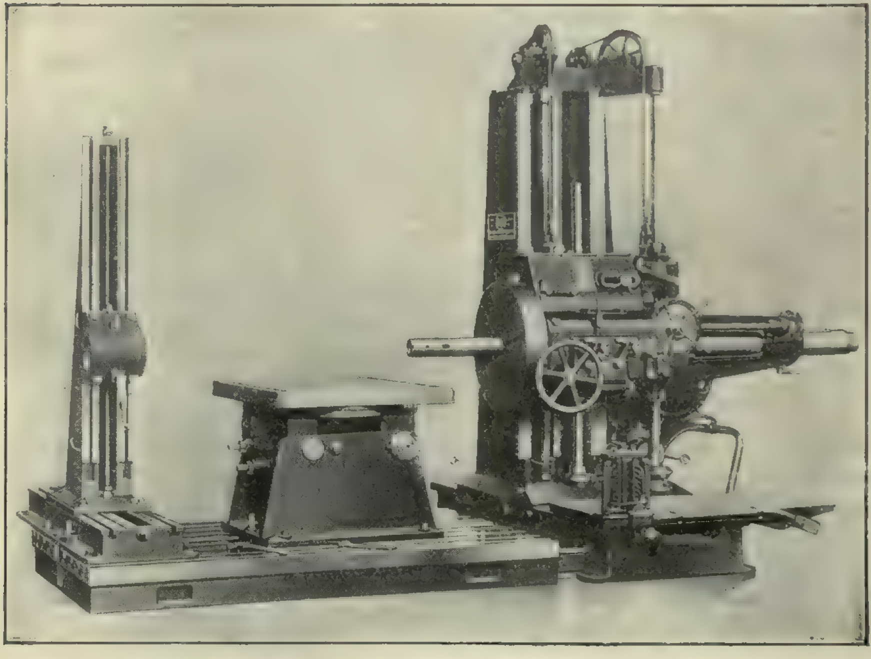


FIG. 1. PAWLING & HARNISCHFEGER NO. 4-F HORIZONTAL BORING, MILLING AND DRILLING MACHINE

Specifications: Diameter of spindle, 4 in. Taper hole in spindle, No. 6 Morse. Feed of spindle, 36 in. Vertical travel of spindle saddle, 48 in. Horizontal travel of column, 48 in. Speeds: number, 18; range, 5½ to 200 r.p.m. Drilling feeds: number, 8; range, 0.0076 to 0.45 in. per revolution. Milling feeds: number, 8; range, 0.009 to 0.54 in. per revolution. Rapid traverse, 60 ft. per min. Motor, 10 hp. Height of spindle from 9-in. bedplate: minimum, 25½ in.; maximum, 73½ in. Weight of machine without bedplate, outer support, tables or electrical equipment, approximately 17,000 lb.

There are eight boring and drilling feeds for the spindle, these being provided in either direction and ranging from 0.0076 to 0.45 in. per revolution of the spindle. The milling feeds to the column and saddle, which are also provided in both directions, are eight in number and range from 0.009 to 0.54 in. per revolution of the spindle. These feeds are driven directly from the spindle. A rapid power traverse independent of the feed is transmitted to the saddle and column, having a constant speed of 60 ft. per minute.

All of the operating levers and handwheels are located within easy reach of the operator, being for the most part mounted on the saddle. The control of all movements, feeds and speeds is effected by the operator from the platform attached to the front of the column. It is said that the movements of the levers are inter-locking, so that it is not possible to have any two conflicting speeds or feeds engaged at the same time.

The drive is from either a constant-speed motor variable-speed motor or by belt. When a motor is used, it is mounted on the side of the base of the column, as can be seen in Fig. 2, and moves with it. The machine requires a 10-hp. motor, but when direct current is used a two to one speed variation is employed. Since the machine is double back-geared, eighteen spindle speeds are obtainable for each direction, the range being from 5½ to 200 revolutions per minute.

The bed on which the work is mounted can be furnished in any desired size and is provided with T-slots run parallel to the spindle travel. The outer support is ordinarily made with a 48 in. vertical and 48 in. horizontal traverse. It is adapted for supporting boring bars. A universal tilting and revolving table or a plain revolving table, with movement by either hand or power, can be furnished. Also, a screw-chasing attachment can be supplied, to cut threads from 2 to 16 per inch.

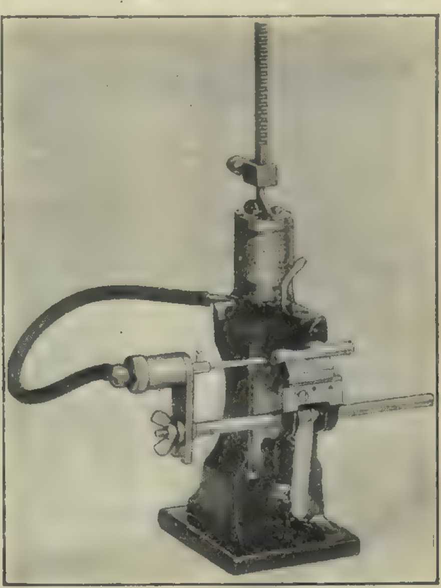
Caulkins Automatic Drilling Jig

E. L. Krag & Co., 50 West Randolph St., Chicago, Ill., has recently placed on the market the Caulkins automatic drilling jig, shown in the accompanying illustration. The device is intended for mounting on the table of a sensitive drilling machine that is employed on parts made in large quantities. It can be attached to any make of high-speed sensitive drilling machine, but is especially suited for use on the Avey No. ½ and Leland-Gifford machines.

The purpose of the device is to leave the hands free to manipulate the work that is being put in the machine, the operator controlling the clamping, the drilling and the discharging of the piece by a pedal. The rack at the top of the device runs on a gear on the feed shaft in the head of the drilling machine. This shaft, ordinarily turned by hand by means of a small lever, is connected to the pedal, so that when pressure is applied by the foot the drill is fed to the work and the jig is operated. It is said to be possible thus to keep the drill cutting nearly continuously, so as to conserve time in the performance of a job. The method of operation is particularly adapted to the drilling of cotter-pin holes up to 1/16 in. in diameter.

The clamping of the work is done automatically, and the tripping of the feed is also automatic, so that the drill is not fed to too great a depth. When the drill is allowed to rise, the work is automatically ejected, and the operator can insert a new piece by hand. For drilling such work as pins, grooved blocks are used to hold the parts. More elaborate holders can be made, however, for work requiring more operations. It is thus possible, it is claimed, to perform indexing, cross-drilling, or drilling two or more holes in one piece.

An automatic lubrication system can also be supplied, the cutting fluid being automatically turned on and off by means of the mechanism connected with the pedal, so that it requires no further attention and flows only while the drill is cutting. The maker calls attention to the fact that the jig requires no belt, and that it is very effective in its operation. It is claimed for it that a great reduction can be made in the time required to perform drilling operation on small parts.



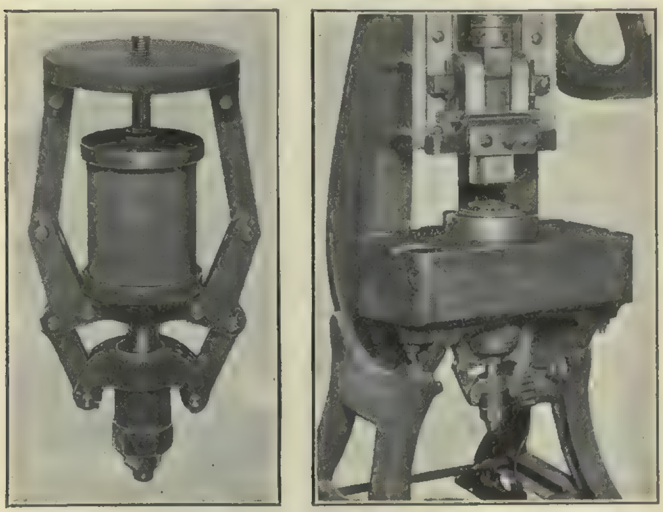
CAULKINS AUTOMATIC DRILLING JIG

Bliss Spring-Pressure Combination Die Attachment

The E. W. Bliss Co., Brooklyn, N. Y., has recently placed on the market a spring-pressure attachment, shown at the left of the accompanying illustration, for use on small punch presses equipped with combination dies. On the right of the illustration is shown the attachment mounted on the No. 20 press. A toggle motion is used to give a uniform pressure on the blank during the entire draw, thus reducing the total rubber or spring compression.

It is claimed for the attachment that the strain on the press is reduced by its use, and a saving of the power required to operate the press is effected. Because of the reduction in the compression, the life of the rubber or spring should be materially increased. Reduction of the compression is also said to permit of the use of combination and reducing dies for drawing shells deeper than ordinarily made in that manner. Certain types of parts usually made with double-action dies can thus be handled. It should be noted, the maker states, that, when drawing in one operation shells of greater depth than ordinarily made by that method, correct working proportions between the diameter and the depth of shell must be maintained. The elimination of the accumulative spring pressure and the use of the uniform pressure causes, it is said, a reduction in the strain on the metal and in the wear on the dies, and gives a more uniform edge to the work. Back lash on the upward stroke is reduced because of the lessened spring compression.

The attachment is regularly made in four sizes, to fit standard Bliss presses. The depth of the draw obtainable is 1¼ in. for the No. 18 press, 1½ for the No. 19, 2 in. for the No. 20, and 2½ in. for the No. 21 press. The attachment does not interfere with the operator, and the dies can be removed the same way as in the old style attachment. When ordering the dies it is necessary to specify the size of the tap hole for the spring barrel stem, but no change in the press is necessary when installing.

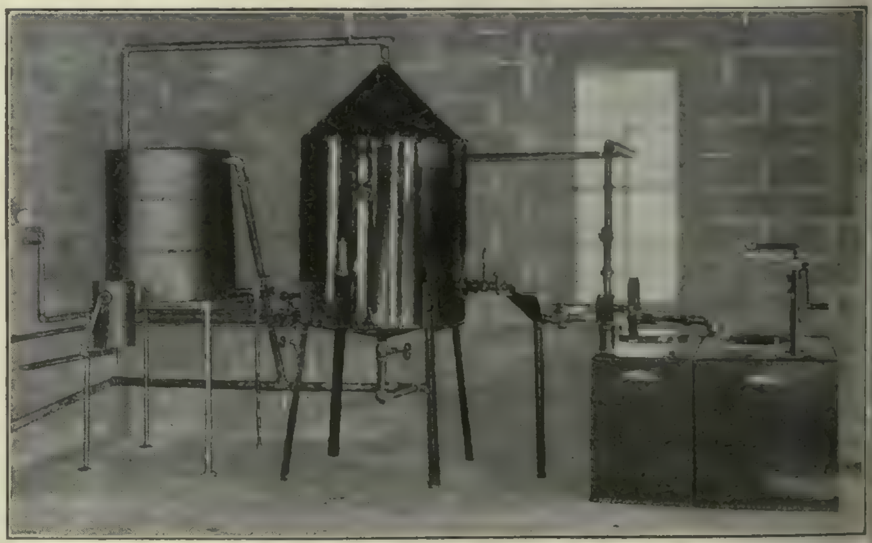


BLISS UNIFORM SPRING PRESSURE ATTACHMENT

Bowser Oil Reclaiming Outfit

S. F. Bowser & Co., Inc., Fort Wayne, Ind., is placing on the market the oil reclaiming outfit shown in the accompanying illustration. The apparatus can be adapted to the reclaiming of different sorts of lubricating oils, but it is especially intended for use on oils employed in internal combustion engines. Since the oil in the crankcase of such an engine becomes diluted by the presence of the fuel which escapes into it, it is necessary to remove the gasoline, as well as to remove all dirt, grit and particles of metal which become entrained in the oil. The apparatus is said to perform both of these functions, and to restore the oil to its original condition as to viscosity, flashpoint and purity, so that it can be used indefinitely. It is urged that the oil be changed much oftener than ordinarily done, the life of the motor being prolonged by the use of clean oil.

The oil reclaimer is ordinarily manufactured in two sizes, one having a capacity of 50 and the other of 100 gal. per 24 hours. The reclaimer proper, which is the large tank shown at the center of the illustration, is made of 14-gage galvanized steel and supported on legs made of angle iron. It is provided with the necessary inlet and outlet flanges, valves, gage glasses, thermometer and draw-off funnel. It requires a floor space of 54 x 72 in. and has an overall height of 6 ft. 8 in. in the 100-gal. size, the dimensions being 40 x 60 in.; and 6 ft. 11 in. for the 50-gal. outfit. The reclaimer can also be furnished in a 500-gal. size, for large establishments.



BOWSER OIL RECLAIMER

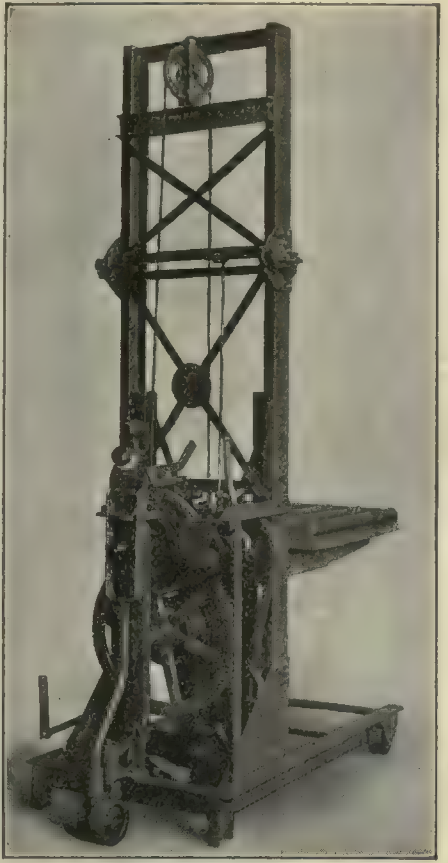
The large rectangular tank at the right of the illustration is for the clean oil, it being provided with a manhole and a cover and a 1 gal. hand-operated measuring pump, as well as means for admitting oil from the reclaimer. It has a capacity of 1 bbl. for the 50-gal. size and of 3 bbl. for the 100-gal. reclaimer. The tank for the dirty oil is also made of 14-gage galvanized steel, and is equipped with a 15-in. manhole and pressed steel cover, a drain for the reclaimer, and a hand rotary pump. The 50-gal. apparatus uses only a 1 bbl. tank, while a 2-bbl. tank is used for the 100-gal. size.

The apparatus shown at the left of the illustration is a still and condenser, which takes care of the fumes created in the distilling process and removes the gasoline from the oil. This action is accomplished by means of steam, while the precipitation of the foreign matter in the oil is hastened by means of a coagulant that is added. It is claimed that the approximate cost of operating the apparatus, including the cost for labor and steam, is about five cents per gallon.

Accessories for the apparatus can be furnished if desired. For the handling of the barrels a chain hoist and barrel drainer can be supplied. A transfer pump can be provided for handling the dirty oil, or a barrel cradle, track and chain hoist can be used. In case steam pressure is not available, a steam boiler, either gas or coal fired, can be furnished. Because of the fact that the conditions affecting each installation vary, the pipes and fittings are not furnished as a part of the standard equipment, but are made up to suit the measurements of the particular installation. The tanks can also be supplied to suit special needs, those intended for the 100-gal. reclaimer being furnished with the 50-gal unit if desired.

"Little Lifter" Portable Elevator

A portable elevator for lifting and tiering materials has been placed on the market by the Economy Engineering Co., 2635 W. Van Buren St., Chicago, Ill. The machine, shown in the accompanying illustration an known as the "Little Lifter," is operated by an electri motor. The difference between this elevator and thos made by the concern in the past lies principally in th fact that it can be operated from the ordinary 660-wat lighting socket, and that it can be hand-operated as well. Since it is equipped with a ⅓-hp. motor, the lighting circuit is not overloaded at the rated capacity of the machine. The speeds of the platform vary from 7 ft. per minute in the 1,000-lb. capacity machine to 12 ft. per minute for the size having 500-lb. capacity. The hand crank can be applied in the same way as for the ordinary hand-operated machines, making a machine for combination service and one that does not require special power wiring for its operation.

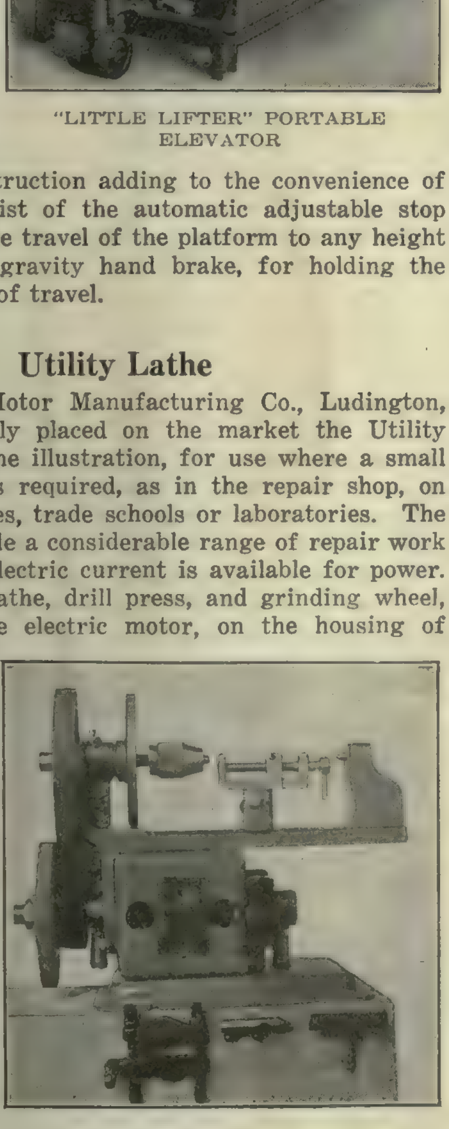


"LITTLE LIFTER" PORTABLE ELEVATOR

Details of construction adding to the convenience of the machine consist of the automatic adjustable stop device, limiting the travel of the platform to any height desired, and the gravity hand brake, for holding the load at any point of travel.

Utility Lathe

The Electric Motor Manufacturing Co., Ludington, Mich., has recently placed on the market the Utility lathe, shown in the illustration, for use where a small machining unit is required, as in the repair shop, on the farm, in stores, trade schools or laboratories. The machine can handle a considerable range of repair work in places where electric current is available for power. It consists of a lathe, drill press, and grinding wheel, all driven by one electric motor, on the housing of which it is mounted, being intended for bench use. The grinding wheel is mounted directly on the motor shaft, so as to give it the required speed. The spindle of the lathe is driven by covered gears from the motor shaft, and is provided with a faceplate. A center point can be inserted in the spindle, or a chuck used for holding a drill up to ¼ in. in size. The position of the tailstock of the lathe is adjustable, and work 12 in. long and 4 in. in diameter can be handled. A tool-holder is provided for use when turning metal, a screw on it being used to provide a feed. For turning wood, the steadyrest shown in front of the machine and below the base is used.



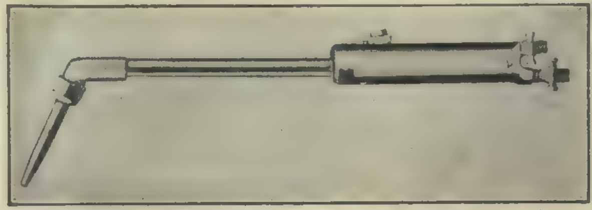
UTILITY ELECTRIC LATHE

The motor can be furnished either for 32-volt, d.c. current or 110-volt, a.c. current. Oil cups of large capacity are provided. If it is desired, it is possible to mount a buffing wheel in place of the abrasive wheel, particularly for use when polishing automobile parts. The apparatus can be furnished complete, as shown, for lathe work; but where only a grinder is required, the motor with an abrasive wheel and toolrest can be supplied.

"Cut-Weld" Type-J Oxy-Acetylene Torch

The illustration shows the type of oxy-acetylene torch recently placed on the market by the Alexander Milburn Co., 1420 West Baltimore St., Baltimore, Md. The maker states that the particular features of the torch are incorporated in the design of the tip, which is so constructed as to give a triplicate means of mixing the oxygen and acetylene.

As each gas enters the tip, it passes through a number of small jets, and each jet from the oxygen merges with one carrying the acetylene. The small jets carrying this mixture converge into a conical expansion chamber. The gases then pass through a single tube and come to the flame end of the tip. It is claimed that the mixing is so perfect that no part of the gas is unconsumed, and that the metal is not oxidized or carbonized in making the weld. The structure of the tip is said to prevent the flame from flashing back, which saves time on the part of the operator. It is necessary that the pressure of each gas be maintained at about the same degree, so that there is no syphoning effect on either gas.



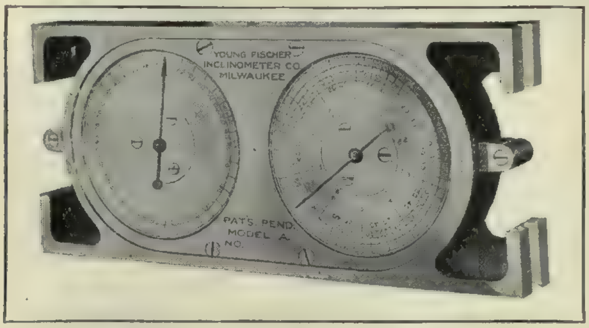
"CUT-WELD" TYPE-J OXY-ACETYLENE TORCH

It is claimed that the method of seating the tip in the torch head prevents leakage of the gas, and also of splitting and cracking of the tip and head. The torch is ordinarily made in three sizes, the 20-in. size for general repair work, the 14-in. for bench work, and the 10-in. size for manufacturing work. Each torch is provided with five tips to suit various types of work. Larger torches can be furnished, if desired, for special work. The tip for the type-J torch is made in ten sizes, No. 1 being for 16-gage metal and No. 10 being intended for use on metal 1 in. or more in thickness.

The torch is made of brass and all parts are accessible. The tip, placed at an angle of 60 deg. to the torch, is made of a piece of special bronze having a high percentage of copper. The change from welding to cutting can be quickly made by merely changing the tip.

Young-Fischer Inclinometer

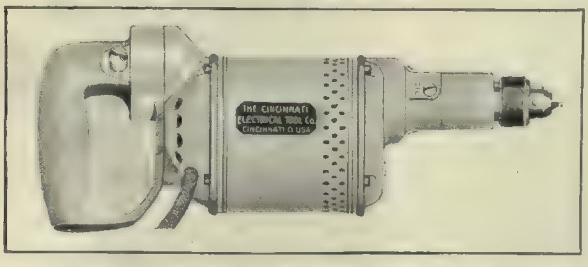
The Young-Fisher Co., Milwaukee, Wis., has developed an instrument known as the inclinometer, which is shown in the illustration. This instrument is intended to take the place of the plumb, level, or protractor in mechanical laboratories and machine shops where angles are to be determined, and especially where extreme accuracy is required. The inclinometer consists of a machined case of cast metal containing a gear train driven by gravity impulse. The hand on the degree dial moves in unison with the impulse, while the hand of the minute dial is driven by the multiplying gear train, causing the minute hand to make 36 revolutions while the degree hand is making one. It is said that this instrument indicates directly, not only the vertical and horizontal, but any angle as well. For the accurate inspection of angles it is claimed to be superior to the sine-bar, as no calculations are necessary.



YOUNG-FISCHER INCLINOMETER

Cincinnati Portable Electric Drill

The illustration shows a light-weight, hand-portable electric drill of $\frac{3}{16}$-in. capacity recently added to the line of portable electric drills and grinders manufactured by the Cincinnati Electrical Tool Co., Cincinnati, Ohio. The drill has a pistol grip and is said to be light, practically frictionless, high-speed and powerful. It is adaptable to all kinds of drilling in steel, brass, aluminum, sheet metal and wood, and is especially useful for work on automobile bodies, car building and window frames.



CINCINNATI PORTABLE ELECTRIC DRILL

Simplicity of construction, compactness and strength are claimed for the drill. It is equipped with a universal motor, for use on direct and alternating current of the same voltage. The motor housing, end caps and handle are made of aluminum, to reduce the weight. The armature and gear studs are mounted on ball bearings. Steel gears are used. The switch is of the quick make-and-break type, with a 50-per cent overload allowance. It is entirely enclosed in the handle and is operated by a button conveniently located on the handle.

A New, Light Metal

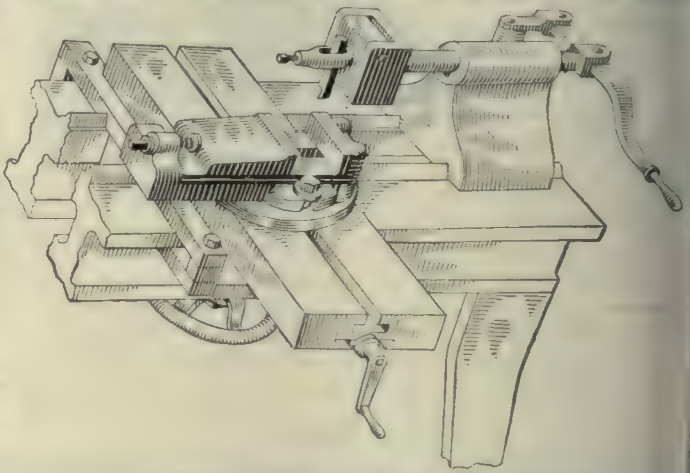
The Magna Metal Corporation, 227-229 High St., Newark, N. J., announces a new metal for various mechanical purposes where strength and lightness are essential features. The base is metallic magnesium which forms over 90 per cent of the alloy known as "Magna Metal." It can be used as castings and forgings, or it can be rolled into any shape desired. The specific gravity is given as 1.742 and the weight per cubic foot as 108.8 pounds.

Tests show the tensile strength to be 19,300 lb. for castings; 27,600 lb. for rolled; and 31,900 lb. for forgings, making a forged piece about the same strength as good gray iron. The metal can be machined very easily without lubricant and leaves a clean cut surface in threading and similar operations.

A Lathe Shaping Attachment

By Charles H. Willey

In the shop of J. E. Gage, an old-time expert lock and gunsmith, located in Concord, New Hampshire, I found a very interesting attachment that he had made many years ago. I have tried to sketch it so that the readers may see how this mechanic built an excellent device that enabled him to do all his shaping of slots in key blanks and other small work that comes to the shop of a lock and gunsmith.


AN IMPROVISED SHAPING ATTACHMENT

The lathe bed was a long one so that there was plenty of room to put on an extra tailstock which was fitte up to make the shaper ram. The ram, or spindle, ha a keyway on its under side; the toolpost and clapper ar secured to it by studs.

The cross-slide and vise were made for a millin attachment for use at the headstock end of the lathe and can be so used. There is a vertical slide in betwee the shears of the lathe bed, which is operated by th handwheel underneath.

Art Tool Co. Base Block for Height Gage

In the description, published on page 410 of th *American Machinist,* of the base block intended f holding a vernier height gage and made by the Art To Co., Bridgeport, Conn., it is not stated that the devi is made in two sizes, one to accommodate caliper blad 0.125 in., and the other 0.140 in. in thickness. Tw taper-bodied screws, adjusted on the bottom of the ba by a screwdriver, grip the jaw of the vernier caliper a also pull it against the bottom of the slot.

NEWS SECTION

G. B. Bell Heads Implement Division of Commerce

George B. Bell, of Jamaica, N. Y., has been appointed chief of the Agricultural Implements and Vehicles Division of the Bureau of Foreign and Domestic Commerce. This is one of the new commodity divisions established in the Department of Commerce under the authority granted by the export industries appropriation act.

Mr. Bell has had wide experience in the agricultural implement field. He was with B. F. Avery & Sons, of Louisville, Ky., engaged in export work for 20 years, and was later director of foreign sales with Bateman & Co., of New Jersey. He has traveled in many sections of the world building up markets for American agricultural implements and has had experience in this country in manufacturing, traffic, field demonstration, advertising and sales, etc. He is familiar with all types of implements and vehicles and it is felt that the acquisition of his expert knowledge and experience will greatly aid the Department in expanding the sale of American agricultural implements in foreign countries.

◆

New York Man to Aid Hays in P. O. Department

Postmaster General Hays announced on Sept. 15 the appointment of Ralph H. Matthiessen, president of the Motor Haulage Co. of New York City, as a special assistant of the Postmaster General to reorganize the motor transportation.

Mr. Matthiessen was selected because of his experience in the motor transport business, and because of the success he has made in New York City for efficiency and conomy in this work. His acquisition adds to the corps of successful business men that Mr. Hays is introducing to all branches of the Postal Service.

Mr. Matthiessen, during his service to the Government will organize a Bureau of Motor Vehicle Transportation in the department of the Fourth Assistant Postmaster Genral. There are now 271 cities in which government-owned motor vehicles are operated, maintaining over 3,600 motor ehicles. Its operating expenses annually mount to about $15,000,000. There are early 5,000 supervisory officials, clerks, hauffeurs, mechanics, etc., employed in this lass of service. There are used for these trucks about 25,000 tires each year.

The Post Office Department began operating its own machines on a small scale with he establishment of the Parcel Post. Its great expansion has been made possible hrough the large number of motor trucks received from the War Department.

Postmaster General Hays believes that he motor truck service of the Post Office Department should be a big mail transporation aid just as is the Railway Mail ervice, and as efficiently managed.

Mr. Matthiessen will organize a force of xpert field men taken from cities where he service is best managed and endeavor to build up the weak points. There will e expert mechanics and garage men picked o organize the repair work, and the operaion of garages now a part of the motor ehicle service. There will be men picked or their traffic experience because street ongestion is a factor in the operation of ny motor vehicle in large cities. The ostal management is determined to know hat this, and all other branches of the rvice is costing. Statisticians for that urpose will be selected from cities where he best cost keeping methods are used.

Secretary of the Navy Approves Wage Reductions Recommended by Navy Wage Board

The Navy Wage Board after exhaustive hearings has recommended, and the Secretary of the Navy has approved sweeping changes in the schedule of wages for employees in the mechanical service of the navy.

Machine shop superintendents are to receive $5,000 per year. Mechanical aids are to receive from $9.40 to $8.32 per day. Mechanical inspectors are to receive from $8.32 to $5.68 per day. Mechanical instructors in the technical service are to receive $6.96 a day while their assistants will receive $6.16. Mechanical laboratorians are to receive $5.36 and $4.88 per day. Special mechanics are to receive pay ranging from $8.72 a day to $5.68 per day.

Hourly wage rates of employees more particularly concerned with machine shop work are now as follows: Machinist helpers 48 cents; laborers from 31 cents in the Southern districts to 41 cents in the North Atlantic, Great Lakes and West Coast districts; blacksmiths 73 cents to 85 cents; die sinkers 83 cents; press drillers 57 cents; drop forgers 73 cents; heavy forgers $1.31; foundry chippers 52 cents; furnace men 57 to 69 cents; instrument makers 78 cents; machine operators 56 cents; machinists 73 cents; molders 78 cents; armour plate pressmen $1.01 to $1.21; punch and shear operators 57 cents; sheet metal workers 73 cents and toolmakers 78 cents.

◆

Export Publishers To Aid Foreign Trade

The organization of an association to counteract the determined campaign being made in all parts of the world to undermine America's predominance in foreign markets was announced last week by Edwin C. Johnston, publisher of the *American Exporter*. The association, known as the Export Publishers' Association, comprises twelve of the leading publications in English and in foreign languages, having a world-wide circulation of approximately 400,000 copies monthly.

The combined facilities of the information and research departments of all of the publications are to be used to obtain definite sales data for the use of American manufacturers, and the closest co-operation is to be effected with the Bureau of Foreign and Domestic Commerce. It is hoped, according to Mr. Johnston, to develop an organization similar in its scope to the British Board of Trade.

The organization will endeavor to work in a militant fashion to forward the cause of American foreign trade, both in this country and abroad. It will carry the gospel of American industry and will use its varied sources of information for the benefit of American manufacturers.

Edwin C. Johnston has been elected as the association's first president.

◆

W. A. Fenn Succeeds Father as President

At a meeting of the Fenn Manufacturing Co. directors on Sept. 12 for the election of officers, necessitated by the death of W. L. Fenn, former president, W. A. Fenn, son of the former president, was elected president and treasurer. Thomas Hewes was elected vice-president and S. L. Livingston was named secretary and assistant treasurer.

National Convention of Business Men at Chicago

There will be a meeting of the National Conference of State Manufacturers' Associations at the Congress Hotel, Chicago, September 29 and 30, to consider the industrial situation, giving special attention to congressional legislation, such as the tariff (including American valuation), taxation and transportation.

The agitation as to the three subjects referred to must be settled before the country can enter upon an era of prosperity.

The convention is called at the urgent request of manufacturers generally and manufacturers' associations, with particular reference to pending legislation. Invitations are being extended to manufacturing organizations of the United States to send representatives and also to corporate and individual manufacturing firms.

A well considered program will be arranged for the two days' meeting. Every line of manufacturing business will be given an opportunity to be heard so far as is possible in the two days' session.

At the close of the convention, resolutions resulting from the deliberations will be offered for action by the convention.

William Butterworth, of Moline, Ill., is president of the conference.

◆

Durant to Operate in Canada

William C. Durant, president of Durant Motors, Inc., has just closed a deal in which his company has taken over the plant and other property of the Leaside Engineering Co., of Canada. The Leaside munitions plant which was completed just at the close of the war, and which has never been occupied, will soon form the center of activities around which Durant Motors of Canada will be developed. Mr. Durant announced that the buildings now on the property would be utilized at once and new buildings would be constructed with a view to having the Canadian plant in production by March 1 next. Plans call for a manufacturing capacity of 100 finished cars a day.

◆

Industrial Relations Conference

Plans for the Industrial Relations Conference to be held under the auspices of the Department of Labor and Industry on October 24 to 27, at Harrisburg, Pa., are well under way. Commissioner Connelley announced that it is likely that Vice-President Coolidge, Secretary Hoover and possibly Secretary Davis will be among the speakers at the Conference.

◆

Exhibit at Gas Men's Convention

Optimism for the immediate future and a general revival of business activity for the industry is to be the keynote of the third annual convention and exhibition of the American Gas Association, the national organization of the manufactured gas industry in this country, which will be held in the Congress and Auditorium Hotels, Chicago, Nov. 7 to 12.

More than one hundred manufacturers will exhibit their latest gas-burning appliances and the business sessions of the convention will draw an audience of gas men estimated at 1,500.

Reports coming into the association headquarters show that when the general business situation improves there will be a tremendous jump in the demand for gas service. The industry is now making engineering and financial plans to meet this anticipated demand.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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At some time and place which I cannot now recollect accurately, I have seen grotesque two-faced statuettes. One face was serene and smiling, but when the figure was turned an ugly leering countenance was disclosed on the other side.

I am reminded of these little statuettes by the divergent courses which business in the United States and business abroad have been taking during the past fortnight. In this country trade, industry and finance are showing a consistent, if gradual, improvement; but on the other side of the globe, especially in the countries of Central Europe, the steady decline in the values of their currencies is alarming because it is, I fear, a precursor of complete demoralization of their ability to do business.

Few persons really appreciate the near-worthlessness of these currencies. The following table shows how many dollars a thousand marks or crowns would cost at par and how much they cost today:

	Price per 1,000	
	Par	Current Rate
German mark	$238.	$9.10
Austrian crown	203.	.90
Hungarian crown	203.	1.95
Polish mark	238.	.24
Czecho-Slovakian crown	203.	12.05
Jugo-Slavian crown	203.	4.00
Roumanian leu	193.	9.00

In the international exchanges, therefore, and particularly in the United States, these currencies may be said to have only a nominal value, and though the people of these countries still accept them at a much higher valuation in exchange for their goods and labor, they are kept in circulation more by the momentum of tradition than because their value justifies their existence. In fact the national currency has practically gone out of use in some districts of Poland, Austria and Hungary, being replaced by village tokens which are merely instruments of neighborhood barter.

That these peoples, even the Germans, will soon realize the relative worthlessness of their currencies seems to me inevitable. When this happens paper money will be demonetized and they will be without a circulating medium except as gold and silver may be attracted to them. Whether the governments will recognize these conditions by formally declaring a moratorium or the demonetization of paper money does not make much difference.

Of course, countries in which the circulating medium is so discredited that it will not be accepted in exchange for real property, cannot do much business and must suffer accordingly, financially and otherwise. The Polish cabinet has already fallen because of its inability to finance the government save by running the printing presses overtime, and a military dictatorship may result.

To the world at large the most important outcome of the currency debacle will be the delay in the rehabilitation of Germany and the impairment of her ability to make reparations payments. Unless she is given reasonable opportunity to trade with the rest of the world it is idle to expect her to pay the damages assessed against her. The depreciation of the mark is a bar to her imports and the tariff walls and the trade obstructions raised against her block her exports as effectively. Without money she will be helpless in international trade, and all indicators seem to herald a financial debacle.

The fear of German competition, therefore, which has taken hold of many exporters, now seems particularly ill-founded. Contracts made are not the equivalent of goods delivered. As Germany's credit disappears and the internal value of the mark declines, the productive efficiency of the nation is correspondingly decreased in many ways. Reports of faulty manufacture and oversold markets are frequent, and the prices of several iron and steel products have advanced 50 per cent in the past two months, according to a dispatch from Frankfort-am-Main.

There are other signs that the "menace" of German competition is unquestionably less than has been advertised, while opportunity for American financial penetration into Germany was never greater. The American Woolen Co., with a foresight which should help both German and American trade, has taken an option on the output of thirty-five German textile mills, and plans to sell the product in Europe and Central America.

As foreign finances grow more parlous the approaching Disarmament Conference assumes increasing importance. If the world's expenditure for armament can be cut in half by international agreement currency inflation will be reduced, the burden of taxation will be lightened and funds released which will stimulate productive activity to an extent which markets will quickly reflect. I believe business men are beginning to anticipate this more affirmatively and that their expectation has been influential in strengthening the feeling of optimism so noticeable in the past fortnight.

Aside from the currency demoralization the foreign news contains both favorable and unfavorable items. The door to Anglo-Irish comity has been closed again by the insistence of De Valera that Ireland is already what a compromising conference might have made it—a virtually independent state. It has not been locked, however, and the strength of the English markets in the face of the depressing outlook is reassuring. Another sore spot in Mexico, our equivalent of the Irish problem, is likely to be removed by the action of an international banking pool in sending Thomas W. Lamont to Mexico, presumably to plan the funding of the defaulted Mexican debt. Trade prospects are improving in many countries where deflation set in early, and our foreign trade during August showed exports of $54.000 000 and imports of $17,000,000 above the July totals.

In the United States praise of the boll weevil is heard up and down the markets. Cotton has fallen from the high point reached in its sudden upturn, but has clung to a slightly lower level with a tenacity which I, for one, scarcely expected. Its recovery has started rolling a ball of industrial improvement which should gather size and momentum as it goes.

Appreciation of this and other favorable factors has injected into business a more confident feeling than has been felt in months. The stock market, despite the weakened technical position which results from a wave of short covering, has settled back but little. Grains, despite a lapse in export demand, are steady. Copper, hides, wool and most other commodities are also firm, and in iron and steel, most depressed of industries, two important price advances have been recorded in a week. These are the first since the decline started, and in conjunction with statistics showing inoreased production during August they may be interpreted as proof that July was the bottom of the downward swing and that this great laggard in deflation is now definitely recovering.

Furs, a "luxury," have been bought briskly at advanced prices in the Montreal auction. Detroit and Toledo are taking on new hands in automobile plants. Railway traffic is still increasing. In retail trade the significant feature in all reports is that stocks are at the irreducible minimum, and that though dealers are buying only from hand to mouth a more complete replenishment will soon be inevitable.

Virtually all other barometric signs are favorable. The liquidation of agricultura loans has proceeded smoothly, following th heavy movement of farm products to mar ket, and as gold imports are still pourin in, easier money is in sight. The Federa Reserve statement shows a further gai in the reserve ratio from 66.2 per cent t 67.7 per cent, and a gain in gold holding of $28.000.000. New issues of bonds an notes are being put out in increasing vol ume and are generally oversubscribe The government issue of $600.000.000 short term notes, despite the lowered rate of interest, has been greeted by the larges oversubscription on record.

This sufficiency of capital is one of th surest signs that our domestic business fundamentally healthier. It is marchin ahead as fast as the confidence of i leaders will permit. Whether it will slowed up by the distress which will fo low the precipitate deflation in store f Central Europe I do not venture to pr dict, but it is evident that is the quart of the world on which our eyes should most closely fixed.

	End of Last Week	End of Previous Week	Last Year
Bank Clearings (Bradstreets):			
In thousands	$6,126,234	$4,967,471	$8,307,313
Business failures	334	306	144
Security prices, N. Y. Stock Exchange:			
20 Industrials	70.68	70.58	86 63
20 Railroads	73.28	73.00	79 01
40 Bonds	79.10	78.73	75.42
Commodity prices:			
Wheat, No. 1 spring	$1.75	$1.71	$2.62
Corn, No. 2, yellow	.72	.74	1.55
Beef, good dressed steers	15.25	15 75	24.50
Pork, mess, bbl	25.00	25 00	31.00
Sugar, refined	.0560	.0560	.1450
Coffee, Rio No. 7	.07$\frac{9}{16}$	.07$\frac{7}{8}$	.07$\frac{1}{4}$
Cotton, middling	.1970	.2110	.3100
Print cloths	.06	.06	10½
Wool, domestic average	.4000	.4000	....
Silk, No. 1, Sinshiu	5 80	5.65	6.70
Rubber, crude, plan	.1425	1425	.2350
Hides, pack. No. 1	.14	.17	.28
Iron, No. 2, Phila	20 34	20.34	55.00
Steel billets	30.00	30.00	60.00

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American Trade Bureau in South America

Colonel S. Graae widely known in Sou America and Europe as a civil engine sailed from New York for Buenos Aires Aug. 25 to perfect the organization of t new American Trade Bureau which he h established. This Bureau's field includ Argentina, Uruguay, Paraguay and Boli and its main headquarters will be Buenos Aires. Colonel Graae also will re resent some of the enterprises of E. Korbel and Worth Colwell, of New Yo in South America. These include seve large industrial expositions in vari cities.

Colonel Graae will have headquarters the Plaza, Buenos Aires.

Stocks of Iron in Japan

In view of the fact that there are la stocks of iron in Japan, the Governm Iron Works supplies amounting to 196. tons, it is reported that no more iron be imported for the rest of the curr year.

Business Conditions in England

By Our London Correspondent

The general tone of the industrial world seems more cheerful, though justification for it in the form of new orders received will not easily be found. In engineering production costs will probably be lessened shortly by the removal of the Churchill bonus of 12½ per cent on time rates, etc., for though there will doubtless be discussion—a conference has in fact been called for the end of September—it is pretty generally thought that this reduction in wages will be made without an undue amount of friction. The coal position is beginning to lead to some questionings on the part of miners' leaders, for supply outstrips demand, though in a broad sense prices have been reduced. But the ring or federation of retailers, at any rate in the London district, have determined to do their best to keep up the price for household qualities, with the result that an unorganized but very general strike of consumers is in operation. Few people are ordering, at any rate while the days and evenings remain fairly warm. The weather has had a marked effect on the position of the miners. Some dealers have undertaken to compensate customers for any reduction in retail prices between now and Christmas. According to present signs, the miners will find that when the 10-million-pound government subsidy is exhausted the wages reduction will remove all the gains obtained through recent legislation.

Wages are being reduced all round and now at the beginning of the month civil servants, major and minor, to the number of something like 300,000, and more than half that number of workpeople employed by municipal authorities, will find their salaries and wages automatically decreased as the result of the decline in official cost of living figures. The estimated saving on civil service costs is about 10 million pounds per annum. Other classes to experience a fall in wages are building trades workers, dock workers, flour mill workers, gas workers, agricultural workers, etc., but the printing trades workpeople have by a majority decided against accepting reduction and trouble is possible at the end of September.

Mine Operation Resumed

The main features in the improved labor world is the resumption of work by the miners, and a steady decline has been shown for several weeks in the number of people reported as unemployed. The latest official figures available put the number at 1,575,800 and on short time 444,400, some 150,000 being registered as out of work at the London labor exchanges. The apparent improvement in the general position is in part due to the exhaustion of out-of-work benefit and, further, many persons do not register. In certain of the London boroughs the unemployed are organizing, throwing themselves in a body on the guardians of the poor with a view to greatly increasing relief provided. In two of these boroughs a man and his wife will from now on get 12s. 6d. a week each, plus 5s. for each child, and rent up to 15s. a week, with a coal allowance of 3s. 6d. It has been necessary to sentence men to imprisonment with hard labor for refusal to work in return for workhouse accommodation. The prospect for the winter is not altogether encouraging.

In shipbuilding, with the termination of the joiners' strike, more men have been employed, to complete work in hand, but few fresh orders are reported, and Yarrow & Co., Ltd., some time ago gave definite notice of its intention to close its yard at Scotstoun, on the Clyde, on account of excessive cost of production and difficulties in guaranteeing delivery. A case has been instanced of a tender for a ship at £25,000, the lowest British quotation, but actually £6,000 more than a Dutch offer. This is of course not the first time that Yarrows has closed a yard. The company removed from Poplar, London, E., several years ago to the Scotstoun works in much the same circumstances, and several months ago the announcement was made that the firm would probably diminish its production in Scotland, while increasing the work in Vancouver.

Builders of locomotives appear to be quieter, but as regards automobiles, several of the smaller makers of the lighter cars have had a fair season. The Morris-Oxford people, with an output of 100 a week, have been unable to satisfy all demands, while one or two firms which had closed down temporarily have re-opened. For the most part however the spurt seems to have spent itself and Coventry is not hopeful of export trade. The report of the Vulcan Motor Co., Southport, for the 15 months ending with last December is not particularly encouraging, a loss of £434,260 being shown. It will be remembered that Harper Bean, Ltd., bought about 75 per cent of the Vulcan shares, the capital of which was raised at the middle of last year from £150,000 to £620,000. Dividends paid have ranged from 5 to 10 per cent, free from tax, and while the business was under government control bonuses of 20 per cent net were also paid. The Singer Co. of Coventry this year paid 10 per cent which, taking into account the distribution of bonus shares last year, really represents 20 per cent on the capital that was invested.

Machine Tools Quiet

The machine-tool position cannot be described as any easier; the only business that appears to be passing is in connection with heavier tools. In fact, one firm of merchants has described this branch of engineering as a forgotten industry. Ready cash is so scarce that they would be willing to sell tools at a discount of 25 per cent for a sight of the money. Departing from their settled policy of devoting attention to a few well-known types of tools, Alfred Herbert, Ltd., since the armistice has steadily branched out, beginning perhaps with radial and other drilling machines, and passing through hardness testers to the latest arrival in the form of ordinary screwing machines with one or two additional features like the Coventry diehead.

Market reports of the iron and steel trade are still discouraging. While London notes that the amount of business effected this week was negligible, Manchester states that little of any interest has been going on; in particular the need for reduced fuel and labor costs is indicated. Although the tendency may be towards reduction of difference between British and Continental prices by the lowering of home charges and the hardening of Continental prices, a considerable gap still remains. For instance, a difference in price of £5 a ton shows between British and German ship plates, while French plates are still cheaper. The Ebb Vale Co., after six months closure, is re-starting the whole of its iron and steel plant, and some 8,000 workpeople will, it is anticipated, be engaged by October. Generally speaking blast furnaces in operation show a steady if slow increase in number (a battery of five furnaces in Wolverhampton owned by the Hickman firm will probably be in full operation in the course of two months) and Scottish steel makers similarly mention a slow, steady improvement. Middlesbrough reports that the Cleveland pig iron trade is idle, without sign of revival at present rates, the high prices of fuel again being noted. Generally, makers do not expect anything like normal conditions before October and the need for cheaper furnace coke is pressed. As to pig iron, a Northampton trader has suggested that a loss of nearly 40s. a ton would be involved if prices offered were accepted.

Sheffield Sees No Optimism

Interviews with heads of Sheffield steel firms hardly suggest optimism. W .Clark, managing director of Vickers, Ltd., has said that any improvement in trade is very slight, while reduction in wages and cost of material are insufficient to permit competition with foreign firms. T. H. Firth, of the Brightside Co., also said that the drop in wages and cost of materials has not been sufficient and that workpeople must give a greater output; he added emphatically that, as regards foundries and rolling mills, there has been no revival. T. G. Mander, secretary of the local engineering employers' association, asserted that no authoritative person could say there was any indication of trade revival in the Sheffield district. While rolling mill proprietors have reduced charges by 7½ per cent and forgers and tilters by 10 per cent, prices still remain well above those of foreign competitors.

Based frankly on the New York example, the London Engineers' Club was opened on Sept. 1 in Coventry St., between Piccadilly and Leicester Square. The accommodation includes 76 bedrooms, and the membership is at present 2,700.

Brazil a Good Market for American Motor Cars

Commercial Attaché W. L. Schurz, Rio de Janeiro

The principal factors governing the market for motor vehicles in Brazil in normal times are the small purchasing power of the average citizen, the lack of good roads, the large number of old European cars still in use (especially in taxi service), the high cost of gasoline, and the high cost of upkeep. The latter is due largely to the lack of mechanical skill on the part of most Brazilian chauffeurs.

Foreign Imitation of American Cars

There is no question of the superiority of appearance and mechanism of American cars. Their lines are more attractive and the cars are easier to run than European cars, but the European producers are rapidly approximating the designs of American models. A few attractive British closed cars have been noted lately, and some of the new Italian mode's show clear signs of imitation of American models. Particularly is this true of the new shipments of Fiats and Lancias received recently. The Italians, moreover, are producing a good engine for automobile use. On the other hand, the American prices are lower than those of European competitors. A local Brazilian company which sells an American seven-passenger touring car at 22,000 milreis also sells a French car of the same general grade for 40 000 milreis. The Benz and Mercedes, German cars, are now selling in Rio de Janeiro at 35,000 milreis.

American Cars Favored

Native trade is generally well satisfied with the results given by American cars and has been especially attracted by the service-station feature offered by Americans. American representation in the automobile market is usually well handled, particularly in Sao Paulo and Rio de Janeiro, which cities take most of the cars imported. Sao Paulo is rapidly becoming the foremost field for automobile sales, due to the expansion of the State road system and its prosperity and progressiveness in normal times. The money put into circulation by the valorization of coffee makes Sao Paulo at present the only real market for motor vehicles in Brazil, sales having almost stopped in Rio de Janeiro in spite of the advantageous prices offered. Considering the exchange relations between the two currencies, American cars are now being offered at prices considerably lower than the price at which they can be obtained in the United States, and one American company is now proposing to sell on the basis of 5 milreis to the dollar, on the assumption that exchange will return to that figure within at least a year.

Sales Methods in Practice

The common terms of sale to purchasers of known responsibility are one-half down and the remainder in six months. Most German cars are shipped to Brazil on consignment, the custom being formerly for the Germans to sell cars to taxi chauffeurs at 1,000 milreis down, and the remainder in long-time payments, secured by the chauffeur's note to the German bank which financed such transactions. German competition in this line, however, is not of such serious concern for the present, but Italian and French competition is becoming very active, and some of these foreign cars still have considerable prestige in the market.

[A list of importers and dealers in motor cars and accessories in Brazil may be obtained from the Bureau of Foreign and Domestic Commerce or any of its district or cooperative offices by referring to File No. K. A.-12023.]

New Iron Works in Osaka, Japan

The recent organization of the Niniwa Iron Works and the Tanaka Iron Works in Osaka, Japan, the latter capitalized at 100,000 yen, to manufacture machinery and boilers is announced in the *Far Eastern Review*. It is also stated that the Aki Shoji Co., with a capital of 200,000 yen, has been formed in Osaka for the sale of iron, pig iron, and steel.

Ohio Manufacturers To Meet at Cincinnati

Through the efforts of John E. Edgerton of Nashville, president of the National Association of Manufacturers, a general meeting of Ohio manufacturers has been called to be held at the Hotel Sinton, Cincinnati, on Oct. 14. J. Wallace Carrell, David C. Jones, W. S. Stearns, J. W. Strobridge, Lucien Wulsin, Walter Friedlander and Milton Adler have been named a committee to arrange details of the meeting.

The meeting was arranged to bring together manufacturers to discuss national problems, such as the merchant marine, transportation, tariff, waterways, taxation and labor relations and to devise methods for their solution. State meetings of manufacturers probably will be followed by one of manufacturers of the entire country in an effort to get together on a common platform, it was said.

Atlanta Has New Welding Plant

The Bird-Potts Co., of Atlanta, Ga., have opened in that city a completely equipped plant devoted exclusively to the welding of metals. It is located at 376 Marietta St., and provides 12,500 sq.ft. of floor space. An investment of nearly $75,000 is represented.

There are four electric welding machines, oxy-acetylene welding machines, traveling cranes of 10-ton capacity, and all other machinery necessary for welding of any metal article of from 1 lb. weight to 10-ton weight. George Bird, senior member of the company, is a pioneer in the industry in the South, organizing and operating the first welding plant south of the Mason and Dixon line about fifteen years ago. During the war he was a member of the welding committee of the Emergency Fleet Corporation.

Buenos Aires Wants Oil-Well Supplies

It is suggested that manufacturers of oil-well supplies, accessories and tools, including drilling outfits, send catalogs to the Bureau of Foreign and Domestic Commerce, Washington, D. C., for transmission to the American Embassy in Buenos Aires, one copy for delivery to the Direccion General de Petroleo, the other to be retained in the office of the commercial attaché. There has been one inquiry for twelve pipe-cutting machines of various sizes, and Commercial Attaché Edward F. Feely states that all indications point to a greatly increased interest in the petroleum industry, with a consequent large demand for oil-well supplies and equipment.

Wages in the German Automobile Trades

Assistant Trade Commissioner W. T. Daugherty, Berlin

A strike for higher wages in the German automobile building trades in February and March, 1921, resulted in pay increases for both unskilled and skilled workmen.

The following wage schedule, furnished by the Schebera Aktein Gesellschaft, motor car body builders of Berlin-Tempelhof, presents, for practical purposes, the approximate current wages being paid in the automobile building trades. Unskilled labor in 1913 received 20 pfennigs per hour; before the strike it received 5 marks per hour, and now (July, 1921) it receives 6.40 marks per hour. The apprentice class of labor received in 1913 but 25 pfennigs per hour; before the strike 6 marks, and now 6.80 marks per hour.

The skilled workman before the war, 30 pfennigs per hour; before the strike, 7 marks per hour, and now, 7.80 marks per hour, with the provision that in piecework he may earn up to 10 marks per hour but no more. The first-class workman, "Vorarbeiter," receives between 8 and 9 marks an hour, while the foreman, or so-called "Meister," gets but 8 marks an hour.

Market for Drilling Machinery in Czechoslovakia

Trade Commissioner Donald L. Breed has reported that there is very little chance for the sale of American drilling machines in Czechoslovakia at present. This condition is due both to the unfavorable condition of exchange and to the fact that the domestic makers of similar machinery are now heavily overstocked and find it next to impossible to dispose of their goods. How long this condition may continue is not known, but a change is not to be expected within the near future.

Gilbreth Presents Further Indictment of Stop-Watch Time Study

At a well-attended meeting of the Taylor Society held on Thursday evening Sept. 15 in the Flatiron Building Restaurant, New York City, Frank B. Gilbreth, consulting engineer and internationally known authority on motion and fatigue study, presented what he styled "a further indictment of stop-watch time study." Mr. Gilbreth's paper was entitled "Micro-Motion Study for Current Use," and its preparation and presentation was the outcome of a controversy which had its beginning in December, 1920, when Mr. Gilbreth, assisted by Mrs. Gilbreth, gave a paper before the New York Section of the Taylor Society. This paper, entitled "Time and Motion-Study, Its Fundamental Factors in Planning and Control: and Indictment of Stop-Watch Time Study," caused considerable comment among management engineers, and others. In April of this year criticisms of the Gilbreths were answered by various Taylor Society engineers in a meeting of the Philadelphia Section. As a consequence the editor of the Taylor Society bulletin asked the Gilbreths for "more data-descriptions of cases and figures contrasting micro-motion and stop-watch results." At the meeting on Sept. 15 Mr. Gilbreth presented this data.

The definite point on which the whole issue depended seemed to be whether stop-watch technique is so "unscientific" as to be unsuitable for the determination of standard times and standard rates as a basis for current wage contracts. Mr. Gilbreth stated that the proponents of the stop-watch concede the complete superiority of the micro-motion method for everything, except finding "standard times and standard rates for current use." He added that the stop watch method is now fighting for an excuse for living, and is, so far as permanent value is concerned, a complete surrender to the micro-motion method of securing times. The speaker backed up his remarks with references and quotations from accepted technical data, and went on to prove his theories with a motion-picture camera which was equipped with a clock, the dial of which is graduated into hundreths, the hand making a complete revolution in exactly one minute.

Following Mr. Gilbreth's address there was an open discussion. Several of those present, among them some well-known engineers, aided in bringing out further information on the subject. It is expected that further meetings, at which this subject will be argued pro and con, will come as the result of Mr. Gilbreth's latest indictment.

H. S. Peck Now President of Industrial Cost Association

At a meeting of the board of directors of the Industrial Cost Association held on Sept. 8, at Pittsburgh, Pa., the resignation of J. W. Stannard as president and director was accepted. Horace S. Peck, comptroller, S. K. F. Industries, Inc., New York City, was elected to fill the vacancy. Messrs. Christopher Haigh of the General Electric Co., West Lynn, Mass., Joseph P. McLean of the Pittsburgh Forge and Iron Co., Pittsburgh, and Ernest J. Wesson of the W. T. Raleigh Co., Freeport, Ill., were elected directors.

It was decided to hold the fall conference at Pittsburgh, Nov. 2, 3 and 4. Full details and the program of this conference will be announced later.

Demand for Mild Steel Plates in British Malaya

There is a considerable call from the tin mines of British Malaya for mild steel plates of 8 x 4 ft. in $\frac{1}{32}$, $\frac{1}{16}$, $\frac{3}{32}$, and $\frac{1}{4}$ in., reports Trade Commissioner John A. Fowler. Recently Belgian mills quoted prices, successfully competing with the British mills.

McClintock Appointed Commerce Adviser

Dr. Samuel McClintock of Chicago, Ill., has been chosen by Secretary Hoover as editorial adviser of the new commodity divisions of the Bureau of Foreign and Domestic Commerce. Investigations of importance to the major industries of the country will be made under Dr. McClintock's direction. Dr. McClintock was formerly American Consul in Latin-America. He comes to the department from New York, where he was editorial director of the McGraw-Hill Book Co. He is also known as a lecturer in applied economics at the College of the City of New York.

Business Awakening Throughout Southern States

Industrial conditions continue on the upward trend throughout the South. A general survey of the employment situation based on actual count in the six most important industrial centers shows an increase of 6 per cent in Chattanooga during August, as compared with July; 5.2 per cent in Birmingham; 5 per cent in Memphis; and 1.5 per cent in Richmond. In Atlanta a decrease of 8.27 per cent is shown during August, with a decrease in New Orleans of 1.6 per cent.

In Florida a state-wide shortage of labor is indicated by the survey, with practically no unemployment.

As a whole the survey indicates industrial improvement with a promise of even greater improvement by the end of the year.

In Georgia, Florida, South and North Carolina and Virginia, this territory being known as the South Atlantic district, considerable improvement is shown in textile mill conditions, with slight improvement in lumber. Gratifying increases are also shown in railroad occupations.

In Tennessee, Alabama and Mississippi, this section being known as the East South-Central district, considerable improvement also is shown in railroad and textile mill employment, with some improvement in lumber. Demand for coal is far below normal and coal mining operations in the district are not encouraging. Building is more or less active in spots. This district shows much greater improvement among the metal trades industries than the South Atlantic district. August noted an increase in operations among many of the plants in Alabama, which is the largest iron and steel section in the South, and there is promise of considerable improvement during the next few months. In fact, most of the iron and steel and kindred plants in Alabama are preparing to gradually increase operations.

Demand for Machinery

Another indication of improvement in industrial conditions over the South is the steady increase in the demand for machinery, mill and machinery supplies, reported by manufacturers and distributors in Atlanta. Atlanta is the largest distributing point in the South for mill and machinery supplies and the demand for these lines is always an accurate barometer of industrial conditions over the South. At present most of this demand is among textile plants, lumber mills and cotton oil mills, while an increase also was noted during August for machinery and supplies among the metal trades industries. The outlook is encouraging for a return to normal in this line by the end of the year.

Pig iron production gives promise of still further improvement after Oct. 1, because of an approximate reduction of 30 per cent on raw materials to the furnaces. Coal, coke, iron ore and limestone are affected by the rate reduction which was ordered by the Alabama Public Service Commission. This is interstate transportation and the case has been pending for several months. The new rates become effective Oct. 1, and as a result of this favorable decision there is a much better feeling among furnace operators in the district. It will have the affect of increasing or improving conditions among virtually all of the metal trades industries.

The stiffening of high-pressure cast-iron pipe prices is having a favorable effect on the pipe making industry in Alabama, most of the larger plants reporting increased operations the past few weeks. The National Cast Iron Pipe Co., at Tarrant City, Ala., one of the largest pipe plants in the state, is operating at 100 per cent capacity. The stiffeneing of the prices is of considerable importance in Birmingham, for that city is the largest manufacturer of high-pressure cast-iron pipe in the country.

All lines of commerce and industry throughout the South, in fact, are showing steady improvement, the recent tremendous boom in cotton prices being one of the primary factors contributing to this improvement.

Bosch Magneto Co., of Stuttgart, To Enter American Market

Hugo Borst, chairman of the board of the Robert Bosch Magneto Co. of Stuttgart, Germany, has left New York after a two weeks' visit spent in looking over the prospects of marketing the original German company's product in this country. It is planned to go after the American market on a large scale.

Evolution of an "American Machinist" Article—VIII

The illustrations appearing in the text columns of the *American Machinist* are photoengravings—the photographs usually being made into halftones, and drawings, charts, etc., into line cuts. The general meaning of the word photoengraving is a process by which a design, or image, is, by means of a photograph, transferred to a metal plate, which is then etched, or cut away, by chemical and mechanical means.

Fig. 1 shows the "camera" for making a halftone. A negative of the photo is made, the light passing through a "screen" before it falls upon the negative plate. This "halftone screen" consists of two pieces of glass ruled with parallel lines and joined together so that the lines run at right angles. A halftone screen is shown at A. The effect of the screen is to break the rays of light into separate beams on the negative thus forming the myriad of dots that you will notice in an illustration. If it were not for these dots the result would be a solid, black mass. Line cuts are produced on the negative without the use of the screen.

Fig. 2 shows the stripping process, where the film is stripped from the negatives. These strips are repasted on a large flat glass plate so that several can be used for printing on a single sensitized copper or zinc plate. This enables faster and more economical work to be accomplished. Photographs in our work are usually made into copper halftones while drawings are made into zinc plates.

Owing to the inadvisability of using a flashlight it was only possible to photograph the corner of the printing room shown in Fig. 3. Here are shown the developing tanks. The design is transferred from the glass negative to the sensitized copper, or zinc, plate in a manner similar to that by which a photographic print is made. After developing, the parts of the plate which are to remain high enough to be inked are treated with an acid-resisting chemical, after which the plate is given a preliminary acid bath in a tank such as that shown in Fig. 4. In order that the acid may not cut away parts to be inked the plate is removed from the bath, examined, recoated with the chemical if necessary, and then suspended in an inclosed tank where acid is sprayed against it. Halftone plates are etched by chloride of iron, and zinc plates by nitric acid.

Fig. 5 shows the machine room where the plates are sawed, trimmed, routed and tacked onto wooden blocks. Hand finishing is required on a great many cuts, to do which a large force of engravers are employed. When the cut is finally completed, proofs are taken. The cut is then stored, the number of the cabinet and drawer in which it is placed being marked on the proof, and the latter sent to the makeup man.

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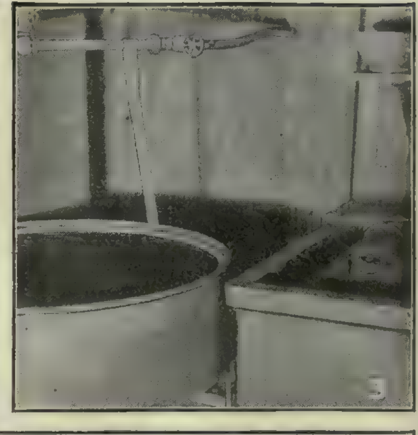
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Business Items

A Southeastern branch has been opened in Atlanta by the Winchester Repeating Arms Co., one of the five branches of this kind the company maintains in various parts of the United States. Edward Lee is manager.

Fire, thought to have been of incendiary origin, recently destroyed the $500,000 plant of the Flake Graphite Corporation, at Goodwater, Ala. This is said to have been the largest plant of its kind in the United States.

The Gifford Screw Products Co., of Worcester, Mass., has been recently organized and incorporated under the laws of Massachusetts, to make screws, etc. The president is William E. Gifford, of Worcester; J. Boyd Coats, of Glenside, Pa., is the treasurer.

The B. F. Zimmerman Manufacturing Co., Inc., of New Haven, Conn., has been organized and incorporated to make tools, etc. The capital stock of the company is $150,000; the incorporators are B. F. and M. Zimmerman, and Harry A. Waldron.

The English Electric Co., of Canada, has purchased the plant and business of the Crocker-Wheeler Co., at St. Catherines, Ont. The new management will produce electrical equipment and appliances, rolling stock for railroads and tramways, and switchgear and control apparatus of all kinds. Gordon F. Perry, president of the National Iron Corporation was elected chairman of the board.

The Supple & Walker Machine Works, Portland, Oregon, has been incorporated to manufacture and sell machinery and mechanical equipment. Joseph Supple, C. T. Walker and L. E. Crouch are directors.

The Wopeco Machine Co., has been incorporated at New Haven, Conn. Capital stock $69,000. Directors are G. H. Woodruff, W. S. Perry and J. W. Commerford.

An Anglo-Chinese-Japanese syndicate has been organized with a capital stock of $15,000 to establish a large iron foundry on Shinwa Island, China, where it is planned to produce 200 tons of pig iron per day.

The Ace Motor Corporation of Philadelphia, Pa., has been sold at a receivers sale to Max M. Sladkin for $500,000.

The Waugh Foundry and Machine Works, Williamson, W. Va., announces that work has been started on the new plant of that company. It is expected that production will be started in about a month.

The Grip Tool and Machine Co., has been incorporated at Worcester, Mass., with a capital stock of $50,000 to manufacture tools and machinery. Carl G. Grip is president and John F. Hjort, treasurer.

Increase of the capital stock of the National Cash Register Co., Dayton, Ohio, from $15,000,000 to $30,000,000 has been authorized by the secretary of state. The new stock is all preferred. Expansion of business is given as the reason for the increase by company officials.

The Dayton-Wright Co., a subsidiary of the General Motors Corporation operating three plants in Dayton, Ohio, has completed the development of a five passenger, air-cooled automobile which it is arranging to place on the market. The company is also engaged in the production of airplanes, having recently obtained a $500,000 contract for building airplanes for the U. S. Government.

The Bureau of Applied Economics, Inc., has removed from 921 Fifteenth St., N. W., to its new quarters at 921 Southern Bldg., Washington, D. C.

The Springfield Motor Specialties Co. of Springfield, Mass., was recently organized and incorporated with offices at Springfield, Mass., to manufacture automobile specialties, etc. The capital stock is $110,000. The officers are Charles P. Whittall, president; Edward A. Higney, vice-president; and John G. Waddell, treasurer.

The Metal Goods Manufacturing Co., of Boston, Mass., has recently been organized and incorporated with a capital stock of $100,000, to manufacture metal goods, metal stamping, etc. Ralph C. Heath, of Boston, is president; Reginald C. Heath, of Melrose, is treasurer.

A company is being formed by J. H. Gardner, of the Colliery Investment Trust of America, Inc., New York, for the purpose of developing a reciprocal American-Irish trade. It is intended to export to Ireland coal and other products and it is hoped to obtain orders from American firms for Irish products. Agencies for American goods are desired by the company.

Kerman & Swift, factory representatives, have opened offices at 45 West 18th St., New York City. This is a newly organized partnership formed by Frank G. Kerman and Clarence M. Swift. They will handle all kinds of machine tools as agents for several prominent manufacturers.

The Liberty Machine Tool Co., Hamilton, Ontario, Canada, has built to order, two planers for the Harrisburg Foundry and Machine Co., Harrisburg, Pa.

The Paris despatches to newspapers of negotiations for the purchase of the properties of Archduke Ferdinand of Austria have been confirmed by J. Leonard Replogle, president of the Vanadium Corporation of America. The properties include the Teschen Steel Works and iron mines, employing between 20,000 and 25,000 men and now operated at about 85 per cent of capacity.

The Equalizer Roller Bearing Co., Cleveland, Ohio, has increased its capital stock to $750,000.

William Jessop & Sons, Inc., of New York, has recently opened new offices and warehouse at 112-118 North May St., Chicago, Ill. This branch is under the management of C. V. Luin.

Trade Catalogs

Small Tools. Greenfield Tap and Die Corporation, Greenfield, Mass. Catalog No. 46 covering a comprehensive line of taps, dies, screw plates, drills and reamers, milling cutters and pipe tools. Specifications and prices are also furnished.

Watson Motors. The Mechanical Appliance Co., Milwaukee, Wis. Bulletins Nos. 401, 402, 403, 404, and 405 describing several types of alternating and direct current motors, embodying many new features.

Motors and Generators. Electro Dynamic Co., Bayonne, N. J. Bulletin No. 300, describing by word and picture the process of manufacture of electric motors and generators in the company's plant at Bayonne.

Personals

Ogden R. Adams, machinery merchant of Rochester, N. Y., has been elected president and general manager of the Seneca Falls Manufacturing Co., Seneca Falls, N. Y., manufacturer of "Star" and Adams "Short-Cut" lathes. Mr. Adams still remains at the head of his Rochester business, which will not in any way be interrupted by his new connection.

E. W. Ebilhare, general superintendent of the Locomobile Company of America, with works at Bridgeport, Conn., has tendered his resignation.

G. A. Thompson and J. R. Hussey are now associated with the Brown & Zortman Machinery Co., Pittsburgh, Pa., having sold out their interest in the Thompson Machinery Co.

L. R. Samuels, formerly assistant sales manager of William Jessop & Sons, Inc., New York, has returned to that company after a year's absence. Mr. Samuels will make his headquarters in New York.

Paul Fugler, superintendent of materials of the Walworth Manufacturing Co., Boston, Mass., recently resigned his position in order to return to his home in England. Mr. Fugler was with the Walworth concern for seven years.

William Podolski, has recently been appointed superintendent of materials of the Walworth Manufacturing Co., of Boston, Mass. Mr. Podolski has been with the concern since 1905.

F. M. Travis, has recently been appointed general sales manager of the Locomobile Co., of America, Bridgeport, Conn., manufacturer of Locomobile automobiles and Riker trucks.

Robert J. Metzler, formerly treasurer of the New Jersey Machinery Exchange, has organized the R. J. Metzler Co., Inc., with offices at 15 Mechanic St., Newark, N. J. His associate is John T. Elliott, who was also an official of the exchange.

W. E. Mathews, secretary of the Carrol Foundry and Machine Tool Co., Bucyrus, Ohio, has assumed full charge of the Lambert boring mill branch of the concern.

Charles E. Hildreth of Worcester, Mass., has been appointed receiver for the Springfield Automatic Screw Machine Corporation, of Springfield, Mass.

D. D. Lewis has been appointed general manager of the Carrol Foundry and Machine Tool Co., Bucyrus, Ohio. Mr. Lewis has been identified with several manufacturing concerns including Southwark Foundry and Machine Co., Buckeye Engine Co., Cambria Steel Co., and Jones & Laughlin Co.

Daniel S. Rhodes, of Gloversville, N. Y., has been granted a patent for a machine for renewing worn-out threads of any description. Production of the machine will begin as soon as facilities are obtained.

John D. Hurley, president of the Independent Pneumatic Tool Co., Chicago, Ill., manufacturer of Thor air and electric tools, arrived in New York on the steamship "New Amsterdam" on Sept. 9, and reached the home office in Chicago, on Sept. 15. Mr. Hurley accompanied by Mrs. Hurley, has just completed a six weeks' trip abroad, visiting all the principal points of Continental Europe.

Fred W. Jacobus, superintendent of machinery at the Moore plant of the Bethlehem Shipbuilding Corporation at Elizabeth, N. J., has resigned.

Obituary

Morris T. Wright, founder and president of the M. S. Wright Co., Worcester, Mass., died on Sept. 6. He was 62 years old. He was widely known as an inventor and developer of mechanical appliances.

H. B. Busch, of Bedford, Ohio, president of the Busch Electric Co., was instantly killed on Sept. 1, while demonstrating an instrument of his own invention. The fatal accident happened in the plant of the New England Power Co., at Worcester, Mass.

Albert Hellwig, president of the Steel Heddle Manufacturing Co., of Philadelphia, Pa., was killed by an automobile at New Brunswick, N. J., on Sept. 6.

W. A. Patterson, president of the Patterson Automobile Co., of Flint, Mich., died on Sept. 9. He was 82 years old.

George H. Hall, former Senator, of Bristol, Conn., died Sept. 10 from apoplexy after an illness of two hours. Senator Hall was seventy years of age. He was for thirty-five years superintendent of the J. H. Sessions & Sons Co., hardware manufacturers of Bristol, Conn. and retired from the concern about twelve years ago.

Melville F. Goodrich, former president of the United States Motor Transportation Co., of Boston, who was stricken by pneumonia recently, died in a hospital in Omaha, Neb., on Sept. 13.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

An American citizen located in Brazil desires to secure an agency from manufacturers for the sale of calculating machines and typewriters. Reference No. 43.

A commercial agency firm in Norway desires to purchase and secure an agency for the sale of motor cycles and accessories. Quotations should be given c.i.f Norwegian port. Reference No. 40.

A firm in New South Wales, Australia desires to purchase clothes-cleaning and general utility dyeing machinery and dry-cleaning equipment, and also laundry machinery. Quotations should be given f.o.b. New York and San Francisco. Payment to be cash against documents. Catalogues and price lists are requested. Reference No. 28.

A manufacturing company in South Africa desires to purchase grinding and crushing machinery for the manufacture of bone meal. The capacity of the entire plant is to be 2 to 5 tons per day. Prices, specifications, and full information are required as soon as possible. Reference No. 34.

An engineer in Norway desires to secure an agency for the sale of motor boats and marine engines for fishing and pleasure; motor cycles; motor tractors; and automobiles. Quotations should be given f.o.b. New York. Terms: Payment against documents in New York. Reference No. 31.

A firm of importers in Chile desires to secure an agency for the sale of automobile accessories, supplies and equipment; iron and steel, paints and varnishes; and also motor trucks on consignment. Quotations should be given f.o.b. New York, or c.i.f. Talcahuano, Chile. Reference No. 29.

The government of a country in Asia desires to purchase various types of industrial machinery, such as paper-making machinery and spinning, weaving and knitting machinery. Quotations should be given c.i.f. Karachi or Bombay, India. Catalogues and prices should be forwarded. Reference No. 21.

A manufacturing company in Natal, South Africa, desires to purchase machinery for producing plain and reinforced concrete pipes and also the most modern machinery and molds for the production of anything in concrete (excepting building blocks) which may be factory made. Reference No. 18.

A merchant in Switzerland desires to purchase machines for casting in stabs under pressure (understood to mean "die casting"). Quotations should be given c.i.f. Havre or Genoa. Correspondence should be in French. Reference No. 19.

A mercantile firm in India desires to secure an agency for the sale of hardware supplies, builders' supplies, electrical appliances and automobile accessories. Payment to be made through bank in India. Reference No. 8.

An agency is desired by a merchant in Canada for the sale of automobile accessories and hardware. Reference No. 4.

Forthcoming Meetings

The third annual convention and exhibition of the American Society for Steel Treating will be held in the Manufacturers Building, State Fair Grounds, Indianapolis, Ind., during the week of September 19 to 24 inclusive.

The annual congress of the National Safety Council will be held at Boston, Mass., during the week of September 26. C. W. Price, 168 North Michigan Ave., Chicago, Ill., is general manager.

The twelfth annual convention of the American Manufacturers Export Association will be held in the Waldorf-Astoria Hotel, New York City, on October 5 and 6. A. W. Willmann is secretary.

The fifth annual convention of the Society of Industrial Engineers will be held at Springfield, Mass., Oct. 5, 6 and 7.

A joint meeting of the American Society of Mechanical Engineers, the Society of Automotive Engineers and the Army Ordnance Association will be held at Aberdeen, Md., Friday, October 7.

The annual meeting of the National Association of Purchasing Agents will meet in the Claypool Hotel, Indianapolis, Ind., on Oct. 10 to 13, inclusive. L. F. Boffey, 19 Park Place, New York City, is secretary.

The American Gear Manufacturers Association will hold its semi-annual meeting at Rochester, N. Y., October 13, 14 and 15. F. D. Hamlin, 4401 Germantown Ave., Philadelphia, Pa. is secretary.

The National Machine Tool Builders' Association will hold its fall meeting at the Hotel Astor, New York City, October 18, 19 and 20.

The third annual convention and exhibition of the American Gas Association will be held in the Congress and Auditorium Hotels, Chicago, Ill., on Nov. 7 to 12.

NEW *and* ENLARGED SHOPS

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Md., Baltimore—The Machinery Clearing House Corp., Coca-Cola Bldg.—
One 16 in. x 8 ft. lathe.
One screw machine to take 2¼ in. stock.
One lathe, 18 to 20 in. swing with 8 to 10 ft. bed.
One lathe, 24 in. swing to take 6 ft. 6 in. between centers.
One Lodge & Shipley, LeBlond or American motor driven lathe.

N. J., Jersey City—The Great Atlantic & Pacific Tea Co., Bay 1st and Provost Sts.—machine tools including planers, power hammers, etc., for new motor truck body shop.

N. Y., East Aurora—F. Slade—coal hoist or elevator, Galon preferred.

N. Y., New York—J. F. Oberle, 238 West 42d St.—Buffalo forge combination slitting shear, punch and bar cutter, etc.

N. Y., New York—Reliable Iron Machine Wks., 5311 2nd Ave.—punch and shear.

Pa., Sunbury—The Butter Krust Baking Co., c/o B. Apple—mixers, conveying systems, etc.

Ga., Milltown—Lanier County Lumber Co., R. Henderson, Purch. Agt.—steam nigger, combination edger, two-saw board trimmer, log kicker and roller, (used).

La., New Orleans—The Dixie Auto Repair Shop, 1412 North Rampart St.—equipment for auto repair shop including medium size lathe (new or used).

La., New Orleans—The E. A. Dumas Co., Inc., 741 St. Charles St.—automobile repair shop equipment.

La., New Orleans—The Orleans Steel Products Co., Inc., 1021-25 Bienville St., or P. O. Box 274—One Loy & Nawrath, G. A. Ohl or equal $\frac{1}{8}$, $\frac{3}{16}$ or 7/32 capacity, 10 ft. 6 in. power cornice press brake, (used). One $\frac{1}{8}$, $\frac{3}{16}$ or $\frac{1}{4}$ capacity G. A. Ohl or Loy & Nawrath power squaring shear 10 ft. 6 in. long, belt or direct motor driven, (used). One 24 x 24, 10 ft. clear bed, late model planer, (used).

N. C., Wilmington—The Atlantic Coast Line RR., Nutt St.—truck drills.

Va., Richmond—W. Moore & Co., 17th and Dock Sts., manufacturer of fire brick sewer pipe, etc.—one 18 in. Bonnot mill, and No. 8 and No. 10 Cyclone dust collector.

Ill., Chicago—The Chicago Metal Mfg. Co., 216 West Ontario St.—one 10 ft. 6 in., 10 ga. power press or brake.

Ill., Kankakee—W. C. Burrell—one 14 in. engine lathe, one 12 in. or 14 in. screw machine and one cylinder grinder.

O., Cincinnati—Norton Broadway Mchy. Co., 236-8 Bway., W. D. Norton, Purch. Agt.—one 10 in. extending to 16 ft. old style horizontal boring mill with 1 or 2 heads, one 500 lb. belted power hammer and one set of 10 to 12 in. boilermakers plate rolls, (used).

O., Columbus — The Columbus Forge & Iron Co., West 1st Ave., D. W. Singleton, Secy. and Treas. — several large steam hammers, presses and other equipment for factory.

O., Columbus—The Gem Gasoline Lock Co., Long St. and Grant Ave., O. Redman, Genl. Mgr. — machinery, including lathe, drill press and shapers.

Wis., Antigo—Matlefs Bros. Co., G. Matlefs, Purch. Agt.—wood turning lathes, sanders and gluers.

Wis., Hartford—H. Lohr—presses, lathes, vises, etc. for automobile repair shop.

Wis., Milwaukee—The Smith Specialty Mfg. Co., 503 East Water St., H. Smith, Purch. Agt.—24 in. crank shaper, back geared.

Wis., North Milwaukee—J. Greenbaum Tanning Co.—vats.

Wis., Saukville—A. Horn—machinery for automobile repair work.

Wis., Tomahawk—The Tomahawk Steel and Mchy. Co.—punch and drill presses.

Minn., Minneapolis — The Sturr-Bullard Motor Co., 1208 Harmon Pl.—machine shop equipment.

Mo., Kansas City—The Bd. Educ.,, c/o J. B. Jackson, Secy.—manual training equipment for Woodland School.

Tex., Austin—The Pitts-Noyes Co., Inc., 112 East 5th St., H. Pitts, Pres.—equipment for foundry including small and medium punch presses, 16 in. shapers, filing machines, high speed drills, surface and universal grinders, $\frac{1}{2}$ to 10 hp. lathes, 24 in. x 10 ft., 3 phase, 60 cycle, 220 volt. motors.

Que., Montreal—The Kennedy Taxi Co., Cathcart St., T. Kennedy, Purch Agt.—$2,800 worth of equipment for auto repair shop.

Mass., Boston—The United Shoe Mchy. Corp., 205 Lincoln St.—stripping machinery for 16 gage steel.

Md., Baltimore—The Chapman Self Locking Nut Co., 721 Equitable Bldg.—special milling machines for the manufacture of patented self-locking railroad nut.

Fla., Jacksonville—Certain Thyson Milk Co., Myrtle Ave.—ice machine, 30 ton capacity, motor driven, vertical inclosed type, with or without motor, with high side for 25 ton shell-type brine cooler.

Fla., Sarasota—The Sarasota Bee Co., C. M. Biorseth, Genl. Mgr.—complete machinery for the manufacture of bee hives, bee-keepers' supplies, window sash, door frames, blinds, etc. Prefer individual machines, motor power.

Ga., Ideal—The Ideal Bauxite Mining Co., W. Hite, Genl. Mgr.—crusher, grinder or pulverizer that will reduce bauxite so it will pass through 100 mesh screen, capacity 10 ton per hour. Not interested in crusher that will crush limestone or granite.

Ga., Madison—The 8th Dist. Agricultural & Mechanical School, B. F. Gay, Pres.—machinery for canning plant.

Ill., Chicago—The Alto Mfg. Co., 1801 Cornelia St.—one 36 in. square shear screw machine, $\frac{5}{8}$ in.

Ind., Mitchell—W. T. Moore—machinery to grind crushed limestone to flour form.

Wis., Haugen—The Haugen Box & Crating Co., J. E. Lee, Purch. Agt.—modern mill-working machinery and machine tools including Duplex lathes, planers, sawing machines and presses.

Wis., Neillsville—The Sweet Shop—machinery for making candy.

Wis., Tomahawk—The Tomahawk Steel & Iron Wks., W. Drever, Pres.—drilling machines, 7-8 overhead traveling cranes, several ton presses, punches and complete set of light and heavy machines.

Ia., Oskaloosa—The Artificial Ice Co., R. F. Panders, Mgr.—machinery for artificial ice plant.

Ont., Toronto—The Automobile Service Syndicate, 21 Dundas St., E.—machinery for automobile repair shop.

Ont., Toronto—The Durant Motors Inc.—machinery for automobile manufacturing plant at Leaside.

Metal Working Shops

NEW ENGLAND STATES

Mass., East Boston (Boston P. O.)—B. M. Miller, 491 Saratoga St., has awarded the contract for the construction of a 1 story, 100 x 125 ft. garage, etc., on Saratoga St. Estimated cost, $50,000.

Mass., Northampton — F. C. Magrannis, Court St., is having plans prepared for the construction of a 1 story, 100 x 125 ft. garage and service station on King and North Sts. Private plans.

Mass., Springfield—W. J. Hyland Mfg. Co., 151 Dwight St., is receiving bids for the construction of a 3 story, 50 x 90 ft. plant on Liberty St., for the manufacture of heaters. Private plans.

Mass., Watertown — C. H. Hodge, 45 Bates Rd., will build a 1 story, 80 x 135 ft garage on Salem St. Private plans.

MIDDLE ATLANTIC STATES

Md., Baltimore—C. R. Bealmear, Title Bldg., represent interests who plan to build a 5 story garage and service station on Linden and Monument Sts. Architect not selected.

Md., Baltimore — The Cook Nuts Corp., Paca and Lexington Sts., has awarded the contract for the construction of a 4 story, 56 x 104 ft. factory on 1st and Toon Sts., to include a machine shop, etc. Estimated cost, $85,000. W. R. Spruill, Pres.

Pa., New Brighton—The Wyckoff Drawn Steel Co., Frick Bldg., Pittsburgh, will build a 1 story, 60 x 200 ft. factory at Wyckoff, near here. Estimated cost, $75,000.

Pa., Philadelphia—W. Price, c/o S. Tyre, Archt., 1509 Arch St., is having plans prepared for the construction of a 1 story sales and service station on 29th and York Sts. Estimated cost, $75,000.

The Weekly Price Guide

This Week's Market

Pittsburgh quotes soft steel bars at $1.65@$1.70, structural shapes at $1.70@$1.75 and plates at $1.60@$1.70 per 100 lb. Mill shipments, New York, of steel bars and bar shapes are quoted at $2.03, plates at $2.03@$2.08 and structural shapes at $2.03@$2.18 per 100 lb. Steel prices in the New York warehouses remain firm, with the exception of cold finished shafting and screw stock which are quoted at $4.03 as against $4.23 and cold-drawn flats, squares and hexagons, quoted at $4.53 as against $4.73. The new Pittsburgh basing card of Sept. 16 quotes increased discounts on black and galvanized wrought pipe.

Chicago reports increases in discounts ranging from 6 per cent to 7 per cent on wrought steel pipe. Advances of ½c. to 1c. per lb. are quoted on old metals. Chicago also reports a slight decline in babbitt metal prices.

Tin is quoted in New York at 27c. as against 27½c. per lb. Linseed oil has advanced 2c. in New York and 3c. per gal. in Chicago.

Cleveland prices have remained firm throughout the week.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	*$24.50
Northern Basic	†21.52
Southern Ohio No. 2	†22.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	†30.26
BIRMINGHAM	
No. 2 Foundry	*20.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	†21.76
Virginia No. 2	†28.74
Basic	†19.76
Grey Forge	†21.26
CHICAGO	
No. 2 Foundry local	†21.00
No. 2 Foundry, Southern, sil 2.25@2.75	†26.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	†22.96
Basic	†21.46
Bessemer	†21.96

*F. o. b. furnace. † Delivered.

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.25	3.28	3.10	3.38
No. 12	2.35	3.33	3.15	3.43
No. 14	2.45	3.38	3.20	3.48
No. 16	2.55	3.48	3.30	3.58
Black				
Nos. 17 and 21	2.60	3.80	3.55	3.95
Nos. 22 and 24	2.65	3.85	3.60	4.00
Nos. 25 and 26	2.70	3.90	3.65	4.05
No. 28	2.75	4.00	3.75	4.15
Galvanized				
Nos. 10 and 11	2.75	4.00	3.75	4.15
Nos. 12 and 14	2.85	4.10	3.85	4.25
Nos. 17 and 21	3.15	4.40	4.15	4.55
Nos. 22 and 24	3.30	4.55	4.30	4.70
No. 26	3.45	4.70	4.55	4.85
No. 28	3.75	5.00	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of Sept. 16, 1921:

Steel			Iron		
Inches	Black	Galv.	Inches	Black	Galv.
BUTT WELD					
1 to 3	68½	56	¾ to 1½	39½	24½
LAP WELD					
2	61½	49	2	34½	20½
2½ to 6	65½	53	2¼ to 4	37½	24½
7 to 8	62½	49	4½ to 6	37½	24½
9 to 12	61½	48	7 to 12	35½	22½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66½	55	1 to 1½	39½	25½
2 to 3	67½	56			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59½	48	2	35½	22½
2½ to 4	63½	52	2½ to 4	38½	26½
4½ to 6	62½	51	4½ to 6	37½	25½
7 to 8	58½	45	7 to 8	30½	18½
9 to 12	52½	39	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	60%	46%	52½%	43½%	68½%	56%
2½ to 6 in. steel lap welded	51%	37%	55½%	40½%	65½%	53%

Malleable fittings. Classes B and C, Banded, from New York stock sell at plus 6%. Cast iron, standard sizes, 15% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (heavy)	5.00	6.50	8.25
Spring steel (light)	6.00	6.50	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.03
Hoop steel	3.88	3.29	3.48
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	4.85	2.74	5.23
Cold finished shafting or screw	4.03	3.85	4.00
Cold finished flats, squares	4.53	4.35	4.50
Structural shapes (base)	2.88	2.74	2.88
Soft steel bars (base)	2.78	2.64	2.78
Soft steel bar shapes (base)	2.78	2.64	2.78
Soft steel bands (base)	3.43	....	.....
Tank plates (base)	2.88	2.92½	2.88
Bar iron (mill 2.25)	2.78	3.52	2.78
Drill rod (from list)	55@60%	55%	50%

Electric welding wire........ New York $\frac{3}{32}$, 8½c. per lb. ⅛—7.15c.; $\frac{5}{32}$ to ¼—6.75c. Swedish iron sells at 18½c. per lb. in Chicago

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	12¾@13
Tin, 5-ton lots, New York	27.00
Lead (up to carlots), St. Louis, 4.35; New York	4.75
Zinc (up to carlots), St. Louis, 4.60; New York	5.00

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.00	25@26	21.00
Antimony (Chinese), ton spot	5.25	6.00	6.00
Copper sheets, base	19.75	20.50	19.50
Copper wire (carlots)	15.50	15.50	14.00
Copper bars (ton lots)	18.00	22.00	17.50
Copper tubing (100-lb. lots)	19.50	23.00	19.50
Brass sheets (100-lb. lots)	15.25	18.00	15.25
Brass tubing (100-lb. lots)	18.00	20.00	18.00
Brass rods (1,000-lb. lots)	13.25	15.50	13.25
Zinc sheets (casks), (8% dis. carlots)	11.00	11.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ½), (case lots)	19.50	23.50	17.50
Babbitt metal (best grade)	70.00	36.50	32.00
Babbitt metal (commercial)	30.00	13.50	8.00

—Shop Materials and Supplies

MONEL METAL—Base price in cents per pound, f.o.b. Bayonne:

Shot	35.00	Hot rolled machine rods (base)	53.00
Blocks	35.00	Hot rolled rods (base)	42.00
Ingots	38.00	Cold rolled rods (base)	56.00
Sheet bars	40.00	Hot rolled sheets (base)	55.00

Special Nickel and Alloys

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	9.50	9.00	10.00
Copper, heavy, and wire	9.00	9.00	9.00
Copper, light, and bottoms	7.00	7.00	8.00
Lead, heavy	3.25	3.00	3.75
Lead, tea	2.00	2.00	2.75
Brass, heavy	5.00	5.00	7.50
Brass, light	4.00	3.00	4.50
No. 1 yellow brass turnings	4.50	4.00	5.00
Zinc	2.50	2.00	2.50

TIN PLATES—American Charcoal Plates—Bright

	New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:			
IC, 20x28, 112 sheets	21.50	......	....
IX, 20x28, 112 sheets	24.00	......	....
IXX, 20x28, 56 sheets	13.75	......	....
IXXX, 20x28, 56 sheets	15.50	......	....
IXXXX, 20x28, 56 sheets	17.00	......	....
"A" Charcoal Allaways Grade:			
IC, 20x28, 112 sheets	18.50	......	....
IX, 20x28, 112 sheets	21.50	......	....
IXX, 20x28, 56 sheets	12.25	......	....
IXXX, 20x28, 56 sheets	14.00	......	....
IXXXX, 20x28, 56 sheets	15.75	......	....

Coke Plates, Bright

Prime, 20x28 in.:		(56 sheets)	
80-lb, 112 sheets	13.60	......	....
90-lb., 112 sheets	13.80	......	....
100-lb., 112 sheets	14.00	6.50	....
IC, 112 sheets	14.30	6.65	....
IX, 112 sheets	16.30	......	....
IXX, 56 sheets	9.15	......	....
IXXX, 56 sheets	10.15	......	....
IXXXX, 56 sheets	11.15	......	....

Terne Plate

Small lots, 8-lb. Coating:			
100-lb., 14x20	$7.50	6.25	6.25
IC, 14x20	7.75	6.50	6.50
IX, 14x20	8.00	7.00	7.00

SHOP SUPPLIES

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	—50%	—60%	—60–5%
1⅛ and 1¼x3 in. up to 12 in.	—40%	60–10–10%	—55%
With cold punched sq. nuts	—30%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	—40%	....	.. ..
Up to 1-in. diameter, with cold punched hex. nuts (plus std. extra of 10%)	—30%	....	.....
Button head bolts, with hex. nuts	—20%	390 base	.....
Hex. head and hex. nut bolts	—20%	....	.....
Lag screws, coach screws	—50-10%	....	.....
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	50–10–10%	50–5%
Bolt ends, with hot pressed nuts	—50%	....	.....
Tap bolts, hex. heads	—20%	....	.....
Rivets, 7/16 in. dia. and smaller. *New list*	—50-10%	60-10-10%	—60-10%
Rivets, tinned	—50-10%	60-10-10%	—45%
Semi-finished nuts, all sizes	—70%	75%	50%
Case-hardened nuts	—60%	....	.....
Washers, cast iron, ½ in., per 100 lb.	$5.00	$4.50 off	$4.50
Washers, cast iron, ⅝ in. and larger, per 100 lb	4.25	3.75 off	4.50
Washers, round plate, off list per 100 lb.	3.00	....	.....
Nuts, hot pressed, sq. Off list	2.00	3.00	3.25
Nuts, hot pressed, hex. Off list	2.00	3.00	3.25
Nuts, cold punched, sq. Off list	1.50	3.00	3.00
Nuts, cold punched, hex. Off list	1.50	3.00	3.00
Rivets:			
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb	$4.40	3.50	3.68
Cone heads, ditto	4.50	3.60	3.78
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	....
⅞ in. diameter *EXTRA*	0.15	....	....
½ in. diameter *EXTRA*	0.50	....	....
1 in. long, and shorter *EXTRA*	0.50	....	....
Longer than 5 in. *EXTRA*	0.25	....	....
Less than 200 lb. *EXTRA*	0.50	....	....
Countersunk heads *EXTRA*	0.35	....	....
Copper rivets	50–10%	40–10%	50%
Copper burs	25–10%	15%	20%

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb.	.055@.09	.09	.10
Wiping cloths per M., 13¼x13¼	....	55.00	55.00
Wiping cloths per M., 13¼x20½	....	65.00	65.00
Sal soda, 100 lbs	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb	2.55	3.25	2.75
Linseed oil, per gal., 5 bbl. lots	.80	.83	.87
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 100 lb.	(Ottawa, .80)	.80	
Coke, prompt furnace	$3.25	Connellsville	
Coke, prompt foundry	4.25@4.50	Connellsville	

Pa., Philadelphia—S. Wilensky, 826 Reed St., has awarded the contract for the construction of a 1 story, 60 x 208 ft. garage at 4028 Poplar St. Estimated cost, $50,000.

Pa., Schwenkville—The Bremer-Talis Co., has had plans prepared for the construction of a 2 story, 60 x 125 ft. sales and service station on Main and Perkimonen Sts. Estimated cost, $100,000. Schermerhorn & Phillips, 430 Walnut St., Philadelphia, Archts.

MIDDLE WEST STATES

Ill., Chicago — The Interstate Garage Corp., 110 North Market St., is having sketches made for the construction of a 10 story, 150 x 200 ft. garage on Wabash Ave. and South Water St. Estimated cost, $225,000. H. D. Jackson, Pres. L. E. Stanhope, 59 East Madison St., Archt.

Ill., Chicago—H. L. Newhouse, Archt., 4630 Prairie Ave., is receiving bids for the construction of a 1 story, 100 x 180 ft. garage at 5018-24 Cottage Grove Ave., for H. Salvat, 5322 Harper Ave. Estimated cost, $50,000.

Ill., Elmhurst—The Crefar Co., 144 York St., has awarded the contract for the construction of a 1 story, 50 x 135 ft. garage. Estimated cost, $55,000. Noted May 26.

Ill., Evanston—V. C. Carlson, 701 Church St., is having plans prepared for the construction of a 1 story, 40 x 130 ft. auto sales and repair shop. Estimated cost, $50,000. Architect not announced.

Ill., Herrin—The Illinois Central R.R., 135 East 11th St., Chicago, has awarded the contract for the construction of a 1 story, 60 x 200 ft. repair shop. Estimated cost, $60,000. Noted July 21.

Ill., Rock Island—J. M. Schaab, 1601 4th Ave., has awarded the contract for the construction of a 1 story, 62 x 150 ft. garage. Estimated cost, $50,000. Noted Sept. 15.

O., Columbus—The Columbus Forge & Iron Co., West 1st Ave., has awarded the contract for the construction of a 1 story, 70 x 200 ft. and 110 x 120 ft. plant. Estimated cost, $50,000. Noted Aug. 11.

Wis., Beloit—The Beloit Iron Wks. manufacturer of paper mill machinery, plans to build a 1 story, 60 x 85 ft. pattern shop and machine shop. Estimated cost, $50,000. Address E. H. Neese, Vice-Pres. Architect not seletced.

Wis., Hartford—H. Lohr is receiving bids for the construction of a 1 story, 50 x 142 ft. garage, etc. on North Main St. Estimated cost, $55,000. Private plans.

Wis., Madison—The University of Wisconsin, M. McCaffrey, Secy., will receive bids until Sept. 26 for the construction of a 1 story addition to its service building and electric sub-station. Estimated cost, $55,000. A. Peabody, Capitol, State Archt.

Wis., Manitowoc—The city, c/o F. L. Alter, City Hall, is having revised plans prepared and will receive bids in October for the construction of a 4 story, 210 x 360 ft. high school. Plans include a machine shop. Estimated cost, $1,400,000. Perkins, Fellows & Hamilton, 814 Tower Ct., Chicago, Archts.

WEST OF THE MISSISSIPPI

Colo., Denver—The General Iron Wks. Co., 1720 California St., will probably receive bids in December for the construction of an iron foundry on 33d and Blake Sts. Estimated cost, $500,000. J. R. Henderson, 1720 California St., Engr.

Colo., Denver—The Super-Service Motor Assn., Colorado Bldg., plans to build a 3 story, 125 x 250 ft. co-operative motor repair shop on Sheer Blvd., Bannock St. and West 7th Ave. Estimated cost, $300,000. H. W. J. Edbrooke, Tabor Opera House Bldg., Archt.

Ia., Des Moines—J. P. Condon and G. E. Davis, 3200 Ingersoll Ave., have awarded the contract for the construction of a 2 story, 135 x 167 ft. garage. Estimated cost, $60,000.

Minn., Minneapolis — The Sturr-Bullard Motor Co., 1208 Harmon Pl., has awarded the contract for the construction of a 2 story, 75 x 120 ft. or 75 x 200 ft. garage on La Salle Ave. and 13th St. Estimated cost between $45,000 and $65,000.

Mo., Eldon—The Chicago, Rock Island & Pacific R.R., 137 West Van Buren St., Chicago, Ill., has awarded the contract for the construction of a 1 story round house, here. Estimated cost, $50,000.

Mo., Trenton—The Chicago, Rock Island & Pacific R.R., 137 West Van Buren St., Chicago, Ill., will build a 1 story, 87 x 400 ft car repair shop. Estimated cost, $60,000. Noted June 2.

CANADA

Ont., Leaside—The Durant Motors Inc., Toronto, plans to build a 3 story, 130 x 600 ft. factory, here, for the manufacture of automobiles. Estimated cost, $800,000.

Ont., Toronto—The Automobile Service Syndicate, 21 Dundas St., E., is having plans prepared for the construction of a 3 story garage on Dundas St. Estimated cost, $50,000. N. A. Armstrong Co., Ltd., 7 King St., E., Archts.

General Manufacturing

NEW ENGLAND STATES

Me., Farmington — The Franklin Farm Products Co. has awarded the contract for the construction of a 1 story, 30 x 100 ft. canning factory.

Mass., Fall River—The Amer. Printing Co., 56 Water St., (textile fabrics), has awarded the contract for altering and building additions to plant. Estimated cost, $40,000.

Mass., Roxbury (Boston P. O.)—J. Donnelley & Sons, 97 Warrenton St., have awarded the contract for the construction of a 2 story, 60 x 125 ft. plant on School St., for the manufacture of poster advertisement.

R. I., Providence — The Sunshine Ice Cream Co., 372 Cranston St., will build a 2 story, 40 x 80 ft. ice cream plant on Cranston St. Noted June 9.

R. I., Providence—C. S. Tanner Co., 246-256 South Water St., is having plans prepared for the construction of a 2 story, 56 x 60 ft. starch factory and storage building. Estimated cost, $40,000. W. R. Walker & Son, 49 Weybosset St., Archts.

MIDDLE ATLANTIC STATES

N. Y., Amsterdam—The Mohawk Carpet Mills, Inc., 57 Lyons St., have awarded the contract for the construction of a 6 story, 56 x 60 ft. addition. Estimated cost, $275,000. Noted July 21.

Pa., Braddock—B. Markvitz Baking Co., 1019 Talbot Ave., is receiving bids for the construction of a 3 story, 70 x 75 ft. bakery. Estimated cost, $75,000. W. M. Williams, Magee Bldg., Pittsburgh, Archt.

Pa., Hollidaysburg—The Blair Ice and Storage Co., 1112 Allegheny Ave., recently organized with $100,000 capital stock, plans to build a 4 story cold storage plant. G. B. Miller, Pres. Estimated cost, $100,000.

Pa., Monessen—The Reliable Upholstering Co. is receiving bids for the construction of a 3 story, 23 x 100 ft. factory. Estimated cost, $25,000. J. M. Beal & Son, Monessen, Archts.

Pa., Philadelphia—M. Polin, 5th and Pine Sts., will soon award the contract for the construction of a 1 and 2 story, 12 x 22 ft. and 22 x 80 ft. factory at 1520 North Broad St., for the manufacture of woolen goods. L. B. Rothchild, 1210 Sansom St., Archt.

Pa., Pittsburgh—The Air Reduction Co., 342 Madison Ave., New York, is having sketches made for the construction of a 2 story oxygen plant on Ridge Ave., here. Estimated cost, $250,000. Francisco & Jacobus, 511 5th Ave., New York, Archts. and Engrs.

Pa., Sunbury—The Butter Krust Baking Co., c/o B. Apple, has awarded the contract for the construction of a 2 story, 70 x 130 ft. bakery at 249 Eckman Ave. Estimated cost, $150,000. Noted Aug. 18.

Pa., Williamsport—C. A. Reed & Co., Laurel and Willow Sts., will soon award the contract for the construction of a 4 story, 70 x 180 ft. factory on Chestnut St., for the manufacture of paper goods and novelties. Estimated cost, $100,000. Noted July 28.

MIDDLE WEST STATES

Ill., Chicago—W. G. Kohlfeldt, Archt., 400 North Michigan Ave., is receiving bids for the construction of a 1 story, 76 x 133 ft. noodle factory on State and 46th Sts., for the Klein Noodle Co., 3713 Wentworth St. Estimated cost, $25,000.

Ill., Chicago—The Mothers Wet Wash Co., 6337 North Clark St., is having plans prepared for the construction of a 1 story, 60 x 125 ft. laundry on Lawrence Ave., near Irving Ave. Estimated cost, $40,000. C. E. Pearson, 1930 North Keystone Ave., Archt.

Ill., Moline—The Moline Daily Dispatch, 1509 3rd. Ave., is having plans prepared for the construction of a 2 story publishing plant. Estimated cost $150,000. Clausen & Kruse, Central Office Bldg., Davenport, Ia., archts.

Ill., Mt. Vernon—The Faulkner Candy Co., c/o W. H. Faulkner, plans to build a 3 story factory. Estimated cost, $50,000. Architect not selected.

O., Cleveland—The R. B. Biscuit Co., 2522 Carroll Ave., has awarded the contract for the construction of a 1 story, 32 x 107 ft. addition to its factory. Estimated cost, $25,000.

Wis., Clinton Junction — The Bowman Dairy Co., 140 West Ontario St., is having plans prepared for the construction of a 1 story, 57 x 200 ft. bottling plant. Estimated cost, $60,000. F. B. Gray, First Natl. Bank Bldg., St. Louis, Mo., Archt.

Wis., Jefferson—C. A. Baumann is having plans prepared for the construction of a 2 story, 60 x 95 ft. factory for the manufacture of cheese. Estimated cost, $40,000. Private plans.

Wis., Milwaukee—The Red Star Yeast and Products Co., 79 Buffalo St., has awarded the contract for the construction of a 50 x 100 ft. addition to its vinegar plant on 27th St. and St. Paul Ave. Estimated cost, $15,000. Noted Aug. 25.

Wis., Portage—The Portage Co-operative Canning Co., c/o W. H. Hallwell, Pres., Michel Bldg., has purchased a site and plans to build a 3 story, 60 x 210 ft. canning plant. Estimated cost, $275,000. Architect not selected.

Wis., Sauk City—The Sauk City Canning Co. plans to construct a cannery, to include a 3 story, 80 x 80 ft. main building, a 1 story, 32 x 40 ft. boiler house and a 2 story, 75 x 120 ft. warehouse. Estimated cost between $75,000 and $80,000. J. Dresen, Sauk City, Archt. Noted Sept. 8.

Wis., Waukesha—The Manitowoc Church Furniture Co., has had plans prepared for the construction of a 1 story, 60 x 150 ft. factory on Main St. Estimated cost, $60,000. C. F. Schuetze, Mgr. Private plans.

WEST OF THE MISSISSIPPI

Ia., Davenport—The Davenport Ice Co., 1st and Myrtle Sts., plans to build a 2 story plant for the manufacture of ice. Estimated cost, $75,000. Architect not selected.

Ia., Davenport — Kambach & Kettman Leather Co. plans to build a 2 story, 37 x 80 ft. factory. Estimated cost, $50,000. Architect not selected.

Ia., Oskaloosa—R. F. Panders, Mgr. of the Artificial Ice Co., has awarded the contract for the construction of a 2 story cold storage plant. Estimated cost, $55,000.

Kan., Hutchinson—The Hutchinson Office Supply Printing co. c/o G. Hanson, has awarded the contract for the construction of a 2 story, 60 x 80 ft. printing plant. Estimated cost, $60,000.

Mo., Kansas City—The Kelly Mill Co., c/o A. B. Kelly, Pres., Rochester and Park Sts., is having plans prepared for the construction of a flour mill. Estimated cost, $500,000. Architect not announced.

Mo., Sedalia—Swift & Co., c/o G. H. Trader, local Mgr., will soon award the contract for the construction of a 2 story, 100 x 200 ft. packing plant. Estimated cost, $175,000. Architect not announced.

Okla., Oklahoma City—The Smith Baking Co., 437 West Park St., plans to build a 2 story bakery on 39th and Oklahoma Aves. Estimated cost, $150,000. Architect not selected.

Tex., Amarillo—The Chicago, Rock Island & Pacific R.R., 139 Van Buren St., Chicago, Ill., has awarded the contract for the construction of a 92 ft. round house, containing 8 stalls. Estimated cost, $50,000.

American Machinist

Volume 55 NEW YORK, SEPTEMBER 29, 1921 Number 13

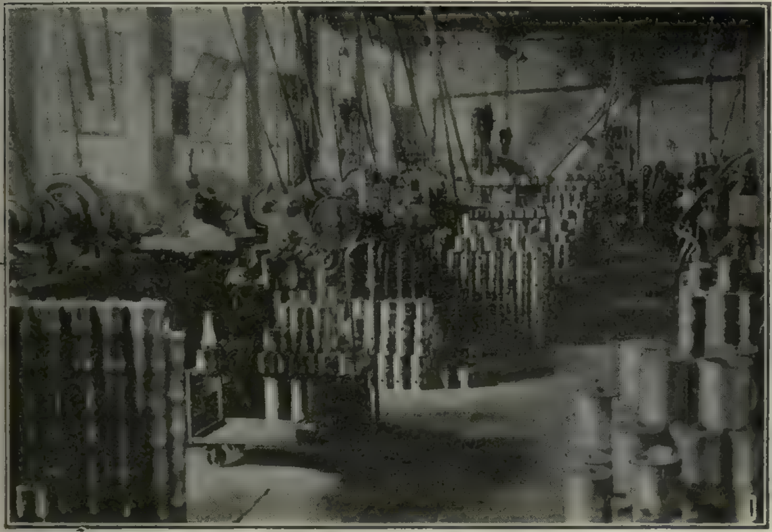
493.

Manufacturing Automobile Pistons in a Jobbing Shop

Manufacturing on a Small Scale Made Possible in the Job Shop by the Use of Simple Tools and Fixtures

BY ROBERT MAWSON

READERS of technical magazines are well aware of the many excellent articles which have been published describing the manufacture of automobile pistons. The builders of automobiles however have the advantage of making only the particular type of pistons used in their cars, and can tool up in the way of jigs, fixtures and special machines accordingly.



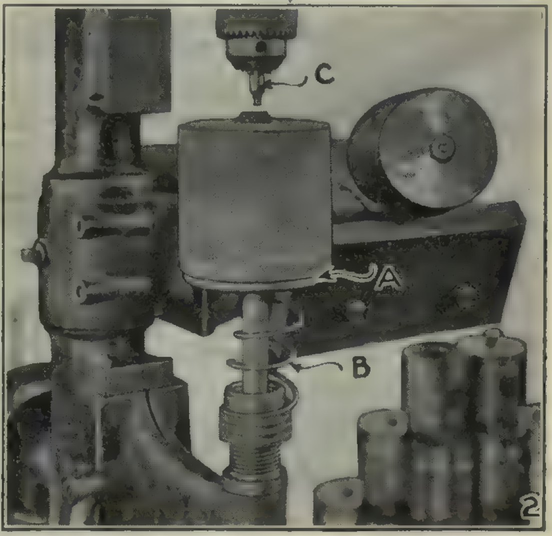


FIG. 1. THE PISTON DEPARTMENT. FIG. 2. CENTERING THE HEAD END

The Dyer Co., Cambridge, Boston, Mass., however, had to meet a different proposition in that it is producing pistons for a variety of different makes of automobiles and the tools employed must be designed to be somewhat flexible so that they may be changed if necessary to machine other pistons slightly different in design.

In Fig. 1 is shown a portion of the piston machining department, from which some idea of the quantity of various types of pistons made may be gathered.

Some of the pistons to be seen are in the rough while others are ready for the final operations of grinding and inspection. It will also be observed that the shop is kept in an orderly manner; the aisles free from castings, and the pistons stacked against the machines in a manner convenient for the operator.

A casual examination of automobile pistons will show how they vary in design, though many of the variations are so slight that the layman often wonders if it would not be an advantage if some standard were adopted, as by so doing repair parts could be obtained more readily and at less cost.

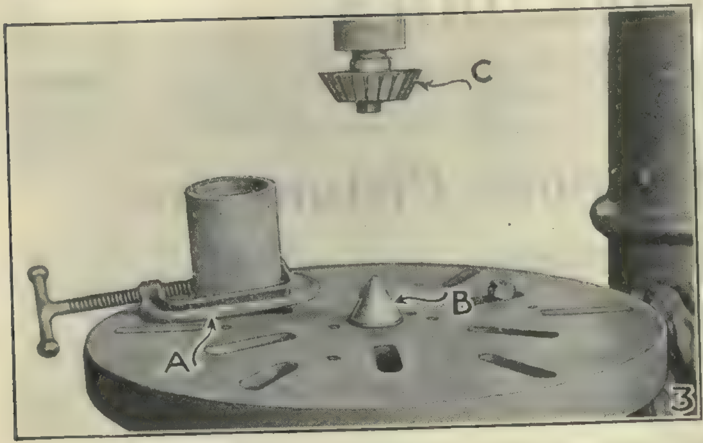
So long as each manufacturer thinks that his automobile and its particular parts are the best on the market, the user of cars will have to wait for a time before standardized parts are made.

The first operation in machining the pistons is shown in Fig. 2. This is centering the head end. The piston is located on the snout-nosed center *A* which is forced upward by the spring *B*. Should the operator crowd the center-drill *C* too much, the work will be pushed down against the spring and many breakages of drills will be prevented. One of the pistons after being centered in this operation is shown at the right of the drilling machine.

The next operation is centering the open end of the piston and the drilling machine set up for this purpose is shown in Fig. 3. The piston is held by means of a C-clamp as shown at *A* and placed with the end centered in the previous operation on the center *B*. The 45-deg. cutter *C*, attached to the machine spindle, is then fed down into the open end of the piston for a slight distance, thus forming a beveled seat.

The pistons are then rough-turned, and a rear view of one of the lathes used, with the piston removed, is shown in Fig. 4. The open end of the piston is placed on the snout-nosed center *A* and supported at the other end by the tail center of the lathe.

The driver *B* fits inside the piston between the pin bosses, thus adapting itself to any variations in the castings. The turning tool may be seen at *E*. In this operation the pistons are left about $\frac{3}{32}$ in. oversize. Fig. 5 shows the operation of rough-facing the head end, the



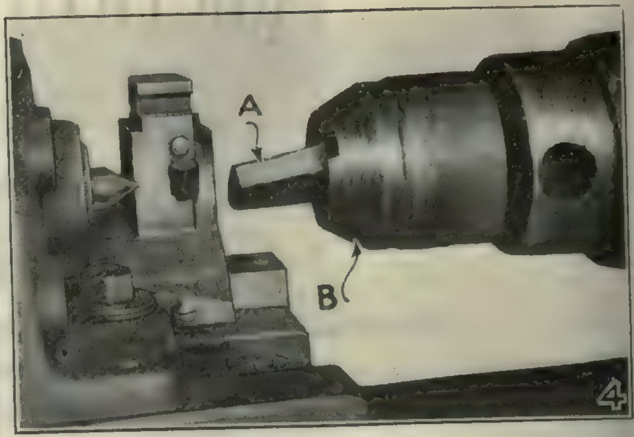
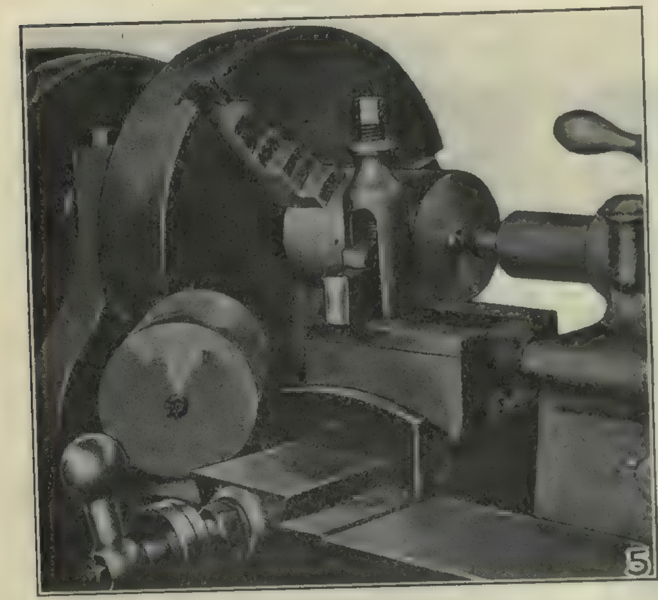


FIG. 3. CENTERING THE OPEN END. FIG. 4. ROUGH-TURNING THE BODY



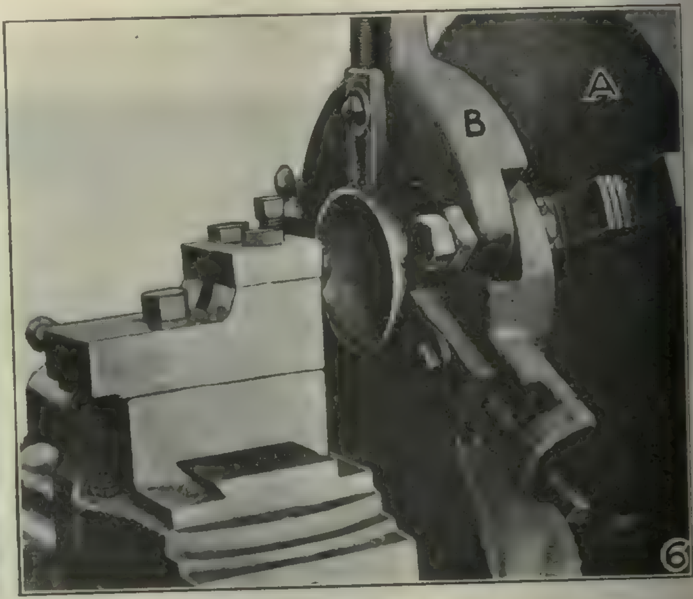
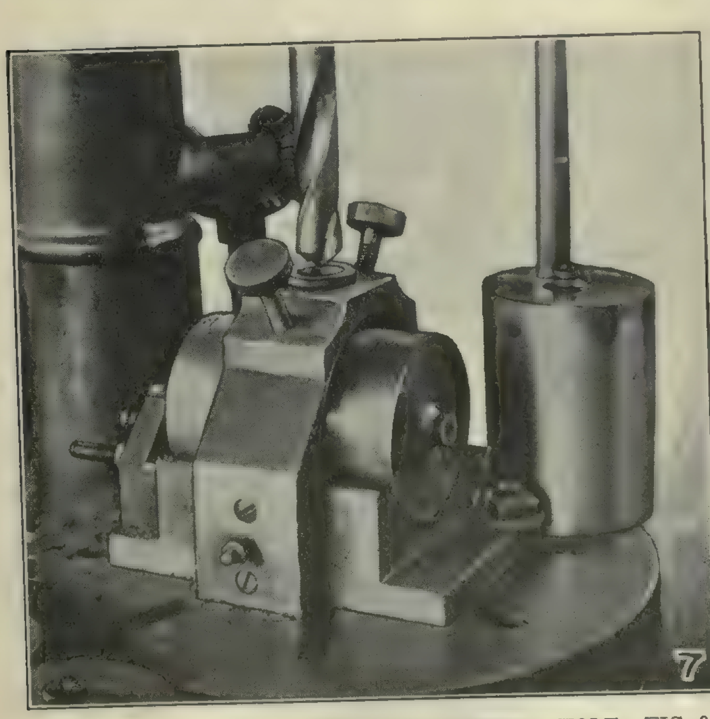


FIG. 5. ROUGH-FACING THE HEAD END. FIG. 6. FACING THE OPEN END



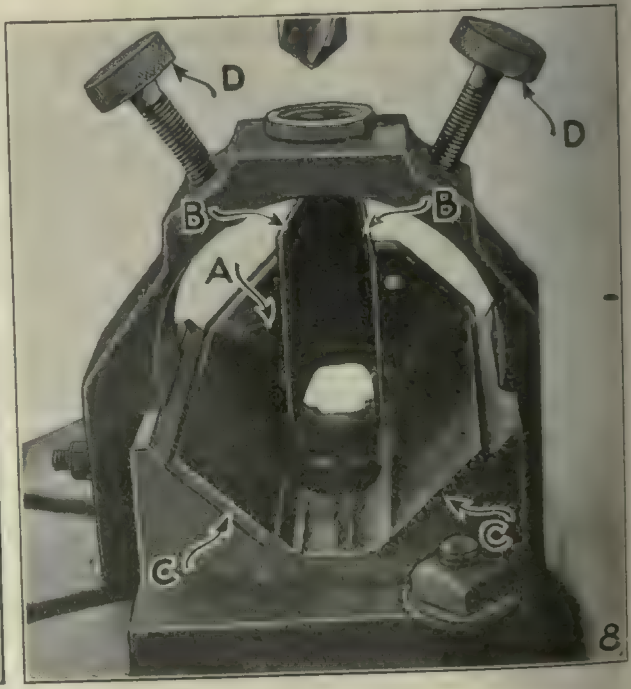


FIG. 7. DRILLING WRISTPIN HOLE. FIG. 8. JIG FOR DRILLING WRISTPIN HOLE

piston being left about $\frac{1}{8}$ in. overlength. The piston is held in a three-jawed universal chuck, and the lathe carriage is locked after it has been set to the proper position to give the desired length. The cross-feed of the lathe is then put into operation and the piston end faced. One of the pistons before being faced is shown resting on the lathe carriage.

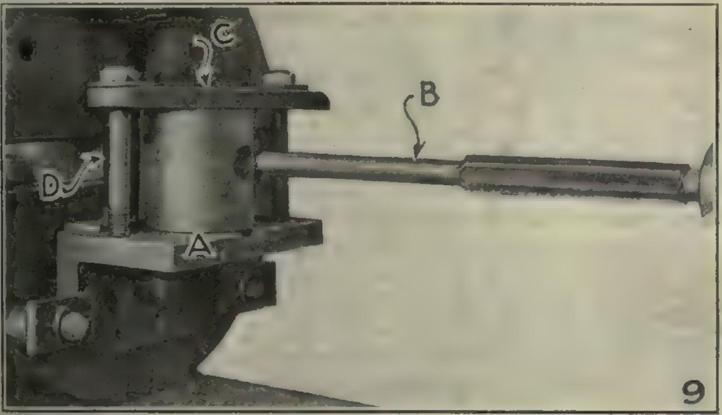
The next operation is facing the open end and is illustrated in Fig. 6. The piston is located against the end of the lathe spindle and held by means of the three-jawed universal chuck *A*. The outer end of the piston is supported by the steadyrest *B*. With the piston in this position the open end is faced, leaving the length about $\frac{1}{16}$ in. over the finished dimension. The beveled surface is also trued up at this setting. The piston is then finish-turned leaving it about $\frac{1}{32}$ in. over size. This operation is performed in a lathe similar to that shown in Fig. 4.

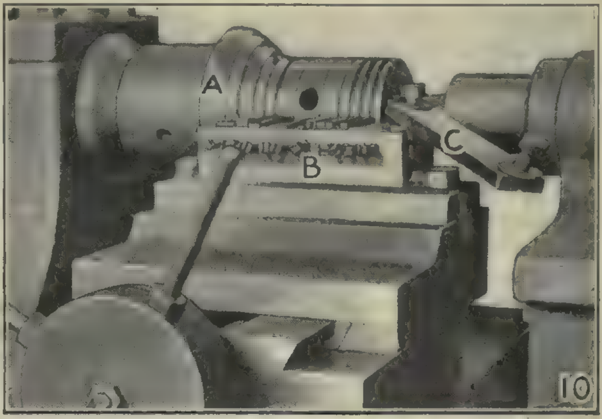
The piston is then finish-faced to length. For this operation it is located on and driven by a snout-nosed center of similar design to that already described. After the piston has been removed from the lathe the length is given a final check with snap gage to test its accuracy.

The piston is now ready for drilling the wristpin holes, which is the next operation and is shown in Fig. 7. The piston is located in the jig against the stop *A*, Fig. 8. Two steel plates *B* are attached to the rear of the jig and straddle the wristpin bosses, the piston being placed in the jig with the open end toward the rear wall. This method of locating insures drilling the holes in the correct position in relation to the wristpin bosses.

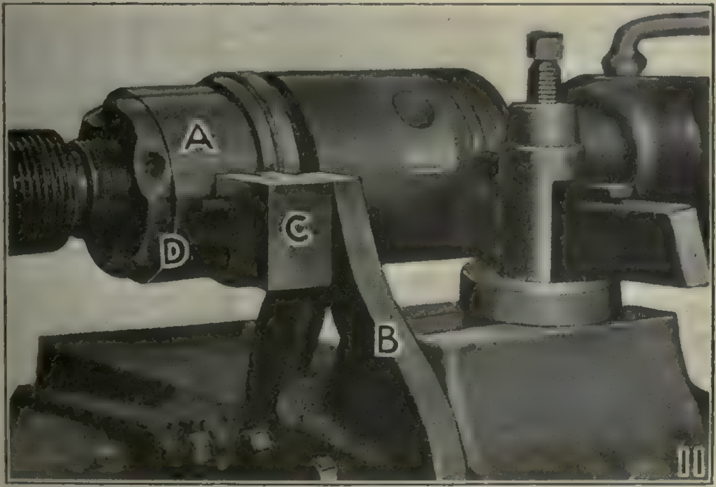
Packing strips *C* are employed in the jig so that it may be used for other diameters of pistons which have wristpin holes at the same distance from the open end. After the piston has been located as described, the two knurled screws *D* are tightened, thus holding it securely. The hole drilled is $\frac{1}{8}$ in. smaller than the finished size.

The wristpin holes are then reamed as shown in Fig. 9, leaving $\frac{1}{64}$ in. for the final hand-reaming operation. The piston is placed on the angle plate *A* so that the wristpin hole will be central with the lathe center. The reaming bar *B* is then fed through the piston, the clamp *C* holding the piston securely. The rear of the fixture is made with a guide at *D*, the hole being the correct diameter to suit the long pilot on the reamer *B*. It is easy to see how this fixture can be changed to suit various sizes of pistons, it being only necessary to change the position of the angle plate *A*.





FG. 9. REAMING WRISTPIN HOLE. FIG. 10. MACHINING THE GROOVES



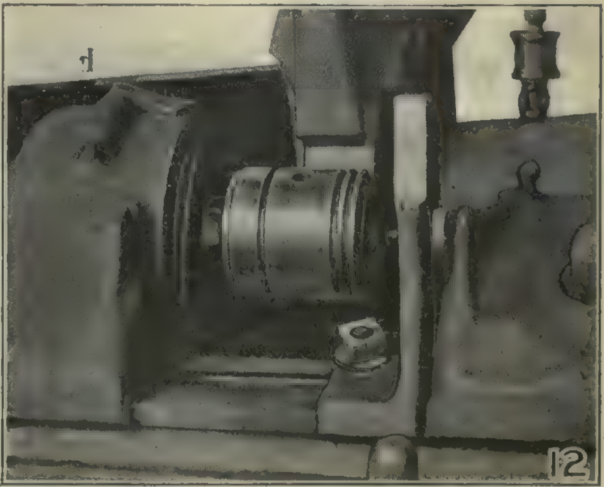


FIG. 11. CUTTING THE RELIEF. FIG. 12. GRINDING THE BODY

Machining the piston ring grooves is illustrated in Fig. 10. The piston is placed on a snout-center at *A*, and supported by the tail center at the head end. The grooving toolblock may be seen at *B*. The various tools are made of rectangular steel bars, separated with spacers of the proper thickness to obtain the correct location of the various grooves.

The tools are set out by means of the screws shown to obtain the desired depth of grooves. After this has been done the clamp *C* is swung into position and the screws tightened to hold the tools rigidly in place.

A variety of pistons can be grooved with this toolhead, it being only necessary to change the separate tools and spacers to conform to the required spacing and depth.

The pistons are then relieved around the wristpin holes, this operation being shown in Fig. 11. The piston is held and driven by means of a snout-nosed center as previously described, the head end being carried on the lathe center.

The cam *A* is made with two depressions which come in line with the wristpin holes of the piston. On the bracket *B*, fastened to the lathe carriage, is attached the block *C* which is provided with a hardened steel roller revolving on the pin *D*.

In operation, the crossfeed screw being disconnected, the roller follows the contour of the former, the tool being held against the piston by means of the weight and the material is turned away as shown by the illustration.

To remove any burrs and to insure a perfect beveled edge the piston is then finish-reamed at the open end.

Grinding is shown in Fig. 12. The piston is held and driven by means of a snout-nosed center of similar design to that already described, the head end of the casting being supported by the tail center. The grinding operation is obvious from the halftone and needs no description.

The boss or tit is then removed from the head end. The head end of the piston is smoothed and polished in a double disk-grinding machine. After this operation it is transferred to the other side of the disk-grinding machine which is provided with a scratch brush to remove burrs or dirt from the grooves.

The piston is now hand-reamed for the wristpin holes and given a final inspection.

The Origin of the Milling Machine

By F. P. Terry
Belfast, Ireland

I have read with pleasure the contribution on this subject by L. L. Thwing, on page 1085, Vol. 54, of *American Machinist*. His sketch, Fig. 1, is particularly interesting but the machine shown is not, I think, entitled to any claim as the first British milling machine; although Mr. Thwing's surmise as to its age being 1845 would be correct. The work shown, a double throw crank, is of a type that came into general use very soon after the invention of Nasmyth's steam hammer in 1839; and the machine above mentioned is no doubt more entitled to rank as one of our earliest single purpose machines, than as the first milling machine.

Having read all the contributions on this subject which have appeared in the *American Machinist* during the past twenty years, I would ascribe the origin of the milling machine in America to Eli Whitney (described by J. W. Roe, page 1037, Vol. 31) and its origin in Britain, if not in the whole world, to Maudsley and Nasmyth.

The evolution of the milling machine may be said to have commenced after the introduction of the slide rest by Maudsley about 1790. It is well known that Maudsley invented many machines and appliances for the manufacture of Bramah locks, some of which, we may safely assume, consisted of revolving cutters used in the lathe and operating upon work fixed in some way to the slide rest. This method was known as hobbing, and in the old days many interesting operations were performed in this way.

Away back in the eighties I was serving my apprenticeship in a shop that constructed a sewing machine having a serrated feed wheel about 3 in. in diameter by 3/8 in. wide. The machining of these wheels, which were completed in the lathe, was looked upon as a fine job for a boy, and many schemes were tried to get on this lathe. I well remember my turn.

The wheels were bored and turned in the usual way, after which they were dropped flat on to a pin in a small fixture attached to the toolpost. For cutting the teeth a hob about 15 in. in diameter by 1 in. wide was placed between the centers. It was correctly threaded to suit the serrations, of teeth, and fluted to present cutting edges but not relieved in any way. It was revolved slowly and the work was fed in to the proper depth, the hob revolving the work and completing the serrating in about two minutes. Considering labor costs of those times, it is doubtful if any method of today would beat this.

This operation appeared very simple, and so it was—after you had bought the secret from the boy who had done the job previously. I well remember spoiling half my first bath before paying up for the secret.

As before mentioned, the pitch of the hob revolved the work, but often upon coming to the last tooth the latter would be left very thin or there would be a wide space. The secret to avoid this was to grip the work when nearly completed and by eye judgment alone retard it slightly or help it along, whichever was preferred, and a perfect finish was obtained.

To return to the subject of milling. In 1802 Maudsley commenced the construction of his blockmaking machinery, and in the same year Bramah took out a patent for a "producing straight, smooth and parallel surfaces on wood," which is further described as making use of tools fixed to and rotating on upright and horizontal shafts, and other tools sliding in stationary grooves. This invention may or may not have been suggested by the work being done by Maudsley at the time, but probably had some influence in introducing the milling machine, as a little later we find (as already described by H. H. Manchester) that attempts were being made to strengthen and arrange wood working machines for the working of metals.

What may be described as the first British milling machine was made by Maudsley in 1829, a sketch of which appears in the "Life of Nasmyth" and in connection with which Nasmyth is credited with the invention of the dividing head. Mr. Nasmyth designed this head together with a revolving cutter to work in the headstock of the lathe for the purpose of milling hexagon nuts with a circular collar; this he describes as so successful that an enlarged edition of this collar nut cutting machine was soon introduced in the works and became a specialty of manufacture. Later, when in business for himself, he manufactured it, and he states that it was in great demand among mechanical engineers. Thus we may assume that the manufacture of milling machines commenced in 1829 by Maudsley and in 1834 by Nasmith, followed later by Whitworth, Smith & Coventry and others.

The machine of Maudsley's, which is on similar lines to that of Eli Whitney, can, I think, be designated the first British milling machine; due allowance is made for other revolving cutter machines of Bramah, of Wilkinson (inventor of boring machines), and the hobbing methods which originated with Maudsley and were carried further by others.

The Economics of Production

VI. THE PRODUCER'S JOB AND PROFITS

By Prof. D. A. McCabe, Ph.D.

WE HAVE TRIED to make clear in the previous articles that production depends upon demand and must be adjusted to it. A point that has come out again and again is that the producer cannot fix both the prices and the quantity to be sold. He may fix a price and accept the decision of the demanders as to the quantity that will be taken. Or he may fix a quantity and then await the decision of the demanders as to the price that will be paid for that quantity. He cannot fix both. It must be understood that when we speak of producers fixing the quantity to be produced, we do not mean that the producers fix the *total* quantity of their kind of goods. Each producer fixes *his own* quantity and that alone. He has no say as to what the total quantity is to be. He has to take his chances on that, unless, of course, he is the only producer in his line. This does not mean merely that he makes a patented or trade-mark article. There may be a dozen different models or types of the same kind of article, all competing for the same demand. The advertising pages of this magazine afford many illustrations of this.

The producer's job is not merely one of estimating the total demand, or that plus guessing what his competitors will do. He must also purchase materials, supplies, and even labor at about the same prices or rates that his competitors pay for them and turn out a product at a total cost that is less than the price the demanders will pay for a goodly quantity. That price can be no greater, of course, than the price asked by his competitors.

When demand is increasing the producer's job is not so difficult. When demand is stationary or declining, he can continue to produce at a profit only if he keeps his costs down inside the price he can get for a reasonable output.

Nor may the individual producers get together and fix by agreement the total quantity to be produced in their line. That is absolutely forbidden by law. The ideal situation in the eyes of the law is one in which each producer adjusts his quantity to the probable demand without any consultation with the other producers as to what they are doing in the way of quantity or what they have in mind in the way of price. The ideal of the lawmakers is not always realized in practice. Yet it is generally true that the individual producer has to adjust his output not only to an estimated total demand but to an estimated total contribution of products from the other producers to meet that demand. He has to guess both on demand and on supply.

On the other side, what the individual producer can do in the way of production to meet the situation as he sees it depends upon his costs of production. He sizes up the probable demand and the probable output of the other producers and estimates the price he can get for this or that quantity. Then he looks to his costs. To a considerable extent these are also beyond his control, as has been pointed out. He must pay about the same prices for such things as coal, pig iron, steel ingots, supplies and equipment as others who use these things in production. The more they are worth to others as means of producing goods for which they find a demand, the higher will the cost of them be to the individual producer. Thus we see the producer standing between certain costs which he does not control, on the one side, and a total demand which he does not control, on the other. Alongside of him stand other producers of the same kind of goods also trying to estimate the total demand. Whatever the total demand turns out to be, it is clear that the quantity that can be sold in the aggregate will depend upon the price at which the goods are offered. It is also clear that each individual producer must be prepared to meet the price at which the others will sell if he is to get for himself his share of the sales. And finally, it is clear that his ability to do that at a profit depends largely upon what it costs him to produce.

The producer's job is not merely one of estimating the total demand, or that plus guessing what his competitors will do. He must also purchase materials, supplies, and even labor at about the same prices or rates that his competitors pay for them and turn out a product at a total cost that is less than the price the demanders will pay for a goodly quantity. That price can be no greater, of course, than the price asked by his competitors.

When demand is increasing the producer's job is not so difficult. When demand is stationary or declining, he can continue to produce at a profit only if he keeps his costs down inside the price he can get for a reasonable output. And this price, be it remembered, is influenced not only by the demand but by what the other producers are willing to accept. If they can produce for lower costs than he can, he must reduce his costs or lose.

It may be seen, therefore, that a business which produces at a profit under ordinary circumstances does it by keeping its costs of production as low, at least, as those of its competitors and lower than the price that the demanders are willing to pay for the quantity produced. If it pays the same prices for machinery, supplies and materials that its competitors pay and pays the same going rates of wages, without sweating its labor, it is doing its job well, as things go. The business may be owned by an individual, by a partnership, or by a corporation. Whatever the form of ownership, its job is the same and the profits are gotten by keeping its costs down below the price the demanders will pay for the total quantity turned out by all the producers in that line.

In the large and complex producing units of today, costs cannot be kept down without the co-operation of most of the persons in the organization. If workmen waste materials, if they leave tools around carelessly to be broken, lost or to gather rust, the costs will mount alarmingly. But the workmen have nothing to gain by this, and few are likely to do it deliberately. On the other hand, costs are affected by the *quantity* of production turned out in a given time for a given expenditure for overhead and wages. If the workmen hang back on production, the costs will rise; if they turn out more, costs will ordinarily fall.

Which of these two policies is to the advantage of the workmen? Is their interest in production different from that of the owners? Are the wage interest and the profits interest inside the same business necessarily in opposition on the matter of the output of the individual workman? We have seen the relation between production and profits. What is the relation between production and wages? That will be the subject of the next article.

Volume of Liquid in a Horizontal Tank

By H. J. Geerlings

The figuring of the amount of liquid contained in a partially filled horizontal cylindrical tank can be facilitated by the use of curves. Fig. 1 shows a curve used in determining the amount of liquid in a tank having flat ends, the inside length and diameter of the tank and the height of the liquid being known.

The method of developing the curve was as follows: Since the areas of two circles are directly proportional to the squares of their diameters, the areas of similar portions of circles are also directly proportional to the squares of the diameters. The curve is an area curve for a cylinder whose diameter is one, being developed by figuring a large number of spherical segments. From the curve, one can get the required per cent of the total area of the circle, which, multiplied by the square of the diameter of the tank in inches and the length in inches and divided by 231, gives the contents in gallons.

The following example shows the calculation necessary, although some of the steps can be combined. Find the volume of liquid standing 36 in. high in a tank 90 in. in diameter and 70 in. long.

Solution:

36/90 = 0.4, or 40 per cent of the diameter.

Following the 40 per cent line to the curve, then down to the horizontal scale, we read 0.293.

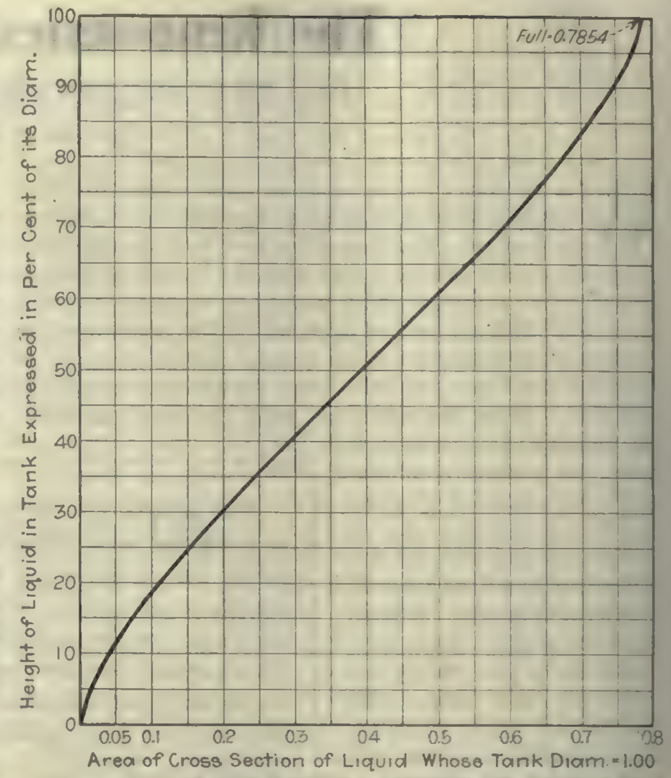


FIG. 1. CURVE FOR FINDING AMOUNT OF LIQUID IN A HORIZONTAL TANK

$0.293 \times (90)^2 = 2{,}374$ sq.in.

$2{,}374 \times 70 = 166{,}180$ cu.in. = volume of liquid

$166{,}180 \div 231 = 719$ gallons = volume of liquid

$166{,}180 \div 1{,}728 = 96.25$ cu.ft. = volume of liquid

Semi-Spherical-Ended Tanks

In developing a curve to find the volume of liquid in a partially filled saucer end of a tank, the radius of the saucer being equal to the diameter of the tank, it is necessary to know only the height of the liquid and the tank diameter. Since the volumes of two spheres are directly proportional to the cubes of their radii, the volumes of similar portions of two spheres are also directly proportional to the cubes of their radii. The curve shown in Fig. 2 is a volume curve for the saucer end of a tank, the diameter of the tank and of the end being unity. The curve was developed by figuring many portions or segments of a saucer end having a diameter of one, and plotting the results.

To use the curve, get the height of the liquid in the saucer in per cent of the total height or diameter of the tank. From this value on the vertical scale, follow the horizontal line to the curve and drop down vertically to the horizontal scale. This reading gives the volume of the section of the saucer whose radius is one. Multiply the reading by the cube of the radius of the saucer to obtain the volume in the section of the saucer required.

The curves are quite accurate, working to within one-half of one per cent when made 10 in. high; and they have been of great help to the author.

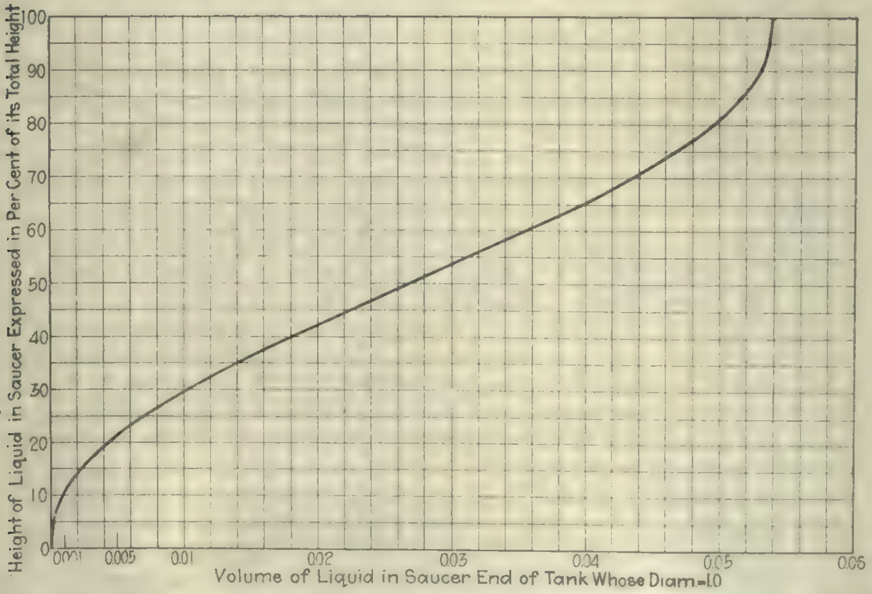


FIG. 2. CURVE FOR DETERMINING THE AMOUNT OF LIQUID IN A SEMI-SPHERICAL TANK END

Grinding Irregular-Shaped Holes on the Bryant Internal Grinding Machine

Handling Combinations of Straight, Tapered and Curved Internal Surfaces — Grinding Done in One Operation—Laying Out Special Control Plates

SPECIAL CORRESPONDENCE

THE construction and the method of operation of the internal grinding machine made by the Bryant Chucking Grinder Co. of Springfield, Vt., permits of the handling in one operation of a part having a hole of varying diameter, whether the hole be tapered, curved or irregular in section. The construction of the Bryant internal grinding machine is well known, but Fig. 1 is given to show the arrangement of the essential features of the machine.

The work is held in a rotating chuck at the left of the machine. There is no cross-slide; a one-piece member carries the wheel spindle and is suspended from a heavy shaft. The crossfeed motion of the wheel *W* is obtained by the swinging of the arm about the shaft, while the longitudinal motion arises from the axial movement of the shaft. A curved extension on the swinging member carries the control plate *P*, against which the feed screw presses. Due to the leverage, the movement of the wheel is only half that of the feed screw, which enables accurate control of the diameter.

GRINDING A TAPER

It will be evident that the principle of the design offers advantages for grinding not only straight and taper holes, but also curves and various combinations of these shapes. This is accomplished not by grinding with a formed wheel, but by traversing the wheel the full length of the hole. The wheel is caused to generate the desired shape by using a suitable control plate *P*. Since the plate or cam is attached to the arm of the wheelslide, it moves with it; and it remains in contact with the plunger in the end of the feed screw. Diameter control is obtained by manipulating the handwheel and it is said that exact duplication from piece to piece is easily maintained.

The machine as regularly furnished is equipped with a straight-edged control plate. For grinding straight holes this plate is lined perfectly true with the axis of the slide cylinder, which carries the slide box and wheel spindle. This slide cylinder moves laterally in its bearings to traverse the wheel, and it can also rotate in the same bearings for cross-feeding the wheel. The control plate is accurately pivoted and when it is desired to grind taper holes, it is swung to such a position as to cause the wheel to move at the desired angle. The work spindle, however, is left in position with its axis parallel to the axis of the slide cylinder.

The sketch in Fig. 2 shows the control plate in position for taper grinding. Since the plate has a leverage ratio of two to one over the grinding wheel, allowance must be made in proportion. However, the control plate is graduated, indicating the angle actually ground, or one-half the included angle. When grinding a taper the wheel is also trued to the same angle as the work. This is automatically taken care of as the slide has the same motion when the wheel is being dressed as when the hole is being ground. A standard plate provides for an angle of 30 deg. included, but an included angle as great as 90 deg. can be taken care of with a suitable control plate.

Fig. 3 illustrates a combination of two tapers finished by using a special guide or control plate. Not only was it necessary to maintain the tapers exactly correct, but a sharp edge was required at the junction of the tapers. It was also necessary to maintain an approximate relation between this edge and the face of the work. The control plate is utilized for giving the wheel its proper shape, as well as for guiding the wheel when grinding.

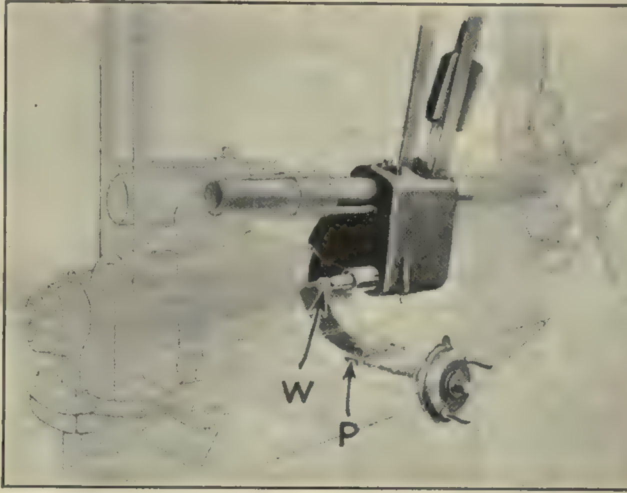


FIG. 1. ARRANGEMENT OF BRYANT WHEELSLIDE CONTROL

As the grinding wheel wears down, the relation of its surfaces changes slightly, and this, of course, shows up on the surface ground. In the piece under consideration, the wearing of the wheel would cause a variation in the distance of the junction of the tapers from the face of the work, if no adjustment were provided. To furnish a means of correction for wheel wear, a longitudinal adjustment has been provided for the follower on the end of the crossfeed screw. The movement of this follower is controlled through bevel gears by a small handwheel at the front of the machine.

In order to maintain the proper shape of hole, as well as to give lasting qualities, particular attention must be paid to the shape of the follower. From the figure it is evident how it is possible to give a sharp edge at the junction of the tapers. The plate moving on the surface of the follower causes the wheel to grind one taper. When the steeper surface of the plate strikes the follower, the wheel immediately starts to grind the corresponding angle. When truing the wheel, the wheelslide is near the right end of its stroke and hence the guide for truing the wheel is furnished at the left end of the control plate.

Drawing dies of various designs can be ground to good advantage by this method. The layout in Fig. 4 shows a die with a hole having two straight and one taper surface finished by traversing the wheel. This does not vary greatly from the work shown in the previous figure.

The majority of dies are curved, similar to that shown in Fig. 5. In laying out control plate for this shape, it is necessary to figure on the proper shape of the grinding wheel periphery, as well as the shape of the control-plate follower. The shape of the wheel is determined by the nature of the work. Often a true radius can be used to advantage. In this instance a radial truing device was used to dress the grinding wheel. The control plate follower was given a 3/16-in. radius on the contact point. To grind the hole the wheel was automatically traversed, and guided by the formed plate, it generated the desired curve. A very good finish was obtained by using a slow speed for traversing the wheel across the work.

An interesting example of irregular-shaped hole grinding is shown in Fig. 6. The saucepan shown is not bored, but is ground from the rough casting. Of course, precision is not required, it being desired merely to clean the surface. The castings come to the grinder somewhat distorted, and the problem was presented of removing a uniform amount of stock from the whole surface, instead of grinding a perfectly round hole. This was necessary as thin spots in the pans would be very objectionable.

For this job, the standard crossfeed screw was used, instead of the adjustable feed screw already referred to. By inserting a spring of proper tension back of the follower in the feed screw, the wheel was caused to follow the surface of the casting, removing just enough stock to give a smooth surface and maintain the uniform thickness of the original casting. The bottom surface was face ground with the same wheel that ground the sides.

Before starting to lay out special control plates, it is best when possible to place the work in its proper position in the chuck and observe the position of the feed screw on the control plate when the grinding wheel is through the work. This shows the distance between the center lines of the feed screw and the pivot dowel in the control plate, and gives the starting point in making the cut on the control plate.

On account of the fact that the grinding is done on the back side of the work, and also that the slide box, grinding wheel and control plate move while the feed screw remains stationary, the curve to be ground is drawn in a reverse position in order to lay out the curve on the control plate, as can be seen by referring to the previous figures. Since the slide box swings about the axis of the slide bar and since the control plate is below the grinding wheel, the cut on the control plate must be deeper than the curve of the work by the ratio of the radius of the plate to that of the wheel about the bar.

In Fig. 7 is shown a section of a wheel with a radius *D*. As the wheel wears away, it will take a shape on its edge from the part ground. This shape should in the design be assumed from the work as nearly as possible, and the wheel should be kept trued to maintain it.

The first step in the layout will be to draw in reverse position the curve to be ground. Then with the radius that is assumed on the wheel, work back to the curve that will be taken by the center of this radius, as shown by curve *A*. With this curve *A*, and using the proportional scale for the particular machine under consideration, lay out a curve for the control plate, as shown at *B*. This curve *B* would be the true curve of the control plate if the follower were a point. The follower, however, having a ¼-in. ball point, it is necessary to use a ⅛-in. radius, and work from curve *B* to curve *C*, which is the curve of the control plate desired.

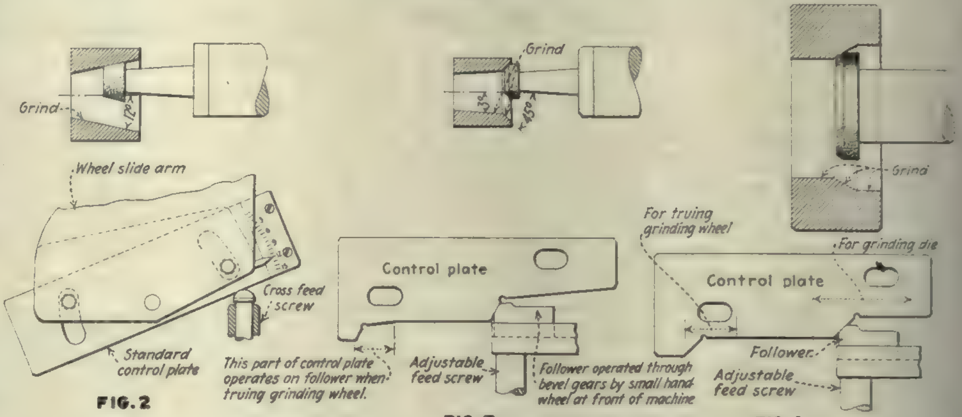


FIG. 2. POSITION OF CONTROL PLATE FOR TAPER GRINDING. FIG. 3. CONTROL PLATE FOR GRINDING A COMBINATION OF TAPERS. FIG. 4. TAPERED DRAWING DIE

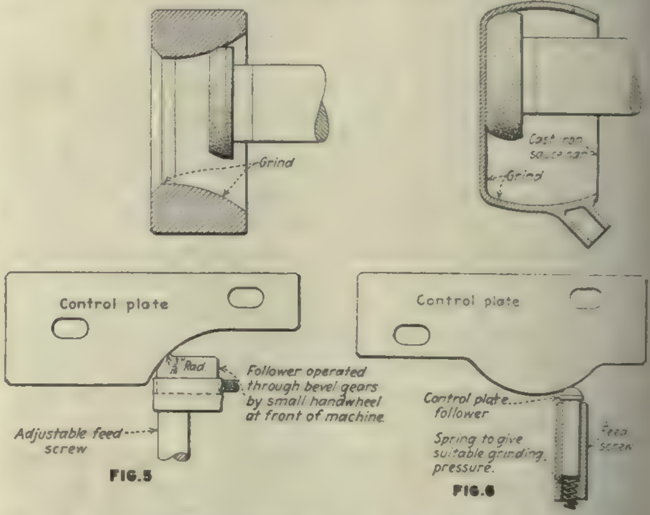

Grind
Control plate
Rad.
Follower operated through bevel gears by small handwheel at front of machine
Adjustable feed screw
FIG. 5
Grind
Control plate
Control plate follower
Spring to give suitable grinding pressure.
Feed screw
FIG. 6

FIG. 5. CURVED DRAWING DIE. FIG. 6. COMBINED INTERNAL-CURVE AND FACE GRINDING

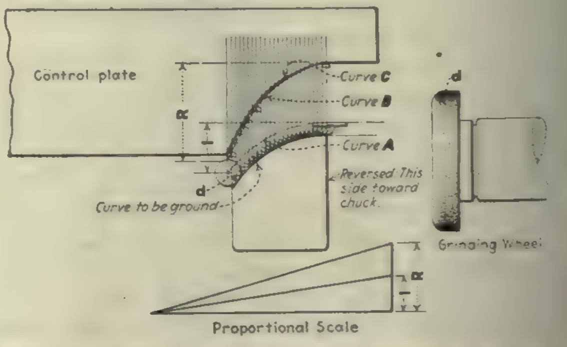
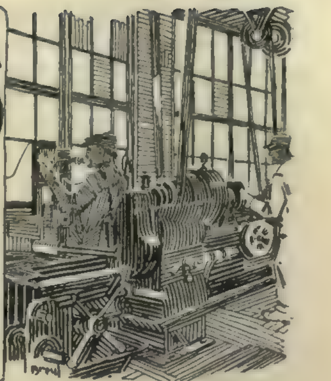


FIG. 7. LAYING OUT A CURVED CONTROL PLATE

MODERN PRODUCTION METHODS

By
W R. Basset
of
Miller, Franklin, Basset & Co.



XXII. The Fundamentals of Correct Time Study

The Various Uses of Time Studies — Attitude of the Workman — Some General Rules for the Time Study Observer

TIME STUDIES are commonly thought of only as a guide in setting piece rates. Certainly that is the principal use to which they are put, but those concerns which have dug deep into the science of management realize that this is but one of their many uses. Frequently there are conditions which prevent the adoption of piece rates on work which is otherwise admirably fitted to that method of payment. That should not deter the management from profiting by the betterments which accurate time studies often show.

The wide scope of these betterments is indicated by the following list. Each one has to my knowledge been achieved in many machine shops. Time studies, then, may be used to: (1) Set just standards of production; (2) determine the most efficient size of gang; (3) detect the inefficient use of machines; (4) indicate that a present operation should be subdivided; (5) indicate that two or more of the present operations should be combined; (6) determine the efficiency of supplies and tools; (7) show whether new machines would be more economical; (8) standardize the best shop practice; (9) determine the best location of work and tools; (10) show how fatigue may be reduced; (11) improve the design of tools, jigs and fixtures; (12) detect improper handling in previous operations; (13) indicate the possibility of using wage incentives; (14) set piece rates; (15) determine the best arrangement of machines; (16) get equipment into balance; (17) test the fitness of the man to the work; (18) show up faulty planning and management.

When one realizes the many betterments to which time studies may be put, it becomes apparent that the greatest care is warranted in getting accurate studies. It would be a dangerously broad statement, perhaps, to say that most time studies are seriously inaccurate; yet I have seen so much labor trouble and restriction of production traceable to this fault that I have come to believe that accuracy is rare. Inequitable piece rates set upon inaccurate time studies act as an incentive to soldiering rather than to production.

The workers themselves are usually the first ones in a plant to realize that rates are carelessly set. Too high a rate restricts production, for experience has taught the workers that a hastily set rate will be just as hastily cut, if they show it up by making high earnings on it. Rates that are too low stir up discontent and stimulate floating.

Just recently, we were asked to help a manufacturer iron out labor unrest in his plant. A few talks with individual workmen showed that they felt the piece rates to be unjust. We made more than a hundred test time studies among workers of the same grade and found a surprising range in the amount that could be earned by the same person on various jobs. One man had a job on a Tuesday at which, by working industriously, he could earn $2.85 a day; on Wednesday he had a job that would have paid him $8.46—if he had dared to work hard enough to earn it! And yet the management claimed that the rates had all been set on time studies and brought forth the alleged time studies in proof. They were far from being real studies; typical was the one which simply noted that Operation 3 on part L47AB had consumed 84 seconds when performed by a good workman. Without further study to see if the methods of performing the various sub-operations could be improved, and with no knowledge of the relative skill of the man, this was set as the standard.

That exemplifies the commonest fault in most time studies; which is to take an overall time. To be a study on which fair rates and constructive betterments can be based, each part of an operation must be segregated and studied. Anything less cannot, except by courtesy, be called a study. In fact, the taking of time studies, expecially in a machine shop requires a scientific approach. I do not mean that it requires a laboratory scientist and so is beyond the abilities of a foreman or even of a bright clerk. Nearly every shop contains a half dozen men who in a few weeks can be trained to take time correctly, but it *is* essential that they thoroughly understand the problems involved and be taught the scientific methods of making their observations and studies. It is my purpose to give in this series of papers the information that a student will need.

Theoretically, it would be possible to set rates with overall studies only. But this would require that we have in the shop a workman whose skill could be reckoned at 100 per cent, whose conscientiousness could be relied upon, and the detail of whose procedure could be reduced to the most efficient basis. Unfortunately, these conditions can rarely be obtained in conjunction. It is therefore necessary to develop the standard time per operation from the performance of such workmen as may be available.

Analysis shows that the time of the ordinary workman will vary from standard because of three reasons. First, the wrong tools, speeds and feeds may be used on an operation. If those already in use are improper, that fact will be readily apparent when the cutting time is isolated. After the correct tools, speeds and feeds are substituted, they can be timed.

Second, nearly every operator will throw in a few or many needless motions or activities. If the operation be analyzed in careful detail, those elements which are unnecessary and which therefore a highly skilled worker would omit can be omitted in the standard, even though they have persistently recurred in the observed operations; frequently, for instance, we will find that several operators take three cuts to remove a given amount of stock when the time studies show that two cuts should be sufficient. The time consumed in the third or superfluous cut is of course dropped from the standard.

Thirdly, no man will work at an absolutely uniform rate throughout all the stages of an operation, no matter how uniform his time for the complete operation may run. Therefore, if we take horizontal sections through a series of operations, we can build up a standard, from the sum of recurring minima in the progressive stages. As a case in point, suppose the task be "burring corners" on a small collar. The performances making up the operation may be: (1) Chucking the part; (2) picking up the scraper and breaking the corner; (3) removing the part from the chuck and returning it with the opposite side outward; (4) burring the second side; (5) removing the part from the chuck, laying it aside and picking up a new part.

Average Time the Standard

Every part must submit to all five of these performances on its way to completion. If the time on all of the above performances be taken separately and charted, it will be found that even if the overall times be uniform it takes the operator less time to chuck the part in some instances than it does in others. Again, we would very likely find that the burring time will vary appreciably not only for different collars, but for the two sides of a single collar. Never mind what causes the difference; it may be the material or it may be the workman. In building up a standard we pick out for each performance the lowest time that recurs with any frequency, and adopt it as the probable average of a 100 per cent workman—in other words, as a standard.

I have already said that taking the overall time of an operation cannot be relied upon to give an accurate standard. In the foregoing description of the three factors that enter into a standard it is apparent that the faults of the workmen can only be uncovered by taking detailed studies.

The only way that an operation can be properly studied is to break it up into its component performances and take times on each. It is a fundamental rule of scientists who are attacking a problem to break the complex problem up into its simplest elements; these simple problems can then be minutely studied and easily solved, and the complex problem is thus solved.

Therefore, the first step in making time studies is to analyze the operation into its recurring stages or "performances" which will be found with a little practice, to be easy. The "burr corners" operation on a small collar, given above, is typical. As an illustration of straight machine work, consider what must be done in broaching the keyway in a small gear. On each part the performances are found to be: (1) Pick up a new part from the table; (2) raise the part and lower it over the broach; (3) pick up the arbor and, fitting the slot over the broach, inset the arbor within the gear; (4) throw on the power and make a cut, meanwhile applying oil to the cutter from the oil can; (5) take part and arbor off the table and remove the arbor, with the other hand return the finished part to the conveyor and take therefrom another part and place it on the table; (6) shut off the power, as the broach by this time has reached the top of its stroke and clean the chips preparatory to mounting the new part. It will be found that the operator duplicates the above performance every time he broaches a keyway.

The time study man then lists these performances and secures ten sets of isolated times on each of them which will add up to a total time for the complete process of broaching a keyway. Then he notes the speed and feed, and if they are not correct makes the needed correction.

Next he will study each performance in turn to determine whether or not it contributed to the result. If it did not, it is eliminated in setting the standard. Finally, he studies the actual times for each performance and selects the lowest recurring figure as standard.

In analyzing an operation into its constituent performances, it is necessary to be guided by the complexity of the operation; the duration of the complete operation; the proportions of machine time and hand time; and the variation in design of the part and of other similar parts to which results of the study may be extended.

There may be any number of performances from three up; and the time of each performance may vary from a fraction of a second to several thousand seconds.

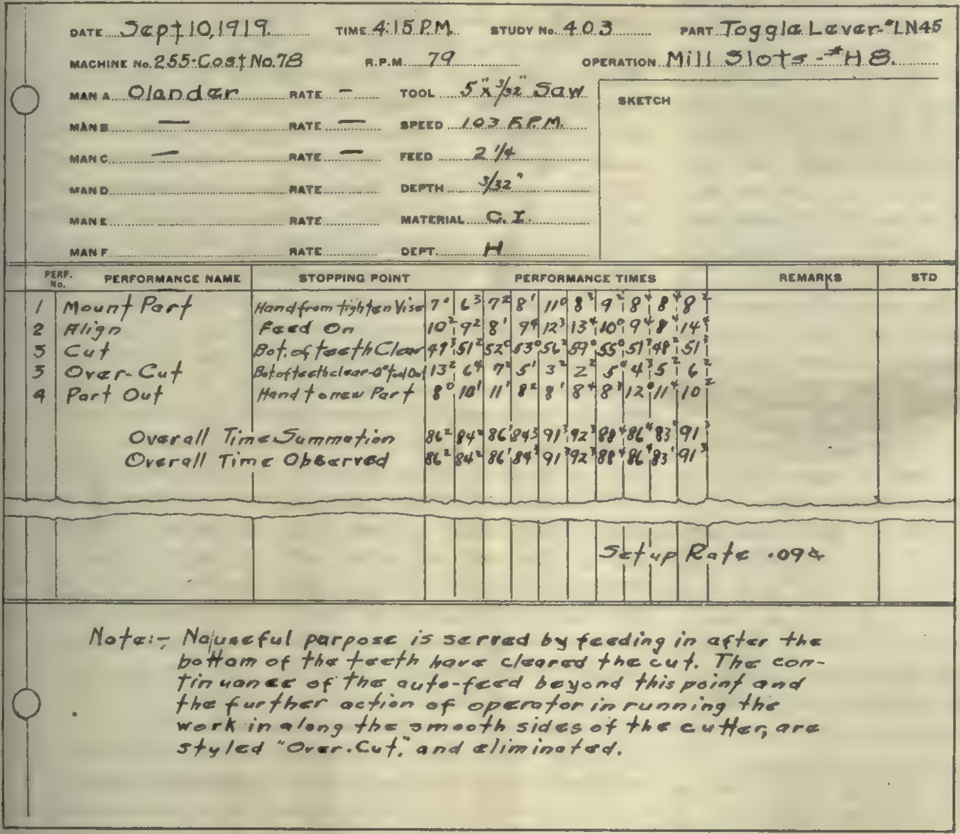
General Rules

The general rules governing performances are that the longer an operation is in total, the longer is it permissible for the individual performances to be; and the more complex the operation becomes, the greater will be the number of performances. If the performance is a simple one requiring hand time throughout, the first two factors influencing the standard are commonly absent, and three or four performances may give sufficient detail to take care of the third factor.

The points of division between performances are indicated by the nature of the processes; and marked natural points of division should always be watched for even though the simplicity of the operation and its short duration might on the surface indicate that they could be ignored. Continuous cuts and other continuous process are not ordinarily divided; therefore, out of two operations requiring a given time, that which has the largest machine time concentrated in a few performances will ordinarily have the smaller total number of performances. An operation consisting of hand time throughout will ordinarily be divided into a greater number.

The design of the parts also has an effect upon the analysis. For instance, the original analysis of the performances involved in milling squares on shafts divided the body of the study into successive performances of "cut" and "turn part." The latter performance comprised lowering the table to the original position for beginning a cut and then turning the part to present the next side for cutting. When we attempted, from this study, to derive standards for shafts of different sizes, we found that the variation in cutting time due to the variable length of the square could be readily calculated. But the time required to lower the table for new sizes of squares could not be deduced because the performances "turn part" consists of variable time for "lower table" plus a constant time for "turn part", each part regardless of its size, being turned through an angle of 90 degrees.

Accordingly, it was necessary to take another series of studies in which the original performance "turn part" was split up into two performances, "lower table" and "turn part." This simple illuustration shows how design affects the methods of study.



DATE Sept 10, 1919 TIME 4:15 P.M. STUDY No. 403 PART Toggle Lever-#LN45
MACHINE No. 255-Cost No. 78 R.P.M. 79 OPERATION Mill Slots-#H8.
MAN A Olander RATE — TOOL 5" x 3/32" Saw
MAN B — RATE — SPEED 103 F.P.M.
MAN C — RATE — FEED 2 1/4
MAN D RATE DEPTH 3/32"
MAN E RATE MATERIAL C. I.
MAN F RATE DEPT. H
SKETCH

Perf. No.	Performance Name	Stopping Point	Performance Times										Remarks	Std
1	Mount Part	Hand from tighten Vise	7^0	6^3	7^2	8^1	11^9	8^3	9^2	8^4	8^4	8^2		
2	Align	Feed On	10^2	9^2	8^1	9^9	12^3	13^4	10^0	9^4	8^4	14^4		
3	Cut	Bot. of teeth Clear	47^8	51^2	52^0	53^0	56^2	59^0	55^0	51^7	48^2	51^3		
3	Over-Cut	Bot. of teeth clear-Autofeed Out	13^2	6^4	7^7	5^1	3^2	2^2	5^9	4^3	5^2	6^2		
4	Part Out	Hand to new Part	8^0	10^1	11^1	8^2	8^1	8^4	8^3	12^6	11^4	10^2		
	Overall Time Summation		86^2	84^2	86^1	84^3	91^3	92^3	88^4	86^4	83^0	91^3		
	Overall Time Observed		86^2	84^2	86^1	84^3	91^3	92^3	88^4	86^4	83^1	91^3		

Setup Rate .094

Note:- No useful purpose is served by feeding in after the bottom of the teeth have cleared the cut. The continuance of the auto-feed beyond this point and the further action of operator in running the work in along the smooth sides of the cutter, are styled "Over-Cut," and eliminated.

FIG. 104. A TYPICAL TIME STUDY RECORD

The analysis which portrays an operation should be clean cut enough to make any performance interchangeable with the corresponding performance in another operation. This requires that each performance be rigidly defined not only as to what is done, but as to the precise moment when the performance ends. Accordingly, in the time study analysis as shown in Fig. 104, two columns are provided, the one headed performance, the other headed stopping point.

While the nature of the performance is given by the performance name, the points at which the stop watch is to be started and stopped are given by the stopping point. It is the stopping point and not the operation name which secures the desired interchangeability. It is, therefore, important that the stopping points should be outstanding events in the progress of the part and they should be so chosen that a variation in the operator's procedure cannot alter their essential character. Where possible, they should be not only visible but audible; an audible snap, such as that made when the automatic feed is tripped on a milling machine is ideal. Failing to find audible stopping points, instants of contact make good sharp stopping points. The recurrance of such stopping points as "hand to feed," "hand to wrench," "hand to new part" are entirely satisfactory and will be found much used in the studies which will be shown in later articles. Accuracy depends upon choosing stopping points which are sharply defined, instantaneous; and these so far as possible should be made standard. For instance, I recommend that all operations which precede machine feed cuts end at the moment when the feed is thrown on, and that the cuts themselves end when the feed is thrown off. These two points are always clearly recognizable. They limit the observed interval of the cutting operation to the time when the feed is on, and thereby facilitate the consideration of feed and speed in arriving at the standard, and also make it easy to compare corresponding studies. Similarly, the stopping of the last performance at "hand to new part" is recommended, since it gives evidence that the cycle of preformances covers a complete operation which may be multiplied indefinitely for any number of parts.

The manner of making an analysis will depend upon the complexity and duration of the operation. On short operations, the operator will almost always be found to work with a definite rhythm which the observer can readily sense and on which he can base his analysis. Merely observing such an operation on a few parts will enable him to write down all of the performances.

If the operations are long and complicated, the sequence of performances may be difficult to determine. In such a case, the observer will begin an operation at his standard point "hand to new part"; and thereafter follow it through for one part, setting down in detail each performance that the operator makes. The observer will then lay the record aside and proceed to record the performances on another part. It may be advisable to make a half dozen or so independent observations. Having accumulated the proper number of detailed records of performances, those performances which persistently recur in all of the operations will comprise the analysis, the others being thrown out as unessential. In using this method, it is necessary that the observer be very alert, and carry in his memory the stopping points which he has previously used on similar performances, so as to make the different performances interchangeable when the analysis is compiled. Here is one place where the advantage of a standard stopping point is apparent.

Rarely will an operator continue through a series of operations without interruptions of intermissions. On a short operation, the operator is apt to seek relief from the strain of continuous application by taking short intermissions between parts. On a long operation the intermissions will naturally occur during the progress of the operation. In either event, this lost time must be eliminated from the study. The completed study should ordinarily contain only the time for productive performances.

However, unless the interruptions have clearly nothing to do with the processing, the observer should not attempt on snap judgment to eliminate them. If he is working from a fixed analysis, he should make foot notes showing where the lost time comes in and what it is used for; if he is recording the running story of the operation, he should describe just what occurred. This will enable him to study the matter after the analysis is complete and determine whether the times marked "lost" should be accounted for in the standard.

Lost time which is the result of fatigue or of attention given the tools is usually eliminated from the analysis for it is taken into account in another way which will be described in a future article. Sometimes, however, interruptions are accounted for in the standard as in a certain operation on a milling machine. In this operation, the analysis of the productive performances, showed that lost time which regularly occurred at the end of the cuts was unavoidable because it was due to the fact that the operator attended two machines at once.

Time is often lost by throwing in the feed in advance of contact between tool and part, and by permitting the feed to continue after the tool has cleared the cut. If the standard stopping points "feed on" and "feed off" are used, the time observed will not represent the actual cutting time. The way to handle this in a time study is to set the starting point of the cut at the instant of contact between tool and part, and the finish at the moment of clearance and show the two periods when the tool is "cutting the air" as separate performances which are eliminated from the standard. This is done in study 403, Fig. 104.

In a later article when the setting of an actual standard is described in detail, further instances of lost time and the methods of handling it will be discussed.

Having developed an alalysis of the operation into its standard sequence of performances, the next step is to observe the actual detailed times.

TWO KINDS OF TIME STUDIES

Time studies are of two kinds, continuous and discontinuous, depending upon the method of taking the observations. Discontinuous times are the most accurate. Suppose an operation consists of ten performances. On the first part to be timed, the observer would time performances 1, 3, 5, 7 and 9. He would utilize the intervals consumed by performances 2, 4, 6, 8, and 10 to enter on his time study blank the times taken by the preceding performances. Then on the second piece to go through the operation he would time performances 2, 4, 6, 8 and 10 and write them down during performances 3. 5, 7, 9, 1. Thus the complete operation must be performed upon two parts in order to get one complete study. For this method a single hand stop watch may be used, reading the times to fifths of seconds. When the complete observation and its component performances are short, and there are plenty of parts to be processed, by all means use the method of discontinuous times in order to achieve accuracy. Then supplement them by taking several overall times for the complete operation in order to test the accuracy of the discontinuous times. Aside from its accuracy, the discontinuous method gives the observer plenty of time to watch the workman and take notes on his methods of work.

There are cases, however, when it seems best to take continuous times. For this method a watch with two independent second hands is required.

Continuous times are obtained by stopping the auxiliary hand at the first stopping point and recording its reading while the main second hand continues round. After the first performance has been recorded the auxiliary second hand is released, permitting it to snap into coincidence with the main second hand. It is stopped again at the conclusion of the succeeding performance. By this method we secure the elapsed times for our analysis by substracting the observed time for each stopping point, from the one succeeding it. Continuous times are of value when the number of parts to be observed is limited, since a complete series is obtained from each part instead of from two parts. The fact that the overall time is directly available from the continuous time observations makes possible a further saving of the observer's time. Where minute accuracy is not required this method enables complete studies to be made in one half the time of a discontinuous study. On very long operations this may be well worth while. On the other hand, when the analysis is worked up, continuous times demand considerable computation which discontinuous times save. A disadvantage of continuous times is that if the stopping point be carelessly observed the error will not only appear in the first performance but in the observation of the following performance as well. The observer will find use for both methods. The discontinuous method is recommended where it can be used, on account of its greater accuracy.

If two stop watches be manipulated at once, discontinuous times can be obtained, a complete series from a single part, but to do this accurately requires considerable skill and the practice is not recommended.

Authorities generally agree that ten complete observations is the minimum number if the standards are to be absolutely reliable. No number less than ten will give a proper separation of the extremes from the average. A study will rarely be found in which any random four or six operations will tell the same story that the complete series of ten does. On the other hand, ten is a number sufficiently large to reflect the variation in the usual case. For this reason the time study form is designed to accommodate ten, which will, of course, not prevent using additional sheets should circumstances seem to call for more than ten. When the operator is unusually dilatory, it may be necessary to take twenty or more readings. The point to be emphasized is that only the most exceptional circumstances could justify basing a standard on fewer than ten complete readings.

Note that if an analysis includes a number of repetitive and identical performances in a complete operation, time can often be saved by taking only ten of these performances, setting a standard from them and putting this standard into the whole as many times as necessary. In one instance I recall that twelve identical cuts were taken in each operation. Discontinuous times were taken on only ten cuts and the standard secured from them was repeated twelve times in building up the total standard.

I have already indicated how we discount the effect of poor workmanship and intentional soldiering, by eliminating high performance figures and extra performances. Obviously, the most satisfactory studies are those in which such defensive tactics are not needed. But only too often we find that the workman bristles up at the first glimpse of a stopwatch. It is a tradition that stop-watches are invariably the forerunners of killing standards and unjust rates. While not always easy, we have found that it is usually possible to break down his opposition by man to man treatment and in the end secure his fullest co-operation. In the first place, criticism of his workmanship should be very sparingly made, if at all, and while simple constructive suggestions of an obvious sort can be given to him directly, in proportion as he is brought into the proper frame of mind to receive them, most changes in his procedure should be brought about through his foreman.

This emphasizes the importance of first securing the co-operation of the foreman, with whom the various operations should be discussed in detail. He will often be able to supply valuable information which the observe might otherwise miss. Questions from both operator and the foreman about the purpose, scope and method of time study work should be freely and frankly answered. Both should be allowed to see the study. It is surprising how intelligent an interest most workmen will take when they once see and understand the studies.

It is very important that all conditions affecting the performance should be noted down in the rough notes. These will ordinarily include any data bearing on the condition and state of repair of the machine, the condition of the belt, and so on. Nothing relevant should be left to memory; because while memory may perhaps be relied upon for making of the finished study, it cannot reliably decide a controversy that may grow out of the study some weeks after it is made. Rough notes should be carefully filed for reference.

The enthusiastic observer is usually tempted to recommend many changes which will obviously save time. Such savings may be made by changing the position of the conveyor, the manner of grasping the part, place in which the wrench is laid down, and so on. This is entirely a matter of proportion. Saving of five seconds per part brought about by an improved method of picking up the parts would be well worth while on a burring operation requiring only 30 seconds per part, whereas it would hardly repay the time spent in devising it on a milling operation requiring 1,000 seconds; and a saving of 50 seconds would be worth while on the 1,000 seconds operation, but not on an operation requiring 8,000 seconds. If an appreciable saving, and one within the limits of accuracy with which the standards are set, can be made by giving thought to such details, it should by all means be made.

Casting of Brass Ingots

The following paragraphs give a short summary of a paper presented by R. Genders at the annual autumn meeting of the Institute of Metals, held in Birmingham, Ala., on Sept. 21.

The failure of hollow-drawn articles, made from 70/30 brass rod, by splitting an expansion during manufacture or in service has generally been found to be due to the presence of non-metallic inclusions which originated in the cast ingot. In articles drawn from cupped disks, punched from rolled strip, the inclusions in the walls are circumferential in direction and of less effect on the wall strength.

The methods used in casting ingots of brass vary considerably in detail. Much consideration is given to the saving of rolling, and ingots are made in a correspondingly suitable form, those used for the making of rod commonly being very long and narrow.

Such forms are not particularly undesirable when the finished product is solid, but where a hollow article, subject to expanding stresses in use, is to be made, the avoidance of inclusions of foreign matter is vital, and the form of ingot requires considerable modification.

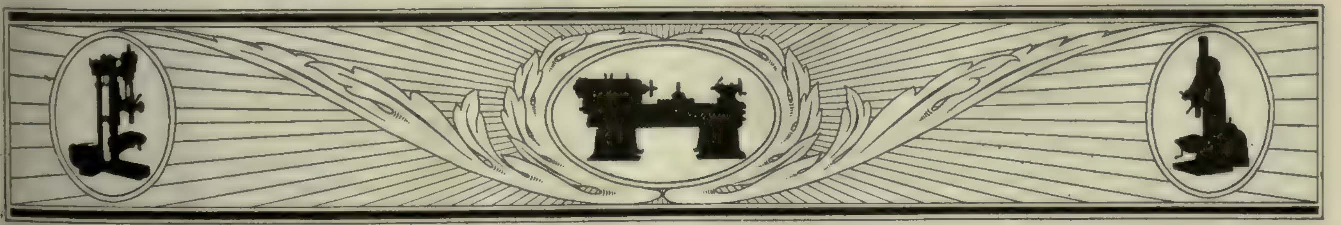
In experiments which were carried out to minimize the occurrence of non-metallic inclusions, a form of ingot was adopted whose length was not great in proportion to the cross sectional area. The ingots made were 3 in. square and 30 in. in length, as compared with the ingots 6 to 7 ft. in length and 1½ in. square section in common use. Steel-making practice was followed in introducing a hot sinking head or "dozzle." The molten brass is poured through the dozzle, which is filled to the top. No pipe is formed in the ingot proper and additions of metal may be made at any time to the metal in the dozzle without risk of introducing defects into the ingot, any dross rising to the top of the still fluid head.

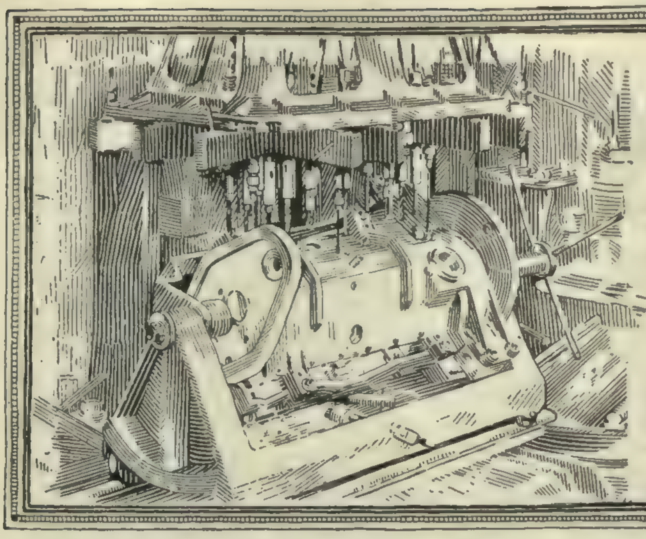
The molds were tapered, the top being enlarged by increasing amounts in successive experiments, and ingots were cast at the usual foundry speed. It was found that with a mold 3½ in. square at the top, tapering to 3 in. at the bottom, no shrinkage cavities were formed and the ingot appeared to be practically perfect as regards soundness.

By those methods, failures which previously reached large percentages were reduced to practically nothing.

Automotive Engineers To Standardize Non-Ferrous Metals

The S. A. E. subdivision on wrought non-ferrous metal alloys has submitted for consideration specifications covering brass forging rod, brass spring wire, naval brass or, as it is sometimes called, Tobin bronze tubing and phosphor bronze spring wire. If these specifications are adopted by the society the S. A. E. Non-Ferrous Metal Specifications, of which there are now twenty-five, will cover a sufficiently wide range to permit automotive vehicle designers to select standard specifications for practically any automotive purpose for which non-ferrous metals are used. The specifications proposed cover, in addition to the compositions in percentage specified, the physical properties, appearance, dimensional tolerances and general information of interest to users.





Tool Engineering

By
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President and Chief Engineer
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Turret and Engine Lathe Tooling—Factors To Be Considered—Types of Machines—Turret and Cross-Slide Tools—Holding Fixtures

IN DISCUSSING tooling methods for turret and engine lathes, we are taking up a subject radically different from any of those mentioned in the preceding articles. Both turret and engine lathes are used extensively in manufacturing and the tooling for these machines is of great importance in its application to high-class production methods. The average tool designer is usually somewhat "out of his element" when called upon to design fixtures and tools for turret lathes. It is of importance therefore to consider not only the design of tools and fixtures but also the construction and operation of the machines used for the work.

The possibilities of the machines from a production stand point are so great that a clear understanding of the class of work to which they are suited is one of the primary requirements when dealing with their their application to production processes. Many factors affect the methods used on this class of work so that it is advisable to specify some of these in order to understand their importance thoroughly.

In turret and engine lathe work we must always consider: (A) the work; (B) the method of holding, and (C) the cutting tools. By separating them in this manner it will be easier to understand various points in connection with each. For example, speaking of the work, it may be made from bar or cut-off stock, it may be a casting or a forging, regular or irregular, cylindrical, tapering or rectangular, or it may be heavy and cumbersome, or it may be light and fragile. These matters all have an effect on the method used to hold the work for the cutting operations. The design of the holding device is effected strongly by the size, shape, and general contour of the piece that is to be machined. The selection of the machine tool on which it is to be manufactured is also governed to some extent by the same items.

Standard types of cutting tools are used for certain kinds of work while for other varieties and classes of work special tool equipment is necessary. It will be seen from the foregoing that there are many points of importance which must be thought of in connection with the design of tools for turret lathe work.

In considering the method of handling any piece of work we must first select the machine, then determine the method of holding and finally design the tools which will do the work. In order to avoid confusion we will consider these matters separately; taking up first various methods of holding different kinds of work. The points of importance to be considered in the design of holding fixtures are quite varied and we will therefore separate them as far as possible and mention important matters connected with each condition.

(1) The work may be a rough casting or forging or it may have been partially finished in a previous operation. If it is a rough casting it may be of regular shape such that it can be held by the outside or the inside in some variety of chuck, either by means of regular or special jaws. Again the casting may be rough and regular in shape so that it can be held with special chuck jaws, but it may also be so long that it requires additional means of support, provision for which may be made either on the body of the chuck or by means of a supplementary fixture on the machine.

(2) The work may be irregular so that it can not be held by chuck jaws, in which case it will require a special fixture for holding. Occasionally fixtures of this kind require a great deal of care in their design, depending upon the nature of the work and its general shape as well as the machine operations that are to be performed upon it.

(3) If the work is thin and fragile, whether it is regular or irregular in shape and whether it is held by chuck jaws or in a special fixture, particular attention must be paid to the method of holding so that there is no possibility of distorting the work and causing inaccuracies in the finished product. Not only must the method of holding provide against this but also the action of the cutting tools must be considered so that the latter do not tend to distort the work during the process of machining.

(4) Work that has been finished in a previous operation may often require a special fixture in which suitable provision is made for locating from one or more important finished surfaces.

The foregoing points all have to do with the condition and general shape of the work but there are additional matters to be considered in connection with the

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design of holding devices which are applicable to practically all conditions. These points will be specified in detail later in this article.

Fig. 210 shows several examples of regular work suited to production on turret lathes. Examples *A* and *B* are made from bar stock with simple tooling of a standard nature. The work *C* is a casting of regular shape which can be held for machining in special chuck jaws and the work done in one operation as indicated by the *f* marks. The work shown at *D* can be held for the first operation in special chuck jaws while the second operation requires a locating device of special form. This piece requires two operations to complete the turret lathe work. The example *E* is a bronze casting having both an internal and external thread. The inside thread should be cut by means of a chasing attachment and the external thread with a self-opening die. Two operations would be required for this piece of work.

These examples of turret lathe work have been given in order to show the great variety which can be handled on machines of this kind. No attempt has been made to show irregular work which would require fixtures, as these will be taken up later in these articles.

SELECTION OF MACHINES

In determining the type of machine most suited to a given piece of work it is necessary for the designer to have a general idea of the various types in common use. The diagrams shown in Fig. 211 are given in order to represent the operation features of several types of machines. All of these machines have somewhat different characteristics and for that reason the diagrams are made in such a way as to bring out the points of difference and to show their effect on the design of tools and fixtures.

The example *A* is a plain turret lathe having a cross slide *B* extending entirely across the bed and a turret *C* mounted on an adjustable longitudinal slide. Chucks or fixtures can be attached to the spindle and tools for cutting off or forming can be applied to the cross-slide. Tools are also applied to the turret. In the example *D* we have an all-geared head machine with a cross-slide *E* which does not extend across the bed of the machine, but which is provided with an indexing turret toolpost *F* in which a number of tools can be placed to operate in sequence on the work. The turret *G* is mounted on a longitudinal slide and can be furnished with tools for various operations. The example at *H* represents several other types, one of which is provided with a cross-sliding head *K* which carries the spindle on which a chuck or fixture can be mounted. In this type of machine there is no regular cross-slide used and the facing operations on work are accomplished by the cross feeding movement of the head. Another type of machine has a stationary head while the turret indicated at *L* has a cross feeding movement. This machine also has no cross-slide. These diagrams of the various types of machines in common use will make it evident to the designer that the application of tools to various turret machines is governed to a considerable extent by the type of machine to which the tools are applied. The movements of the turret, cross-slide, and head are somewhat different in several machines, and as a consequence the tools which are applied to them operate differently according to the particular machine selected.

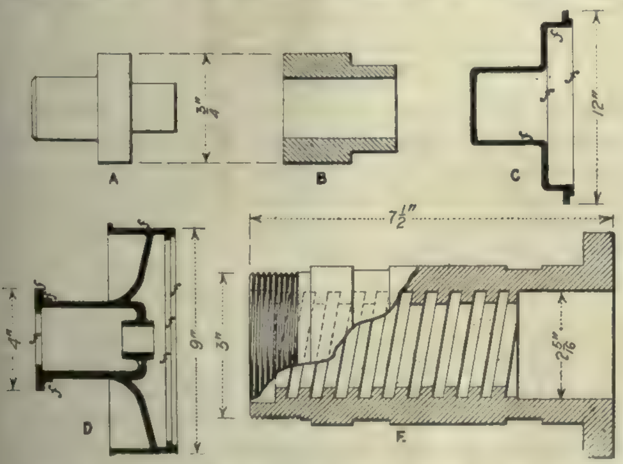


FIG. 210. EXAMPLES OF WORK SUITABLE FOR TURRET LATHES

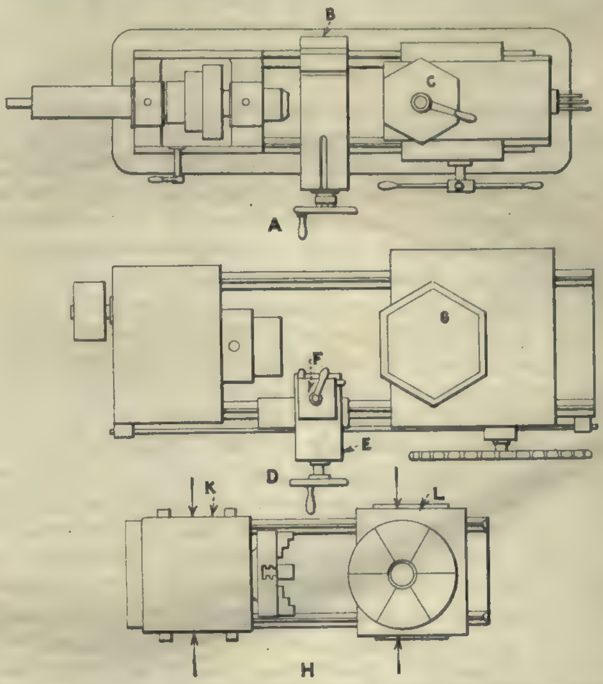


FIG. 211. REPRESENTATIVE TYPES OF TURRET LATHES

In the selection of a machine for the work, judgment must be used in order that the tool equipment may be the most efficient that can be designed. The capacity of a given machine should always be ample to handle the work but it may be found that one type is more suited to certain operations than another; hence the machine selected should be one that will give the most satisfactory results.

MACHINE REFERENCE SHEETS

As there are so many different movements to be taken into consideration in the operation of a turret lathe, it is necessary to know the range of movement of cross-slide and turret in relation to the spindle. Also it is essential that the various machine dimensions which affect the design of tools should be readily accessible. It is undesirable to go into the shop and measure up every machine to which tools are to be applied, therefore data sheets giving complete information regarding machine sizes, ranges and capacities should be at hand for the tool designers ready reference.

Fig. 212 illustrates a data sheet for one certain size and variety of turret lathe. Attention is called to the various dimensions that are given on this sheet as they will all be found of value when designing tools or fixtures. Sheets of this kind should be prepared for all production machines in the factory. They can be made on tracing cloth and blueprinted to form a data book for convenient reference. It is advisable to give the factory machine number on each of these sheets together with any other information that will be of help in locating a particular machine in the factory.

APPLICATION OF FIXTURES AND TOOLS

In machining any piece of work on a turret or engine lathe we have first to provide a means of holding the work and next to furnish cutting tools which can be presented in sequence or combination to perform the various operations required. Fixtures are necessarily applied to the spindle of the machine while the cutting tools are used on the turret and cross-slide.

In the application of holding devices to the spindles of various machines the design of the spindle itself affects the fixture to some extent. Fig. 213 shows a number of types of spindles to which adapters, faceplates, chucks, collets and other holding devices can be applied. Any spindle which is designed to hold chucks or fixtures should be provided with a cylindrical portion for centering the chuck and a shoulder or surface for squaring it up in relation to the spindle. In nearly all cases the threaded portion provides a means of fastening the fixture and a cylindrical portion together with a squared up shoulder assists in truing up the fixture and taking the pull of the cutting tools.

In the example *A* the fixture screws on to the body of the spindle and is squared up by the shoulder *B* and centered by the outside diameter *C*. Example *D* is similar except that it has an additional bearing surface at *E*. Example *F* has a short threaded portion and two bearing surfaces at *G* and *H* in addition to the shoulder shown. The spindle shown at *K* is of a different variety as it is arranged so that the fixture screws into the female portion and obtains a bearing at *L* and also against the shoulder *M*.

In designing fixtures for use on turret lathe spindles it will be found good practice to fit the fixtures to an adapter such as that shown at *O* rather than to fit them to the spindle itself. The adapter is screwed directly to the spindle as indicated, and the fixture is made with a recess so that it will fit the flanged portion *P* on the adapter. By standardizing the adapters a great deal of fitting can be avoided so that the fixtures will be cheaper in first cost and they will also be interchangeable on different machines by simply changing the adapters. This is sometimes an advantage when there is a possibility of changing a fixture from one machine to another.

The example shown at *Q* is an adapter hood which is screwed to the spindle and so arranged that a special plug or other device can be fastened into it as indicated by the dotted lines at *R*. Other matters connected with the application of faceplates to the spindle will be taken up later in these articles. The various examples of spindles shown here are given in order to illustrate the differences between them and to show how they must necessarily affect any holding devices or fixtures which are applied to them.

Turrets on various machines are quite different in construction so that the tools which are applied to them must be designed to suit the particular type of turret on which they are to be used. We shall not attempt to show each style but will simply indicate those that are quite different in general design and which therefore require a different method of fastening and locating on the turret. Fig. 214 shows three types of turrets. The example *A* is of hexagon shape with six flat faces, in the center of which there is a hole for the stem of the tool and also four tapped holes on the face to assist in fastening it in place. In the example *B* the tools are set on the flat surface of the turret *C* and fastened in place by two or more screws as indicated at *D* and *E*. The location of the tool is assured by means of the slot *F*. Another type of turret is shown at *G*. This form is dove-tailed at *H* and *K* so that the tools can be fitted to this portion and clamped firmly in position.

It will be evident from the foregoing description of the various types of turrets that the construction of tools to be applied to them would be quite different on account of the different methods of fastening and locating used. There are some other types of turrets besides those shown but their general construction is not greatly different from these examples and therefore it is unnecessary to illustrate them.

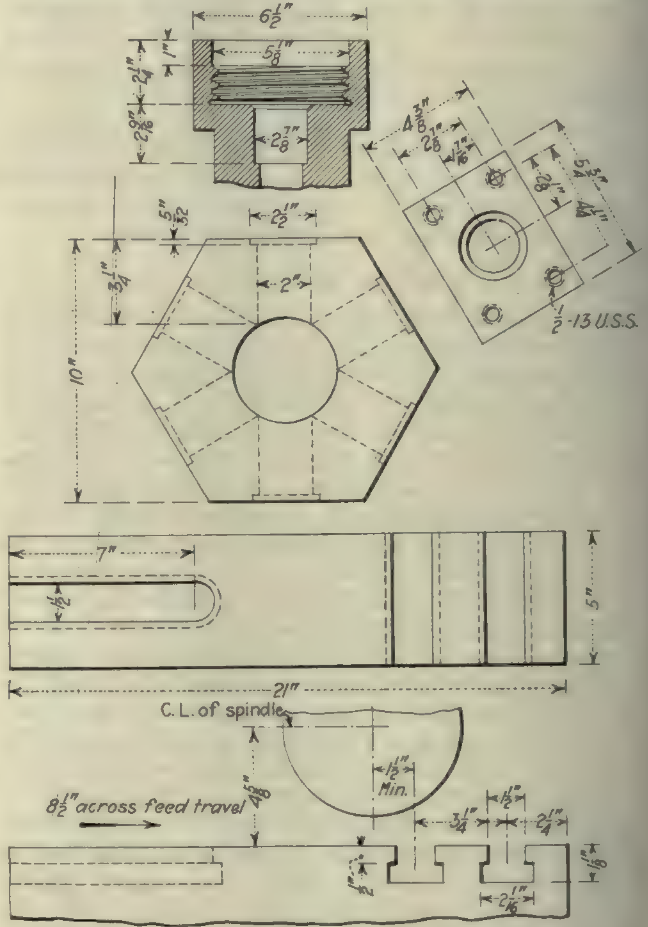


FIG. 212. DATA SHEET FOR TURRET LATHE

TYPES OF CROSS-SLIDES

In designing cross-slide tools there are only two types of slides that need to be considered. One of these types, shown at *A* in Fig. 215, does not extend across the ways of the machine and the toolpost which is mounted on the slide is generally of the turret variety, having provision for three or four tools as indicated at *B*. The other type of cross-slide, shown at *C*, extends entirely across the ways of the machine and is so arranged that standard or special toolposts can be applied to it as indicated at *D* and *E*. This particular form of cross-slide is in common use on operations requiring forming cuts and grooving and cutting-off operations. In case special tools are required the toolblocks can be designed to carry a group of tools at both the front and rear of the machine so that they will operate successively. The tools used for the cross-slide will be taken up separately in another part of these articles.

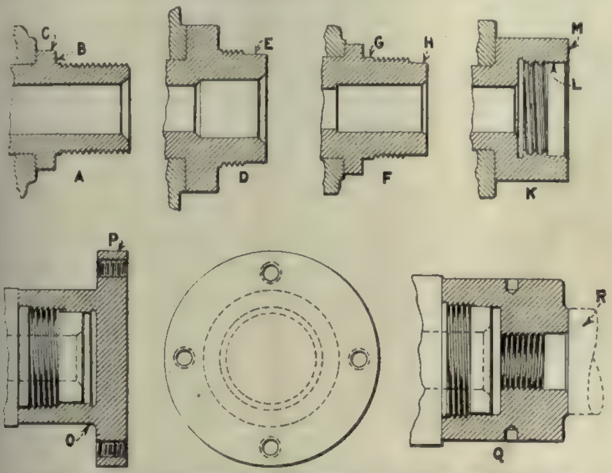


FIG. 213. TYPES OF TURRET LATHE SPINDLES

In pointing out the various factors of importance which must be considered in the design of holding devices for turret and engine lathe work, there are a number of matters which can be taken up to best advantage in the form of general notes. A number of these points are given herewith and more specific cases will be treated in their proper place.

(1) The production required, machine to be used, accuracy necessary in the product and material to be cut, must all be considered before attempting to design the holding fixture for any piece of work. The production required naturally affects the design of the fixture because a cheap fixture could be used when only a small number of pieces are to be machined, and no provision would need to be made for replacements in a fixture of this kind. But for high production work the fixture would need to be provided with refinements to permit of replacements of worn parts and to insure the required accuracy under severe service. The machines used for a given piece of work must be selected carefully, keeping in mind the size of the work, the range required and the accuracy necessary. The machines available in the factory should be listed and a judicious selection made of the machines most suitable for the work. The accuracy required in the finished product makes it necessary not only to consider the condition and quality of the machine tool but also makes it essential to provide accurate fixtures. If a high degree of accuracy is needed provision must be made so that the fixture can be adjusted to run true with the spindle. This is particularly desirable when the work is produced in large quantities.

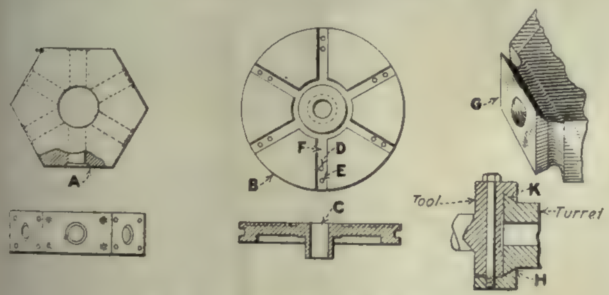


FIG. 214. TYPES OF TURRETS

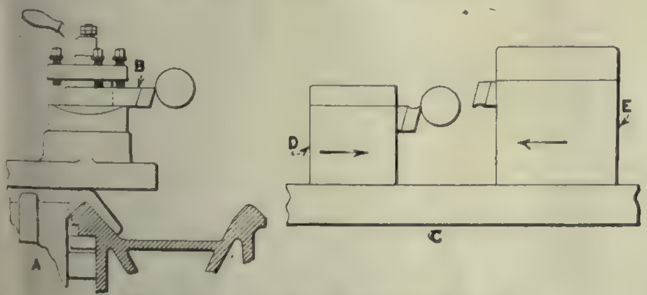


FIG. 215. TYPES OF CROSS-SLIDES

The material that is to be cut influences the design of fixtures to some extent, but the shape of the work, its size and general characteristics are of more importance. A piece of work which is irregular in shape and which has thin sections will require a very carefully designed fixture in order that there shall be no distortion of the work either while clamping or during the cutting action of the tools.

(2) Rigidity: Care must be taken that holding fixtures applied to the spindle of a machine are properly balanced so that they do not vibrate when in motion. It is sometimes necessary to use a counterpoise on fixtures which run at high speed. If the work that is to be held is long and the fixture used overhangs some distance beyond the end of the spindle, it may be found advisable to provide an "outboard bearing" in order to give the proper support. When anything of this kind is used it can be fitted to the ways of the lathe and adjusted so that it will greatly assist in preventing vibration in cases of an excessive overhang. In considering the matter of rigidity in connection with fixtures, the speed at which they will run should always be noted as it is evident that high-speed fixtures would need to be more carefully proportioned than those which run at slow speed.

(3) Location of work: If chuck jaws are used for either inside or outside holding on rough work, they must be carefully proportioned so that their bearing on the work will not be too long. Jaws should be substantial in section in order to withstand the stresses of cutting, particularly when they overhang from the chuck some distance. If fixtures are used for rough castings care must be taken to see that the work locates on only three fixed points. The matter of location of rough castings has been taken up in one of the previous articles. Selection of working points on which to locate castings must take into consideration the shape of the work that is being located and any parting lines, seams or fins on castings or forgings, in order that inaccurate work may not result from improper locating points. Occasionally pattern numbers on the outside of the casting cause trouble in location.

(4) Clamping Methods: Many methods and devices for clamping have been mentioned in previous articles and while the application to turret lathe fixtures may be slightly different from those which have been illustrated, the principles are the same in each case. It must be remembered however, that turret lathe fixtures revolve and therefore loose clamps should be avoided. Work should be supported as nearly opposite the clamps as possible in order that there will be no distortion of the work when clamping.

(5) Safety of the operator: As turret and lathe fixtures are applied to revolving spindles, care should be taken in the design to avoid the use of protruding

screws, clamps or lugs so that the operator will not be endangered by such things catching on his clothing. It is important also to pivot any swinging members or clamps in such a way that the accidental starting of the machine will not tend to break the fixture on account of these members striking the machine as they revolve.

(6) Lubrication of tools: On deep work when long holes are to be bored or when surfaces are to be machined which are not readily accessible, it may be necessary to provide a means of carrying the cutting lubricant to certain surfaces. In some instances a pipe can be carried through the spindle to discharge the lubricant in front of the cutting tools, depending on the centrifugal action to throw it out to all parts of the fixture. At other times openings in the fixture can be made to allow the lubricant to reach the various parts.

(7) Convenience of operation: As the turret lathe is a high production tool, attention should be paid to the convenience of setting and removing the work in order to make it as easy as possible for the operator. The clamps should be arranged so that they are convenient of access and easy to operate. A little attention paid to these points when designing a turret fixture will be appreciated by the operator and will be found to increase the production to a considerable extent. It is sometimes necessary to make sure that the work is properly positioned in the fixture while the clamps are being set up. On work that is difficult to locate, a device may be used in the turrent of the machine so that it will assist in locating and will help to hold the piece in an approximately true position while fastening the clamps.

There are a number of other specific points in connection with the design of fixtures, but as these cannot be handled under the head of general notes they will be treated specifically as the occasion demands. A number of cases will be cited during the progress of these articles and the important features will be mentioned in the description.

Machining Two Peerless Rear-Axle Parts

The Rear-Axle Housing, Its Machining and Assembly—Fixtures Used in Production of the Brake Spider

By FRED H. COLVIN

Editor, *American Machinist*

THE Peerless rear-axle housing is of pressed steel, enlarged in the center to receive the differential and its carrier, and is suitably welded and reinforced at necessary points. There are twelve operations as follows:

Operation 1. Face and center both ends.
Operation 2. Drill six rivet holes and drill one hole for 1-in. pipe tap.
Operation 3. Press two collars in place.
Operation 4. Drill six rivet holes in collars.
Operation 5. Drive six rivets and tap for 1-in. pipe.
Operation 6. Straighten.
Operation 7. Grind taper ends.
Operation 8. Mill both faces.
Operation 9. Disk-grind both faces.
Operation 10. Drill twenty holes for $\frac{7}{16}$ x 14 tap and two holes for $\frac{1}{2}$-in. tap.
Operation 11. Tap twenty-two holes.
Operation 12. Final Inspection.

The first operation is performed in the fixture shown in Fig. 1. The fixture is mounted on the carriage of a plain engine lathe and is indexed so as to alternately present the ends of the housing to the inserted tooth chamfering cutter held in the lathe spindle. The housing is positioned by the hole in its center and is clamped at that point and at both ends, the fixture being so designed as to allow the work to be easily handled in and out of the machine and at the same time to be held firmly and correctly while in place.

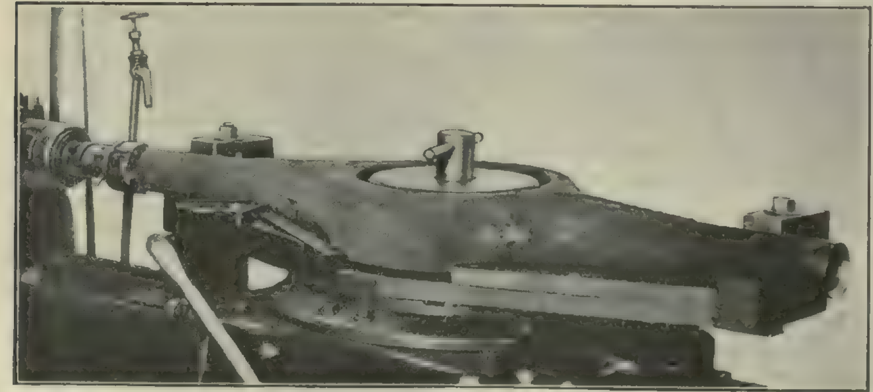


FIG. 1. FACING AND CENTERING ENDS

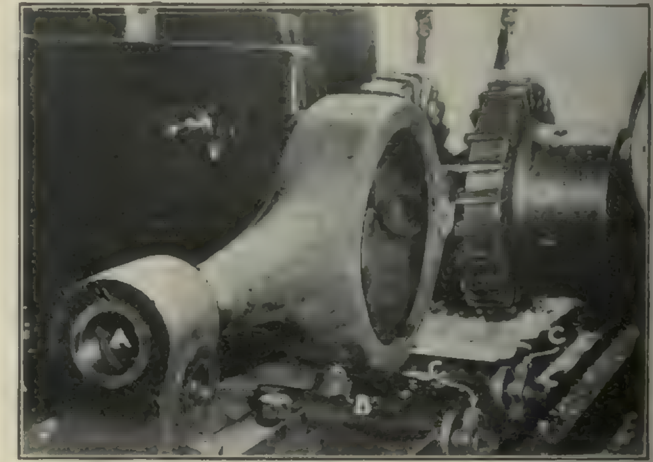


FIG. 2. MILLING BOTH SIDES OF HOUSING

When operations 2 to 7 have been performed the housing goes to the double-end Lucas boring machine, shown in Fig. 2, where the sides are milled as can be seen. The housing is held by the ends that have been previously finished as at *A* and is also supported under the center at *B*. The supporting pins at *B* are controlled by the knobs *C* and *C* so as to insure steadiness under the thrust of the two milling cutters, which work simultaneously.

After inspection, the housings go to the assembling department, where the combined brake spider and spring pad are forced in place as in Fig. 3. Here the housing is clamped at *A* while the assembled brake spider is forced over the finished ends by means of the hydraulic ram *B*. The guide *C*, which is pivoted by a cross-shaft, makes it easy to locate the spider by means of the spring pads and locates them both in line so as to insure even action of the springs on both sides of the car.

Leaving this department the axles go for further assembly to the department shown in Fig. 4, where they are slid along substantial assembling stands which are of a convenient height and here the brake bands and other attachments are put in place. Here too, are the rear axles as can be seen in the box under the first assembling bench. After the brake bands and the differential carrier are put in place, together with the cover on the back the rear axle is ready to go on its way toward the final assembly.

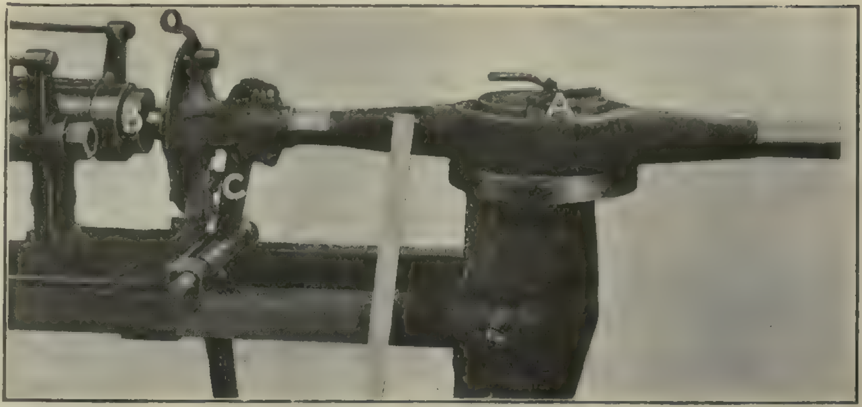
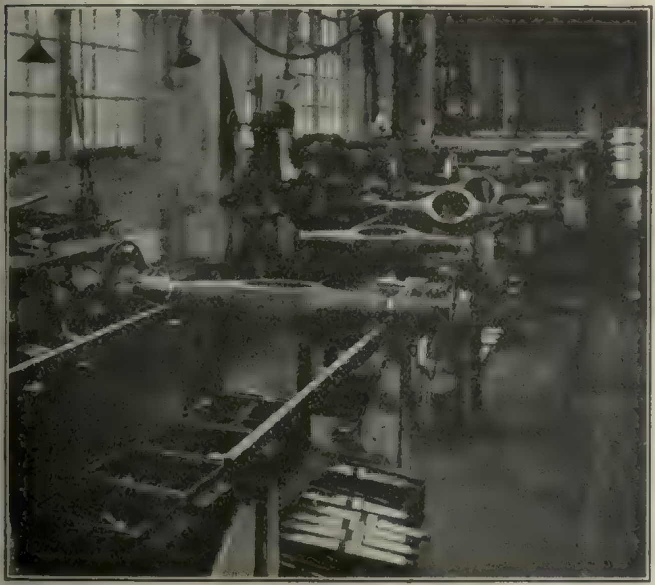


FIG. 3. FORCING ON THE BRAKE SPIDER

The brake spiders with their spring pads are made of malleable iron and are both right- and left-handed. While there is considerable work on them only eleven operations are necessary, including the inspection. The sequence of operations is as follows:

Operation 1. Bore, face flange and tap.
Operation 2. Finish bore taper hole and chamfer.
Operation 3. Mill spring pads.
Operation 4. Drill thirteen holes.
Operation 5. Drill eleven holes.
Operation 6. Drill five holes.
Operation 7. Spot-face four holes.
Operation 8. Drill two tap holes.
Operation 9. Ream taper hole.
Operation 10. Tap two holes.
Operation 11. Final Inspection.



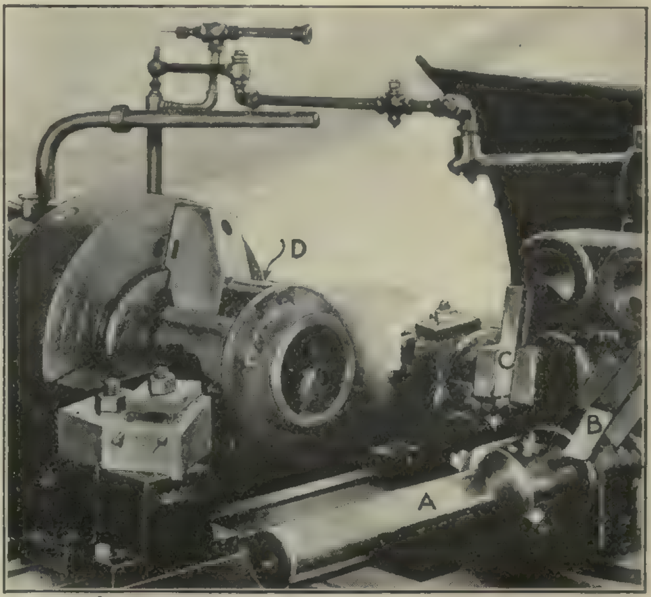
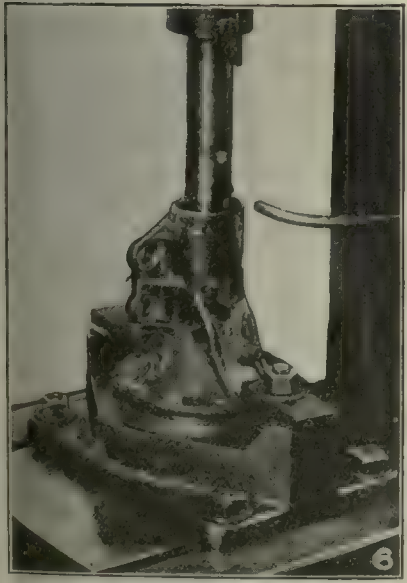


FIG. 4. ASSEMBLING THE REAR AXLES. FIG. 5. BORING AND FACING BRAKE SPIDER



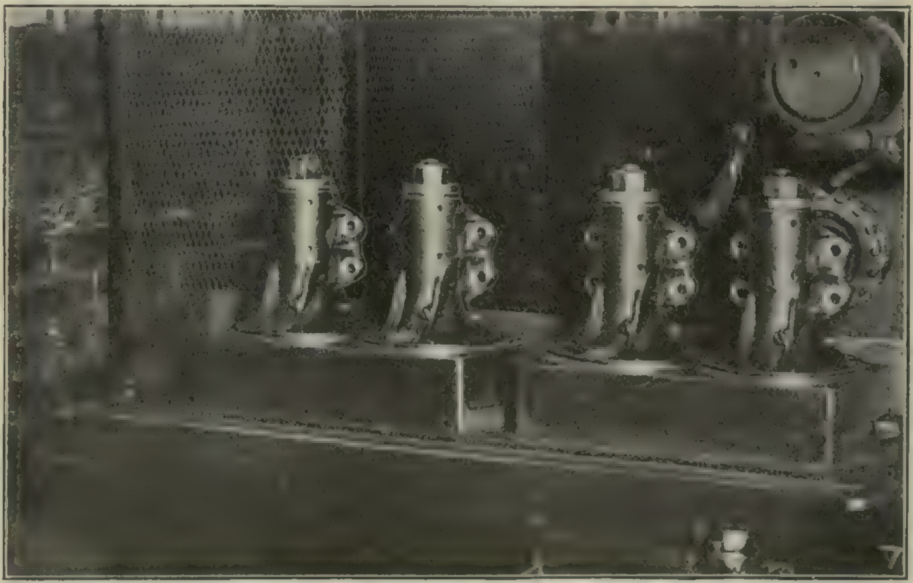
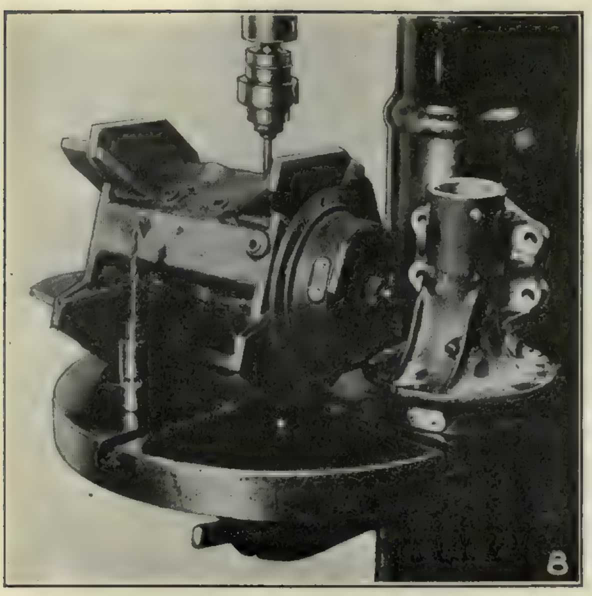


FIG. 6. FINISHED BORING AND CHAMFERING. FIG. 7. MILLING THE SPRING PADS



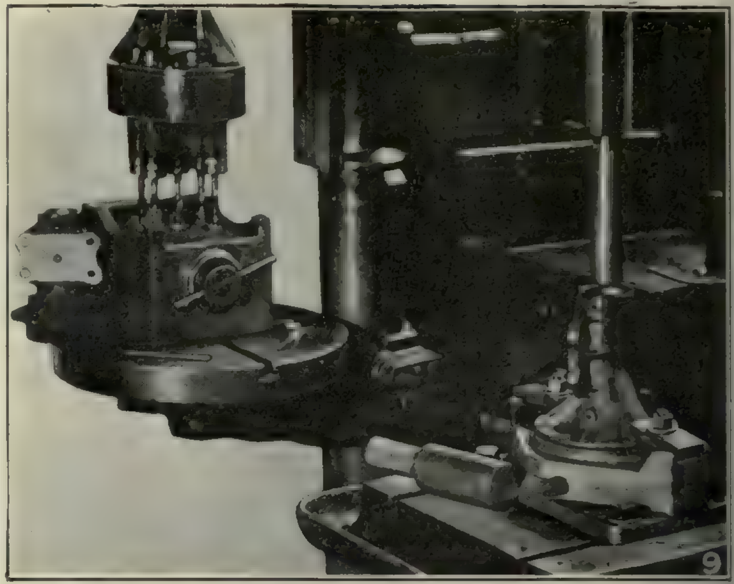


FIG. 8. DRILLING ANGULAR HOLES. FIG. 9. DRILLING SPRING PAD AND REAMING SPIDER

The first boring, facing and tapping is done on a Potter & Johnston machine as shown in Fig. 5. The boring bar *A* shown in the foreground, is guided by a bushing to insure steadiness of the boring tools. The cross-slide is used in facing and some of the turning, while the two cutters *B* and *C*, substantially supported on the turret, finish the turning. The work is supported by internal guides, so as to insure concentricity and reduce the strain on the chuck. Another interesting feature is the use of long studs projecting from the jaws for reaching the back side of the flange. One of these is shown at *D*, each of the other jaws being similarly provided.

The finish boring, including the taper hole and the chamfering is done on a Foote-Burt drilling machine, as shown in Fig. 6. This view shows how the fixture locates the spider by its flange and holds it by means of the two straps shown.

Milling the Spring Seat

The milling of the spring seat or pad is accomplished on a Cincinnati knee type milling machine with fixtures which handle the work in pairs as shown in Fig. 7. These fixtures are simple blocks, raised high enough from the table to accommodate the projection on the end of the work and are cored for lightness. They are simple fixtures and require no further explanation.

Fig. 8 shows an interesting "roll-over" drilling fixture which provides for drilling a number of holes at varying angles. By using quick change drill chucks, the two sizes of holes are readily secured. The angles on the flanges of the fixture make it easy to roll it from one position to the next.

Drilling the spring pad and reaming the taper hole where the spider fits over the housing, are both shown in Fig. 9. The Hoefer five-spindle drilling head used, is attached to a Cincinnati drilling machine and completes drilling the pad at one operation.

Cut the Force or Reduce Working Hours?

By W. Burr Bennett

On page 375 of the *American Machinist* Mr. Forbes makes some observations that to the writer's mind are very much to the point and entirely coincides with our own experience. Especially is this true with regard to the last part of the article.

We have been running full time since Jan. 1st, 1921, chiefly by making persistent efforts to acquire business, and it is also our experience that we have fewer applicants for employment than during either the war or "boom" times. In fact we have had to advertise to get men at all and our records show only ten voluntary applications for machine operators, machinists or toolmakers since the first of this year. The daily press tells us that there are something like 500,000 men out of work but we haven't seen any around looking for jobs. Possibly it needs a little cold weather to bring them in. And a little observation on the writer's part among some other factory managers shows the same results. We realize of course that the large industrial centers have plenty of men looking for jobs but in the smaller towns we don't get them. But we do notice and we cannot help from commenting on it, that the pool rooms and cigar store "hang outs" are well occupied. (We hold no brief for or against pool rooms or cigar stores, but make the point as an illustration that seemingly everyone still has plenty of wealth.)

Organization and Management of the Small Shop

VI. Value of Cost Records—What Profit Should Be Based Upon—Classification of Material and Labor Accounts—Overhead and What It Consists Of

By E. W. LEACH

I KNOW of one manufacturer who, when approached by a salesman of any kind, always asks as one of his first questions, "Why do *I* need that?" It makes no difference if the salesman is trying to put over a new adding machine, a set of books or an advertising campaign, the old stand-by question is never forgotten. That manufacturer has about 300 men in his plant under normal conditions, his products are varied, and the men work on a premium plan of payment. I can easily imagine that he said to himself a good many times, "Why do I need a cost system?" But the system now in use in his plant is complete without any unnecessary frills, and in October, 1920, when so many neighbors were retrenching considerably or even closing down for thirty days, his company experienced its largest month in sales in twelve years.

No doubt you in your small shop have asked yourself the same question, "Why do I need a cost system?" but the fact that you are small and susceptible to the sorts of negligence that characterize so many small shops is all the more important reason why you should know exactly what your products cost you. A great many small manufacturers say to themselves, "Well, my competitors' products average about $50 in selling price. Mine is really a little better, but I'll put it out at the same figure. They must be making lots of money at that rate, so I guess I will." I'm not going to waste any great amount of space or time combating such a foolish theory as that, but it is certainly unfortunate that business men should be led astray so often just because it seems to be so simple a way of apparently solving what might otherwise be a complicated problem.

Business at its best has the element of guesswork conspicuously present; and without a cost system a manufacturing business is a hit-or-miss proposition of the most haphazard sort, with most of the emphasis on the "miss."

What Profit Should Consist Of

Whatever may be the product you are manufacturing and whatever may be the special conditions or circumstances peculiar to your own business, you are engaged in that business for the same reason as anyone else—*to sell goods at a profit.* That profit is not determined by selling price, it is determined by *cost.* The proper procedure is to determine your *cost,* add a fair and reasonable *profit,* and let the selling price depend upon the first two considerations. And in order to determine your cost with any degree of accuracy at all, you must be guided by certain methods and follow some definite plan—you must have a *system.*

No one system could ever be designed that would fill the exact needs of two different plants. By reason of their very differences, the same forms could not be used in both shops, nor could the same rules of practise apply. I feel, therefore, that this article will accomplish most if I let theory share with practice to quite an extent, with the hope that I may be able to suggest certain principles from which you can decide what physical form a cost system for your shop must assume.

The cost of an article is divided usually into three parts—material, labor and overhead. The material cost includes the actual cost of the materials in that article; the labor cost includes the actual cost of the labor directly expanded in making that article; and the overhead includes the portion or percentage of the expenses of the business that should be charged against that article. Determining the cost of the material used in any certain part is a very simple matter. On the bill of materials shown in the previous article, for example, you can determine the cost of the castings from their weight and from the price per pound that you are paying for them. The cost of the steel parts you can determine by knowing how much steel is used in each part and knowing the cost per hundred pounds. Any other parts or materials can be priced from the invoices.

Price Versus Cost

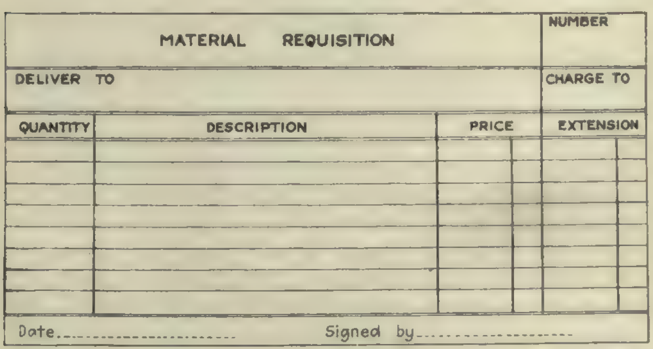
However, the mere price you pay for these different materials may not be all of their cost to you. Even before you have done any work on the raw materials you may have hauled them from freight depots or from local warehouses to the shop in your truck, you may keep a man busy in your stockroom looking after the material after it arrives, or it may be in such quantities that is occupies a considerable amount of space in the shop, for which it really should pay "rent." All of those things cost you money, and that cost should be added to the cost of your material and included in the item you call your "Material Cost." Make a list of the expenses incurred in direct connection with your material before any actual labor is put upon it to transfer it into the finished product. If the cost of those expenses amounts to 5 per cent of the invoice costs of the materials, it will be worth considering separately. If it is not that large, it will be sufficient to let those expenses be included in your general overhead charge, even though that may really be an incorrect distribution of the expense.

Materials should be divided into two classifications; direct and indirect. Direct material is that which is actually used in the product itself; and it is direct material that we have been talking about. Indirect material includes such items as oils, waste, brooms, small tools and similar supplies that are used in the shop. The cost of indirect materials is a part of overhead expense and should be included in that item. Paint or enamel may be used on your machines or products, and because of that fact should be considered truthfully as direct materials.

However, it is difficult to say with accuracy just what the cost of the paint on a certain part may be, therefore practically everyone considers paint as indirect material and the labor of painting as indirect labor. Permanent materials such as machinery and equipment do not enter directly into the cost of your product because they represent an asset the same as your plant, and their increase is a part of your profits just as though you took those profits out in cash instead of letting them stay in the business in those forms.

There are different ways of figuring the cost of indirect materials each month. The most accurate, and therefore, the correct way is to compute the cost of the materials actually used during that month. This will necessitate use of some form of "Material Requisition" (Fig. 3). A material requisition is an order to deliver certain goods to the person presenting it. With this there is tied up a second form that we might call a "Purchase Requisition" (Fig. 4). A purchase requisition is a memorandum to the person who does the buying, indicating a need of certain materials or supplies.

A purchase requisition has certain virtues which make it one of the first forms a small shop should use. For one thing, it requires the person making the request to "put it in writing." Unless you are an exception, you are a very busy man and have any number of matters constantly on your mind, all of which demand their proper share of your attention. When Bill Jones stops you on your way through the shop and tells you they're all out of $\frac{9}{64}$-in. drills, the chances are that you will have forgotten all about drills before you ever get to the office. Later, when the matter again comes to your attention and you want to make out some orders, you can't just remember with certainty whether it was $\frac{9}{64}$- or $\frac{9}{16}$-in., and Bill may not be sure of it himself either.



MATERIAL REQUISITION				NUMBER	
DELIVER TO				CHARGE TO	
QUANTITY	DESCRIPTION	PRICE		EXTENSION	
Date		Signed by			

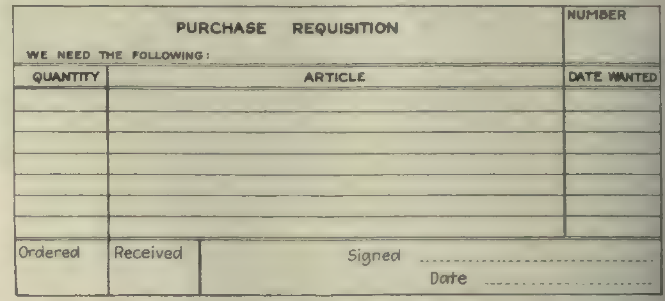
FIG. 3. SAMPLE "MATERIAL REQUISITION" FORM

But if Bill Jones can make out a requisition for a half dozen $\frac{9}{64}$-in. drills, give you the original and keep a duplicate copy for his own reference, *he* knows that *his* part of it has been taken care of, and *you* know the shop needs drills, That requisition is there to constantly remind you until they are ordered and *your* part of it is taken care of also. The purchase requisition shown is a bit different in one or two details from the stereotyped requisition form, and I believe it is especially a "small shop form" for several reasons.

Systematic Checking of Materials

In general, it is another "multi-purpose" form. I would recommend that it be made out in duplicate, one copy to be kept by the person issuing it, and one copy to be turned over to the person who will order the goods called for. The item "ordered" acts as an additional check for yourself and should be filled in by you at the proper time, so that you will have on the requisition a record showing that the goods have actually been ordered. The item "received" should be filled in when the goods arrive at the shop, and the requisition kept with the others until the invoice for the goods reaches you, when it should be pinned to the invoice for ready reference when the invoice comes up later for payment. When the goods are received and put into stock or given to the workman who issued the requisition, his copy should be given to you, so that any requisitions which any of the men may have at any time will represent goods they need that have not yet arrived at the shop.

If you plan to require written requisitions for materials issued, you will have to have some sort of stockroom with a man or boy in charge. Frankly, you will have to keep your materials under lock and key, or you might just as well figure the amount of their monthly use with an ouija board and expect accurate figures. There is hardly any occasion for making out but a single copy of a "Material Requisition," for the goods are delivered at once when the requisition is presented. If they are not (because of lack of those materials) the person in the stockroom should call your attention to the shortage by means of a purchase requisition. At the end of the month, instead of charging indirect materials with the entire half dozen $\frac{9}{64}$-in. drills, you will charge that account with the cost of the number of those drills that have been given out, and so on with all your supplies.

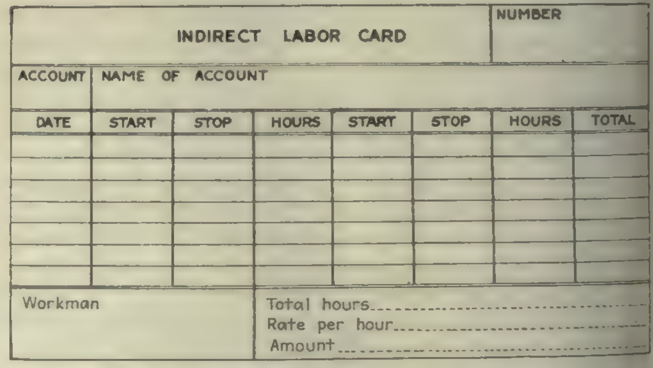


PURCHASE REQUISITION WE NEED THE FOLLOWING:		NUMBER
QUANTITY	ARTICLE	DATE WANTED
Ordered	Received	Signed Date

FIG. 4. SAMPLE "PURCHASE REQUISITION" FORM

The Indirect Materials Account

A less accurate way, but one that is much easier and quite satisfactory in many shops, is to figure the cost of the indirect materials bought during a certain month—or, to be strictly accurate perhaps I should say the cost of the materials *paid for* that month. That is the method the writer used in his first small shop, and it served the purpose adequately for some time. Whenever I listed a check, the amount of that check was charged to some one or more accounts, such as indirect materials, for example. Goods bought in February were paid for early in March, so in March when I made out my overhead report for February, I used the total sum charged to the indirect materials account during March.



INDIRECT LABOR CARD						NUMBER	
ACCOUNT	NAME OF ACCOUNT						
DATE	START	STOP	HOURS	START	STOP	HOURS	TOTAL
Workman			Total hours Rate per hour Amount				

FIG. 5. SAMPLE "INDIRECT LABOR CARD" FORM

That method, obviously, has one disadvantage that would condemn its use in large plants. If you bought a barrel of cutting compound, it would last you three or four months. It would hardly be fair, really, that all its cost should be charged into one month and not any of it the other two or three months; but in some small shops there is not a large enough percentage of indirect materials stocked up for months ahead so that that phase of the cost distribution need be considered seriously.

DIVISION OF LABOR ACCOUNTS

Labor, also, is of two kinds—direct and indirect, and you can readily understand the distinction. Direct labor is the labor actually put into making your machines. Indirect labor is sometimes called "non-productive labor," and includes wages paid to the superintendent or foreman, draftsman, stockkeeper, packers, shipping clerk, truck driver, errand boy, and similar employees. Indirect labor, like indirect materials, should be made a part of your overhead. If you are not interested in knowing the divisions of your indirect labor expense, it can be figured very easily.

When I had less than ten men on the shop payroll, I totaled each week the cost-per-job on all job cards turned in during that week, and substracted that amount from the payroll for the week. The different gave me the amount I had paid for indirect labor. This was really very accurate. Of course, this gave me all the indirect labor in one lump sum without analyzing it in detail. If you wish to do that, you can make up an "indirect labor card" (Fig. 5) very similar to a job card, on which the men record the time they spend on indirect work. These cards can be turned in at the end of the week and sorted according to the accounts charged. In this way, too, every minute of the men's time is recorded on some card; and there is a reaction from their knowing that you are keeping a complete record of everything that they do.

The methods for figuring and recording direct labor were discussed in the previous article, so that it would only be repetition to explain them here. Direct material cost plus direct labor cost gives what is usually grouped under the general term, the "Direct Cost." The actual cost to you of the finished part, however, must include something more—the overhead.

THE DEFINITION OF "OVERHEAD"

Overhead is an expense, or rather a summary of expenses. It is the expense incurred incidental to the manufacturing of a finished product. There is another type of expense that must be computed, and that is selling expense. Overhead expense must be added to the value placed on finished products in making up cost figures and inventories. Selling expense overhead cannot be included at that time because *that* value has not been added to the product until it has actually been sold. We are immediately concerned, therefore, only with manufacturing expense, or factory overhead.

Two important items to be included in your factory overhead have already been discussed—indirect labor and indirect materials. Some other expenses that are a part of factory overhead are repairs, maintainance, heat, light, power, taxes, rent, interest, insurance and depreciation. There may be still other items peculiar to your own business.

One good way to determine whether the cost of an item should be charged into factory overhead is to ask yourself this question, "Does the spending of this money add to the permanent value of my business?" Heat, power, indirect labor, all such items add nothing of a permanent nature to the value of your business. While they all contribute to your comfort and your success, they cannot show up on your financial statements. For instance, a broom that costs one dollar will quickly be used up and should therefore be charged into factory overhead through the indirect materials account.

Permanent additions to your building or your equipment, however, are quite different. A high-speed milling cutter, or a new concrete floor in part of your shop, is something that increases the total value of your tools or plant, and therefore should not be included in overhead.

In discussing factory overhead we must bear in mind that we are thinking of it only in connection with small shops. A discussion of departmental distribution is unnecssary, because the class of plants in which I am interested have no departments, the whole productive section being combined into one place, known as "the shop." So I shall waive the importance of distributing factory overhead among departments, believing that your purpose will be amply served by considering your overhead expense as a single total.

COMPILING THE OVERHEAD REPORT

You will want to make out an overhead report each month (similar to the one shown in Table 5), partly because the month is the standard business unit of time, and partly because the various expenses in your overhead are usually paid each month. Overhead expense is usually compared with direct expense in terms of percentage, the direct expense including either the labor cost or the labor and material cost. In a previous article, an illustration of a factory order card showed the following in one corner of the card; "Note, overhead is figured on labor only."

TABLE 5. SAMPLE "OVERHEAD REPORT"

Office expense	$ 9.20
Indirect labor	142.78
Superintendence	90.00
Indirect materials	27.75
Light and power	19.62
Rent	50.00
Taxes	2.08
Interest on Notes	13.33
Depreciation on Equipment	37.50
Total	$392.26
Direct labor	896.02
Overhead expense	392.26
% Overhead	43.7
SELLING EXPENSE	
Office salaries	162.00
Office expense	0.20
Printing and advertising	73.50
Total	244.70
Cost of goods sold	1,328.09
Selling expense	244.70
% Selling Expense	18.5
Production cost per machine	6.356
Selling expense	1.176
Total cost per machine	7.532
Net selling price	12.00
Profit	4.468

The factory overhead expenses incurred in operating your shop will more likely be proportionate to the cost of the work that is performed on each part rather than to the weight in pounds of that part or the cost of the material of which it is made. As was explained earlier in the article, there are certain expenses incurred defintely on materials, and those expenses should be kept separately and their percentage of the total cost of all materials purchased, figured as an overhead all by itself—a material burden, and should be added to the cost of the material whenever the cost is to be used in figuring the cost of the part or product. The other overhead expense, however, (which will be 90 per cent of the total) should be included in the general factory overhead. The total amount of such expenses should be figured each month as a percentage of the total direct labor, arrived at by totaling the job cards turned in for that month. This percentage is your overhead.

In the typical overhead report shown it is 43.7 per cent. The cost of a certain casting would then be figured as follows:

Material	.1450
Labor	.0848
Overhead (43.7%)	.0370
Total cost	.2668

Very nearly all of the items that enter into the overhead can easily be grouped into monthly amounts because they are paid for each month. Taxes are more often paid once a year. If that is your case, the amount you pay for taxes should be divided by twelve and that amount used on your monthly overhead report. Depreciation is simply the decrease in value of your plant and equipment, and how much it shall be figured in your overhead is something to be determined only by your own good judgment. It depends on the condition of your building and your machinery and tools, and on how long they will be serviceable. An average charge for depreciation of buildings is 5 per cent a year and of machinery, 10 per cent. Small tools, such as milling cutters, chucks, vises, etc. will not last as long as the machines themselves, and patterns (if wood) will last an even shorter period.

Remember that when including your overhead expense in the cost of your goods you are simply making the purchaser of your product pay those expenses, and if you leave out items that should be included, or if you make your overhead too low (in an apparent attempt to keep down costs) you are actually giving your customer a discount, because you, yourself, are paying for some of the expenses that really should be included in the purchase price of your product.

A cost system (any sort of record, for that matter) is of no value to you unless you make constant use of it. The principal function of a cost system is to determine the cost of your product. It is not sufficient to determine the cost of a certain machine, and then forget about that cost until a year later when the possibility of a change in price may occur to you. Such a practice is overlooking the greater purpose of your cost records—that of providing comparisons. You should compare the cost this month with the cost in previous months, not merely of each machine and each part, but of every single operation.

If certain jobs seem to be advancing in cost out of all proportion to the averages, it is time to inquire why. If the drill press operations have advanced 20 per cent in cost when operations on other machines have not advanced at all, it is time to investigate the drill press and its operator. If the milling machine operation costs are consistently lower, pass a part of the saving along to the man who created it for you by putting another 5 cents an hour into his pay envelope. You should also keep records or graphic charts to show monthly changes in the average wage per hour paid to your men compared with changes in cost of some machine taken for comparative purposes. With these two items you might also show on the same chart the changes in factory overhead and selling expense. Those records and charts will tell many an interesting story if you'll just let them; and in many cases they will act as a barometer and foretell some impending condition in time for you to take steps to prevent or counteract it.

If your competitor is able to sell products similar to your own for considerably less money than you sell your products for, it is probably not because he has a monopoly on material supply or because he makes slaves of his men and forces them to work long hours on short salaries. It is most likely because he is able to *save* in places where you do not. If you wish to decrease the cost of your product, your biggest possibilities lie along the lines of increased efficiency in manufacture through elimination of wastes and the lowering of unit costs through faster and better ways of doing things. A cost system, however simple it may appear to someone else, if it determines and records your costs and provides information that you can interpret into facts that are a help in increasing production efficiency and decreasing the very costs of which it is built—is worth its weight in gold. And that is mighty valuable.

Measurement of Ring Gages by Ball Method

Several rings were tested during the month at the Bureau of Standards by the ball method. The method used is a modification of that heretofore employed, which uses two balls the sum of whose diameter is slightly greater than the diameter of the ring. The new method consists of placing three balls of the same diameter in a ring 120 deg. apart with a fourth ball resting on them. This method gives substantially the same results as the two-ball method. In this connection there is need for a more accurate method of governing the contact pressure in measuring precision balls. The machine with a drop plug indicator on which this work is now done has sufficient friction in the anvil end to cause an uncertainty in the measurement of the contact pressure used. To provide a better means for measuring balls, and also for comparison of precision gage blocks by mechanical means, drawings of the millionth comparator used at the National Physical Laboratory, England, and by the Pratt & Whitney Co. have been secured and it is to be expected that a similar comparator will be constructed at the bureau.

Metal Cutting Tools—XV

By A. L. De Leeuw

(Continued from last week's issue.)

Hobs are made in various ways: With single or multiple thread, as shell or shank hobs, with parallel or with spiral gashes. Furthermore, the angle of spiral may vary, though all other elements of the hob and the elements of the gear to be cut may be the same.

In Fig. 245 a hob is shown at the moment when it begins to do work on the gear. It will have to penetrate a distance *a* before the centerline of the hob is on the same plane with the top of the gear; that is, before it begins to finish any one part of the gear. This distance *a* is the approach and the time consumed to feed this distance may be considered as waste time. As the hob is shown in Fig. 245, its axis is supposed to be parallel to the face of the gear, which is a condition which we cannot realize in practice when cutting a spur gear.

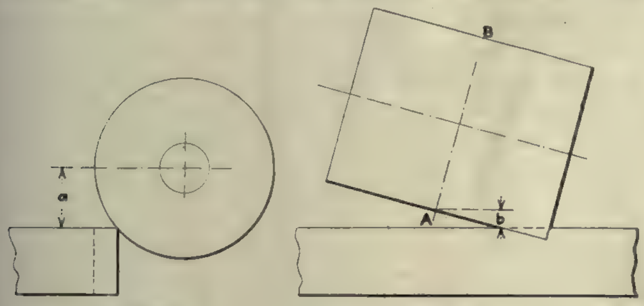


FIG. 245 FIG. 246

FIG. 245. HOB ABOUT TO ENTER WORK. FIG. 246. HOB SET AN AN ANGLE TO WORK AXIS

Fig. 246 shows a hob set at an angle to the gear. This angle is supposed to be equal to the angle which the teeth around the hob make with its axis. In Fig. 245 it was the section *AB* which we considered. We see from Fig. 246 that the hob will have to travel a distance *b* in addition to the approach *a* before the hob begins to finish any part of the gear. The distance *b* depends on the spiral angle of the hob. With a multiple thread hob the spiral angle becomes greater than with a single thread hob, so that the distance *b* is also greater. If we have to cut gears (either a single gear or a stack of gears) with a total face *f*, then we would have to cut a total length of $f + a + b$ for a single thread hob, and a distance of $f + a + b_1$ for a multiple thread hob. We will readily see that $f + a + b_1$ is more than $f + a + b$, so that we have a greater loss with the multiple thread hob. However, the loss is never very great and where rapid production is the controlling factor multiple thread hobs should be used. As a matter of fact, they are largely used for roughing or for the production of gears where no extreme accuracy is required.

In the hobbing process indexing is not required, and as we know, indexing is one of the sources of error in gear cutting. Furthermore, a hob does not finish a single tooth and then proceed to do work on the next one, but it distributes its work around the entire circumference of the gear, so that there can never be local heating and consequent distortion of the blank. The spiral of the hob is made in the same manner as a screw thread is made, and screw threads can be produced with a very high degree of accuracy. Altogether, then, the hob has inherent qualities which will cause it to produce a very accurate gear. However, if we use a double, or in general a multiple, thread hob we eliminate some of these inherent good qualities. This was discussed at some length in article X.

If a spur gear is cut with a single thread hob and if the normal pitch of the thread is equal to the pitch of the gear, it becomes necessary to set the axis of the hob at an angle with the face of the gear, and this angle is the same as the spiral angle of the hob. If the gear to be cut were a helical gear it would be necessary to make this angle equal to the angle of the helix plus or minus the angle of the spiral of the hob. If the angle of the helix is great and we make the direction of the thread of the hob such that we have to add the two angles, then the hob will make a very large angle with the face of the gear. This will mean in the first place that we have a very large approach and in the second place that the hob will have to travel some distance below the face of the gear in order to finish up both sides of the teeth; and therefore that it would interfere with anything which might be directly below the gear. This happens when cutting herringbone gears; so that if herringbone gears must be cut with a large helix angle, a very wide groove must be left between the two parts of the gear in order to allow them to clear the hob.

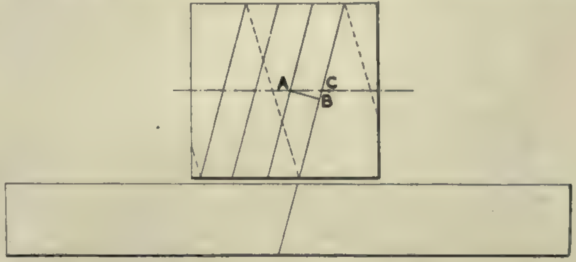


FIG. 248. MULTIPLE THREAD HOB FOR HELICAL GEARS

Besides all this, at the beginning and toward the end of the cut the cutting action takes place from only one side of a tooth; so that there is liable to be an offset or shoulder at a point where the hob begins to act on both sides of the teeth. This is shown in diagrammatic form in Fig. 247, where *AB* represents the axis of the hob at the beginning of the cut and A_1B_1 near the end; while the lines *XY* and X_1Y_1 represent the two sides of the tooth gap.

These difficulties in the use of a hob for herringbone gears and, for that matter, to a certain extent for all helical gears can be very neatly overcome by the use of multiple thread hobs. If, for instance, the angle of the gear teeth is 25 deg., all we have to do is to construct a hob of which the angle of the spiral is 25 deg., in which case we can place the hob parallel with the face of the gear. This condition is shown diagrammatically in Fig. 248. When using a hob in this manner it becomes necessary to select a diameter of hob which permits the application of this scheme. The spiral angle of the hob is determined by its diameter, by the number of threads, and the normal pitch. As the normal pitch and the number of threads are predetermined and as we want to obtain the same angle as the angle of the helix, we must calculate the diameter. However, this is a simple matter, as the following example will show.

Angle of helix—25 deg.
Number of threads—4.
Normal pitch—6 diametral.

In Fig. 248 the line AB equals $3.1416 \div 6 = 0.5236$. The line AC equals $AB \times$ sec. 25 deg. $= 0.5236 \times 1.034 = 0.5414$.

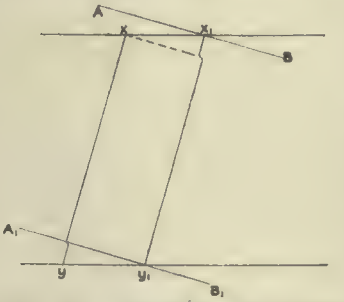


FIG. 247. DIAGRAM SHOWING OFFSETS AT BEGINNING OF CUTTING

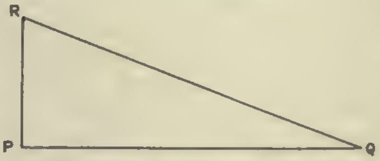


FIG. 249. DIAGRAM OF HOB CALCULATIONS

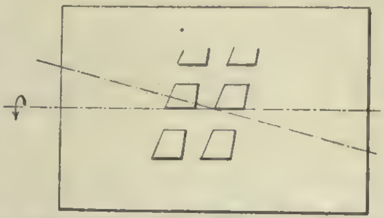


FIG. 252. HOB WITH GASHES PARALLEL TO AXIS

The lead is therefore $4 \times 0.5414 = 2.1656$. In Fig. 249 the thread is developed. The line PQ is the circumference of the pitch circle of the hob, and PR is the lead, 2.1656; while the angle PQR is 25 deg. We find that the line $PQ = 2.1656 \times$ cotg. 25 deg. $= 4.644$; so that the pitch diameter of this hob would be 1.478. This is probably too small and, unless it should be possible to use a shank hob, we would have to make another trial with more threads in the hob, say six or eight. A hob used in this manner has, of course, the disadvantages of all multiple thread hobs, but there are many cases in which the required accuracy of the gear is not so exacting but that we would be permitted to use this method. There is another practical consideration against the use of such hobs. As long as we use a hob by setting it at the required angle, namely, the sum of the angles of the helix and the spiral of the hob, we produce a normal pitch in the gear equal to the normal pitch of the hob, and we can therefore use this hob for helical gears with any helix angle and also for spur gears. However, as soon as we use a hob in the manner shown in Fig. 248 we can only use it for helical gears with the particular angle for which the hob is calculated; though here again, we have some leeway, as we shall see. Using a hob in this manner we depend on the axial pitch and we reproduce this axial pitch in the gear to be cut. As soon as we turn this hob to any angle with the gear, we produce a new axial pitch. If we should wish to cut a gear with a helix angle of 24 deg. instead of 25, all we would need to do is merely set the hob to an angle of 1 deg., and we would again have the same normal pitch as we had cut in the gear with an angle of 25 deg. This shows that after all we can cut more than one angle of helix with the same hob, but this is only true to a very limited extent. The teeth of the hob have clearance and, in the nature of things, this clearance cannot be very great and if we tilt the hob to a certain angle, we very soon destroy part or all of that clearance.

Fig. 250 shows a hob with spiral angle of 30 deg. The clearance of the individual teeth is 6 deg. The direction in which a tooth cuts is shown by arrow No. 1. It would seem at a first glance that the tooth has negative clearance on the right and an excessive amount of clearance on the left; and this would be true if the gear were stationary while the cut is being taken. However, the gear has a movement toward the right and this causes the cut to be in the direction of arrow No. 2. It is well that one should have a vivid picture of this thing in order to understand clearly the possibilities and limitations of the hobbing process.

Let us imagine a chisel being forced down in the direction of arrow No. 1 (see Fig. 251). It must split off all the material to the left of AB and it must push the rest of the piece to the right. If the piece is rigidly held, as it is supposed to be in a machine tool, the chisel itself must move toward the left. If it cannot do so, something will have to break, provided the machine is not stalled. If, however, the piece of work has a movement in the direction of arrow No. 2, the line CD will be the line along which the cut is taken and the tool may clear if the motion of the work in the direction of arrow No. 2 is sufficiently rapid as compared to the motion of the tool. The shaving removed will no longer be all the material to the left of AB, but the piece CDD_1C_1. This is exactly what happens when we apply the principle of the multiple thread hob to the cutting of helical gears.

A hob may be made with right- or left-hand thread. If made with right-hand thread and running right hand, it will have a tendency to pull the blank it is cutting; in other words, it would cause the blank to rotate in right-hand direction (looking at the top of the blank) and therefore that is the direction in which the blank should be driven by the machine. If the hob were made with left-hand spiral and were rotating in a right-hand direction, the direction of the blank would have to be left-hand. The directions referred to are, of course, relative only and depend on the way we look at hob and blank.

As to the cutting of a spur gear, the direction of the spiral has no effect; but when helical gears must be cut this direction of spiral must be taken into consideration. The effect has been mentioned before: namely, that the angle between the axis of the hob and the face of the gear is, in one case—angle of helix plus angle of hob spiral, and, in the other case, angle of helix minus angle of hob spiral.

If we want to cut a helical gear with 25-deg. helix angle we can reduce the angle to which we have to set the hob by making the spiral angle of the hob large and by giving it such a direction that we can set it to the difference of the two angles. By making the spiral angle 25 deg. we can even set the hob parallel to the face of the gear. But if we wish to cut a herringbone gear, one part of which, of course, has a right-hand and the other part a left-hand helix we will need two hobs: one with left-hand and the other with right-hand spiral angle, and we must use the left-hand hob for the right-hand helix and vice versa.

In the foregoing discussion it was taken for granted that the cutting face of the hob tooth was at right angles to the direction of the spiral, which is the case with the ordinary spiral gashed hob. However, not all hobs are made this way. Many hobs are made with the gashes parallel to the axis, as indicated in Fig. 252. The main advantage of this construction is obvious. It becomes much easier to regrind the hob. Its chief disadvantage lies in the fact that the hob acts as if it had negative rake on one side of the teeth. As a consequence it is liable to produce rough work.

To minimize this effect a hob of large diameter is required, because a large diameter means a small spiral angle, and this in its turn means a small angle between the axis of the hob and the face of the gear. However, large hobs are expensive, and for that reason a compromise is often made in the following manner:

The hob is made of a size which would naturally be required for depth of tooth, thickness of metal, size of bore, etc. But it is set in the machine at an angle smaller than the spiral angle. This will reduce the negative rake, but at the same time it generates a gear of which the pitch is different from the normal pitch of the hob. It is therefore necessary to make the hob of such a pitch that, when it is set at the prescribed angle, it will generate the desired pitch in the gear. Hobs made in this manner should be marked as to the angle to which they should be set in the hobbing machine.

From the foregoing it will be seen that the hob is a tool which lends itself to many wrinkles and kinks. A great part of the use of a hob is devoted to the making of very accurate gearing, and where that is the case, accuracy must be maintained at any cost; so that wrinkles and kinks no longer apply if they affect the accuracy even to the slightest degree. One of the sources of inaccuracy lies in the fact that a hob must be hardened before it can be used and that this hardening is liable to cause distortions of various kinds.

It is very apt to make the hob eccentric. It is also apt to make it longer or shorter, according to the nature of the steel used; and furthermore, this lengthening or shortening may not be even throughout the entire length of the tool. For these reasons it becomes impossible to use a hob for the very finest kind of work, unless it is finished after hardening. This is now generally done for the better classes of work. Though the first cost of such a hob is considerably greater than that of an unground hob it is doubtful if the total cost of hob and work done is any greater for a ground than for an unground hob. The reason is that a ground hob will do more and faster work for one grinding than an unground hob. The matter of grinding a cutter all over in order to avoid the roughness and irregularity of outline of a milling tooth has been discussed before; the same reasoning applies to hobs. Nevertheless, there will always be a call for unground hobs, especially in cases where they are not used for quantity work, so that the first cost becomes important.

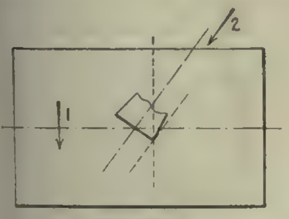


FIG. 250

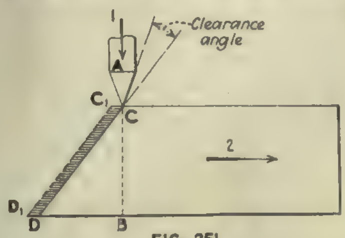


FIG. 251

FIG. 250. HOB WITH SPIRAL ANGLE OF 30 DEG. FIG. 251. CHISEL ACTION TO ILLUSTRATE HOB PRINCIPLE

The matter of grinding hobs has been discussed in a general way and it was pointed out how necessary it is to locate a gage point from which to grind the hob. At the present time there is no machine in existence which will take care of this matter in a satisfactory way; but even if there were, it would not be possible to grind the hob so that all its teeth are as they should be. The gage points can only be located on one single turn of the spiral. When this is done the hob can be ground so that that particular turn of the spiral is entirely correct and this turn should then be used for the finishing of the gear to be cut, while the other turns of the spiral should be used only for roughing.

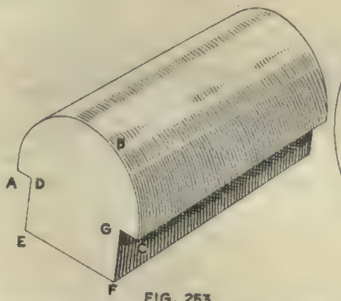


FIG. 253

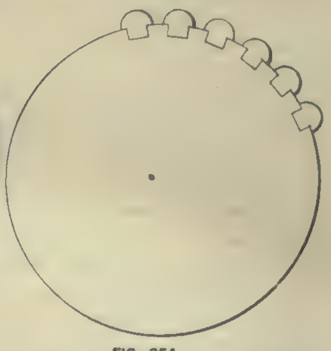


FIG. 254

FIG. 253. A PIECE OF WORK THAT CAN BE MACHINED BY HOBBING. FIG. 254. WORK SET UP ON DRUM FOR HOBBING

In order to save first costs and also for the purpose of avoiding excessive width of groove between the two parts of a herringbone gear, hobs are sometimes used which are shorter than they should be for the perfect generation of a gear. So long as that part of the gear tooth which has an actual bearing is properly generated, this shortcoming does not cause any trouble. But if the hob is made too short, it is liable either to affect the bearing part of the tooth or else it may not round the top of the tooth sufficiently to avoid interference, so that one should not go too far with the shortening of the hob without first looking into the matter.

It should be noted that not all teeth of the hob do the same amount of work. It will be found after cutting a certain number of gears that one turn of the spiral is worn or dulled much more than the rest of the hob. As it becomes necessary to regrind the hob if even a single tooth is dulled too much, it is well to watch the dulling of the teeth very carefully and, if possible, shift the hob lengthwise so as to bring a new convolution into play for the heavier part of the work. In that manner the wear may be distributed over more teeth and the hob will cut more gears between grindings.

So far we have looked at the hob almost exclusively as a tool for the cutting of gears. However, it is equally adapted to the cutting of ratchets, sprockets, spline shafts, and other pieces with teeth or projections or depressions evenly spaced around a cylindrical body. As a matter of fact, spline shafts used in automobiles are generally made this way.

There is another class of work to which the hobbing process might be successfully applied. Where pieces of relatively considerable length must be form-milled, it might be possible to clamp these pieces around a drum and then apply the hobbing process to this drum with its pieces as if it were a gear or sprocket or spline shaft. If, for instance, pieces had to be made of the shape shown in Fig. 253 they might be placed around a drum as shown in Fig. 254. Much more complicated shapes than that shown in Fig. 253 might be made that way, but there is one thing which should not be forgotten. Though it is possible to make the portion *ABC* by means of hobbing process, it is not possible to make the portion *DEFG* in that manner, because a hob cannot make a square corner such as *ADE*, although it is able to make a square corner such as *DEF*.

Conserving Steel Stacks

By John V. Schaefer

Rather than tear down a steel stack which was in a condition requiring renewal, which would force a shutdown of the pumping station at Southworks, Illinois Steel Co., South Chicago, the company decided to coat the stack with cement.

The steel stack was 175 ft. high and 9 ft. in diameter. A reinforcing network of sufficient strength to make the new stack self-supporting was built up of rods and wire mesh and secured to the existing foundation by bolts. A cement-gun was then used to shoot cement through the mesh against the steel shell of the stack to the required thickness. Fig. 1 shows the operators at work. A mixture of sand and cement hydrated in the nozzle was applied with an air pressure of about 35 lb. The cement is 18 in. thick at the base, tapered rapidly to 6 in. just above the bell base and then gradually decreased to 4 in. at the top. The cement-gun remained on the ground and the mixture of dry sand and cement was blown through the hose by air from a compressor working at about 50-lb. pressure. Water was forced through the water hose, shown in Fig. 1 as the smaller one of the two hose lines, at a pressure great enough to give a pressure at the nozzle in excess of the air pressure. The operator worked upward from the bottom, finishing as he went, so that at the end he was 175 ft. above the cement-gun, which was forcing material up to him at that point.

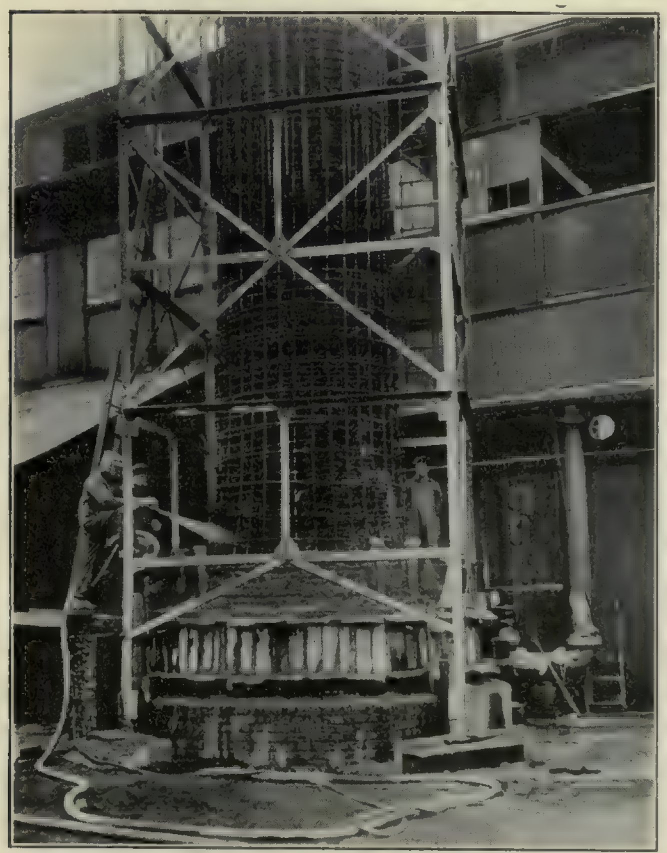


FIG. 1. BEGINNING OPERATIONS AT BASE OF STACK WITH A CEMENT-GUN

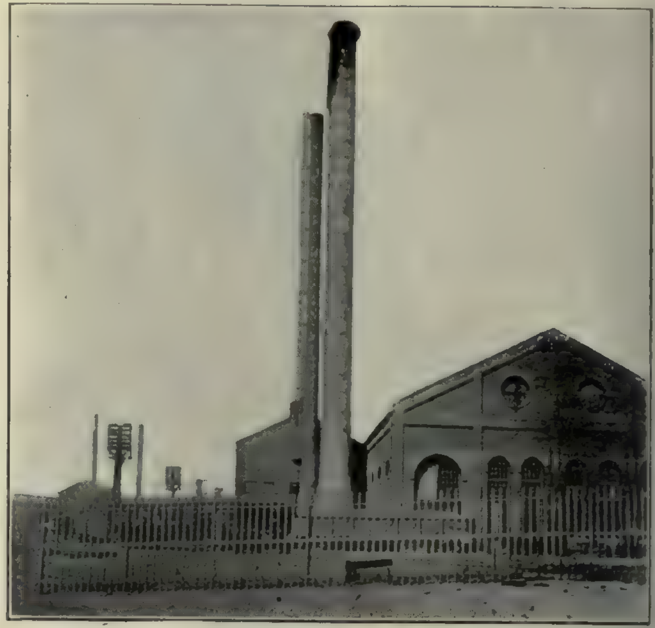


FIG. 2. CEMENT-COATED STACK

All the work was done without interrupting the use of the stack, the cement being applied while the stack was too hot to permit of holding the hand against it. The breeching extending from the side of the boiler house to the stack was also encased with 3 in. of cement while it was so hot that water thrown against it boiled. The completed stack, as now in use, is shown in Fig. 2.

This was done in 1918 and after nearly three years of continuous use the cement is sound everywhere and shows no cracks. Since that time a number of other stacks of various sizes have been treated in the same way, some being treated in freezing weather, others while in operation in hot weather and showing a temperature of 1,200 deg. A recent inspection shows that all of them are in daily service and perfectly sound. This not only appears to be an excellent solution of this problem, but the interesting feature of it is that the work can be done without interruption of service. This alone may sometimes be worth more than the price of the stack.

Baptists vs. Machinists

By W. L. Cheney

On the boardwalk in Atlantic City, with a "grip" in my hand, I was accosted by a long-faced individual, with the following conversational result:

"Good morning, brother, have you been to the convention?"

"As there are over fifty conventions in town, I could answer you better if I knew which convention you have in mind."

"*Why!* the *Baptist* convention!"

"No, I have not been to the Baptist convention, but to a convention of machinists."

Then, solemnly wagging his head: "Oh, well, *they* are necessary *too!*"

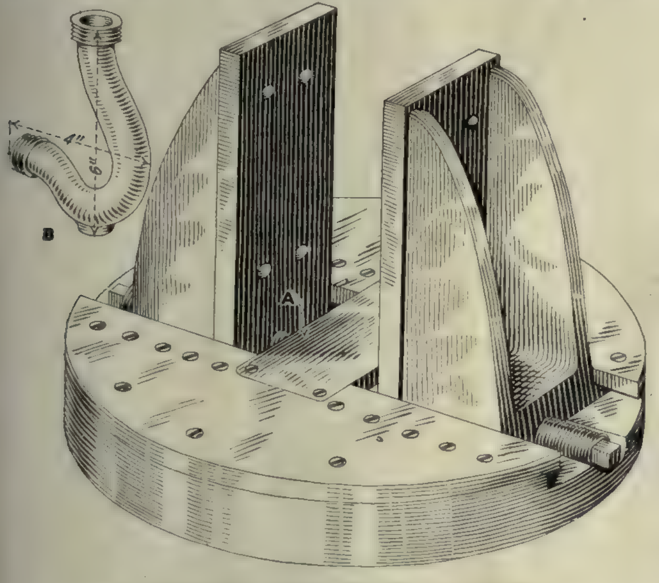
Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

A Chuck to Hold Unusual Jobs

By R. Grant

Some plumbing goods, such as traps and similar parts, present a difficult problem of machining. They are too long to be held in any ordinary chuck while the operations of turning, threading, etc., can be more readily done in a lathe than elsewhere. Too often this class of work is done in a hit-or-miss fashion, due to lack of means to hold it properly and the resulting finished surfaces stand at all kinds of angles to each other.



A CHUCK TO HOLD UNUSUAL PIECES

It was to overcome this trouble that the special chuck shown in the cut was made and very little explanation is needed to describe it. The chuck was about 18 in. in diameter, or as large as our Warner & Swasey hand machine would swing, and had two cast-iron angle plate jaws moved by a right and left hand screw.

The jaws were about 8 in. high and 5 in. wide and an extended base reached under the steel crossbar *A* to help hold them down. A typical example of work done in this chuck would be a trap casting as shown at *B* having three operations to be done.

A pair of false jaws would be made to hold the piece and these jaws would be held on the chuck jaws by capscrews through the most convenient holes, the jaws being spotted through after lining up the work properly.

Any number of castings would be machined on one face and then the jaws shifted in turn to each of the others, but one set of jaws being needed for all operations on the same plane.

Quite a saving is made on these jaws as the ordinary chuck requires a set for each operation, and again there are no dovetails or tongues to plane and fit. The jaws may be made of iron if large quantities of the parts are to be made, while if but few parts are wanted, wood jaws can be used to advantage.

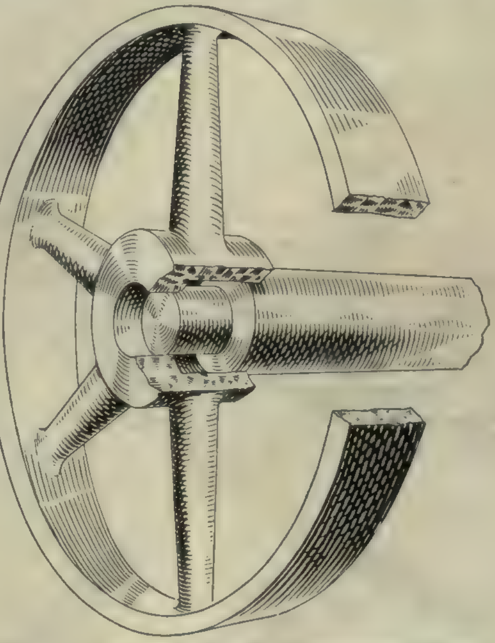
Another method of making jaws for such work is to make a plaster cast from the work, and use it as a pattern from which to cast brass jaws which are then machined to suit the chuck.

Forcing Flywheels on Shafts

By H. S. Trecartin

A large manufacturing company for which I worked adopted a method of fastening flywheels to shafts that has many advantages over the customary method. Ordinarily the hub will be bored two or three thousandths of an inch smaller than the end of the shaft, and the shaft will be driven into it against a shoulder. With shafts from 2 to 8 in. in diameter and the hub 6 or 12 in. wide this forcing process is a difficult and tedious operation. By the time the end of the shaft has been driven through the 8 or 10 in. of the hub bore it is quite likely to have been squeezed to a fairly easy fit.

By boring the flywheel two diameters, as shown in the sketch, and turning the shaft to fit the two diameters, the distance that is required to drive the shaft to bring it to a fit is reduced to about a quarter of the width of the hub, and the shaft will be securely gripped at both sides of the hub. When properly keyed it will be found that this method of construction is much more secure than the conventional one, as there will be no possibility of the shaft being tighter at the middle of the hole than at the ends.

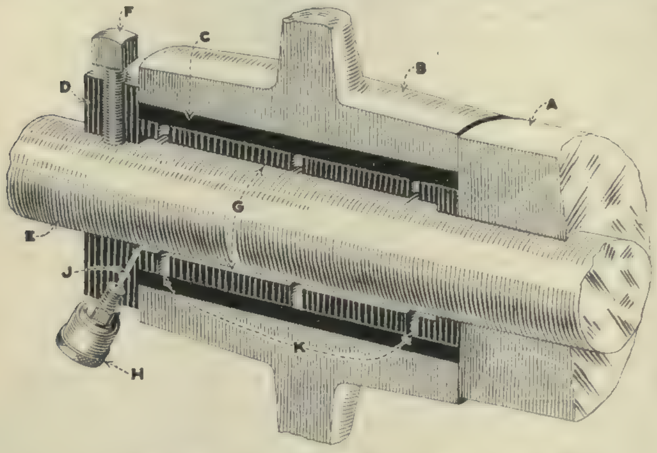


TWO-DIAMETER FIT FOR FLYWHEEL HUBS

Another Suggestion for the Cure of Loose Pulley Troubles

By Edward Heller

With reference to W. T. Elzinga's article on page 1049, Vol. 54, of *American Machinist*, relative to loose pulley troubles, I wish to relate an experience I had with one such pulley and how the trouble was remedied. The accompanying sketch will help make things clear.



A CURE FOR LOOSE PULLEY TROUBLES

A is the tight pulley and *B* the loose one. We bored the loose pulley large enough to receive a bronze bushing *C* and a cast-iron sleeve *D*. The sleeve was held tight to shaft *E* by means of the setscrew *F*. This sleeve also had a pocket *GG*. An oil or grease cup *H* leads to it through an oil hole *J*. In addition, a number of oil holes *K* were drilled all around the sleeve, and this finished the job.

The advantage of this arrangement is that neither the shaft nor the pulley ever wears out. All the wear is taken by the cast-iron sleeve *D* and bronze bushing *C*, and even they are well provided for. The reservoir *G* contains enough oil to last for a long time and every few months, more oil or grease can be added through the cup *H*.

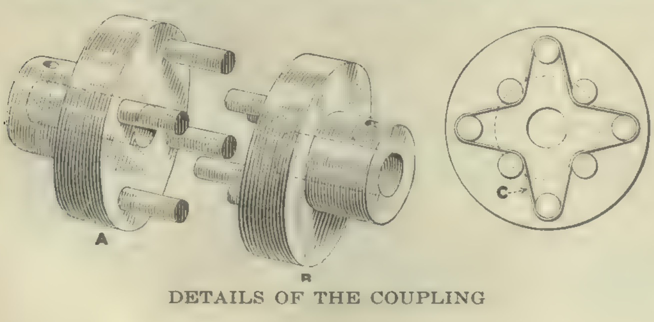
It will be noticed that the sleeve *D* acts also as a stop collar for the loose pulley and such a collar is often necessary on a job of this kind.

A Simple Compensating Coupling

By Joseph A. Olberding

Charles H. Willey's article under the above title, on page 111 of *American Machinist*, tempts me to describe a compensating or flexible coupling that we have been using for a couple of years. It is illustrated herewith.

Parts *A* and *B* are castings drilled and tapped for four ½-in. studs; *C* is a small endless leather belt about 1¼ in. wide. Part *A* is attached to the motor shaft. Part *B* is attached to the generator shaft and belt *C* is slipped on the outside of studs on *A* and inside of studs on *B*.



DETAILS OF THE COUPLING

The result is a good self-aligning flexible coupling.

Shrinking a Bushing

By Charles Reimschissel

The hole in a bushing may be shrunk from four to six thousandths, according to its size, by the following method:

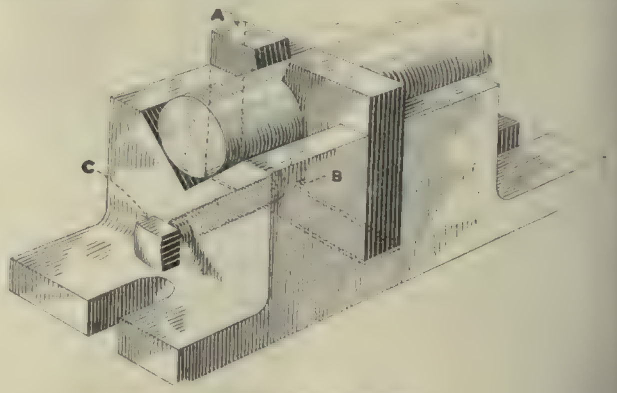
Heat the bushing to approximately 1,400 deg. F. and, holding it vertically, quench about two thirds of its length, allowing the upper third to cool in air above the surface of the water. Repeat the process, this time dipping the other end of the bushing. Reheat again and quench all over.

On short lengths the last operation is not necessary as the first two will do the work. This method will apply to all metals that will withstand the required heat.

Clamping Device to Hold Shaft for Cutting Keyway the Full Length

By Harry Moore

Certain shafts require keyways milled the entire length, and the drawing shows the special V-blocks used to hold them. The blocks are ordinary milling machine V-blocks, furnished with a tongue and made to bolt to the table. The method of holding the work however differs from the usual practice. A slot is cut through the center of the blocks to take the clamping piece *A*. This piece is bored to fit the shafts, is then cut away to clear the cutter, then a hole drilled, which is afterwards filed out as shown at *B*, the bottom portion being taper. With the V-blocks bolted in position the shaft is slipped through the clamping pieces and screw *B* tightened. This screw bearing on the tapered part of the slot in *A* pulls down the latter and seats the shaft securely in the V. Very little pressure is required to hold the work firmly.



DETAILS OF V-BLOCK

An End Mill of Unusual Design

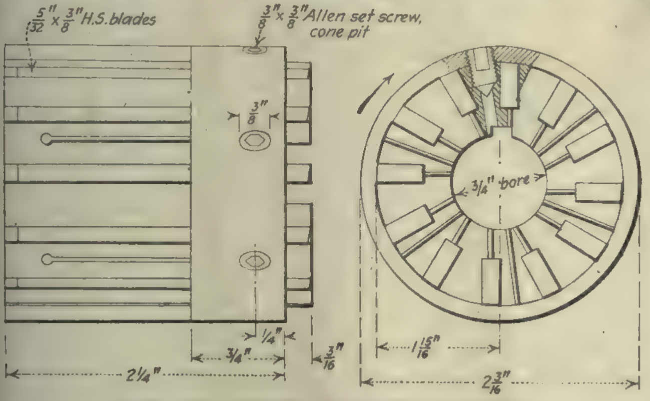
By Donald A. Hampson

Having had trouble with the usual form of inserted blade-end mills the writer designed the cutter shown in the drawing herewith. This tool is rugged enough to stand all the belt will pull; the blades are sufficiently large to carry away the heat and maintain an edge for one to two days' steady running on cast iron; there are no loose pieces and the wear is confined to six stock safety setscrews per cutter. The cutter circle is nearly as large as the clearance circle, and could be increased somewhat if necessary.

The drawing shows a right-hand cutter. The body is a piece of machine steel which is bored, keyseated and slotted for a dozen blades. One end of the body is turned back part way to allow a steel ring to be slipped over. This ring serves the double purpose of effectually preventing any lifting of the blades, retaining them at the point of greatest strain, and of confining the split portions of the body when the blades are tightened.

There is a saw slot at the bottom of each blade slot and six other equally spaced slots through the body, all of these ending far enough from the back of the cutter body to leave a good solid ring of metal at that end. Just as there are six slots through the body, there are six binder screws for the twelve blades. These screws are centered on the slots and are let in far enough to be flush with the outside. Their cone points bear against a similarly tapered bottom which is relieved by a small center hole, allowing the screw point to wedge itself between slanting surfaces.

In assembling the cutter, the blades are fitted to the slots and under the retaining ring. The pair of blades adjacent to a screw is effectually locked the minute the screw is tightened; the splitting of the body allows the sides to grip the blades close to the work. The grip thus afforded is almost unbelievable. The hollow hex head of the screw is infinitely superior to a screwdriver slot—it is positive at all times.



END MILL WITH INSERTED BLADES

Because of its sterling qualities, this end mill has become a favorite with the machine operators; which is in itself an important factor in production, even if there were not the other time and money saving features to commend it.

A Back Counterbore

By Galen D. Watson

The advantage of the counterbore shown herewith is that there is nothing to lose out of the bar, once the parts are assembled. The key *C* can only be removed by pushing plunger *D* down with a pointed piece of steel. The cutter *F* is notched at *A*, Fig. 3, and is a sliding fit on the bar at *B*, holding the cutter in a central position.

The bar is made of a good grade of common steel, case-hardened. The plunger, cutter and key are made of tool steel, hardened. Fig. 1 shows the tool in position to use. The taper key *C* is tapped into position lightly with a hammer, bringing pressure on the plunger *D*. The spring *E* is compressed slightly and the cutter *F* is held firmly down. Fig. 2 shows the cutter released by tapping key *C* lightly on the small end. Spring *E* pushes the plunger up into the notch in key *C* so that the cutter can be removed. The whole operation can be done quickly and easily. Details of the parts are shown in Fig. 3.

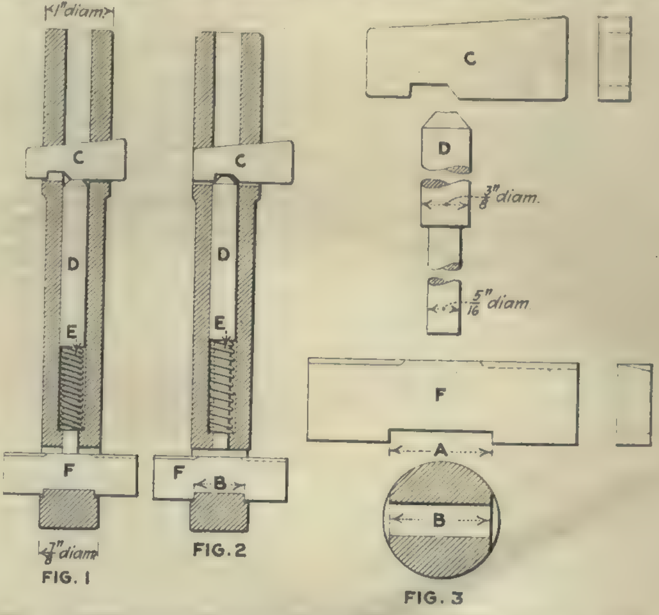


FIG. 1. THE COUNTERBORE READY FOR USE. FIG. 2. THE COUNTERBORE WITH CUTTER RELEASED. FIG. 3. DETAILS OF COUNTERBORE PARTS

This tool has been in use three months in the plant of the Hyde Windlass Co., Bath, Me.

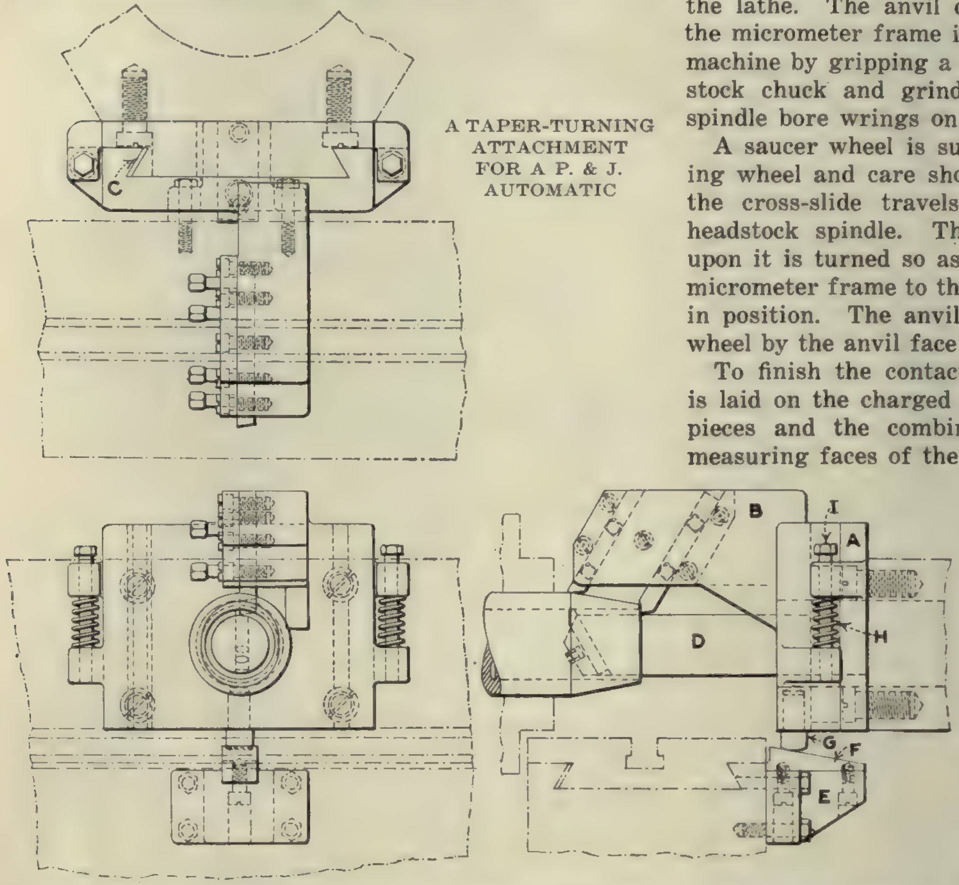
A Taper-Turning Attachment for a P. & J. Automatic

By J. W. Kaiser

The accompanying sketch shows the details of an automatic taper-turning tool which was constructed in our shop some time ago for use on a Potter & Johnston lathe. We had a number of short tubes 3 in. O.D. which were to be bored 2 in. deep and to have a 10-deg. taper turned on the outside. As the equipment included a number of P. & J.'s, it was decided to rig up the lathes with the fixture shown. The result was practically a perfect job with a minimum of upkeep. These fixtures were in use for nearly five years and all the repairing required was the grinding of the taper block *F* about every six months.

Part *A* is bolted solidly to the face of the turret. Part *B* slides on part *A*, the gib *C* being used to obtain the proper sliding adjustment. In the overhanging arm on part *B* are inserted the boring and facing tools, which are held in the usual way with a plate and setscrews. An oblong hole is cored through *B* for clearance for the boring bar *D*, allowing it to slide vertically as required. The boring bar is held by a shank which is a snug fit in the turret and in part *A*. The bracket *E* is bolted to the cross-slide and carries the hardened taper block *F* which is tapered to correspond with the angle required on the work. *G* is a hardened pin in the bottom of part *B*. As the turret advances this pin rides on the taper block *F*, raising the entire block which holds the tools and thus turning the taper.

The pressure necessary to hold the tool to the work while cutting and also to bring *B* back to the original position for starting is supplied by the stiff springs *H* which are inserted between the lugs cast on *A* and *B*. The distance that part *B* can drop is limited by the screws *I* which pass through a clearance hole in the part *A* and are screwed into the lugs in part *B*. While this action is taking place, the boring tool in bar *D* is boring a straight line in the work as shown.



A TAPER-TURNING ATTACHMENT FOR A P. & J. AUTOMATIC

The same idea was followed in rigging a tool for boring taper holes, with the exception that a boring bar holder was used in place of the overhanging arm. The results were equally as good.

Refinishing Anvils on Measuring Instruments

By W. C. Betz

The contact faces on measuring machines and the anvil and spindle end of micrometers need refinishing after a period of service.

The tools necessary are a small India oilstone, medium grade, ¼ x 1 x 4 in., and four cast-iron laps varying in thickness by 0.006 in., these latter pieces to be numbered from 1 to 4. The oilstone should be cleaned thoroughly with gasoline and lapped parallel on a piece of planed cast iron, using No. 1-F carborundum as an abrasive. The abrasive is sprinkled on the lap and the stone rolled over the grains. As soon as the charging material becomes dull or sticky it should be removed and new abrasive sprinkled on.

The set of cast-iron laps are ground parallel and charged with No. 3-F carborundum on one side only, using a hardened and ground block for the purpose.

It seldom happens that a micrometer or other measuring instrument is used until it is in such bad shape as to need regrinding, but if it should happen through neglect or injury, this should be done before attempting to lap.

The end of a micrometer spindle may be ground in a bench lathe by inserting the spindle of the micrometer through the rear end of the spring collet and grinding it with the regular attachment furnished with the lathe. The anvil can best be ground in place in the micrometer frame in a tool, or cylindrical, grinding machine by gripping a small piece of steel in the headstock chuck and grinding it so that the micrometer spindle bore wrings on it.

A saucer wheel is substituted for the regular grinding wheel and care should be exercised to insure that the cross-slide travels at exactly 90 deg. with the headstock spindle. The plug with the frame wrung upon it is turned so as to present the open side of the micrometer frame to the wheel and the headstock locked in position. The anvil is then ground by passing the wheel by the anvil face as in grinding a snap gage.

To finish the contact faces by lapping, the oilstone is laid on the charged side of one of the cast-iron lap pieces and the combination is inserted between the measuring faces of the tool and the lap is drawn in all directions to bring the whole stone surface into contact with the work. Care should be taken that the tension on the lap is just enough to hold the faces in contact, otherwise the tool will be sprung.

After one surface is roughed the lap is reversed and the other face is similarly treated, leaving the surfaces in a semi-finished condition. The oilstone is now removed and the cast-iron lap is used to finish the surface, reversing this so that the charged side comes into contact with each face in turn.

One of the laps is sufficient for lapping the faces of non rotating spindle instruments, including vernier calipers, but for micrometers and tools where one of the faces rotates it will be necessary to use the four laps alternately, both on the oilstone roughing and the finish lapping operation, for the following reason: To lap a rotating spindle instrument the oilstone is used with lap No. 1, and the anvil end cleaned of all wheel or wear marks. Piece No. 2 is next used, also on the anvil, and this lap is 0.006 in. thicker than No. 1. It follows that the spindle end of the instrument is in a position approximately 90 deg. from the first one and would quickly show whether or not the spindle end was parallel to the anvil by a few passes of the second lap.

By using all four laps it can be seen that different positions are presented with each lap, changing 90 deg. each time; which would show the difference beyond mistake by the cross lap marks on the anvil. The relation of the spindle face to the center line could be quickly determined, and by reversing the laps and using them on the spindle end this surface would soon be finished exactly square with the center line.

It might be necessary to use the laps alternately on the anvil and spindle end a number of times to bring the faces parallel, with the spindle in any position.

The idea of using the four laps is analogous to the three-plate method of finishing plane surfaces; if the anvil and spindle ends are parallel, the lap marks on these surfaces will show evenly by a few passes of all four pieces.

EDITORIALS

The Three T's of Prosperity

ACCORDING to a recent statement by John G. Shedd, president of Marshall, Field & Co., prosperity hinges on Congressional action on taxation, the tariff and transportation. Of these three T's it is hard to pick the one most deserving of immediate and wise action.

The revenue bill will be before the Senate for final action before this gets into print and we may therefore expect action that fulfills at least one of the requirements just mentioned. As to the other there is considerable doubt unless the bill is changed in some particulars. In the meantime little is being done to reduce government expenditures.

The tariff act is certainly in no danger of receiving hasty attention from the Senate and may perhaps be benefited by the delay which is bound to occur before its final passage. As it left the House it contains much that can stand revision. As we see it, any tariff provision that will be a hindrance to foreign trade is likely to have the same effect on domestic trade in the long run, although indirectly, of course.

When it comes to transportation it is obvious that with our present national economic organization we cannot get along without adequate railroad transportation and at reasonable rates. The service is adequate for the present small volume of business but there is a dangerously large percentage of bad order freight cars and the figures for deferred maintenance loom large. As to rates, while their altitude may be necessary to the life of the railroads, few men can be found who will call them reasonable. If business increases, rates can be reduced, say the railroad men; if rates are reduced, business will increase, say the business men and farmers. Truly, the problem before our legislators is not easy, but it must be attacked and at once.

A Three-Plane Navy

THE program of tests and attacks soon to be made on the U. S. S. Alabama has just reached us. It indicates encouraging enterprise on the part of military and naval men in an endeavor to supplement the recent bombing tests which were hardly conclusive.

The present tests may be no more conclusive than the others but the program leads us to believe that at least some additional information will be obtained as a result. There are to be two day attacks and two night attacks, and an attempt is to be made to determine the effect of the new chemical weapons upon naval craft. Tear gas, phosphorus bombs, smoke screens for aircraft, parachute flares and demolition bombs are among the various implements to be tried out on the condemned ship which seems likely to come to a very useful end.

If the first line battleship is unable to resist night attack from the air with chemical or explosive weapons it is high time more attention was paid to the aviation branch of both services and less to the terribly expensive big gun ship. A forty-million-dollar dreadnought is a very imposing evidence of the defensive power of a nation but much of its impressiveness vanishes when it is unable to defend itself from a forty-thousand dollar airplane carrying modern fighting equipment.

The tests will be watched with interest by the manufacturers of the country for they should go far to indicate whether our principal reliance in the next war, if disarmament measures prove ineffective, is to be on the machine shop or the chemical plant. There are those who feel that the day of mechanical warfare is passing, to be succeeded by chemical warfare too deadly to be contemplated without horror. If this opinion is justified it will be well to have the facts in the hands of those who are building and authorizing our first line of defense, as the navy has come to be looked upon.

We have made no mention of the submarine for the reason that its success in the last war is indisputable. It is unlikely that we shall ever know just how close the German U-boats came to changing the final decision for that is something which those in a position to know do not care to talk about.

We are very hopeful that President Harding's disarmament conference will be productive of results which will reduce the likelihood of future wars, but in the meantime it will be well to keep on with our experiments to determine how best to defend ourselves from military aggression.

What Can the Unemployment Conference Accomplish?

THE much talked of unemployment conference is now sitting in Washington. There has been a deal of speculation as to just what such a gathering can accomplish, for men interested in the general subject of reduction of unemployment have not forgotten what happened to the two attempts made by the Wilson administration to solve the same problem. It is to be hoped that the same fate does not overtake this one.

The list of names of those accepting Mr. Harding's invitation includes some of the ablest men on industrial relations in this country. With Mr. Hoover in the chair, the stage is set for a supreme effort to remedy the situation. If failure is the result it should prove conclusively that it is useless to try to hasten the working out of economic processes.

No More Extra Fares?

AN ANNOUNCEMENT comes from the Chicago passenger agent of the Pennsylvania Railroad that hereafter no extra fares will be charged on the crack trains of his road running between Washington and Chicago. Here is good news for the Western Congressmen who must needs get back home frequently to mend their fences.

It seems almost too good to be true that anything can be done to reduce the cost of fast traveling. We have looked forward so long to a time when it would be possible to make a business trip without bankrupting the cashier that we can hardly believe that at last the first move has been made. But here we have it in black and white. There is evidently still something to live for.

Shop Equipment News

Henry & Wright Dieing Machine

The art of working sheet metal by means of fixed tools attached to suitable mechanisms and performing the operations of piercing, blanking, forming, stamping, etc., either separately, progressively, or simultaneously, is as old as the machine industry itself. The tools for producing the multiplicity of parts that are made from this material are almost as many and as varied as are the articles produced. Notwithstanding the complexity of modern press tools, there has been little change in the design and appearance of the machine that operates them. Ever increasing in size and power to keep up with the demand for larger pieces of heavier material, or as more and more operations were combined in one set of tools to speed the output, the punch press of today still looks very much like the punch press of a hundred years ago.

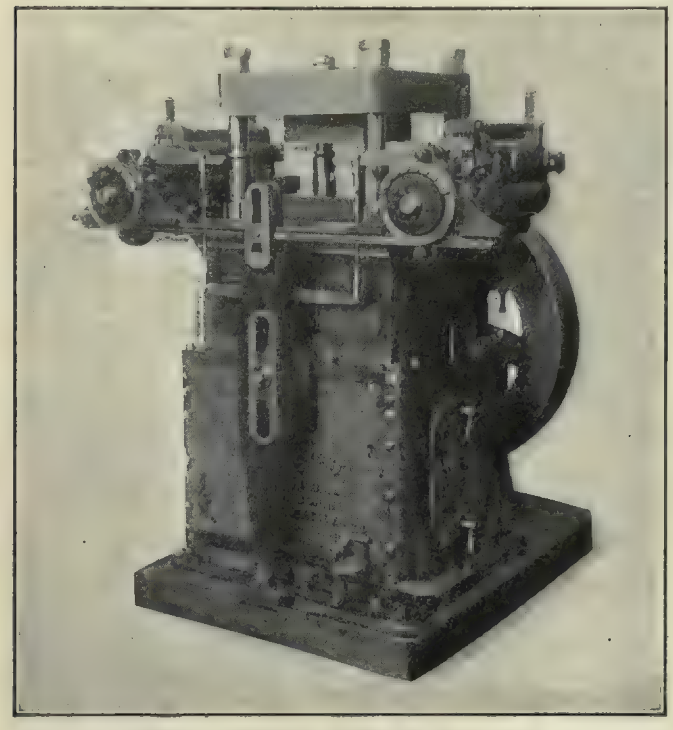


FIG. 1. FRONT VIEW OF MACHINE

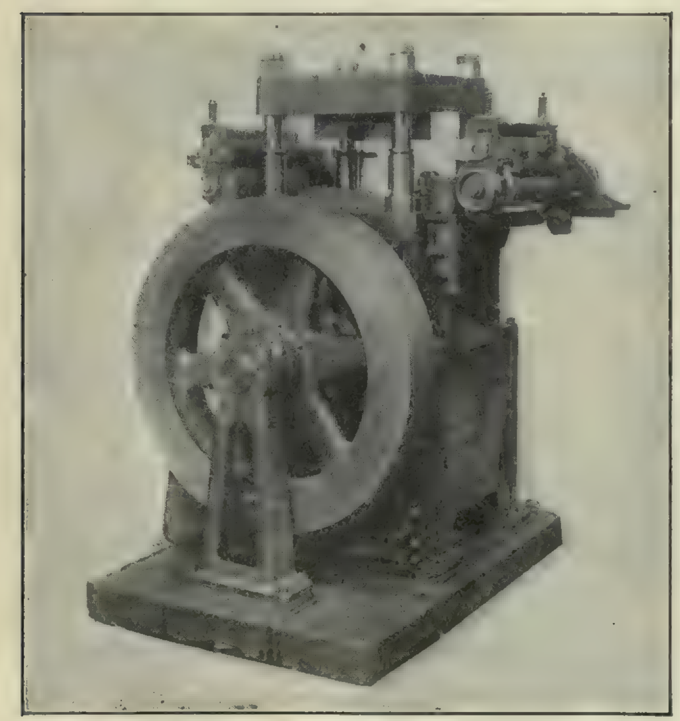


FIG. 2. REAR VIEW, SHOWING FLYWHEEL

It remained for the late Daniel M. Wright, of the Henry & Wright Manufacturing Co., Hartford, Conn., to effect the permanent combination of punch press and pillar-press in the machine described on pages 498 and 499, vol. 49, of *American Machinist* some three years ago, and now known to the trade as the Wright "dieing machine." In this machine, which is a radical departure from the usual punch-press construction, Mr. Wright inverted the mechanism, placed the heavy flywheel on the back side near the floor where it can be suitably guarded, and enclosed all the moving parts except the tools themselves within a cabinet base where they are protected equally against dirt and unwary fingers, and where ample provision is easily made to resist and absorb side stresses. Front and rear views of the complete machine equipped with double roll feeding devices, are shown in Figs. 1 and 2. The cabinet base is made in two built-up sections the lower one of which is fitted with a removable panel that, when opened, renders the working parts of the machine easily accessible for inspection or adjustment. The crankshaft passes transversely through the base at the point of junction of the upper and lower sections and has its bearing in the under side of the upper section so that by unbolting this section the crankshaft with all attached working parts may be lifted out as shown in Fig. 3. By locating the crankshaft at this point, the thrust is upward against the upper base section and the stress imposed by the cutting of metal is thus entirely one of the compression,

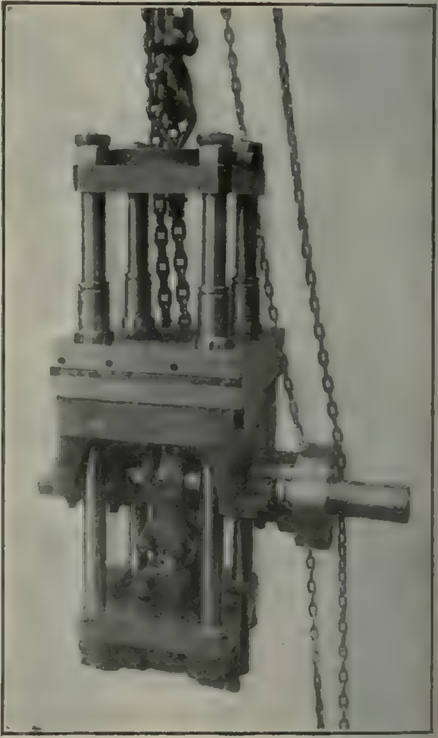


FIG. 3. THE WORKING PARTS LIFTED OUT OF THE BASE

borne by this single casting, the upper surface of which is the die-bed.

In Fig. 4 is a side view of the machine with the panel removed. From the crankpin the connection rod or pitman extends downward to where at the lower end it is joined by a wristpin to a slide or "gate" *A* of the same general shape and dimensions as the upper head that carries the punches or moving member of the tools. This gate moves up and down on two large square-section guides bolted to the inner sides of the base and these guides resist the angular thrust of the pitman.

The upper head is rigidly connected to the gate by four chrome-nickel steel rods, shouldered into the castings at either end and firmly held by double nuts, so that gate and head move together as one unit. The rods pass through long bushings of bronze that are fitted to tapered seats in the upper base section; the bushings are split and provided with adjusting nuts by means of which any wear upon the rods or bushings may be compensated for. The rods are under tensile stress only; any sidewise pressure being borne by the bushings in the same plane as the tools and consequently no bending strains are imposed. The ample guiding surfaces of the lower gate likewise relieve the lower ends of the rods from all side pressur

The weight of the combined reciprocating unit, as well as of the upper tools when the latter are in place, is more than counterbalanced by heavy coil springs, one of which may be seen at *B*, located under the lower gate, so that in making adjustments for position in setting tools there is no possibility for them to drop upon the dies; the pressure is always in the other direction. Height adjustment, to determine the amount the punches shall enter the dies, is made by means of the usual right-and-left screw and locknuts in the pitman.

The crankshaft extends through the front of the base and terminates in a disk with adjustable crankpin and block, the latter engaging in the slot of a vertical lever that is fulcrumed at the base of the machine and attached at the upper end by a yoke to a sliding rack that transmits movement to both sets of feed pawls. The movement of the rack, and consequently the length of the feed, can be minutely adjusted by the operator without moving from his position in front of the machine.

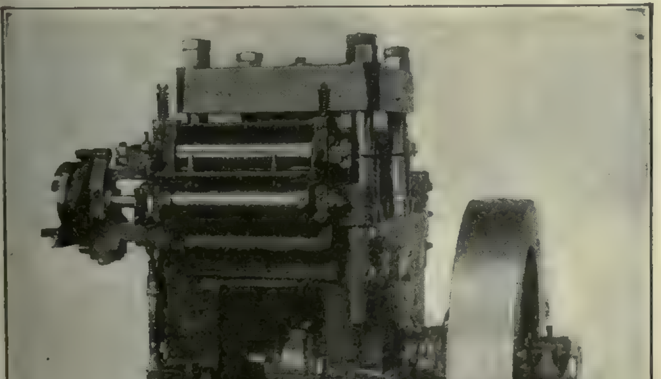


FIG. 4. SIDE VIEW WITH PANEL REMOVED

Both sections of the feeding mechanism are mounted upon pillars at the rear of the die bed and can be instantly unlocked and swung out of the way as shown in Fig. 5 when it is necessary for the operator to get at the dies. The absence of overhead parts and the accessibility of the dies from all sides makes the tool setter's job a comparatively easy one.

The clutch is in the flywheel and may be operated by either of two treadles, one of which locks in the clutch for continuous operation while the other gives a single stroke for each depression. When one treadle is depressed it automatically locks the other out of action so that a double stroke of the machine while setting the dies is impossible.

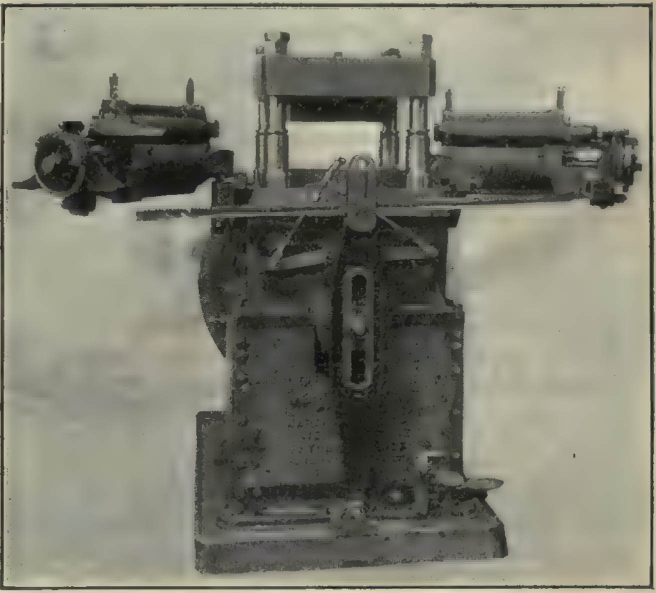


FIG. 5. SHOWING ROLL FEEDS SWUNG BACK FOR SETTING TOOLS

The machine is made in three sizes, designated respectively as 10-, 25-, and 50-ton capacity. The larger machine stands 64 in. high and occupies a floor space of approximately 5 ft. square. It weighs 5,400 pounds. The standard length of stroke is 1½ in. but this can be supplied to suit the customer.

Lees-Bradner Gear Grinding Machine

A machine for grinding the teeth of gears is shown in Fig. 1, it being designated as the No. 10 gear-tooth grinding machine, and recently placed on the market by the Lees-Bradner Co., Cleveland, Ohio. The machine is intended for grinding the faces of involute spur-gear teeth, being capable of working on gears having pressure angles of from 14½ to 24 deg., diametral pitches from 12 to 3, and pitch diameter from 2 to 12 inches.

The abrasive wheel used is 30 in. in diameter and of the saucer type, the grinding face being ground plane. The wheel is supported on a stationary column, and the work is traversed past it on a slide having a reciprocating action. Besides the linear motion, the work is given the correct rotary motion, so as to obtain the desired profile on the tooth face. In this way, the tooth

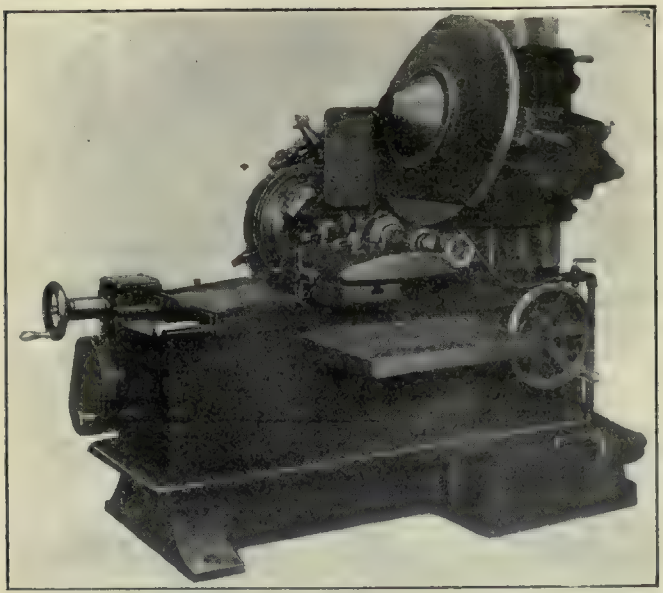


FIG. 1. LEES-BRADNER GEAR GRINDING MACHINE

is generated, as the action is that of a gear rolling along a rack, the rack tooth being the face of the grinding wheel.

The machine may be driven by belt from an overhead line shaft, or driven directly from a motor. The wheel spindle is driven from the countershaft of the machine by a belt contained inside of the base and column. The wheel can be set at the proper angle by means of a worm and segment on the swiveling head. It is trued by means of a diamond, that is caused to travel in a straight line by the use of either a lever or a screw mechanism used in conjunction with the micrometer feed on the wheel spindle.

The work can be held between centers, or supported on a mandrel having a taper shank to fit the spindle, and carried at the outer end by the tailstock. The indexing is accomplished by means of hardened and ground plates secured to the work spindle and inclosed within a case. It is automatic, occurring at each end of the travel of the slide, so that the wheel passes through a different tooth space at each successive stroke. It is said that the tool is capable of generating a perfect involute and of leaving a smooth finish on the face of the tooth, because of the fact that continuity of action is obtained between the wheel and the profile of the gear tooth. It is said that it is not necessary to center the blank.

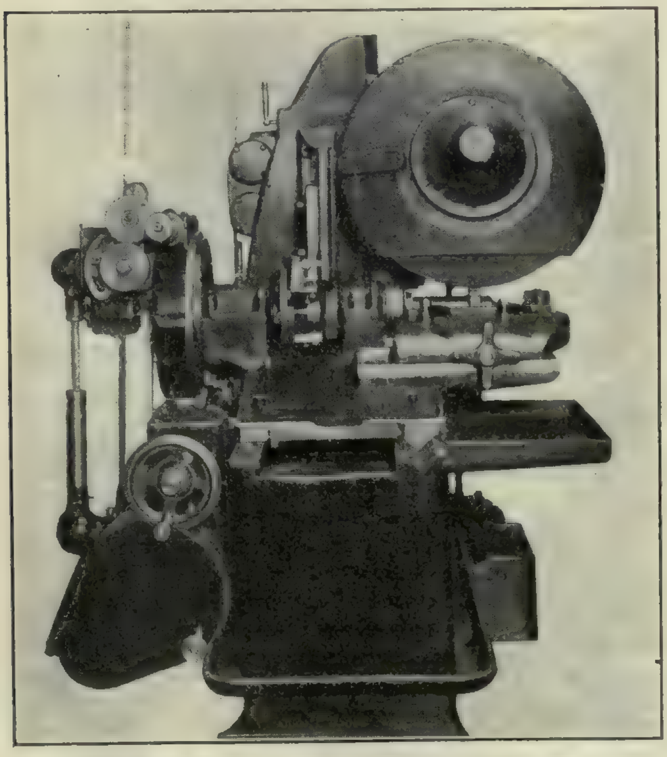


FIG. 2. END VIEW OF LEES-BRADNER GEAR GRINDING MACHINE

The fact that the work is rotated when the slide moves, by means of tapes secured at one end to the bracket on the column and rolling on the other end over a disk with the exact size of the pitch circle of the work, is said to give a more uniform conversion of linear motion into rotary motion than can be obtained by means of racks and gears. The power for moving the slide is not applied directly to it, but is applied to the sleeve that rotates the work spindle. As the sleeve is rotated, first in one direction and then in the other, the tapes are wound and unwound on the segments on which they run. In Fig. 2 can be seen the mechanism operating and controlling the rotation of the work spindle.

The gearing in the feed box is driven from the main pulley shaft, and change gears are used to vary the number of strokes per minute of the work slide. The length of travel of the slide is regulated by a dog located inside of the gear case.

To operate the machine, a segment equal to the pitch diameter of the gears to be ground is first located on the work spindle. The abrasive wheel is then set at the pressure angle of the tooth to be ground, and the head carrying the wheel is located for the correct working depth of the tool. The wheel is then dressed. The ordinary method of procedure is to remove a roughing cut, usually 0.003 in. in depth, and then to feed the micrometer 0.001 in. to finish the teeth. This latter adjustment of 0.001 in. thus brings the wheel back into the generating plane, and the one in which it was dressed.

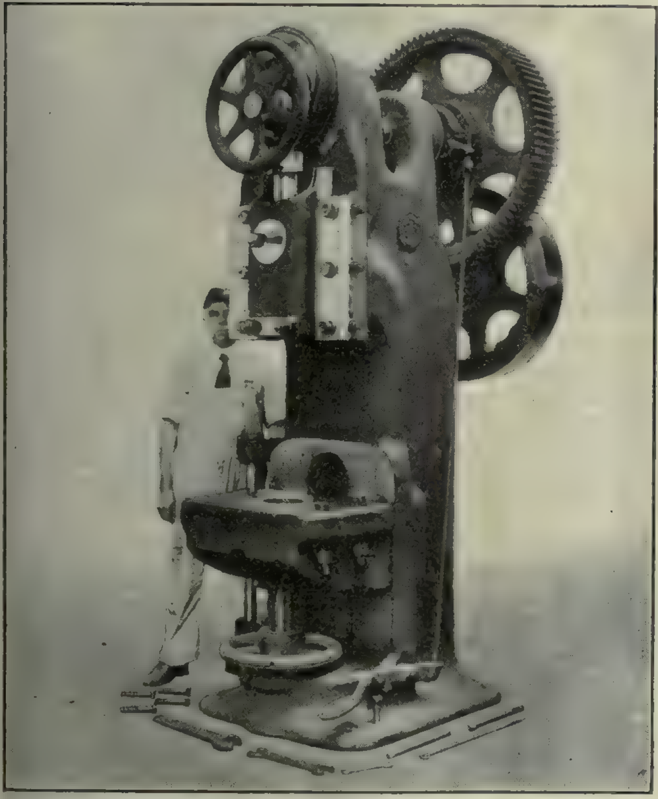
When the wheel requires dressing, which is usually for every other gear, only 0.0004 in. is taken off the face. In order to make this feed, the micrometer adjustment is moved so that the starting and finishing stops do not have to be disturbed. A notched disk and lever pawl, allowing the wheel to be fed up 0.0002 in. for each notch, permits of compensating for the reduction in the size of the wheel.

The roughing of the gear teeth can ordinarily be done best by means of hobbing, and it is not necessary that the work be done accurately, so that speed can be obtained. It is stated that in an actual test on grinding, a 6-pitch gear having 31 teeth was done in a total of 11 min., with a loading and unloading time of 2 min., so as to average 30 gears per 9-hour day. A roughing and a finishing cut were taken on each gear, and the complete grind around required 5 min. On this class of work, the grinding wheel is said to have a very long life, so that about 2,500 gears of the size just mentioned can be ground with one wheel.

Ferracute Adjustable-Bed Punch Press

The Ferracute Machine Co., Bridgeton, N. J., has recently built the press shown in the illustration for work requiring a long stroke and unusual height between the bed and ram. The machine is known as an adjustable-bed punch press. The bed has a vertical adjustment, by means of which the distance between the bed and the ram may be varied, instead of the bed and the frame being in one casting, as in the ordinary form of press. The connection between the bed and frame, which must, of course, be rigid, is made by heavy bolts and the 4-in. adjusting screw, which seats in the base. A projection at the back of the bed fits a vertically planed recessed guide in the frame, in order to keep the bed parallel with the bottom of the ram.

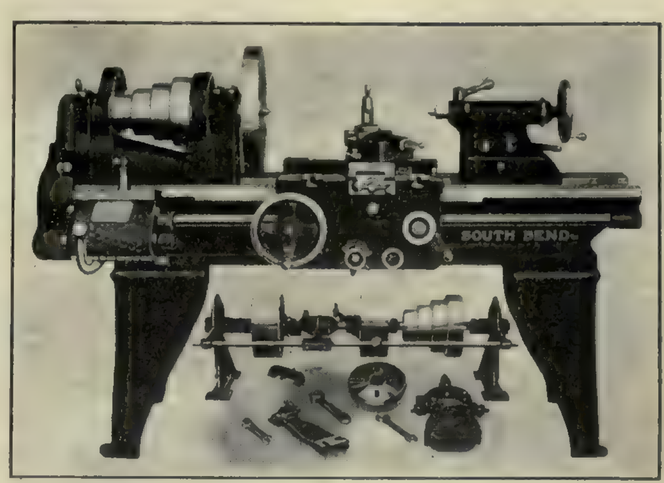
The press may be used for horning by inserting a horn in the 9½-in. hole in the frame at the back of the bed. The hinge formed by the stud at the side of the press enables the bed to be swung out of the way when the machine is used as a horning press. The ram has 3 in. adjustment, and the bed 9 in. A distance of 30 in. is given between the bed in its lowest position and the ram at the top of its stroke and at its highest adjustment. The stroke of the ram is 8 in. The press exerts a pressure of 70 tons and weighs 13,200 pounds.



FERRACUTE ADJUSTABLE-BED PUNCH PRESS

South Bend Quick Change Gear Lathe

The South Bend Lathe Works, 425 East Madison St., South Bend, Ind., has recently placed on the market the quick-change lathe shown in the accompanying illustration. The machine is similar in general construction to the plain type of change gear lathe made previously by this concern. The feed box that has been added is of the type used on the Flather lathe, the maker having secured the right to build the device of this type. Forty-eight changes of feeds and threads are provided, these changes applying also to the crossfeed. The gears are made of steel forgings and are changed by means of the two levers shown at the box, a pin in the end of the tumbler lever holding it in position.



SOUTH BEND QUICK CHANGE GEAR LATHE

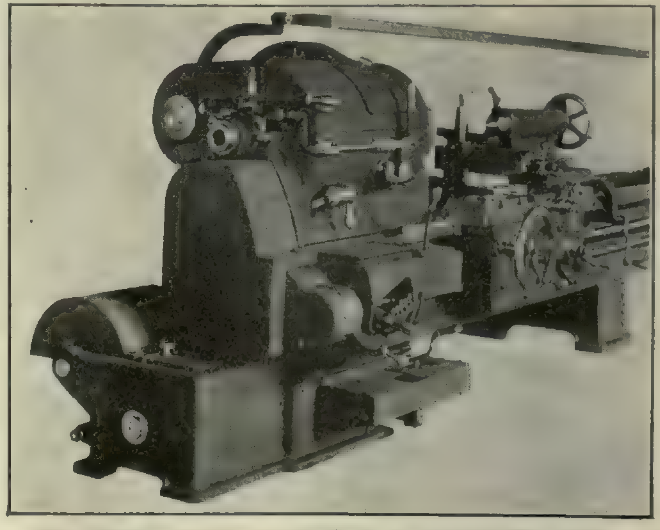
The lathe is made in sizes of 9, 11, 13, 15, 16, 18, 21 and 24 in., with either straight or gap bed. The bed is heavily cross-ribbed, and has three V's and one flat way for guiding the headstock, tailstock and carriage. The headstock has phosphor-bronze bearings and an improved type of reverse mechanism. The carriage is provided with T-slots for clamping work to it, as when milling and boring. All of the feeds are controlled from the front of the apron, and are so interlocked that only one feed can be engaged at a time.

The lathe is equipped with large and small faceplates, graduated compound rest, follower rest, adjustable stop for screw-cutting, semi-machined chuck-back, gear-guards, wrenches and double-friction countershaft. If desired, milling and key-way cutting attachment, motor drive, taper attachment and other extras can be furnished.

Bradford Quick-Change Geared-Head Lathe

The Bradford Machine Tool Co., 8th and Evans St., Cincinnati, Ohio, has recently placed on the market the style of double back-geared, all-geared-head engine lathe shown in the accompanying illustration. The machine is very similar in general characteristics to that described on page 91, Vol. 51, of the *American Machinist*, the principal difference being in the use of the double back-gears.

The lathe illustrated is of 30-in. size, although it is made in swings of 26, 28 and 32 in. It is intended for either single-pulley or direct motor drive. The double



BRADFORD 30-IN. DOUBLE BACK-GEARED LATHE back-gear mechanism is controlled by means of a lever mounted on the rear of the spindle cap and extending to within easy reach of the operator. In this mechanism is incorporated a locking arrangement that permits of shifting the gears only when they are free from the driving action; that is, when the clutch on the main spindle is in the disengaged position. Both of the back gears cannot be engaged at the same time, so that abuse of them is thus prevented. By means of the arrangement, eighteen speeds are provided, these varying from 6.7 to 282.5 r.p.m. The back-gear ratios are 12.57 to 1, and 3.55 to 1.

The changes of threads and feeds are obtained by the shifting of gears. By the use of 16- and 64-tooth gears on the feed stud, 32 standard threads and feeds are instantly available. By means of the two shifting levers, 16 changes of feed are provided without the changing of any removable gears. For threads of coarse and odd pitch, the lead screw is geared directly to the spindle, in which case the quick-change gear box is not used.

Jackson Vertical Milling Machines

The Jackson Machine Tool Co., Jackson, Mich., has recently placed on the market the vertical milling machine shown in Fig. 1. The machine is made in two sizes, and its principal features are the same as those of the No. 5 and No. 6 die-sinking machines made by the same concern. However, it is made for such work as that on drop-forging dies, where a cherrying operation is not required, and where a vertical-spindle milling cutter can be employed.

The head that carries the vertical milling spindle is bolted to the column. The spindle has a vertical movement manipulated by hand through a mechanism which permits of both hand feed and rapid traverse. Near the lower end of the spindle is a vertically sliding bracket, which carries both the main spindle bearing and the thrust bearing. It is operated for slow feed by the handwheel, and for rapid traverse by the spoked wheel near it. A slight turn of a small knurled handwheel engages or disengages the slow feed, the rapid traverse being free to operate when the slow feed is disengaged.

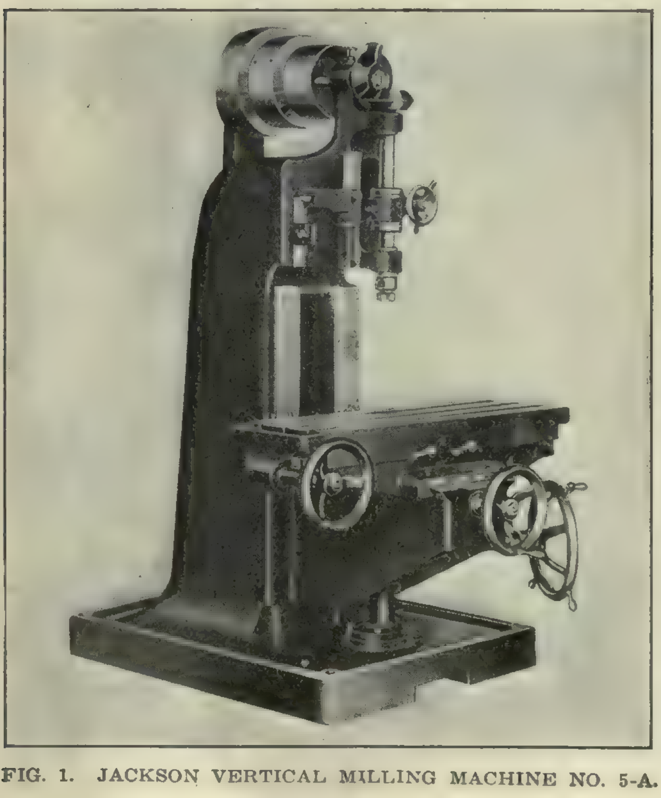


FIG. 1. JACKSON VERTICAL MILLING MACHINE NO. 5-A.

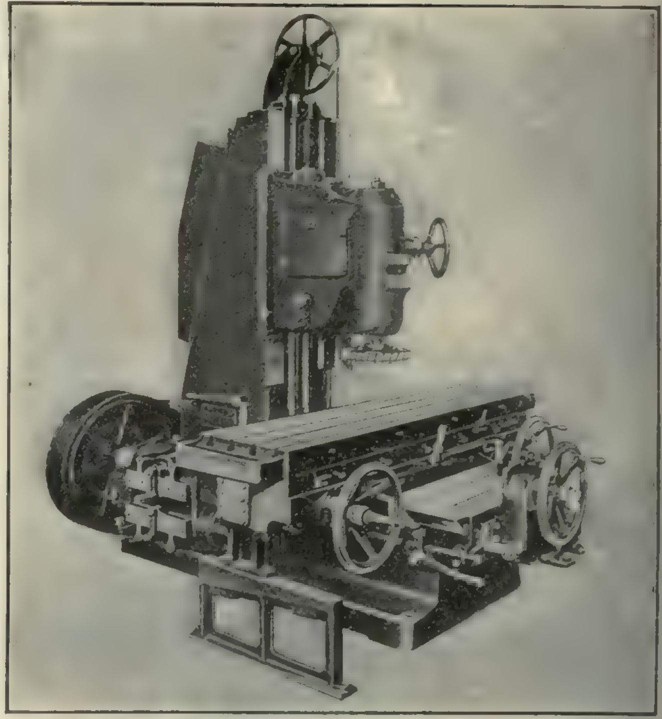


FIG. 2. JACKSON VERTICAL MILLING MACHINE NO. 10-A.

The weight of the spindle and housing is counterbalanced by a weight inside of the column, so that lost motion between the cutting tool and handwheel may be taken care of. The spindle housing may be clamped in position for cutting after the proper depth has been obtained. A micrometer stop is provided for determining depth of cut and vertical position of the spindle.

The machine is made either with or without power feed. The spindle has speeds of 200, 325 and 520 r.p.m., and is provided with a No. 11 B. & S. taper hole. The distance from the center of the spindle to the face of the column is 14 in., and the cross travel of the table 13 in. The table is 13 x 40 in. on the No. 5-A machine, and 13 x 48 in. on the No. 6-A machine, the longitudinal travels being 32 and 40 in., respectively.

The vertical milling machine shown in Fig. 2 is intended for production work on die-sinking, being practically the same as the No. 10 die-sinking machine described in the *American Machinist* on page 1122, Vol. 48. The difference is that the head carrying the vertical spindle and cherrying mechanism has been changed to one carrying a heavy vertical milling spindle. The No. 10-A machine has a table and cross-rail feed ranging from 0.001 to 0.015 in. per revolution of the spindle, while the No. 10-B machine has a range of feeds from $\frac{5}{16}$ to 6 in. per minute, regardless of the speed of the spindle.

Inside of the head is a back-gear arrangement providing thirteen changes of spindle speed ranging from 8½ to 310 r.p.m. A pull-pin lever on the left-hand side of the head provides the means for changing from the direct drive to the back gear, the other changes of speed being secured in the speed-change gear box on the left-hand side of the base near the drive pulley. The lower end of the spindle has a flange 6½ in. in diameter, and is provided with a ¾-in keyway and a No. 13 B. & S. taper hole.

The standard sizes of cutters are 4, 6, 8, 10, 12 and 14 in. in diameter. A circular table 36 in. in diameter may be provided for circular and continuous milling. The feed changes are controlled at the feed-change box on the right side of the base near the back of the machine.

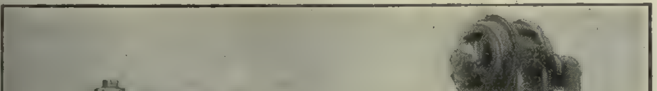
The distance from the center of the spindle to the face of the column is 18½ in., while the maximum distance from the table to the end of the spindle is 27 in. The head has a vertical movement of 24 in. The table, which is 18 x 72 in. on the working surface, has a longitudinal travel of 56 in. and a cross travel of 18 in. The driving pulley runs at 300 r.p.m., a 10 to 15 hp. motor being required.

Southwark-Gray Turret Rotary Shears

The No. 1 Gray turret rotary shear, made by the Southwark Foundry and Machine Co., Philadelphia, Pa., was described on page 1115, Vol. 52, of the *American Machinist*. That machine was intended for cutting metal up to 14-gage.

Since that time, several new models of the machine have been placed on the market. The No. 0 machine is intended for cutting steel of 16-gage or less, and can be mounted either on a bench or a pedestal and controlled by a foot lever. It has a cutting speed of 8 ft. per minute. The diameter of the cutters is 1½ in. and the throat depth is 18 in. The driving pulley runs at a speed of 200 r.p.m., and ½ hp. is required. The machine is 2 ft. 2 in. in height, 3 ft. 6 in. in length and 1 ft. 6 in. wide.

The No. 2 machine is intended for handling metal up to 8-gage. It employs a cutting speed of 10 ft. per minute, with cutters 2½ in. in diameter and requires 1½ hp. to operate, the speed of the driving pulley being 265 r.p.m. It is made with a throat depth of 30 in., a floor space of 5 ft. 9 in. x 2 ft. 3 in.; height of 6 ft. 9 in



SOUTHWARK-GRAY NO. 3 DOUBLE-TURRET ROTARY SHEAR

The accompanying illustration shows the No. 3 machine, which has very recently been placed on the market. This model differs from the others primarily in the fact that it employs two turrets, the lower cutter being mounted at an angle in a turret resembling the upper one. The machine is intended for cutting metal up to ⅜ in. in thickness, employing a cutting speed of 10 ft. per minute. The diameter of the cutters is 4 in. and the throat depth 36 in. The driving pulley runs at a speed of 285 r.p.m., and 3 hp. is required to operate the machine. The total height is 6 ft. 6 in., and the floor space 7 ft. 3 in. x 3 feet.

The machine is driven by a motor mounted on top of the frame, a pedal being placed at each side of the machine for controlling the operation of the driving clutch. The machine can be handled from either side, as the controls are duplicated. The metal can be fed into the turret shears from any direction, the control of this feature being given by revolving the turret. The two turrets keep the same relative position at any degree of the circle to which they are revolved, the handwheel at the top of the machine being used to rotate them. Because of the fact that the cutters, while working, can be changed to any degree of the circle, the machine can be employed to cut various shapes without turning the sheet or plate in the machine. The machine is said to produce a smooth, clean and square edge.

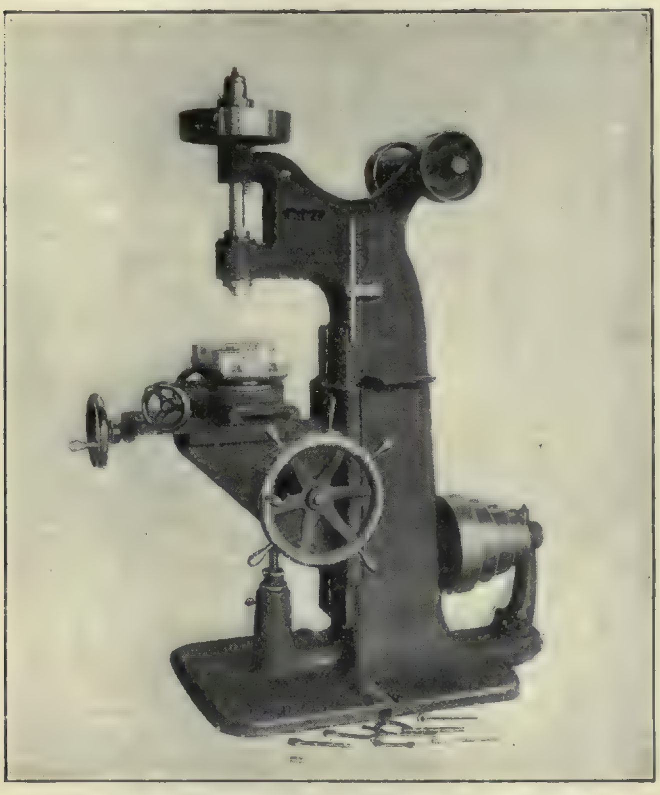
Any shape or opening can be cut, with the minimum radius at the corners equal to the radius of the cutters. Cuts as wide as the throat depth can be made in one continuous operation, but greater widths up to twice the throat depth are cut by first shearing in as far as possible from one edge and then turning the plate so as to work from the opposite edge. When following a line laid out on the plate in making a cut, the course of the cutters is changed by turning the handwheel mounted on the head, while the plate itself maintains the original position. The rotation of the cutters automatically feeds the stock through the shear. If desired, the plate can be guided by hand.

On all of the machines except the No. 0 both of the cutters are rotated by power. Changing the speed of the cutters is controlled entirely by means of the treadle engaging and disengaging the clutch. Only one operating speed is required, as it is claimed that the machine can be started and stopped so easily that it is not necessary to have more. When starting a cut on the inside of a sheet, the cutters are forced through the plate before they are rotated. The adjustments on the shear are so made that the cutters will not interfere when moving them toward each other.

It is claimed that the floor space is less than is generally required for machines of this type, because of the fact that it is not necessary to swing a large sheet while working upon it. The machines are adapted for work of all grades, from aprons, shields and pans for automobiles to large locomotive, bridge and structural work. The small sizes of machines can be operated by one man, while the largest size can ordinarily be handled by two.

Improvements in Pratt & Whitney Die-Sinking Machines

Several changes in design have been made in the die-sinking machines built by the Pratt & Whitney Co., Hartford, Conn., to make them more convenient to operate and easier to maintain.



PRATT & WHITNEY DIE-SINKING MACHINE

In the machine illustrated herewith the driving spindle has been provided with a positive pin lock for four positions, so that the chuck or collet can be tightened without holding the driving belt. The spindle pulley has a system of oil grooving opposite to the direction of rotation, so that oil is continually carried upward, insuring complete lubrication without loss of oil. A floating babbitt washer takes the thrust of the cut on the spindle, a system of oil grooving distributing the lubricant evenly over the entire bearing surface.

The main drive cone has been fitted with a hollow spindle having communicating oil holes delivering the oil to a series of felt-packed grooves, conserving the lubricant and insuring an ample supply. To protect the ways from chips and dirt, leather wipers, held by cast-iron caps, are attached to the knee, fitting close to keep all foreign matter out of the mechanism.

The vise capacity has been increased, and the vise has been strengthened in proportion to this greater capacity. A telescopic elevating screw is now furnished in place of tne single-piece screw previously employed, thus obviating the necessity for boring a hole in the floor. The elevating wheel shaft is provided with a thrust bearing for ease of operation.

The outboard bearings for the knee and vise slides have been strengthened to reduce the chance of breakage, and the slides themselves are grooved and protected.

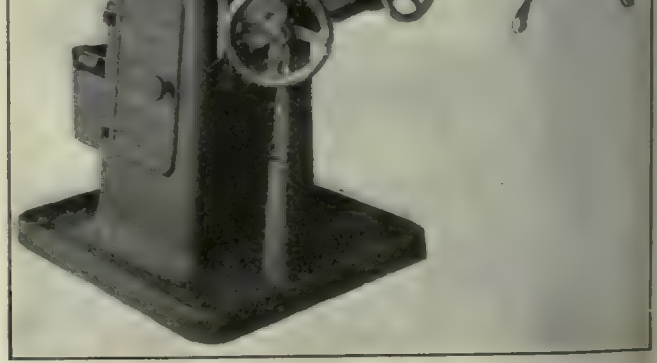
Graham Knee-Type Ring-Wheel Grinding Machine

The Graham Manufacturing Co., 71 Willard Ave., Providence, R. I., is placing on the market the knee-type, ring-wheel grinding machine shown in the accompanying illustration. The machine is known as the No. 41, and, although it greatly resembles a knee-type milling machine in general construction, it might well be called a horizontal-spindle face-grinding machine.

The column of the machine is of heavy box section, and has a high bead at the edge of the base in order to catch waste fluid. Wooden shelves are ordinarily provided on the inside, being placed on cast ledges, or the interior space may be used for the starting box. The head of the machine is a sepaarte part, being secured on the top of the column. The spindle is mounted in Timken roller bearings, which are carried in large removable bushings. The front bushing is tight, and so placed as to reduce the over-hang. In order to take care of end-play, the rear bushing has a close sliding fit and is held in position by a strong helical spring, so that it automatically takes up end motion and wear. Larger adjustments are made by means of a castellated nut. Felt-packed dust collars protect all running parts, and glass oilers indicate the height of the lubricant around the bearings.

The machine is shown equipped for belt drive from an overhead counter-shaft or motor. It can also be very well driven from a motor mounted on a bracket at the back of the machine and attached directly to the spindle through a flexible coupling. The maker favors this arrangement, because the motor and its support thus balance the knee and table at the other side of the column. The motor can be belted to the machine, being placed on a bracket behind the column and near the floor, a method often desired in order to obtain the necessary speed for the spindle. The motor can also be placed inside the column and belted upward to the spindle. A compact unit is provided when the motor is built into the head and mounted directly on the spindle, but this arrangement has disadvantages, partly because end-play is not allowable in the spindle.

The abrasive-ring holder is made of pressed steel, and the abrasive ring itself is clamped in place by drawing a split cone-shaped ring around it into a taper in the body. By means of an adjustment flange screwed upon a large hub in the ring, the abrasive ring may be set out as wear occurs. The heavy hub or center of the holder is fastened to a collar shrunk directly on the end of the spindle. The abrasive rings can be changed in the holders, or the entire holder and ring can be easily removed and replaced. The abrasive rings used are



GRAHAM KNEE-TYPE RING-WHEEL GRINDING MACHINE

12 in. in outside diameter and either 7 or 8 in. on the inside diameter. They are 3 in. in thickness when new, and can be worn down to ½ in. or less, it is said.

The knee is of box section, and is elevated by means of a handwheel set at an angle. The table block on top of the knee has gibs fitted for movements in two directions. It can be moved transversely by means of the handwheel at the front of the machine, the shaft being provided with a dial, so that the depth of cut can be easily adjusted and read.

The table, which slides longitudinally on the table block, has a working surface of 10 x 24 in., and is provided with a trough to catch the cutting lubricant. It can be reciprocated by means of the pilot wheel.

The water supply is furnished by a No. 2 B. & S. centrifugal pump, being secured to the tank, settling pan and strainers at the rear of the machine. The pump can be driven from the spindle or the countershaft. The water is applied to the work through a nozzle fastened to universal pipe joints. In the photograph the guards for protecting the operator from splashing have been removed.

The machine is said to have a capacity for grinding surfaces 6 x 12 in. in size. The extreme travel of the table is 16 in., and its transverse movement is 3½ in., while the table can be raised to the center of the wheel and lowered 7 in. Ordinarily the head is set over just enough to give clearance, so that only one side of the wheel touches the work, the effect not being appreciable enough to cause the surface to be concave. However, the head can be set perfectly straight, the capacity of the machine being greatly increased. The sparks then fly downward at one side and up at the opposite side of the wheel.

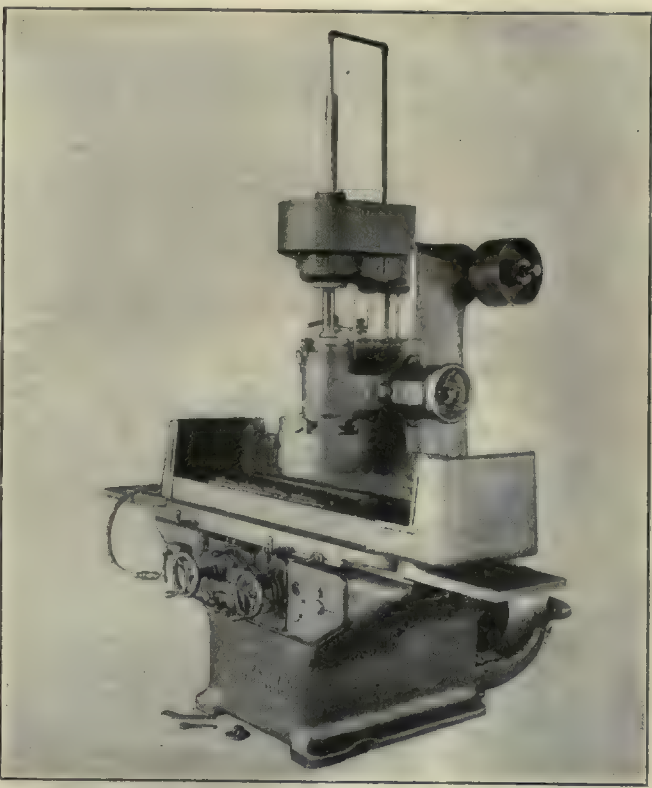
The maker calls particular attention to the method used for dressing the abrasive rings in order to control the speed of cutting. It is possible to dress the face of the wheel so that only a narrow band cuts, the rest of the wheel being relieved. The speed is, of course, much greater when the band is on the outside of the ring than when it is at the inside edge.

A holder for the diamond used in dressing the ring is furnished for mounting on the table. Special equipment and modifications can be provided for, so that the machine can be applied to special work. Automatic feeds can be supplied. It is possible to mount two heads side-by-side, one for roughing and one for finishing at one pass of the work.

It is stated that the wheel is ordinarily driven at a speed of 1,780 r.p.m., the horsepower required varying from 5 for light work to 15 for heavy jobs. The spindle of the machine is 42 in. above the floor, and the floor space required is about 6 sq.ft. The machine weighs about 2,000 pounds.

Improvements in Pratt & Whitney 14-In. Vertical Surface Grinding Machine

A number of changes have been made and improvements incorporated in the design of the vertical surface grinding machine built by the Pratt & Whitney Co., of Hartford, Conn. The ball bearing mounting of the spindle has been redesigned, the weight of the wheel unit now being carried on springs set against the upper bearing. This provides an automatic take-up so that no adjustment for wear is necessary. All openings are carefully guarded from grit and moisture by the interlocking construction of the parts.



IMPROVED P. & W. 14-IN. VERTICAL SURFACE GRINDING MACHINE

Lubrication in the upper section is provided for by oil dripping through the bearing from regulation oilers and falling into whirling cups, which throw it back into the bearing by centrifugal force. In the lower section the oil is poured into a large reservoir, from whence it flows through the upper bearing and runs along the spindle to the lower bearing where the grinding wheel faceplate acts as a retainer. Ribs on this plate throw the oil up into the bearing by centrifugal force.

An aperture in the column, fitted with a removable cover, provides easy access to the spindle counterweight. The table drive has been strengthened by the introduction of hardened shafts, gears and clutches, lubricated from sight feed oilers on the front of the case. Split bearings are now used, and the feed shaft has been fitted with a keyed coupling so that the entire drive shaft unit may easily be removed. Hand operation of the table has been simplified by providing a sliding gear in place of a clutch on the handwheel shaft. The table reverse is assured of smoother action by means of a dwell in the pinion drive so that the table comes to a stop before reversal takes place.

The idlers over which the main drive belt runs have been equipped with roller bearings, lubricated by extra large grease cups in the ends of the stationary shaft. Frictional power losses are minimized and smooth running is assured. The spindle drive pulley is surrounded by a heavy sheet-metal guard.

The tank has been redesigned. A series of baffle plates, cast integral with the tank proper, are provided with openings alternately at the top and bottom so that the solution flows over and under these plates in such a manner that in the last compartment where the solution is drawn off by the pump it is clean and free from grit. Cleaning the tank is a simple matter, as the settling pan can be lifted off, giving accessibility to all compartments.

To add to the oil-retaining capacity of the main drive cone at the rear, the hollow stationary shaft (keyed to the bracket) is supplied with grooves packed with felt. These grooves are connected to the center oil hole.

The motor drive has been improved by making the motor base adjustable, so that the drive belt can be adjusted correctly in relation to the step of the main drive cone. This prevents creeping and curling of the belt.

The drive for the rotary tilting chuck (plain or magnetic) is equipped with a flexible coupling which facilitates mounting the unit and aligning the drive shaft.

Blount Motor Grinder

The J. G. Blount Co., of Everett, Mass., has developed a line of alternating current motor grinders of which the cut illustrates the 2-hp. 12-in. size.

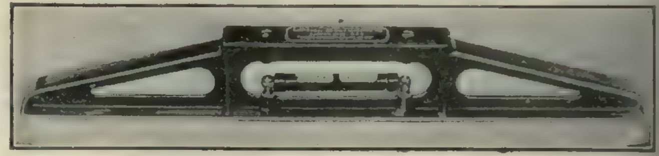
They are of rugged design and are equipped with SKF ball bearings in dust-proof mountings. The bearings are secured to the shaft by a light drive fit and locknuts. The spindles are of high-carbon steel, ground to size. The rests are of one piece and adjustable. Flanges are machined all over and inner flanges are pressed to shoulder of spindle. The tool tray and water pot, which are bolted to the column, are separated and detachable. The equipment includes two grinding wheels, one coarse and one fine, unless otherwise specified. Motors are of the Westinghouse design and the starting switch is of textile snap type.

BLOUNT MOTOR GRINDERS

The machines are built in the following sizes: ½ hp., 8 x 1-in. wheels; 1 hp., 10 x 1½-in. wheels; and the 2 hp., 12 x 1½-in. wheels.

"Universal" Precision Machine Aligning Level

The illustration shows a precision level just placed on the market by the Universal Boring Machine Co., Hudson, Mass. The development of this level is due to the experiences of the field men of the company in finding imperfect leveling at the bottom of many of the machine troubles they were called to correct. While this level is a general purpose instrument it is particularly adapted to the leveling of machine tools.



"UNIVERSAL" ALIGNING LEVEL

The metal frame is 27 in. long, truss construction and the base has an accurately scraped bearing. While the casting is well seasoned it may be rescraped if at any time it should become necessary. The handle is molded of a non-conducting material to keep the warmth of the hand away from the main frame as much as possible. Its design also protects the vial, particularly from the careless or ignorant user.

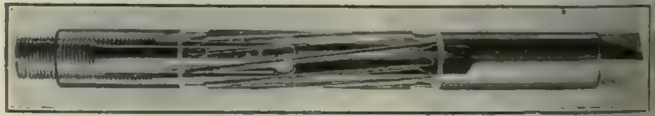
The vial is made of the best Jena glass, specially ground and is filled and graduated by an expert level maker. It is guaranteed to be accurate to 5 sec. of arc per graduation, that is, 0.0002908 in. per ft., and is mounted so that it can be adjusted both in vertical and horizontal planes.

The frame is finished in dull black, the vial case in black japan and the brass adjusting studs and screws in lacquer. A handsome well-finished, felt-lined mahogany case protects the instrument when not in use. The case is also equipped with a strong metal handle.

Kruce Spiral Expansion Reamer

The expansion reamer shown in the accompanying illustration has recently been placed on the market by E. J. Kruce & Co., 322 Harper Ave., Detroit, Mich. The tool is especially intended for reaming piston-pin holes, but can be adapted to other uses. It is said that the adjusting device offers a large range for expansion and gives ease in operation; also that the expansion is concentric, and is not affected by an accumulation of dirt in the slot. When released from its expansion limit, the reamer returns to its original size. Because of the fact that the blades are helical, key-seated or oil grooved parts can be reamed without chatter.

On the reamer shown, the front end of the body is ground 0.005 in. undersize to fit unreamed pin-holes, while the rear end is ground 0.001 in. undersize for a free fit of the hole after reaming. The adjusting screw at the front end is turned by means of a screwdriver, so as to drive forward the expanding roll, which revolves freely on the end of the screw. The roll centralizes itself in the tapered hole in the body and expands the reamer evenly to the oversize required



KRUCE EXPANSION REAMER

NEWS SECTION

ndustrial Relations Association To Meet in New York

The annual convention of the Industrial elations Association of America will be eld at the Waldorf-Astoria, New York City, ov. 1, 2, 3 and 4. The fourth and last ay session will be a joint one with the cademy of Political Science of New York the Astor Hotel.

The dates of the convention were first ked as Nov. 8, 9, 10 and 11 but the calling the Disarmament Conference in Washgton for the week of Nov. 7 made it adsable to change the dates to the preding week in order that certain of the abinet officers might be present.

It is proposed to present a program vering the things most vital at the present me to the successful administration of dustrial relations and its kindred work. ractical men will talk on the practical de of industrial relations.

◆

British Steel Men Return to England

Four British steel men sailed for home st week after a short visit in this country, ring which they appeared before the nate Finance Committee and gave testiny to prove that the proposed tariff es on high-speed steel would have the ect of putting several Sheffield steel manacturers out of business. The delegation nsisted of J. C. Ward, president Edgar en Steel Co., Ltd., Sir Sidney Robinson Wm. Jessop & Sons, Peter MacGregor Sanderson Bros. and Arthur Balfour of thur Balfour & Co., Ltd., who acted as okesman in presenting their views in ashington. In conversation with an *erican Machinist* representative, Mr. ard said that the delegation was very ch pleased with the reception that had n given them at the capitol and felt t they had impressed the members of the nance Committee of the Senate with the tice of their claims. A portion of Mr. lfour's testimony appears on another ge.

◆

British Iron Trade Resuming

Birmingham reports a better tone in the n trade, due mainly to more favorable orts from Sheffield and South Wales. is believed that some improvement will n be felt, and furnaces in the Midlands being prepared for relighting as soon onditions warrant a resumption of work. the Middlesborough district, it is stated, y five blast furnaces have as yet been tarted, but two more may be in operati shortly. The high price of coal and e is delaying a revival, and until there been substantial fall no general return to work can take place.

n the Clyde no blast furnaces are at k, though after the holidays the iron and s l works are expected to be in full operan to clear off accumulated arrears of k. New orders are, however, far from ptiful. In anticipation of better times s of the vessels laid up in the Clyde being made ready for sea.

here is little prospect of much activity in the iron and steel industries of South les for some months, but the tin-plate galvanized sheet works are fairly busy. latter are using considerable quantities of Belgian steel.

Howard Campbell Goes to Chicago as Western Editor

Howard Campbell, who joined the staff of the *American Machinist* last winter, has been appointed Western Editor with headquarters at the Chicago office of the McGraw-Hill Co. Inc., 1570 Old Colony Building. The western territory is not new to Mr. Campbell as he came to the *American Machinist* from the *Michigan Manufacturer*, of Detroit, where he was a special feature writer. He has worked in several middle western shops from apprentice to superintendent and is well fitted to carry the editorial service of the *American Machinist* to the shops in his territory. Mr. Campbell will be in Chicago on October first.

◆

Douglas Sees Prosperity, Based on Demand for Farm Products

The measure of the country's volume of business and of its commercial welfare in the future is to be found in the demand for farm products and their consequent prices, says Archer Wall Douglas, chairman of the Committee on Statistics of the Chamber of Commerce of the United States, in his monthly review of crop and business conditions in *The Nation's Business*.

"The story," says Mr. Douglas, "is much the same everywhere: A partial and unequal harvest; plentiful returns in close juxtaposition with parched and burnt up field; prices and demand for farm products that are far from satisfactory to the producers. Yet these same products are seeking a market wherever they can find it that the obligations of the farmers may be discharged. There is an abundance of foodstuffs in the country despite small yields in some grains.

"Sustained higher prices for cotton mean an amount of business in the South that can come from no other cause. Nor does it seem to be likely that there will be that fatal and futile holding of cotton for possibly higher prices that characterized the previous season. The memory of that desperate mistake and its enduring consequences are too recent to be repeated.

"If there is a demand of any moment, foreign and domestic, from now on—and this at least seems likely—the greater portion of the carry-over of cotton in this country will have been practically used up by July of next year. With general business and readjustment on an ascending scale, at home and abroad, we shall be facing a situation where the greater part of the world's supply of cotton will depend on the growing crop in this country. What such a contingency means to the prosperity of the South sounds too optimistic to put in cold print.

"The new phase of the situation already finds expression not only in widespread more cheerful feeling in the South; but also in somewhat freer buying. This is true likewise in the grain regions where farmers are liberally marketing hogs, wheat and corn.

"The commercial world, however, will not reap as much benefit from this as surface indications seem to promise. A very considerable proportion of the money the farmers receive for their products will go to settling the obligations carried over. In some sections when banks and dealers have been satisfied there will not be much left for the farmers for new purchases. Yet when all has been said the situation will be far better than at present."

Admiral Griffin, U. S. N., Retires With Honors

Robert Stanislaus Griffin, for more than eight years head of the Bureau of Engineering of the Navy Department and engineer in chief of the United States Navy, terminated his long period of active service on Sept. 22 when he retired to private life. The use of electric propulsion on battleships was put into effect many years earlier than would have been the case had Admiral Griffin been a less determined champion of that type of drive. There was strong opposition to what was termed experimentation with a vital feature of a fighting ship. Admiral Griffin, however, did not recommend the electric drive until he had made the most careful study of its application on the collier "Jupiter." Now that the superiority of electric propulsion is conceded, Admiral Griffin retires with the full satisfaction that his judgment has been vindicated.

In reviewing the accomplishments of the Bureau of Engineering under his administration, Admiral Griffin subordinates everything else to the accomplishments of his organization during the war. The engineering features of the maintenance of an enormous fleet were carried out with a success which has called forth the highest praise from the British and the French.

The development of which Admiral Griffin is perhaps more proud than any other is the work done by his Bureau on the radio. Under his direction, high powered stations have been built on the Isthmus, at San Diego, at Pearl Harbor, at Cavite and at Annapolis. The greatest achievement of all, however, was the erection of the world's most powerful station at Bordeaux. This great project was carried to satisfactory completion, despite the feverish haste which characterized every step of the work. The decision to erect the Bordeaux station was reached when there was grave fear that the Germans would be able to hunt out and cut the transatlantic cables. To have had communication severed in those critical days would have been disastrous. Had the Germans succeeded, the station at Bordeaux would have made it possible to maintain communication under all circumstances.

Throughout his more than forty years in the naval service, Admiral Griffin has been an active contender for an increased proportion of engineering talent in the Navy personnel.

Admiral Griffin was born in Fredericksburg, Va., Sept. 27, 1857. He was graduated from the Naval Academy in 1878. He holds the degree of Doctor of Engineering from Stevens Institute of Technology, and Doctor of Science from Columbia University. For his services during the war, he was awarded a distinguished service medal, was made a commander of the Legion of Honor of France and was elected an honorary member of the American Society of Mechanical Engineers.

◆

Exhibition at Mining Congress

Plans are being quickly formulated for the exhibition of mining machinery and products which is to be held in connection with the American Mining Congress at Chicago, on Oct. 17 to 22.

Nearly every mining state in the union will be represented, as well as Mexico and Alaska. The Bureau of Mines will have an exhibit of the shale industry.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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Were it not that the recovery in business that I have so long and so confidently predicted is still in its incipiency I should be suspicious of its permanency because its arrival is now generally recognized and acclaimed. "The West Cheerfully Faces the Winter," "Trade Revives in the Lower South," "The Steel Trade Makes Further Gains," "The Iron Trade Turns the Corner," "Business Gains Headway," "Even Pessimists Are Becoming Hopeful," "Survey Shows Business Is Improving," "Buoyancy in Many Trades," "Dry Goods Sales Big," "Trade Is Picking Up," "Trade Improvement Noted in the South," "Trade Revives," "Business Speeding Up, Says Chicago," "Industrial Gains Real, Says Bank," "Prosperity at Hand, Says Secretary Davis," are some of the headings that appear over the stories of better business that the newspapers published last week.

The detail of the week's record seems to justify the almost unanimous optimism that now seems to be felt. Except in the cotton market, which continues to hang around twenty cents, there has been no speculative outburst to make the situation dangerous and in neither stocks nor commodities is the buying as yet beyond the legitimate investment or consumptive demand.

The weekly statement of the Federal Reserve Bank shows a further increase of $26,000,000 in the gold on hand as a result of which the reserve ratio is up to 68.7 per cent. The New York bank in particular has added $106,000,000 to its gold holdings and its reserve ratio has risen from 75.7 to 84.1 per cent during the week.

It is not surprising, therefore, that the New York and Boston banks have reduced their rediscount rates to 5 per cent or that there is a general expectation that the other ten banks will soon follow suit. The growing ease of money has made the best commercial paper easily salable at 5½ per cent and good bankers acceptances have found buyers at 4¾ per cent. Reflecting this decline in the rental value of credit, investment bonds are active and higher under the leadership of "Libertys" which have been bought with confidence. The stock market has been quiescent but the better class of railway and industrial securities have been in fairly good demand at slightly higher prices.

The Government has thus far succeeded in selling about $63,000,000 of the railway equipment trust notes that it held upon a 6 per cent basis. These are being resold to the public to yield 5.75 to 5.85 per cent and if enough can be marketed it may be that the War Finance Corporation will find itself able to give the railways the assistance needed without the legislation so eagerly hoped for a month ago.

The United States Steel Corporation has advanced its principal products $5 a ton or more and the independents are expected to follow suit. The cotton goods market is steady but those merchants who are frank admit that the advance has to some extent checked buying. Silver, long regarded as a barometer of the world's trade by English merchants, is up to 41½ pence per ounce in the London market. This is the top of the present movement and compares with a low of 30⅝d. touched last March. An increasing demand for diamonds, which is nearly always accepted as an indicator of prosperity, is reported by the dealers in jewels. An advance of 20 yen per picul in silk in Japan is another straw which indicates a quickening in the demand for luxuries. A similar inference is to be drawn from the success of a large fur auction held in New York last week.

At a convention of the tea and coffee trade held in Indianapolis figures were presented showing that the consumption of coffee in the United States had increased from 8.9 pounds per capita in 1919 to 12.7 pounds per capita in 1920. It was claimed that 1921 will show a still further increase, and a shortage with much higher prices when the European demand is normal was predicted. In various other commodities, particularly canned goods and coal, the probability of a serious shortage this winter is becoming more definite.

An attempt to bring about an agreement to reduce the production of plantation grown rubber is reported from London. Its success seems probable, in which case higher prices would be the natural result. The experts of the grain trade are in disagreement as to the probable course of prices. Many of them predict an advance upon the theory that more than half our exportable surplus of wheat has already been sold. As yet, however, the expected advance has not occurred but some usually well informed people are buying both wheat and corn with confidence.

A further gain in railway traffic is reported and the August earnings thus far published show a striking increase in the net despite a reduction in the gross. The F. W. Dodge Co. reports that the building contracts awarded in twenty-seven Northern States during the week ending Sept. 15 amount to $69,505,700, which is a record for the year.

But it is unnecessary to go into further detail. Almost without exception the indicia of our domestic trade are encouraging and the probability is that Secretary Davis is right in announcing that "Prosperity is at Hand." There was never any occasion for the propaganda of pessimism in which so many joined six months ago and I take not a little satisfaction in having persistenly opposed it.

There are, however, a few clouds upon the horizon. They are not large but they should be watched. One is the Senate tax bill. Many of its provisions and some of its omissions will hamper business by an unequal and unfair distribution of the burden of taxation. Another is the bonus bill whose ultimate passage Congressman Fordney promised in a speech he made in Michigan when he was at home looking after his political fences. The bond issue involved in the passage of a bonus bill would be fatal to the business revival now commencing.

Still another is a possible railway strike. The men are said to have voted in favor of it but the labor leaders seem disinclined to order it. They are wise but they should be watched.

Then there are other clouds across the Atlantic. The darkest is the continued decline in marks which sold as low as 89¾ cents per 100 last Wednesday, when it became known that the German bank statement showed that 81,469,115,000 marks were in circulation. It is, of course, impossible that this inflation can continue but just how it will be ended and what effect the ending will have upon the rest of Europe and business in this country is a question that the careful man should carefully consider.

The news from abroad is not otherwise disturbing. Lloyd George has undoubtedly checkmated de Valera, and the sharp advance recorded in the price of Mexican bonds is distinctly auspicious.

A recognition of Obregon by our Government and an agreement to reduce armament at the Congress that is to meet in Washington next November are two possibilities either one of which, if it became a reality, might easily fire the speculative imagination of our people and hasten the boom for which we have been psychologically and financially prepared by our large oversupply of gold.

Third Annual Convention and Exhibition of American Society for Steel Treating, at Indianapolis

It is doubtful if any convention ever held was more productive of results than was the one held by the American Society for Steel Treating at the Fair Grounds, Indianapolis, Ind., during the week of Sept. 19. Over fifteen hundred delegates were registered, representing practically every concern of importance in the metal-working and machine-building industry in the United States. Added to this were about eight thousand executives and others interested in the processes and equipment of steel treating, bringing the total registered attendance to nearly ten thousand.

The great number of papers presented necessitated simultaneous sessions during three days of the convention, besides which a number of papers were presented by title only. These papers will be published later in the official organ of the society.

The convention opened on Monday afternoon with an address of welcome by W. R. Chapin, chairman of the executive committee of the Indianapolis chapter. He was followed by Claude S. Wallin, secretary to the Mayor of Indianapolis, who spoke in behalf of the city. Col. A. E. White, whose term of office as national president of the society has just ended, responded for the Steel Treaters. Reports of the tellers of the election of officers followed; also reports of the secretary and treasurer.

The following officers were elected for the coming year: F. P. Gilligan, of Hartford, president; F. C. Lau, Chicago, first vice-president; R. J. Allen, Springfield, Mass., second vice-president; J. V. Emmons, Cleveland, treasurer; J. J. Crowe, Philadelphia, director.

On Tuesday evening the Indianapolis chapter provided a smoker and entertainment for the delegates and guests. On Wednesday evening the annual reception and dance was held in the Claypool Hotel. A fifty-mile race between Duesenberg, Peugeot and Frontenac automobiles was a feature of the Wednesday afternoon program. Howard Wilcox driving the Peugeot was the winner, covering the fifty miles in 30 min. 50:64 seconds. Jimmie Murphy took second place in the Duesenberg, and Jules Ellingboe, in the Frontenac, was third. The occasion was marred to some extent by an accident when one of the cars went over the edge of the track and landed about a hundred feet away. Fortunately, neither driver nor mechanician was severely injured.

Thursday evening the annual banquet of the society was held at the Claypool Hotel. Doctor Albert Sauveur, of Harvard University, was toastmaster. The speakers and their subjects were as follows: A. A. Potter, Dean of Engineering at Purdu University, "The Engineering Society and Public Service"; Comfort A. Adams, director of engineering division, National Research Council, "Co-operation in Engineering Research"; E. A. White, former president of the society and now of the faculty of the University of Michigan, "What th University Owes the Industries."

The principal speech of the evening was delivered by Howard Coffin on the subject of "Our Air Policies and the National Defense." Governor McCray and Mayor Jewett each spoke briefly. E. P. Hyde, directo of research for the General Electric Company, told where various kinds of researc should be carried on. During the evenin the secretary announced that Dr. John A Matthews, of Pittsburgh, and Elwood A Haynes, of Kokomo, had been electe honorary members of the society.

Some eighty exhibits were shown in th Manufacturers' Building, including variou kinds of furnaces for use in the treatmen of steel; compounds and materials for cas hardening and carburizing; insulatin bricks, cork, powder and other refractorie for use in building ovens and furnaces heat-insulating cements for banding fir bricks, blocks and granular refractories high-speed, carbon and alloy-steels, together with products made from them drop-forgings and die-formed parts; products made from bakelite and raw-hide; heat resisting alloys; metallographic equipment metallurgical microscopes an other equipment for metallurgical research; pyrometers and temperature control equipmen and process timing and signalling instruments; job-time recorders and tim stamps; hardness testing instruments cutting-off machinery, pumps, grinding an polishing machines and blowers. Severa Indianapolis automobile manufacturers als exhibited a line of pleasure cars and commercial trucks.

Balfour Before Senate Finance Committee

Such interest has been manifested in the recent testimony of Arthur Balfour, of Sheffield, England, before the Finance Committee of the U. S. Senate that the following extracts are reprinted from the stenographic report of the hearing, which just has become available:

Senator McCumber. Will you kindly state your name in full, your residence, what interest you represent, and to what you desire to direct your remarks?

Mr. Balfour. My name is Arthur Balfour; I am of Sheffield, England. I am deputy president of the Association of British Chambers of Commerce. I am ex-president of the Sheffield Chamber of Commerce; ex-master cutler of Sheffield, and managing director of Arthur Balfour & Co. (Ltd.), of Sheffield.

I am desirous of drawing your attention to the question of high-speed steels and other steels which have been imported from Sheffield for a great many years.

I am sure you will understand that we feel that we are in a rather delicate situation. We do not for one moment desire to appear to suggest in any way what you should do in your own country; but, owing to the very long time that Sheffield has been associated with America we ventured to come here and put a few considerations before you.

The industrial and commercial conditions in Sheffield created by the war, and in England in general, are very disastrous. We have about 2,000,000 people out of employment. We have another two or three million working only two days a week and a further million working only three days a week, and we are right up against the economic law, owing to conditions created by the war. Sidney Robinson who is with me, represents the firm of William Jessop & Sons (Ltd.). They have been doing business here since 1828.

Mr. Macgregor represents the firm of Sanderson Bros. & Newbould (Ltd.). They have been doing business since before 1829. John Cecil Ward, of Edgar Allen & Co. (Ltd.), and my own concern have been trading here since 1876. We have been in the closest co-operation with the steel makers in this country. During this period we have worked out inventions together and sent workers over here, and in most of your steel firms you will find old Sheffield steel workers today, or their descendants. We are very anxious that these beneficial conditions shall not be disturbed.

Mushet steel, manganese steel, stainless steel, and other varieties, all of which are produced here at the present time, were invented in Sheffield. The Taylor-White process of treating tool steel which has been a very great factor in the trades which we represent, was invented in your country, but as regards the making of high-speed steel, it was perfected in Sheffield.

The population of Sheffield today is over half a million, of which a hundred thousand workmen are largely skilled. We also represent Messrs. Sir W. G. Armstrong, Whitworth & Co. (Ltd.), of Manchester, who make the same class of steel, but it is made in Manchester and not in Sheffield. Taking into consideration their employees, which amount to probably 25,000, we represent about 125,000 workers.

We have also had long personal connections with this country, which has induced us to venture to come to see you. I molded car wheels in Buffalo for four years, from 1892 to 1896. I have been here twenty-seven times. Mr. Robinson has been here forty-three times, and my other colleagues over twenty times. We are all of us local taxpayers, through firms in which we are interested, and all of us employ labor in this country.

We should have liked if it were possible to have no change in the tariff at all. We recognize that that is not possible, and we are prepared to accept the data and proposals made by Mr. Smiley (speaking for the committee of fine steel importers) recently. These gentlemen distribute our products in this country.

Senator Smoot. Take the steel valued above 40 cents per pound. The bill as it passed the House provided 20 per cent ad valorem. That is where the high-speed steel falls. As I remember it, Mr. Smiley wanted 10 per cent instead of 20 per cent.

Mr. Balfour. Yes, sir. Taking paragraph 305——

Senator Smoot. No; that is the first of paragraph 304. Three hundred and five is the paragraph providing 72 cents per pound on the tungsten content in excess of 1⅓ per cent, "and 72 cents per pound on the tungsten content in excess of 1⅓ per cent shall be levied, collected, and paid on any articles containing molybdenum and tungsten."

So, for high-speed steel, you have got to take pargraphs 304 and 305.

Mr. Balfour. In conjunction.

Senator Smoot. It has been suggested, although not by Mr. Smiley, that the 72 cents be cut to 50 cents. Others have suggested that in their testimony. In other words, they were content with making paragraph 304 10 per cent instead of 20 per cent, and cutting 72 cents to 50 cents per pound on the tungsten contained in the steel.

Mr. Balfour. We suggest that the tungsten should be cut to 35 cents from 72 cents.

Senator Smoot. That is what I wanted to find out. You want 35?

Mr. Balfour. Thirty-five instead of 72.

Senator Smoot. And 10 per cent instead of 20 per cent?

Mr. Balfour. Ten per cent instead of 20 per cent; yes, sir.

At the present time, as you have all heard, the fine steel importation is only 2 per cent of the whole; and we feel that that is a very small percentage and, at the same time, a very useful percentage, as it makes an incentive to the manufacturers here and a great incentive to us to give the best value we can as regards quality and price.

We are satisfied that if the tariff went through as it is at present written it would put us out of business. There is no question about that. I understand that it is not your desire to put anybody out of business entirely; but we could not possibly send you steel under that tariff.

Senator McCumber. What you mean is that it would be prohibitive so far as the American trade is concerned?

Mr. Balfour. It would be absolutely prohibitive, sir, because the duty would come to about 200 pounds per ton, in pounds sterling; and as we have to keep stocks in this country from 50 to 100 tons, we will always have to lock up 20,000 pounds sterling in duty alone on our high-speed steel before we could trade at all.

There is another view which bears very strongly on the amount of the tariff. That is the valuation question. We have got along very well under the present valuation. We are in very close touch with the representatives of your Treasury Department in London. They come to Sheffield to see us and we give them every possible facility for looking into matters, and we have always been able to satisfy them exactly as to what we have been doing.

We desire to go on doing that. We are very anxious that the valuation should be fixed in some way so that we can quote a price fixed to our customers in this country; else it is almost impossible to conceive that your buyers here will give us an open order on a price which is indefinite.

If the valuation is put on the basis it has been suggested, it will be almost impossible for us to say on any given day what duty we shall have to pay and what price we can guarantee to our customer here

Senator Smoot. You must take into consideration that you have an advantage in the exchange value that you have never had before; and this committee has to take that into consideration in fixing these rates.

Mr. Balfour. I agree; I quite appreciate that. We have the same exchange difficulties that you have, somewhat intensified with the competition which we have so close to us in Germany.

Senator Smoot. You know something about that.

Mr. Balfour. We know all about the exchange difficulties; but we do put before you for consideration the difficulty of trading on an open indefinite situation of the kind which this new valuation will create. We also have contracts here with some of your big tool makers for steel, which are running contracts for two or three hundred tons. They want to fix a price that is definite in order to be able to fix their costs of production. Under this system it will be almost impossible for either of us to do that.

Senator Smoot. I cannot agree with you there, because it seems to me that your price under the existing tariff law is fixed upon the day of the exportation. If changes in price should occur in England during that time, of course the rate of duty imposed today will be different. The American valuation does not fluctuate any more than the valuations in a foreign country fluctuate.

Senator McCumber. They are probably more stable now, because the currency is more stable.

Mr. Balfour. I quite agree with you that upon tonnage steel it is a fixed thing. It is a fixed market question. But take high-speed steel and these fine steels, and it is not fixed. They have a different composition, a different analysis, and each concern makes a separate quality. They are not standard.

Senator Smoot. But that same difficulty, if you call it a difficulty, exists today with the foreign valuation.

Mr. Balfour To some little extent, but nothing like to the same extent, because we can today make the price and fix the price in cents.

Senator Smoot. We have a fixed price in America, too.

Mr. Balfour. I only ask you to consider these points and see what you can do with reference to these difficulties.

Senator McLean. On the tungsten content the rate is specific.

Mr. Balfour. The rate is specific on the tungsten content, but there is also an ad valorem percentage on the price.

Senator Smoot. All that the question of American valuation affects is the ad valorem duty of the steel above 40 cents.

Mr. Balfour. We are all in agreement on that. High-speed steel is our important product which we have to send to this country. We are also interested in carbon steel.

Senator McLean. Do you manufacture high-speed steel in this country?

Mr. Balfour. No; none of us. We only manufacture it in England.

Senator McLean. You said you had branch interests here.

Mr. Balfour. Jessops have a company at Washington, Pa., where they roll sheets. The others of us have branches in different parts of the country—Chicago, Boston, and New York.

Senator Walsh. I suppose your ownership is associated with Americans?

Mr. Balfour. Yes, sir. They are practically retailing companies, with the exception of Jessops.

We, of course, are very much interested in the export of finished tools from this country which are made from our steel. We buy large numbers in England and great number are sold to the colonies.

We feel that this tariff will certainly put a difficulty in the way of the export of those tools, as it will further depress the exchange and further accentuate the exchange difficulty, and also make the cost of the high-speed steel to the makers here very much higher, particularly in view of the duty on tungsten.

And if you will allow me to say a word on tungsten, I would like to say that we had during the war great difficulties with tungsten, just as you had; but, fortunately, we had the tungsten in the British Empire, as you had it in your country, and the fact that we had a supply in the British Empire saved us a great deal during the war and enabled us to produce munitions, and we are anxious, from our side, to retain a certain amount of tungsten in the British Empire and not work it all out.

Senator Watson. What are your imports to this country of high-speed steel, as you class it?

Mr. Balfour. They have varied enormously. Recently it has been perhaps 500 to 700 tons per annum, something under 1,000 tons.

Senator McCumber. What was the value?

Mr. Balfour. About £250,000 sterling or something of that kind, roughly.

Senator Walsh. What is the unemployment in England? Some figures which have been given us show that it is about 5 or 6 per cent.

Mr. Balfour. We have 2,000,000 unemployed; we have another million employed two days and several other millions employed three days. Our population is about 45,000,000.

Senator Watson. For the entire year of 1920, under the classification of steel by whatever process made, containing alloys, such as nickel, cobalt, vanadium, chromium, tungsten, or wolfram, molybdenum, titanium, iridium, uranium, tantalum, boron, and similar alloys, we imported 883,740 lb., valued at $371,147.

Mr. Balfour. That would be about right. There are about 250,000 of high speed, and the rest would be made up of other steels.

Senator Watson. How much of that comes from Sheffield?

Mr. Balfour. It practically all comes from Sheffield. A little comes from Manchester. Sweden sends practically no crucible steel and no high-speed steel to this country.

Senator Smoot. I suppose half of that amount would be imported into the United States even though the rates were higher than they are here?

Mr. Balfour. Unless the selling price is too high. I do not think you can say that we have ever ruined the price in competition with the American makers. We have always obtained for our steel at least as good a price, or a little higher, on account of special quality.

Senator Smoot. From the information we receive there are certain industries in this country that would use it no matter whether it cost more than it does now or not.

Mr. Balfour. Yes; even more, but the amount proposed I am afraid would make it impossible to do any export trade.

Senator Watson. What wages do you pay in the making of high-speed steel as compared with the wages paid in this country in the same line?

Mr. Balfour. Our wages have gone up very much since the war. I do not think our wages are very much different from yours at the present time. On the other hand, our fuel, which is a very big factor, is very much higher than yours.

Senator Smoot. What are you paying common labor?

Mr. Balfour. The ordinary common labor, that is, a man wheeling a barrow, gets £3 10s.

Senator Walsh. What is your cost of living as compared with that in America?

Mr. Balfour. I should say your living is a little higher.

Senator Smoot. You have no objections whatever to our imposing a duty equal to the difference in the wage and to equalize the exchange value?

Mr. Balfour. Sir, we have no objection to your imposing a duty. It is for you to decide what it is to be and how it is to be done. We understand all that; but we do ask you, after the pleasant connections we have had together, not to put us out of business.

Senator Smoot. Do you think that the proposition would be a fair one that all that we would impose by way of duty would be the difference in the labor cost and to equalize the difference in exchange?

Mr. Balfour. Yes; provided you made the condition that it should not become a permanent thing; that when conditions altered you would be prepared to reconsider the matter and not, when we have the other conditions right, leave us with a high tariff.

Senator Smoot. Of course you must know that no tariff that will be passed is going to remain on the statute books as they have done in normal times in the past.

Mr. Balfour. We certainly hope not. But we do not believe in retaliation. Whatever happens, we shall give a free entry to your goods as far as it is possible. That I am perfectly convinced of.

Senator McCumber. Let me ask you a question in a little different form from that asked you by Senator Smoot.

Would you be satisfied if we put a tariff on that would measure the actual difference between the cost of production, including everything, in your country and in this country?

Mr. Balfour. Yes, sir; we would, because the cost of production of high-speed steel is less in this country than it is with us. That would suit us entirely.

Senator McCumber. Then, according to that view, there would be no tariff in your mind?

Mr. Balfour. I started my remarks by saying that we should be very glad if everything could remain as it was.

Senator Smoot. Remain as it was?

Senator Watson. Have you prepared production costs to show that it costs less to make high-speed steel in this country?

Mr. Balfour. We have great difficulty in giving you production costs of your own people. We know what our costs are. We are constantly giving them to your representative in London.

Senator Walsh. What percentage do your companies ship to America?

Mr. Balfour. I should say a little less than 20 per cent—probably 18 per cent.

Senator Walsh. Assuming that this tariff amounted to an embargo; your reduction would be only 18 to 20 per cent?

Mr. Balfour. But it does not quite work like that. It is not distributed evenly over the trade. We have some gentlemen whom I am representing who do their whole trade with America. I can put my hand on two or three firms that would go clean out of business. Other firms will be hit more or less hard according to the percentage that affects their own trade.

Senator Smoot. You spoke of having this on the free list.

Mr. Balfour. No, sir. Under the same conditions as exist at present, 15 per cent ad valorem. I said no change in the tariff as it is at present.

Senator Walsh. Do you mind giving us the names of firms or tell us the product produced that would be put out of business?

Mr. Balfour. I can give you that at once. The firm of S. C. Wardlow, who manufacture cutlery steel, would be practically put out of business.

Senator Walsh. Can you give us any others?

Mr. Balfour. I can give them to you afterwards.

Senator Walsh. Do they also make cutlery?

Mr. Balfour. There are also other firms who make cutlery and high-speed steel.

Senator Smoot. The average price of high-speed steel in Britain today is about $200 a ton?

Mr. Balfour. Four hundred and twenty pounds a ton is the price of 18 per cent high-speed steel today, f.o.b. England.

Senator Smoot. Thank you; that is all I care for.

World Engineering Council Proposed by Sir Robert Hadfield

A world engineering council of Anglo-Saxons is advocated by Sir Robert A. Hadfield, British scientist and engineer, who in a message to the engineers of America invokes the principles of Gladstone to promote unity among English speaking peoples.

Sir Robert's message, made public at the headquarters of the national engineering societies in New York City, pledges the support of British engineers to the new movement for international co-operation which is to be formally set in motion at a dinner in New York on Oct. 10, when the return of the mission of thirteen sent abroad to confer the John Fritz medal upon Sir Robert and Eugene Schneider, of Paris, will be celebrated.

Sir Robert, upon whom the John Fritz medal was bestowed because of his achievements in the development of manganese steel, asserts that all communities of British origin must forever stand together as they did in the World War for the defense of their common civilization.

Voicing, he says, the opinion of British engineers, Sir Robert asserts that the engineers of Great Britain and America are going to pull together. He advocates the federation of the engineering societies of the entire British Empire with an executive council similar to the American Engineering Council of the Federated American Engineering Societies. He proposes further the establishment of a "General Engineering Council for Anglo-Saxons throughout the world," adding:

"Such a council would indeed be fraught with great prospects for the future of the human race. Engineering does not lend itself to politics or diplomacy, but engineering of all kinds lends itself to improving human effort and helps on in a very high degree of the march of civilization."

Sir Robert cited the work of Robert Stephenson, Sir Benjamin Baker, and Thomas Telford as illustrating the contributions to the world's progress made by engineers in railroad, highway building and bridge construction. The harnessing of Niagara he called a noble feat of American engineering.

Tribute to Lloyd George

Sir Robert said that the British do not pretend that it was they who won the war.

The last war, Sir Robert said, was largely an engineering war. He paid a striking tribute to Premier Lloyd George for recognizing this. "There was no one, I think," said Sir Robert, "who better saw and understood the enormous importance of British engineering and what it was going to stand for in the war than our present Prime Minister, whose name will justly go down through the ages for what he did in those early days of the war in organizing and energizing the engineering capacity of this country. He quickly realized it was to be largely an engineering war."

Calvin W. Rice of the American Society of Mechanical Engineers is charman of a committee which is arranging for the international celebration at the Engineers Club in this city next month. Engineers representing the Allied nations will attend. Invitations have been extended to many men prominent in diplomacy and public life on both sides of the Atlantic.

Executives Comment on Business Revival

Opinion of well-informed executives in the metal trades is that business and industrial betterment will gain ground during the fall. This is already reflected in the strengthened undertone of the iron and steel industry.

The *Public Ledger*, of Philadelphia, Pa. prints the following interviews by prominent industrial managers:

Gustave Kahn, vice president in charge of sales of the Truscon Steel Co., states the greatest ebb in depression is now a matter of history and improvement is gaining. He declares that determination in salesmanship and an unfailing faith in ultimate results are factors which will have an important bearing on future improvement in business.

Shirley S. French, vice-president and general manager of the General Fireproofing Co., says that demand for inside fireproofing materials is steadily expanding. This follows the building season, when dwellings and business blocks are coming to the point of completion and the demand for lathing and other fireproofing materials is proportionately benefited.

L. J. Campbell, president of the Electric Alloy Steel Co., states the business in August showed improvement over July and the outlook is for continued betterment. The company's rolling mill at its Charleroi, Pa., plant has resumed after a prolonged suspension.

Fred B. Kanengeiser, general manager of the Bessemer Limestone and Cement Co., points out that the company's cement plant at Bessemer, Pa., exceeded in August the July record production, and that August shipments of 100,000 barrels established a new shipping record.

J. B. Kennedy, chairman of the board of directors of the Brier Hill Steel Co., looks for a gain of 10 per cent in business during the last quarter of 1921. He predicts that the industry will be operating around 60 per cent of normal, as a whole, by the middle of 1922.

Copper and Tin Deposits in Dutch East Indies

Since the discovery of rich copper deposits near Taninj in South Timor, Dutch East Indies, extensive exploring and developing work has been carried on, states the *London and China Express*. In view of the miscellaneous machinery and hand tools arriving at the mines, and the numbers of workmen engaged, it is believed that the deposits are gaining in importance. It is also stated that in the neighboring district tin has been discovered equal in richness to any yet found in the island of Banka. This should lead to important development and opportunities for supplying plant and machinery.

General Motors To Concentrate Export Manufacture

The "efficiency plan" recently adopted by the executive committee of the General Motors Corporation is getting well under way, according to a statement just made by the General Motors Export Co. to its employes. The "back-to-the-plant" movement, which was started some time ago, called for the transfer of all of the leading operating officials from New York direct to the various manufacturing centres.

In announcing its plans for the export company the General Motors Corporation states that all those associated with the export company are familiar with the fact that there is more or less difference between the necessities of car manufacture from the export standpoint as compared with the domestic standpoint, and for that reason it has been decided to concentrate the manufacture of all export models, with the exception of the Cadillac and General Motors trucks, at the Canadian plant of the corporation, General Motors, Limited, located at Oshawa, Ontario.

As a result of this plan, Paul Fitzpatrick, now vice-president in charge of operations, will be transferred from the export organization and will be made assistant to Alfred P. Sloan, Jr., operating vice-president, with duties pertaining to the transfer of export operations to Oshawa, and the study of all problems incident to such transfer. P. S. Steenstrup, vice-president in charge of sales, will exercise full authority in the export organization, subject to the president.

Testimonial Dinner to Robert L. Crane

On Sept. 8 at the Queen City Club in Cincinnati, a testimonial dinner was given to Robert L. Crane, who has just left Henry Prentiss & Co. to go in business for himself. Those present were Wallace Carrel, of Lodge & Shipley; B. B. Quillen, of the Cincinnati Planer Co.; Fred A. Geier and C. Wood Walter, of the Cincinnati Milling Machine Co.; A. J. Jones, of the Acme Machine Tool Co.; August H. Tuechter and George Gradolf, of the Cincinnati-Bickford Tool Co.; and Arthur Hoefinghoff, of the Cincinnati Grinder Co.

Fred Geier acted as toastmaster and presented Mr. Crane with a Rookwood lamp in token of the appreciation of those present and for his loyal services in the past.

Steel Fabricators To Meet in November

Plans for the annual meeting of the National Steel Fabricators' Association were outlined at a meeting of the executive council of the association at the Waldorf-Astoria on Sept. 20. It was decided to hold it in Pittsburgh the first part of November. The meeting will be held early, owing to the vital importance of topics, which will be brought up, among them being the freight rates, labor and material costs and plans to stimulate sales.

By unanimous vote of the council, H. B. MacMasters, of Canton, Ohio, was elected executive secretary of the association. Mr. MacMasters will assume his duties at the offices of the association, 50 Church St., immediately.

Chapman Co. To Manufacture Safety Nut

Plans for the establishment of a plant for the manufacture of a patent railroad nut, for use on tracks, are being made by the Chapman Self-Locking Nut Co., 721 Equitable Building, Baltimore, Md. Papers of incorporation of the company, with capital stock of $1,000,000 are being prepared and it is announced that they will be filed in the near future.

The nut is the invention of H. D. Chapman, of Baltimore, and tests through which it has been put on the Canton Railroad, Baltimore, are reported to have proved decidedly successful. The tests have covered several weeks and the nuts have remained exactly as placed at each joint, even the compromise joints.

The invention consists of a slit placed in the nut, which is then jammed. When it is screwed upon the bolt it remains exactly at placed.

Legal Help for U. S. Manufacturers Abroad

The Division of Commercial Laws of the Department of Commerce is compiling names of attorneys practicing in foreign countries who have been recommended by some trustworthy source as competent in their profession and in a position to care properly for American interests. These names will be given to American business houses and to their counsel when in need of the services of legal advisers in some particular foreign locality, but will not be supplied as lists for general information. It must be understood by those who apply for this information that these names are furnished on request, and without any responsibility to the Bureau, as a convenience to inquirers. It will be generally possible to indicate the sources by which the various attorneys have been recommended, but, of course, without any responsibility being assumed by authorities so quoted.

Navy Yard Pay to Stand

That the ruling of the Secretary of the Navy in reducing the wages of Navy Yard workers will stand was indicated by the fact that the matter was not even discussed at the Cabinet meeting on Sept. 20. It had been heralded widely by the Navy Yard employees that the matter was to be taken up at the Cabinet meeting on that date.

Representatives of the employees have been very active in bringing the matter to the attention of Cabinet members, Congressmen and the public. Pressure for a review of the wage decision is being brought in numerous quarters, particularly from the communities in which Navy Yards are situated.

Iron and Steel Boom in South

While pig iron production in Alabama during August amounted to only 72,699 tons, it is confidently expected by leading men of the industry that by Oct. 15 the state will be producing at a pace of 100,000 tons per month because of the steady improvement in iron and steel conditions throughout the country during the past few weeks.

Of the Alabama August production 17,291 tons were of merchant iron, or foundry product, while the balance, 55,408 tons, was basic iron. Production during July was only 66,573 tons, an improvement of more than 6,000 tons being shown for August because of steady improvement in conditions.

The Central Iron and Coal Co. resumed operations in mid September at its furnace at Holt, Ala., and at 40 of its 60 by-product ovens. The Kellerman Coal Mines, from which the company draws its main coal supply, will resume late in September. The furnace has been idle for almost a year, and the merchant iron the company had in the yards when it was shut down had been entirely exhausted.

The North Birmingham furnaces of the Sloss-Sheffield Co. are being cleaned up and overhauled preparatory to resuming in the near future. The Alabama Co. will resume at one of its furnaces at Gadsden, Ala., Oct. 15.

The Woodward Iron Co., now operating the only two furnaces in the state that are making foundry iron at this time, is preparing to resume at its third furnace in Woodward within the next month or so.

The furnaces of the Republic Iron and Steel Co., at Thomas, Ala., will also probably resume shortly.

The Gulf States Steel Co., and the Tennessee Coal, Iron and Railroad Co. also are expected to resume operations at some of the furnaces before the end of the year.

Nail making departments of the various wire drawing mills in the South are mostly operating at near capacity because of an increased demand for these lines the past few weeks.

Business Items

L. C. Biglow & Co., Inc., 232 West 55th St., New York City, has been appointed New York district agent for the Hartford Tap and Gauge Co., the Hanson-Whitney Machine Co., Inc., the Taylor & Fenn Co. and The Whitney Mfg. Co., all of Hartford, Conn. As New York agents for these concerns, L. C. Biglow & Co. will handle taps of all kinds and plug thread gages of greatest accuracy; also grinding machines, milling machines, vertical die shaping machines, centering machines and automatic thread milling machines. They will also handle a full line of roller, block and silent types of chain and Woodruff keys.

Production of steel ingots, Pittsburgh district, during August is reported to have been 30 per cent of capacity as against 21 per cent capacity production during July. Low mark was about July 15, when production fell below 20 per cent capacity.

U. S. Department of Commerce has appointed following heads of reorganized geographical divisions: Eastern Europe, E. Dana Durand; Western Europe, Allan G. Goldsmith; Latin-America, Thomas R. Taylor; Near East, James A. Robertson; Far East, Frank R. Eldridge. Commodity experts have been named by the department for each of thirteen important industries, and others are to be appointed.

According to data collected by National Federation of Iron and Steel Manufacturers, wages in British steel industry were at peak in September, 1920. On June, 1920, base as 100, wages were then 107, but employment had fallen to 14.2 per cent of June, 1920 figure, the coal strike being principal cause. By May, 1921, wages had fallen to 65 per cent of June, 1920 rate.

Cleveland investors have organized the Ohio Steel Castings Co. to take over the Cleveland plant of the Aetna Steel Castings Co., which went into bankruptcy about six months ago. The Aetna also has a plant in Lorain. The Ohio Steel Castings Co. has been incorporated under Ohio laws with a capital of 1,000 shares of no par common stock. Incorporators are, John W. Thompson, president and treasurer; Dr. C. S. Fenton, vice-president; Harry Greshen, general manager; John A. Elden, secretary and counsel and W. I. Thompson.

The Batterman-Truitt Co., of Chicago, Ill., manufacturer of ventilating, heating and drying apparatus, has changed the company name to Autovent Fan and Blower Co. There has been no change in the personnel of the organization or in the product manufactured.

The Richard French Iron Works, of Worcester, Mass., has purchased a tract of land in Millbury, Mass., where a new and modern factory will be erected.

The Air Compressor and Equipment Co. has been incorporated at Portland, Ore., to manufacture and assemble air compressors. Directors are G. S. Malcolm, G. Larrobee and W. E. Thomas.

The Vac-Line Engineering Co., has been incorporated at Dover, Del., to design and build motors. Capital stock is $100,000.

Notice has been received of the recent organization of the Franklin Tool Sales Co., at Indianapolis, Ind. The new company will market all kinds of cutting tools, gages, jigs and fixtures and other machine shop equipment. F. R. Beltz is general manager.

The Roxbury Steel Castings Co., has been incorporated at Boston, Mass., with a capital stock of $50,000. Incorporators are I. E. Sexton, A. Sexton and P. C. Rogers.

The Wyckoff Drawn Steel Co., of Ambridge, Pa., is constructing a new plant, to cost approximately $60,000. This addition is being added to take care of increased business.

The Gary Motor Truck Co. and the Chase Tractors Corporation, both of Toronto, Canada, will be merged into one concern as soon as the necessary papers are completed. The combined capital stock will be $2,000,000.

The Wopeco Machine Co., New Haven, Conn., has been incorporated to manufacture and sell can-opening and shear grinding machines. G. H. Woodruff, W. S. Perry and J. W. Comerford are directors.

The Stovall Manufacturing Co., has been incorporated at Port Angeles, Wis., capital stock $150,000, to manufacture machinery, tools, etc. U. M. Stovall, H. Machenheimer and F. L. Plummer are directors.

The G. F. Wright Steel and Wire Co., of Worcester, Mass., has purchased the old plant of the Standard Plunger Elevator Co., at Jamesville, Mass. A corporation will be formed and the plant put into operation at once.

Reorganization and incorporation of the recently combined forces of the Massillon Rolling Mill, Central Steel Co., and the National Pressed Steel Co., all of Massillon, Ohio, has been completed. The capital stock is announced as $10,000,000. The consolidated company will do business under the name of Central Steel Co. R. E. Bebb, president of the old Central company, will be in charge of the new organization.

Durant Motors, Inc., has announced in New York that the Ansted motor, manufactured by the Ansted Engineering Co. at Connersvile, Ind., has been adopted for use in the Durant six-cylinder car, which will be ready for the market Nov. 1. A statement by W. C. Durant is to the effect that Durant Motors will have the exclusive right to the use of the motor.

Personals

Hans Renold, of Manchester, England, maker of the famous chains that bear his name, has been visiting this country with his son to get a line on business conditions.

F. B. Mullin, former superintendent of the Willys-Overland plant at Elyria, Ohio, has been named to look after the work formerly handled by H. J. Edwards, who recently resigned as manager. Production is being increased rapidly.

Charles W. Young, of New York City, has been elected president of the Kelly-Springfield Motor Truck Co., Springfield, Ohio which recently severed its connection with the Hare Motors Corporation. Ed McDonnell, of New York, has been named general manager.

Robert S. Fowler, formerly assistant sales manager of the Northway Motor and Manufacturing company division of the General Motors corporation, and prior to that with the Anderson Electric Co., has been appointed district representative of the Wheel Trueing Tool Co., Detroit.

D. L. Morgan, New Haven, Conn., has been appointed executive chairman of the American Automobile Association to succeed the late A. G. Batchelder. Mr. Morgan has been holding the temporary appointment, pending action of the A. A. A. board which was taken Monday. Formerly, Mr. Morgan was active in the affairs of the Pennsylvania Motor Federation and the New Haven Automobile Club.

Barnard Eberlin and M. L. Filley have organized Filley & Eberlin, New York, and will act as district sales agents for the Sueprior Sheet Steel Co., of Canton, Ohio.

George P. Hansen, formerly in charge of blast furnaces for the Republic Iron and Steel Co., at Youngstown, Ohio, has been appointed superintendent of the blast furnaces for the American Rolling Mill Co., at Columbus, Ohio.

Robert L. Crane for twenty-three years western New York manager of Henry Prentiss & Co., Inc., has terminated his connections with that company but will continue in the same line of business under the name of Crane Machinery Co. with offices at 501 D. S. Morgan Bldg., Buffalo, N. Y. Mr. Crane is now establishing selling connections with a view of establishing branch offices in Rochester, Syracuse and Albany.

F. R. Beltz, formerly president and manager of the Indian Tool and Supply Co., and at one time tool buyer for the Nordyke & Marmon Co., has been appointed general manager of the Franklin Tool Sales Co., recently organized at Indianapolis, Ind.

D. D. Lewis, former manager of Tom L. Johnson's steel plant in Lorain, has been appointed general manager of the Carroll Foundry and Machine Tool Co. of Bucyrus, Ohio.

Frank E. Knickerbocker, formerly in charge of the Flint branch of the Samson Tractor Co., is in charge of a newly opened Oldsmobile branch factory in Lansing. From this branch also, J. W. Rapley will handle general distribution for Michigan.

Obituary

David N. Wilson, Jr., consulting engineer for many years with the Erie Railroad, died at his home in New York City on Sept. 15. Mr. Wilson was the inventor of the welding machine which was used to repair the broken cylinders on the interned German ships during the war.

Albert R. Crittenden, vice-president of the Wilcox-Crittenden Manufacturing Co., Middletown, Conn., died on Sept. 15. He was seventy-six years old.

J. J. Davin, manufacturer of oil-well tools, died at his home in Washington, Pa., on Sept. 11. He was seventy-three years old.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

An agency is desired by a mercantile company in France for the sale of refrigerating machinery. Quotations should be given c.i.f. French port. Correspondence should be in French. Reference. No. 69.

A planter in Angola, South-west Africa, desires to purchase machinery for preparing coffee and palm oil, and also one or two trucks. Quotations should be given c.i.f. Novo Redondo, or Benguela Velha. Correspondence should be in Portuguese. Reference No. 70.

A merchant in Chile desires to purchase electrical goods and motors, automobile accessories, phonograph records, electric lamps and supplies and parts, and electric-light bulbs of 220 and 110 volts. Quotations should be given c.i.f. Talcahuano. Correspondence should be in Spanish. Reference No. 58.

A mercantile firm in France desires to purchase automatic machinery for forging and manufacturing files. Quotations should be given c.i.f. Bordeaux or Havre. Cash to be paid. Correspondence should be in French. Reference No. 64.

A firm of automobile dealers in Spain desires to purchase and secure an agency for the sale of gasoline, air, and oil pumps for use in garages. Quotations should be given c.i.f. Spanish port, or f.o.b. New York. Payment to be made against documents at Spanish port, or in New York. Reference No. 53.

A retail dealer and owner of general stores in Chile desires to purchase machinery and hardware. Quotations should be given c.i.f. Talcahuano. Correspondence should be in Spanish. Reference No. 55.

A mercantile firm in Chile desires to secure an agency for the sale of hardware, iron and steel. Quotations should be given c.i.f. Talcahuano. Correspondence should be in Spanish. Reference No. 46.

An American exporting firm having connections with importers in North Borneo desires to secure an agency for the sale of steam engines, portable one-man saws, light motor trucks, trailers, nails, and motor-boat engines of 12 to 45 horsepower. Quotations should be given f.o.b. New York. Reference No. 47.

A commercial agent in the Netherlands desires to secure an agency for the sale of machinery, motors, rubber tires, etc. Quotations should be given c.i.f. Rotterdam or Amsterdam. Reference No. 48.

Trade Catalogs

Drawing and Tracing Papers and Cloths. New York Blue Print Paper Co., 102 Reade St., New York City. A book of samples of drawing papers, tracing papers and cloths, profile and cross-section.

Steel Lockers. Narragansett Machine Co., 52 Vanderbilt Ave., New York City. Circular describing and illustrating a line of steel lockers, wardrobes, shelving and cabinets. Specifications and price lists are furnished for each type.

Michigan Wiring and Fittings. Michigan Stamping Co., Detroit, Mich. Catalog No. 10 describing a line of metal stampings for cabinet boxes, switch boxes, outlet plates and boxes. Tables of measurements showing prices for the various types and sizes are included.

Illinois Tools. Illinois Tool Works, Chicago, Ill. Revised stock list of the company's products which include all types and kinds of reamers, cutters and hobs. Each model is fully described.

Chains and Sprockets. Cullmen Wheel Co., Chicago, Ill. Catalog No. 12 containing a wealth of illustrative and descriptive information on a great variety of sprockets and chains. Tables of chain speeds are included as well as complete specifications of the various types shown.

Automobile and Service Station Equipment. The Fairbanks Company, New York, N. Y. Catalog No. 10-B, illustrating and describing several lines of labor-saving devices and machines handled by this company. Each device is fully described and specifications and other information supplied.

Standard Toolbits. The New England Tool and Machine Co., Inc., Springfield, Mass. A small four-page circular explaining some of the features of the toolbits manufactured by this company, and marketed by the Carlisle Hardware Co., of Springfield, Mass.

GTD Small Tools. Greenfield Tap and Die Corporation, Greenfield, Mass. Catalog No. 46, four hundred 5 x 7-in. pages. A complete list of GTD products including taps and dies, screw plates, drills and reamers, milling cutters and pipe tools. Full descriptions, specifications and price lists are given for each type.

Ajax-Northrup High-Frequency Furnace. Ajax Electrothermic Corporation, Trenton, N. J. The first of a series of bulletins treating of this recent addition to heat-treating appliances.

Milling Cam Turning Lathe. Walcott Lathe Co., Jackson, Mich. A four-page circular illustrating and describing the latest model cam turning lathe produced by this company.

Pamphlets Received

Welding and Cutting: Davis-Bournonville Co., Jersey City, N. J.; written by Fred. E. Rogers. A book of instructions for the care and use of oxy-acetylene apparatus and equipment. The book is fully illustrated with halftones of apparatus in operation, and specifications and drawings are included.

Furnace Conditions for Proper Treatment of Die Blocks. By Dr. S. Trood, (reprinted from "Forging and Heat Treating"). Distributed by Tate-Jones & Co., Pittsburgh, Pa. A description of an automatically controlled oil-fired furnace designed and built by the Tate-Jones Company for annealing and hardening die blocks; it is said to be less expensive than the electric furnaces previously used.

Employees' Instruction Manual. Published by the Bausch & Lomb Optical Co., Rochester, N. Y. A very good sample of a booklet which many companies distribute among their employees. It contains general information on company rules, regulations, wage scales, working hours, etc.

Standard for Testing Welds: Bulletin No. 1, published by the American Welding Society, New York City. A digest of the report of the committee on standard tests for welds of the American Bureau of Welding.

The Variety of Furnace Design: Distributed by W. S. Rockwell Co., 50 Church St., New York City. The third of a series of bulletins dealing with the fundamentals that influence the quality and cost of heated products. It illustrates the relation of type and arrangement of heating equipment to cost of production, and the many factors that must be considered in adapting such equipment to individual manufacturing conditions.

Catalogs Wanted

A manufacturer in Chicago is desirous of receiving catalogs on machinery for the manufacture of bottle caps complete. Those interested may communicate with D. W. Brown, 3017 South La Salle St., Chicago, Ill.

Forthcoming Meetings

The twelfth annual convention of the American Manufacturers Export Association will be held in the Waldorf-Astoria Hotel, New York City, on October 5 and 6. A. W. Willmann is secretary.

The fifth annual convention of the Society of Industrial Engineers will be held at Springfield, Mass., Oct. 5, 6 and 7.

A joint meeting of the American Society of Mechanical Engineers, the Society of Automotive Engineers and the Army Ordnance Association will be held at Aberdeen, Md., Friday, October 7.

The annual meeting of the National Association of Purchasing Agents will meet in the Claypool Hotel, Indianapolis, Ind. on Oct. 10 to 13, inclusive. L. F. Boffey 19 Park Place, New York City, is secretary.

The American Gear Manufacturers Association will hold its semi-annual meeting at Rochester, N. Y., October 13, 14 and 15 F. D. Hamlin, 4401 Germantown Ave. Philadelphia, Pa. is secretary.

The National Machine Tool Builders' Association will hold its fall meeting at the Hotel Astor, New York City, October 18 19 and 20.

The annual convention of the Industrial Relations Association, of America, will be held in the Waldorf-Astoria Hotel, New York City, on Nov. 1, 2, 3 and 4.

The National Conference of the Industrial Cost Association will be held at Pittsburgh, Pa., on Nov. 2, 3 and 4.

The third annual convention and exhibition of the American Gas Association will be held in the Congress and Auditorium Hotels, Chicago, Ill., on Nov. 7 to 12.

NEW *and* ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

N. J., Newark—The C. & V. Mfg. Co., Inc., 54 Morris Ave.—No. 3 Thurston die milling machine (used if in good condition).

N. J., Newfield—Wilcox-Durand Glass Co. —machinery and tools for machine shop.

N. J., Wildwood—W. Butterfield—lathes for proposed machine shop.

N. Y., Binghampton—E. H. Thatcher & Co., manufacturers of wire goods—wood screw threader.

N. Y., Brooklyn—The Brooklyn Machinery Exch., 559 84th St.—No. 2 Sleeper & Hartley coilers.

N. Y., Rochester—Alent Machine Tool Co., 479 St. Paul St., A. Alent, owner—automatic screw machine.

La., New Orleans — The Gravier Auto Storage & Repair Co., 935 Gravier St., C. E. Thomas, Supt.—medium size lathe, vices and wrenches.

Ill., Chicago—The Auto Radiator Specialty Co., 4852 West Madison St.—8 ft. sheet metal brake.

Ill., Chicago—E. M. Heller Co., 144 West Kinzie St.—six lathes, Sundstrand preferred.

Ill., Granite City — The Cabaret Range Co., c/o A. Holloway—machinery for proposed range plant.

Ind., Muncie—Warner Corp., manufacturer of gears—Nacto drill, No. 14 with 22 spindles, and No. 1 Morse taper 3 spindles, 1½ in.

Mich., Detroit—D. & L. Co., 625 Beaubien St., miscellaneous machine shop equipment including used lathe.

O., Cincinnati—The Pettibone Mfg. Co., 632 Main St., D. Evans, Purch. Agt.—belt driven engine lathe with 6 ft. bed, 14 in. swing.

Wis., Milwaukee—The Fire Ball Spark Plug Co., c/o E. C. Kahn, 4129 Highland Blvd.—several 24 in. drill presses.

Wis., Milwaukee—Safety Wash Stick Co., 758 9th St., J. M. Smaler, Purch. Agt.—polishing machines.

Wis., Milwaukee—Scharf Garage Co., 516 Burleigh St., A. Scharf, Purch. Agt.—drill press for repair work.

Wis., Racine—School Bd., A. H. Schafer, Secy., full line manual training machinery and equipment.

Wis., Racine—C. Stuhr, 1207 10th St.—one 16 in. shaper.

Wis., Saukville—A. Horn—presses, lathe etc. for proposed garage on Main St.

Que., Chicoutimi—Fremblay & Simard, J. E. Oimard, Purch. Agt.—equipment for automobile repair shop.

Que., Montreal—E. Goyette, 803 Laurier Ave., E.—automobile repair shop equipment including medium size lathe.

Que., Montreal—Martel Co., Ltd., 2454 Park Ave.—lathes and vises for repair shop.

Que., Montreal—The Protestant School Comn., 36 Be'mont St.—manual training equipment for two schools.

Conn., Bristol—E. Ingraham Co., 392 North Main St.—double surfacer to be used in connection with a small portable saw mill.

Md., Steyer—The Miners Coal Co., I. G. Mercer, Mgr.—coal mining machinery and equipment.

N. Y., Buffalo—A. J. Ingle, 630 Jefferson St.—printing press with or without type, etc.

N. Y., Rochester — Re-Nu-It Upholstery Co., 413 South Ave., C. V. Quicke, owner —one Universal combination woodworking machine with band saw, cut-off saw, joiner, etc.

Pa., Philadelphia—The City, W. S. Twining, dir., 1211 Chestnut St., will receive bids until Oct. 4 for 2 electric traveling cranes.

Pa., Philadelphia—The Forrest Laundry, 1225 Columbia Ave.—general laundry machines.

Ala., Hartselle—Big Four Ranch Co., W. E. Lynn, Purch. Agt.—complete machinery and equipment for small ice manufacturing plant, also planing machine for hardwood and pine.

La., Willowbrook (Blanchard P. O.)—F. M. Brown, vulcanizing and repairing—equipment and machinery for vulcanizing and repairing automobile tires and tubes.

N. C., Murphy—Eland Mineral Co., Inc., P. O. Box 114—purchase or rent of complete crushing outfit, portable preferred, including crusher 9 x 15 in. or larger, elevator, screen, etc.

N. C., Winston-Salem—The Crawford Mill Supply Co., 438-440 Main St., T. B. Crawford, Purch. Agt.—9 in. moulder, endless belt sander and double and tenoner machine, (used, good condition).

Va., Portsmouth—The Planters Mfg. Co., Inc., manufacturers of fruit and vegetable crates, W. H. Hargroves, 110 Mt. Vernon Ave., Genl. Mgr.—one Derrick boomswinger, one bushel stave basket stapler, berry quart and till basket machine, twenty thousand ft. No. 1 quality 1 in. black pipe, one thousand ft. 6 in. and 400 ft. of 4 in. cast iron water pipe, fifteen fire hydrants, one hundred ft. gravity conveyor, a 250 hp. electric generator alternating or direct current, short log saw mill, twenty-five hamper forms to make 5 and 8 brace hampers standard size, one boiler, 150 to 200 hp., with 125 steam pressure; one veneer printing press, one knife grinder 76 in. or longer for grinding veneer knives, one veneer clipper 76 in. or wider, two rip saws, power fed gang rip saw, one American automatic cut-off saw, one band rip saw, one planer double surface heavy duty, 2-bu. hamper machines, two chain feed crate side staplers, seventy-five factory trucks, seventy-five roller bearing lumber dry kiln trucks, one Ireland Machine & Fdry. Co. hamper basket bottom saw, one veneer dryer, one water tank, 5,000 to 6,000 gal. capacity.

Va., Wytheville—R. P. Johnson, manufacturers of machinery, O. M. Johnson, Purch. Agt.—Complete coal mining or cutting machinery for 4 ft. soft coal vein.

One 4 to 6 in. molder (used).

One 24 to 30 in. circular resaw (used).

One 8 to 12 in. jointer (used).

One 80 h.p. Economic type locomotive boiler on sills with fittings, smoke stack and usual equipment (used).

One 20 to 25 ton 36 gage saddle tank locomotive (used).

One mile of 70-lb. relaying steel rail with splices, bolts and two switches.

Seven miles of 30-lb. relaying steel rail with splices, bolts and spikes.

One-hundred ton of 35-lb. relaying steel rail without splices and bolts.

Two thousand five-hundred ft. 2½ in. black pipe with good threads and couplings.

W. Va., Wellsburg—Eagle Mfg. Co., manufacturers of glassware — Ingersoll Rand compressor.

Ill., Chicago—G. J. Nickolas & Co., 1227 Van Buren St. (bronze work).—One Japanning oven.

Mich., Detroit—Detroit House of Correction, 1441 Alfred St., J. O. Stutsman, Supt. —One Smith sander (used).

O., Cincinnati—The Queen City Crushed Stone and Gravel Co., Federal Union Insurance Bldg., 9th and Vine Sts., H. P. Lange, Purch. Agt.—steam shovel, ¾ or 1 cu.yd. bucket, steam driven, full revolving, Erie, or Bucyrus preferred.

Wis., Kansasville — The Spring Valley Sanitary Milk Co.—machinery for pasteurizing plant.

Wis., Milwaukee — The Badger State Cabinet Co., 387 10th St., G. Baum, Purch. Agt.—One wood jointer.

Wis., Milwaukee—J. J. Jones Co., 1017 3rd St., H. Goeler, Purch. Agt.—Woodworking machinery to manufacture window screens.

Wis., Neenah—The Valley Paper Mills, East Wisconsin Ave.—paper machines, crane, etc.

Ark., Dean—Steinke Oil & Gas Co., D. Steinke, Pres.—deep rotary rig and well casing, (new or used).

Ont., Parry Sound—Conger Lumber Co. —edger, kicker and roller, board trimmer, re-saw mill.

Ont., Windsor—The Essex Provision Co., Ltd., 1120 McDougall St.—packing plant equipment for proposed plant.

Que., Montreal—J. J. Joubert, Ltd., St. Andre St.—complete equipment for artificial ice plant.

Que., Montreal—J. J. Joubert, Ltd., St. Andre St.—modern and complete equipment for creamery.

Metal Working Shops

NEW ENGLAND STATES

Conn., Danbury—J. McNiff, 85 Main St., has awarded the contract for the construction of a 1 story, 40 x 180 ft. garage and service station on Center St.

Conn., Middletown—C. J. Masin, 545 Main St., has awarded the contract for the construction of a 1 story, 100 x 120 ft. garage, etc., on Main St. Estimated cost, $40,000.

Conn., New Britain—The Lash Motor Co., Lincoln and West Main Sts., plans to build a 3 story garage, etc., on Main St. Estimated cost, $50,000. Architect not announced.

Mass., Winthrop—H. Standard, 43 Tremont St., Boston, plans to build a 1 story garage on Somerset Ave. Estimated cost $50,000. Private plans.

R. I., Providence—Williams & Anderson Co., 33 Broad St., has awarded the contract for the construction of a 1 story, 60 x 100 ft. and 65 x 160 ft. factory on North Main St., for the manufacture of jewelry. Estimated cost, $60,000.

The Weekly Price Guide

This Week's Market

Structural steel shapes are quoted at $1.60@$1.70, Pittsburgh, as compared with last week's price of $1.70@$1.75 per 100 lb. Quotations on soft steel bars and steel plates continue without change, plates being quoted at $1.60@$1.70 and bars at $1.65@$1.70 per 100 lb., in small tonnages. Pittsburgh quotes No. 28 galvanized steel sheets at $4 as against $3.75 per 100 lb. Mill shipments, New York, of structural shapes and plates are quoted at $1.98@$2.03; with bars at $1.88@$1.98 per 100 lb.

Advances ranging from 50c. to $1 per ton are reported in pig-iron prices at the various shipping centers.

Cleveland quotes increased discounts on wrought-steel pipe. A decrease of 50c. on both openhearth and light spring steel. A drop of 35c. per 100 lb. on cold-finished steel shafting, squares, flats, etc., is reported in Cleveland.

New York warehouses quote advances of ¼c. on tin and ⅛c. per lb. on lead in quantities under carload lots. Linseed oil has advanced 5c. per gal. (5-bbl. lots) in Cleveland.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	†$24.50
Northern Basic	†22 52
Southern Ohio No. 2	†23.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	†30.26
BIRMINGHAM	
No. 2 Foundry	†20.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	†22 76
Virginia No. 2	†28 74
Basic	†20 75
Grey Forge	†21.75
CHICAGO	
No. 2 Foundry local	†22.70
No. 2 Foundry, Southern, sil 2.25@2.75	†26.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	†22.96
Basic	†21.96
Bessemer	†21.96

*F. o. b. furnace. † Delivered.

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.25	3.28	3.10	3.38
No. 12	2.35	3.33	3.15	3.43
No. 14	2.45	3.38	3.20	3.48
No.16	2.55	3.48	3.30	3.58
Black				
Nos. 17 and 21.	2.60	3.80	3.55	3.95
Nos. 22 and 24.	2.65	3.85	3.60	4.00
Nos. 25 and 26.	2.70	3.90	3.65	4.05
No. 28	2.75	4.00	3.75	4.15
Galvanized				
Nos. 10 and 11.	3.00	4.00	3.75	4.15
Nos. 12 and 14.	3.10	4.10	3.85	4.25
Nos. 17 and 21.	3.40	4.40	4.15	4.55
Nos. 22 and 24.	3.55	4.55	4.30	4.70
No. 26	3.70	4.70	4.55	4.85
No. 28	4.00	5.00	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of Sept. 16, 1921:

Steel			Iron		
Inches	Black	Galv.	Inches	Black	Galv.
BUTT WELD					
1 to 3	68½	56	¾ to 1½	39½	24½
LAP WELD					
2	61½	49	2	34½	20½
2½ to 6	65½	53	2¼ to 4	37½	24½
7 to 8	62½	49	4½ to 6	37½	24½
9 to 12	61½	48	7 to 12	35½	22½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66½	55	1 to 1½	39½	25½
2 to 3	67½	56			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59½	.48	2	35½	22½
2½ to 4	63½	52	2½ to 4	38½	26½
4½ to 6	62½	51	4½ to 6	37½	25½
7 to 8	58½	45	7 to 8	30½	18½
9 to 12	52½	39	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded.	60%	46%	60½%	47½%	68½%	56%
2½ to 6 in. steel lap welded.	51%	37%	58½%	44½%	65½%	53%

Malleable fittings. Classes B and C, Banded, from New York stock sell at plus 6%. Cast iron, standard sizes, 15% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (heavy)	5.00	6.00	8.25
Spring steel (light)	6.00	6.00	10.50
Coppered Bessemer rods(base)	8.00	8.00	6.03
Hoop steel	3.88	3.29	3.48
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	4.85	2.74	5.23
Cold finished shafting or screw	4.03	3.50	4.00
Cold finished flats, squares	4.53	4 00	4.50
Structural shapes (base)	2.88	2.74	2.88
Soft steel bars (base)	2.78	2.64	2.78
Soft steel bar shapes (base)	2.78	2.64	2.78
Soft steel bands (base)	3.43	....	.....
Tank plates (base)	2.88	2.92½	2.88
Bar iron (mill 2.25)	2.78	3.52	2.78
Drill rod (from list)	55@60%	55%	50%

Electric welding wire........ New York $\frac{3}{32}$, 8½c. per lb. ⅛—7.15c.; $\frac{5}{32}$ to ¼—6.75c. Swedish iron sells at 18½c. per lb. in Chicago

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	13.00
Tin, 5-ton lots, New York	27.25
Lead (up to carlots), St. Louis, 4.47½; New York	4.87½
Zinc (up to carlots), St. Louis, 4.60; New York	5.00

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.00	25@26	21.00
Antimony (Chinese), ton spot	5.25	6.00	6.00
Copper sheets, base	19.75	20.50	19.50
Copper wire (carlots)	15.50	15.50	14.00
Copper bars (ton lots)	18.00	22.00	17.50
Copper tubing (100-lb. lots)	19.50	23.00	19.50
Brass sheets (100-lb. lots)	15.25	18.00	15.25
Brass tubing (100-lb. lots)	18.00	20.00	18.00
Brass rods (1,000-lb. lots)	13.25	15.50	13.25
Zinc sheets (casks), (8% dis. carlots)	11.00	11.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ½), (case lots)	19.50	23.50	17.50
Babbitt metal (best grade)	70.00	37.50	32.00
Babbitt metal (commercial)	30.00	13.50	[illegible].00

—Shop Materials and Supplies

MONEL METAL—Base price in cents per lb., f.o.b. Bayonne N.J.:

Shot	35.00	Hot rolled machine rods (base)	53.00
Blocks	35.00	Hot rolled rods (base)	42.00
Ingots	38.00	Cold rolled rods (base)	56.00
Sheet bars	40.00	Hot rolled sheets (base)	55.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	9.50	9.00	10.00
Copper, heavy, and wire	9.00	9.00	9.00
Copper, light, and bottoms	7.00	7.00	8.00
Lead, heavy	3.25	3.00	3.75
Lead, tea	2.00	2.00	2.75
Brass, heavy	5.00	5.00	7.50
Brass, light	4.00	3.00	4.50
No. 1 yellow brass turnings	4.50	4.00	5.00
Zinc	2.50	2.00	2.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

	New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:			
IC, 20x28, 112 sheets	21.50	......	....
IX, 20x28, 112 sheets	24.00	......	....
IXX, 20x28, 56 sheets	13.75	......	....
IXXX, 20x28, 56 sheets	15.50	......	....
IXXXX, 20x28, 56 sheets	17.00	......	....
"A" Charcoal Allaways Grade:			
IC, 20x28, 112 sheets	18.50	......	....
IX, 20x28, 112 sheets	21.50	......	....
IXX, 20x28, 56 sheets	12.25	......	....
IXXX, 20x28, 56 sheets	14.00	......	....
IXXXX, 20x28, 56 sheets	15.75	......	....

Coke Plates, Bright

Prime, 20x28 in.:		(56 sheets)	
80-lb, 112 sheets	13.60	......	....
90-lb., 112 sheets	13.80	......	....
100-lb., 112 sheets	14.00	6.50	....
IC, 112 sheets	14.30	6.65	.. ..
IX, 112 sheets	16.30	......	.. ..
IXX, 56 sheets	9.15	......	.. ..
IXXX, 56 sheets	10.15	......	....
IXXXX, 56 sheets	11.15	......	....

Terne Plate

Small lots, 8-lb. Coating:			
100-lb., 14x20	7.50	6.25	6.25
IC, 14x20	7.75	6.50	6.50

SHOP SUPPLIES

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in	—50%	–60%	—60–5%
$1\frac{1}{8}$ and $1\frac{1}{4}$x3 in. up to 12 in	—40%	60–10–10%	—55%
With cold punched sq. nuts	—30%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	—40%	....	. ..
Up to 1-in. diameter, with cold punched hex. nuts (plus std. extra of 10%)	—30%	....	.....
Button head bolts, with hex. nuts	—20%	$3.90 base	.....
Hex. head and hex. nut bolts	—20%	....	.....
Lag screws, coach screws	—50–10%	....	.....
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	50–10–10%	50–5%
Bolt ends, with hot pressed nuts	—50%	....	.....
Tap bolts, hex. heads	—20%	....	....
Rivets, $\frac{7}{16}$ in. dia. and smaller. *New list*	–50-10%	60-10-10%	–60-10%
Rivets, tinned	–50-10%	60-10-10%	—45%
Semi-finished nuts, all sizes	—70%	75%	50%
Case-hardened nuts	—60%	....	.....
Washers, cast iron, $\frac{1}{2}$ in., per 100 lb.	$5.00	$5.50 off	$4.50
Washers, cast iron, $\frac{5}{8}$ in. and larger, per 100 lb	4.25	3.75 off	4.50
Washers, round plate, off list per 100 lb.	3.00	....	.....
Nuts, hot pressed, sq .... Off list	2.00	3.00	3.25
Nuts, hot pressed, hex .... Off list	2.00	3.00	3.25
Nuts, cold punched, sq .... Off list	1.50	3.00	3.00
Nuts, cold punched, hex .... Off list	1.50	3.00	3.00
Rivets:			
Button heads $\frac{3}{4}$-in., $\frac{7}{8}$-in., 1x2 in. to 5 in., per 100 lb	$4.40	3.50	3.68
Cone heads, ditto	4.50	3.60	3.78
$1\frac{1}{8}$ to $1\frac{7}{8}$-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	....
$\frac{7}{8}$ in. diameter .... *EXTRA*	0.15	....	....
$\frac{1}{2}$ in. diameter .... *EXTRA*	0.50	....	....
1 in. long, and shorter ..... *EXTRA*	0.50	....	....
Longer than 5 in .... *EXTRA*	0.25	....	....
Less than 200 lb .... *EXTRA*	0.50	....	....
Countersunk heads .... *EXTRA*	0.35	....	....
Copper rivets	50–10%	40–10%	50%
Copper burs	25–10%	15%	20%

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb	.055@.09	.09	.10
Wiping cloths per M., 13¼x13¼	....	55.00	55.00
Wiping cloths per M., 13¼x20½	....	65.00	65.00
Sal soda, 100 lbs	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb	2.55	3.25	2.75
Linseed oil, per gal., 5 bbl. lots	.80	.88	.87
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 100 lb		.80	.80
Coke, prompt furnace, Connellsville		per ton	$3.25@3.40
Coke, prompt foundry, Connellsville		per ton	4.25@4.50

MIDDLE ATLANTIC STATES

N. J., Atlantic City—The Union Transfer Co., 1004 Spring Garden St., Phila., Pa., has had plans prepared for the construction of a 1 story, 60 x 150 ft. and 105 x 105 ft. garage here. C. J. Mitchell, 129 South 15th St., Phila., Pa., Archt.

N. J., Mt. Holly—W. A. Jones is having plans prepared for the construction of a 1 and 2 story, 100 x 200 ft. garage and service station on Washington and King Sts. Estimated cost, $70,000. Folsom & Stanton, 10 South 18th St., Phila., Pa., Archts.

N. J., Newfield — The Wilcox-Durand Glass Co. will build a 1 story, 31 x 101 ft. machine shop. Estimated cost, $25,000. W. P. Cameron Eng. Co., Witherspoon Bldg., Phila., Pa., Engrs.

N. J., Wildwood—W. Butterfield is having plans prepared for the construction of a 1 story, 40 x 80 ft. machine shop on Roberts Ave. Estimated cost, $5,000. L. Boyer, Wildwood, Archt.

Pa., Philadelphia—The city has awarded the contract for the construction of a 1 story, 160 x 220 ft. repair shop on 29th and Cambria Sts. Estimated cost, $115,000. Noted April 14.

MIDDLE WEST STATES

Ill., Chicago—The North Amer. Car Co., 328 South La Salle St., is having plans prepared for the construction of a 1 story, 80 x 125 ft. car erection plant on 135th and California Aves. Estimated cost, $40,000. Private plans.

Ill., Granite City — The Cabaret Range Co. is having plans prepared for the construction of a range plant consisting of two 70 x 300 ft., one 24 x 70 ft. and one 70 x 100 ft. buildings. Estimated cost, $300,000. C. Pauley & Son, 19th and C Sts., Archts.

Ill., Waukegan—J. P. Heath & Co., manufacturers of architectural bronze, has awarded the contract for the construction of a 2 story, 100 x 108 ft. machine shop. Estimated cost, $100,000.

Mich., Iron Mountain — The Michigan Land & Lumber Co., subsidiary of Ford Motor Co., Detroit, has awarded the contract for the construction of a 1 story, 120 x 300 ft. plant for the manufacture of auto bodies.

O., Cleveland—Carris-Franklin Sales Co., 3622 Prospect Ave., is having plans prepared for the construction of a 1 story, 100 x 140 ft. garage. Estimated cost, $60,000. Carter, Richards & Griffith Co., Illuminating Bldg., Archts.

O., Cleveland—The Chicago Roller Co., 554 Harrison St., Chicago, Ill., has awarded the contract for the construction of a 2 story, 50 x 92 ft. factory at 1432 Hamilton Ave., here. Estimated cost, $40,000.

O., Cleveland—The Cooley Co., c/o E. A. Markham, 4 Euclid Ave. and 105th Market St., manufacturers of electric appliances, has awarded the contract for the construction of a 1 and 2 story, 39 x 102 ft. factory at 4516 Superior Ave. Estimated cost, $40,000.

O., Cleveland—J. L. Free Land Co., 1004 Prospect Ave., has awarded the contract for the construction of a 1 story, 40 x 78 ft. garage at 4917 Prospect Ave. Estimated cost, $40,000.

O., Cleveland—The Greenline Garage & Supply Co., 4214 West 25th St., has awarded he conract for the construction of a 1 story, 43 x 89 ft. garage on Memphis Ave. Estimated cost, $40,000.

O, Cleveland—The Overland-Larick Co., c/o J. J. Larick, 18526 St. Clair Ave., has awarded the contract for the construction of a 1 story, 65 x 150 ft. garage on East 152d St. and St. Clair Ave. Estimated cost, $50,000.

O., Cleveland—The Rail Welding & Bonding Co., 2400 Woodland Ave., has awarded the contract for the construction of a 1 story, 90 x 180 ft. factory. Estimated cost, $60,000.

O., Cleveland—M. H. and I. Stone, Kirby Bldg., are receiving bids for the construction of a 1 story, 40 x 56 ft. garage at 2150 East 35th St. Estimated cost, $40,000. Private plans.

O., Cleveland—The Vlchek Tool Co., 3000 East 87th St., has awarded the contract for the construction of a 1 story, 40 x 50 ft. factory on East 87th St. Estimated cost, $50,000.

O., Lakewood—J. G. Stern, c/o J. C. Froelick, 214 Williamson Bldg., Cleveland, plans to build a 1 story, 70 x 120 ft. garage, on Madison and Clarence Aves. Estimated cost, $50,000. Private plans.

Wis., Oshkosh—Auler & Jensen, Archts., F. R. A. Bldg., are receiving bids for the construction of a 4 story, 150 x 375 ft. tractor factory on New York St., for the Oshkosh Tractor Co., c/o A. D. Paine, 22 East New York St. Estimated cost, $170,000.

Wis., Oshkosh—R. Lutz, 1270 Knapp St., will build a 2 story, 40 x 80 ft. garage. Estimated cost, $40,000. Auler & Jensen, F. R. A. Bldg., Archts.

Wis., Oshkosh—The Oshkosh Tractor Co., 22 New York Ave., will soon award the contract for the construction of a 1 and 2 story, 150 x 500 ft. and 25 x 100 ft. factory. Estimated cost, $170,000. Auler & Jensen, F. R. A. Bldg., Archts.

Wis., Saukville—A. Horn has had plans prepared for the construction of a 1 and 2 story, 40 x 139 ft. garage and machine shop on Main St. Estimated cost, $45,000. W. F. Hilgen, Cedarburg, Archt.

Wis., Milwaukee—S. D. Austin, 307 Grand Ave., has awarded the contract for the construction of a 1 story, 90 x 120 ft. garage on Oakland Ave. Estimated cost, $45,000.

Wis., Milwaukee—The Dort Motor Co., 242 4th St., is having plans prepared for the construction of a 1 story, 120 x 120 ft. garage on Mason St. Estimated cost, $42,000. A. C. Eschweiler, 141 Wisconsin St., Archt.

Wis., Milwaukee—Pauly & Marx, 2530 North Ave., have awarded the contract for the construction of a 1 and 2 story, 116 x 130 ft. garage on North Ave. Estimated cost, $50,000. Noted Sept. 15.

Wis., Milwaukee—The F. Rosenberg Elevator Co., 174 Reed St., has awarded the contract for the construction of a 1 and 2 story, 120 x 223 ft. factory on Richard and Franklin Sts. Estimated cost, between $60,000 and $75,000. Noted Sept. 1.

Wis., Milwaukee—Smith Eng. Wks., 1154 32nd St., has awarded the contract for the construction of a 1 story, 75 x 100 ft. assembling plant on 32nd St. Estimated cost, $40,000.

Wis., Milwaukee—The Van Buren Garage Co., 174 Ogden Ave., has awarded the contract for the construction of a 2 story, 57 x 127 ft. garage on Van Buren St. Estimated cost, $70,000. Noted Sept. 15.

WEST OF THE MISSISSIPPI

Colo., Denver—The Hardesty Mfg. Co., 1833 Market St., manufacturers of sheet metal products, has had plans prepared for the construction of a factory, consisting of 2 buildings, 100 x 160 ft. and 120 x 160 ft., on 30th and Blake Sts. Estimated cost, between $75,000 and $100,000. C. S. Lambie, Tramway Bldg., Engr.

Kan., Kansas City—The Pennsylvania Tank Line Co., c/o R. W. Lowrey, Mgr., has awarded the contract for the construction of a 1 story, 80 x 300 ft. and 80 x 200 ft. repair plant on 40th and Augusta Sts. Estimated cost, $150,000.

Minn., St. Paul—The Owen Motor Sales Co., 713 University Ave., has awarded the contract for the construction of 1 and 2 story additions to garage. Estimated cost, $40,000. Noted June 9.

Tex., Dallas—J. T. and J. H. Jones, 2401 Travis St., Houston, have awarded the contract for the construction of a 2 story, 100 x 100 ft. garage. Estimated cost, $65,000.

CANADA

Que., Montreal—P. Labelle, 721 Dorchester St., has awarded the contract for the construction of a 3 story, 114 x 175 ft. garage on Argyle and Overdale Sts. Estimated cost, $150,000.

General Manufacturing

NEW ENGLAND STATES

Conn., Hartford—Buck & Sheldon, Inc., Archts. and Engrs., 60 Prospect St., will open bids about Oct. 3 for the construction of a 1 story, 100 x 110 ft. printing and engraving plant on Franklin Ave., for R. S. Peck & Co., 26 High St.

Mass., Boston—The Womens Educational & Industrial Union, 264 Boylston St., has awarded the contract for the construction of a 4 story manufacturing plant and laboratory on Bway. Ext. and Fayette St. Estimated cost, $100,000. Gay & Proctor, 50 Bromfield St., Archt.

R. I., Providence—W. R. Walker & Son, Archts., 49 Weybosset St., are receiving bids for the construction of a 2 story, 50 x 76 ft. starch factory on South Water and Coin Sts., for C. S. Tanner & Co., 250 South Water St. Estimated cost $40,000. Noted Sept. 22.

MIDDLE ATLANTIC STATES

N. Y., Buffalo—J. N. Matthews Co., Washington and Exchange Sts., has had plans prepared for the construction of a 3 story, 100 x 150 ft. publishing plant on Oak St. Estimated cost to exceed $200,000. R. J. Reidpath & Son, Mutual Life Bldg., Engrs.

Pa., McKees Rock—W. L. Singer Ice Co. has had plans prepared for the construction of a 1 story, 50 x 60 ft. ice plant. Estimated cost, $60,000. A. C. Bishop & Co., 427 Guardian Bldg., Cleveland, O., Archts. and Engrs.

Pa., Philadelphia—The Forrest Laundry, 1225 Columbia Ave., has awarded the contract for the construction of a 1 and 2 story, 48 x 53 ft. and 33 x 53 ft. laundry at 1704-12 North Tawn St. Estimated cost, $30,000.

Pa., Williamsburg—The Coleman Lumber Co. plans to rebuild its saw mill which was recently destroyed by fire. Estimated cost, $25,000. J. Coleman, Pres.

SOUTHERN STATES

Fla., Sarasota—The Sarasota Bee Co. plans to build a factory for the manufacture of bee hives, beekeepers' supplies, window sashes, door frames, blinds, etc.

MIDDLE WEST STATES

Ill., Moline—The Moline Daily Despatch, 1509 3d Ave. A., plans to build a 2 story publishing plant. Estimated cost, $115,000. Architect not selected.

Wis., Antigo — Mattefs Bros., c/o G. Mattefs, Pres., plans to build a 2 story, 60 x 180 ft. factory on Main St., for the manufacture of wood products. Estimated cost, $150,000. Architect not selected, probably private plans.

Wis., Appleton Jct.—The Traas Candy Co., 715 College Ave., Appleton, is having plans prepared for the construction of a 2 story, 45 x 100 ft. factory, here. Estimated cost, $50,000. W. Sindahl, Neenah, Archt.

Wis., Fon-du-Lac—The Galloway West Co., 24 West Division St., is having preliminary plans prepared for the construction of a 3 or 4 story, 64 x 160 ft. cold storage warehouse on West Division St. Estimated cost, $75,000. M. Tullgren & Sons, 425 East Water St., Milwaukee, Archts.

O., Cleveland—The City Ice & Fuel Co. is receiving bids for the construction of a 1 story, 52 x 75 ft. ice plant on Addison Rd. Estimated cost, $75,000. C. C. Coneby, Cadillac Bldg., Archt. and Engr.

O., Lakewood—The City Ice & Fuel Co., East 22nd St., Cleveland, has awarded the contract for the construction of a 1 story ice plant on Fisher and Warren Rds., here. Estimated cost, $100,000.

O., Youngstown—The Distilled Water Ice Co., 523 West Federal St., has had plans prepared for the construction of a 1 story, 70 x 160 ft. ice plant on Federal St. Estimated cost, $100,000. A. C. Bishop & Co., 427 Guardian Bldg., Cleveland, Archts. and Engrs.

Wis., Milwaukee—The Sonnenberg Sausage Co., 92 Michigan St., has awarded the contract for the construction of a sausage factory on 32nd St. Estimated cost, $25,000.

Wis., Neenah—The Valley Paper Mills, East Wisconsin Ave., will receive bids about Oct. 15 for the construction of a 1 and 2 story, 80 x 550 ft., paper mill, etc Estimated cost, $800,000. Noted July 26

Wis., Sheboygan—The Ke-No Mfg. Co. Pennsylvania Ave. and East Water St., i having plans prepared for the constructio of a 2 and 3 story, 60 x 100 ft. factor on Pennsylvania Ave., for the manufactur of furniture novelties. Estimated cost $65,000. W. C. Weeks, 720 Ontario Ave. Archt.

Wis., Waupun—C. Snyder and K. Wessel 1285 Como Blvd., St. Paul, Minn., plan t build a 2 or 4 story, 60 x 210 ft. hem factory, here Estimated cost, $100,00 Architect not selected.

WEST OF THE MISSISSIPPI

Mo., Sedalia—Swift & Co., c/o G. H Trader, local Mgr., has awarded the con tract for the construction of a 2 stor 100 x 200 ft. packing plant. Estimate cost, $175,000.

Okla., Oklahoma City—P. H. Anthon Archt., Waldheim Bldg., Kansas City, Mo will receive bids until Oct. 4 for the co struction of a bakery for the Smith Bakin Co., 437 West Park St. Estimated cos $150,000.

CANADA

Ont., Windsor—The Essex Provision C Ltd., 1120 McDougall St., has awarded t contract for the construction of a 4 stor 280 x 300 ft. packing and cold storage pla on McDougall St. Estimated cost, $500,00 Noted Aug. 18.

Que., Montreal—J. J. Joubert, Ltd., S Andre St., plans to build a 2 story, 50 x ft. addition to ice plant. Estimated cos $40,000. Private plans

American Machinist

Volume 55 NEW YORK, OCTOBER 6, 1921 Number 14

The Motor Service Station

The Modern Motor Service Station Is a Machine Shop—Each Branch of the Work Is in the Hands of Specialists—The Toolcrib Is a Necessity

SPECIAL CORRESPONDENCE

NOT so many years ago the average wayside "garage" that flourished in every community center and at nearly every cross-roads was a place of anathema to the passing motorist.

Compelled by force of untoward circumstance to avail himself of its doubtful facilities, the owner of a recalcitrant car could never be certain that his machine would be made to run at all, or, if he was so fortunate as to see it emerge from the "shop" under its own power, he would still be in doubt as to whether or not he would be able to reach home or the next repair station alive and sound of limb.

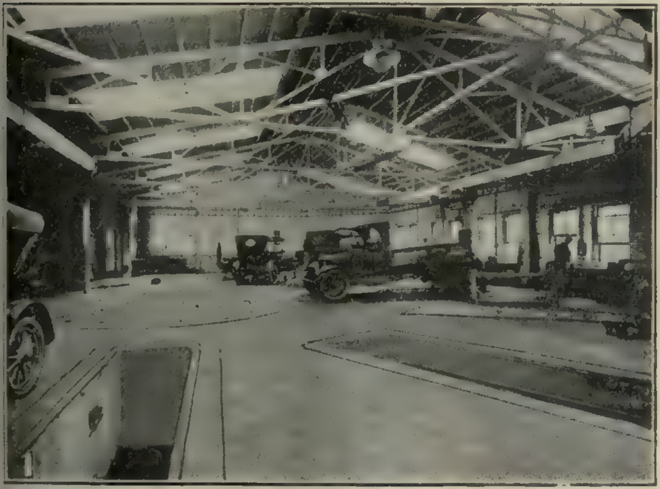


FIG. 1. THE REPAIRING FLOOR, SHOWING THE ARRANGEMENTS OF THE PITS.

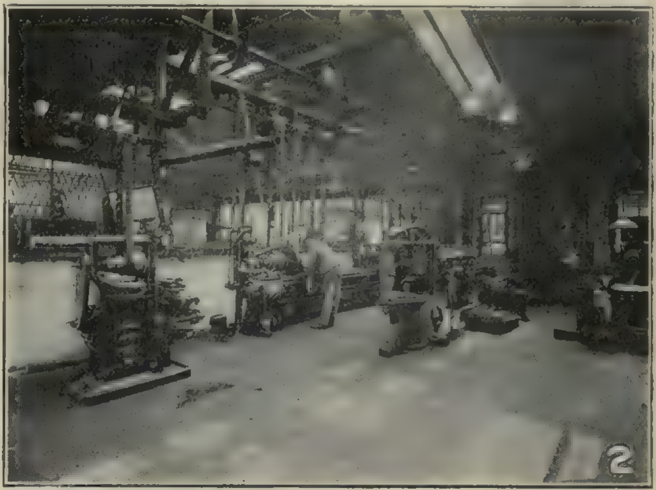


FIG. 2. THE MACHINE SHOP

The logical successor of the bicycle repair shop, its equipment was likely to consist principally of hammers, cold-chisels, wrenches and tools for mending tires, and there was little chance that its personnel would include a trained and skillful mechanic. If there were any machine tools at all the list would begin, and probably end, with an old engine lathe resurrected from the junk heap or dug out of some forgotten corner of a more fortunate machine shop.

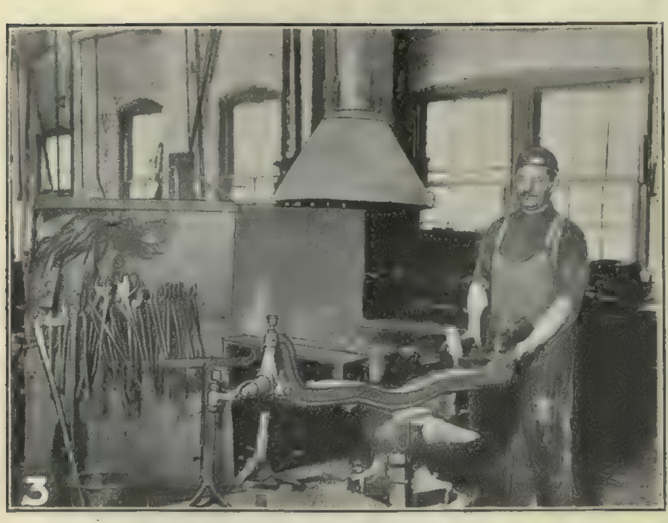
It used to be a common saying that "anybody could fix a bicycle," and until bitter experience taught them differently the same idea prevailed with respect to the automobile. However, as the evolution of the machine proceeded, the heavy weights to be sustained, the speeds at which they moved about, and, above all, the ever-increasing complexity of the mechanisms embodied in the modern buzz-wagon taught owner, driver and repairman that to successfully cope with the problems necessitated a thorough understanding of the fundamental principles of mechanics as well as experience in applying them. Thus was the work of repairing and readjusting automobiles lifted from the hand and brain of the "tinkerer" and transferred to those of the trained mechanic and engineer.

The service station, as it is now called, is no longer the habitat of broken-down tools, ignorant and indifferent workmen, and sundry piles of junk, but has become the contemporary of the modern machine shop with its well-ordered array of the latest mechine tools, its system of handling and checking work, and its corps of trained and efficient specialists.

In the Howard Service Station at New Haven, Conn., where the data and photographs used in the compilation of this article were obtained, when a car comes in for repairs, no matter how insignificant, it is taken in charge by the receiving clerk who enters upon a printed form ticket all the data necessary to the identification of the car, the details of the repair to be made and any other information that may be appropriate to the job.

This ticket is in duplicate, each part with corresponding serial number, and the date and time of entry are stamped thereon by the time clock. The owner or driver who brought in the car and made known the requirements is required to append his signature to this ticket, which is retained in the office and becomes the original order as well as the office record. Thus, when the car is ready for delivery, there is no opportunity for dispute as to what was really ordered.

The second half of the ticket stays with the machine in its progress through the shop and on it are stamped and recorded the time of the various workmen on the job and the nature and amount of material that is used in making the repair. When a job is finished



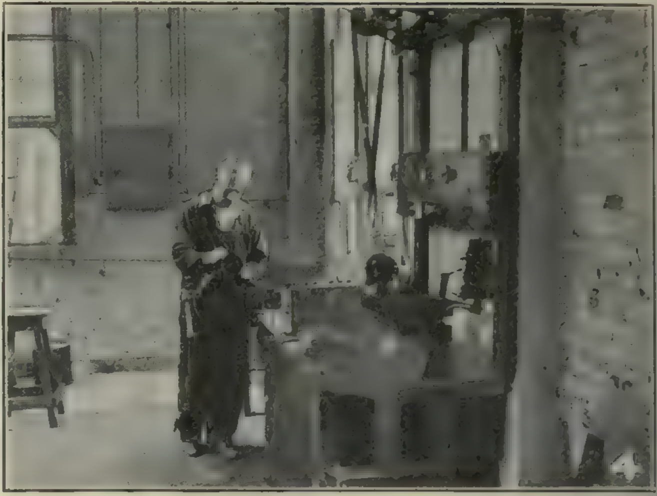


FIG. 3. THE BLACKSMITH SHOP. FIG. 4. ELECTRICAL REPAIRING AND TESTING DEPARTMENT

this part of the ticket is filed and thus becomes a permanent record which may be turned up at any time if for any reason it is desirable to know what has previously been done upon a car in the way of repairs.

Minor repairs or adjustments may be made upon the floor of the receiving room but if the nature of the work is such as to warrant it the machine is sent to the department shown in Fig. 1, where is provided every facility for dismantling and overhauling the heaviest car.

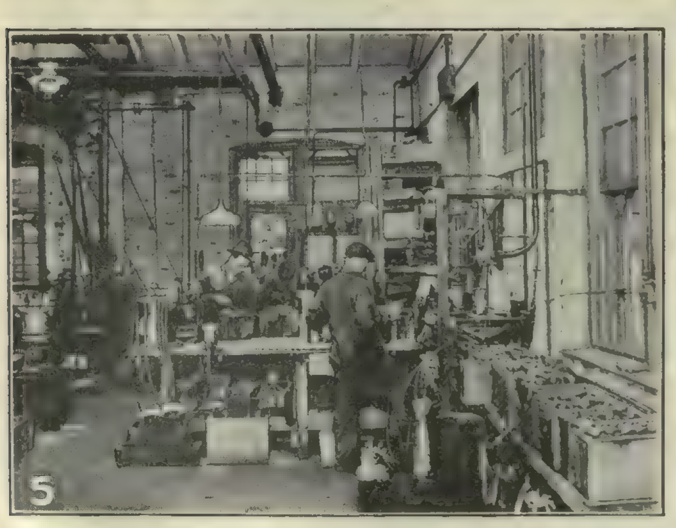
Concrete-lined pits radiate in all directions from the turntable at the center of the floor, each pit being of sufficient depth to enable a workman to stand upright under a car and to get at all the under parts to advantage. Provision is made for draining the pits and each pit has an air duct leading to an independent ventilating stack that extends through the roof so that there is no possibility of retaining carbon dioxide or of the accumulation of poisonous or explosive vapors.

Each pit is provided with a portable bench and vise with an equipment of tools ordinarily needed on any job that would come within the range of bench work, and, unless there are parts to be machined, the workman does not have to climb out until his job is finished. Pockets or recesses in the side walls of the pit provide convenient receptacles for tools so that the workman does not have to bend over to retrieve them from the floor.

Electric sockets in the side walls furnish ready means of attachment for extension lamp cords or for electric drills, etc., as may be necessary. Each pit is surrounded at the floor level of the room with a raised curb having rounded outer edges, so that only by reason of the most inexcusable carelessness may a car be run into the pit. An overhead monorail runs entirely around the room and from trolleys on this rail are suspended chain blocks by means of which any car maybe lifted. This overhead suspension leaves the workman's field unobstructed by jacks or blocking and eliminates the danger of dropping a car prematurely by knocking over the supports.

Adjacent to the floor of the repair department is the machine shop shown in Fig. 2. Here are installed engine lathes, drill presses, milling machines, etc., of modern design. Each is operated by a man who is thoroughly familiar with it as well as with the requirements of automobile repair. Gas furnaces with electric pyrometers for controlling the degree of heat are provided for hardening and tempering such parts as require it, as well as grinding machines for finishing the parts after hardening.

The machine room is separated from the repair department by a heavy wire screen partition so that the work of the machinists may not be interfered with by casual visitors. It is well lighted during the day by ample skylights, and auxiliary lighting is provided by



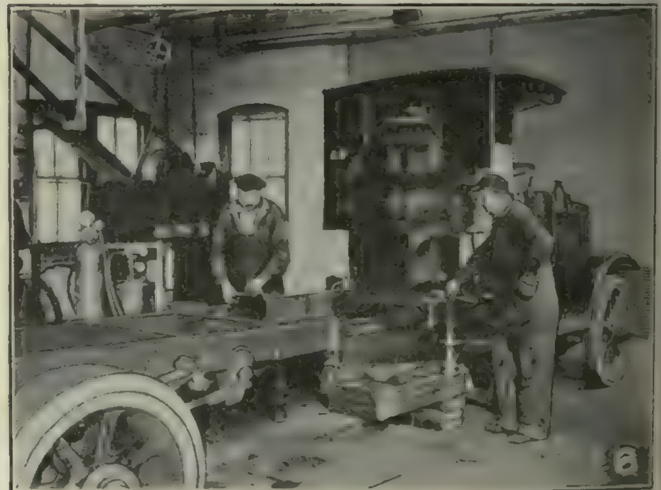
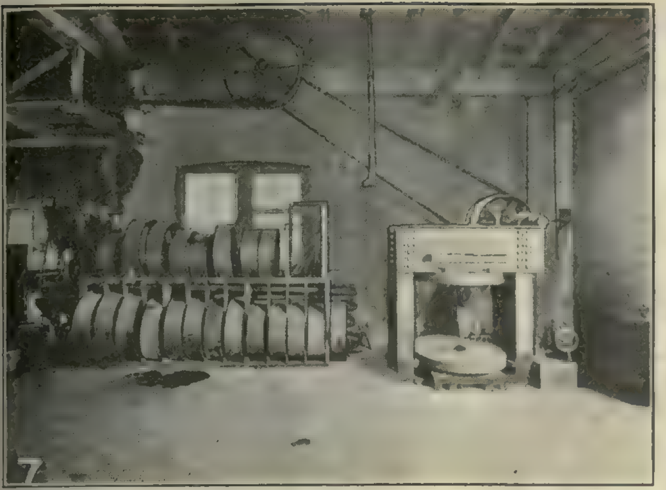


FIG. 5. REPAIRING AND RECHARGING STORAGE BATTERIES. FIG. 6. USING A WELDING AND CUTTING TORCH ON A TRUCK CHASSIS



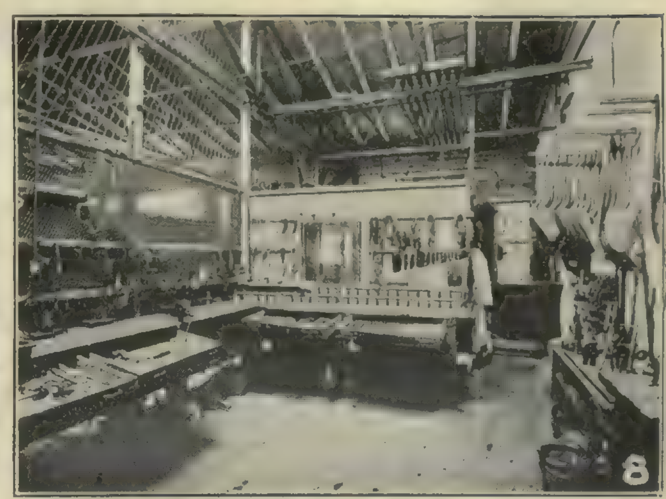


FIG. 7. THE PRESS AND BANDS. FIG. 8. THE TOOLCRIB

shaded electric lights suspended from the roof trusses as well as by individual lamps at the machines.

Each class of work is handled by men who are specialists in their respective lines. The machine work is done by machinists, the blacksmithing by a blacksmith, and all the electrical apparatus with which an up-to-date automobile is equipped is taken care of by an electrician who looks after that part of the work and nothing else.

A blacksmith shop that would do credit to any machine repair shop is shown in Fig. 3. Herein is all the equipment that is needed for welding and straightening parts that have been damaged by collision, and for making small forgings.

The electrician's corner is shown in Fig. 4. The electrical apparatus in a car consists mainly of small delicate instruments and such repairs as are needed may usually be effected without the aid of machine tools. The electrician's bench is, however, located in one corner of the machine room and all the tools of the latter are available if required.

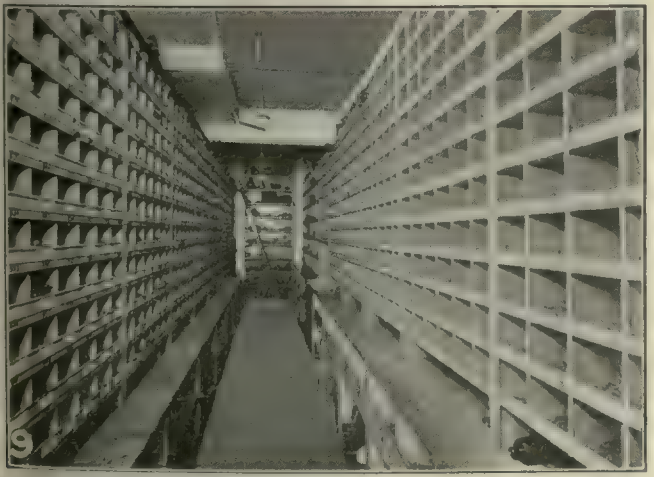
A very essential part of the electric plant in an automobile is the storage battery which furnishes current for the lights when the engine is not running and supplements the generator at other times, and adjacent to the electrician's bench is the department devoted to the repair and maintenance of such batteries. Old batteries are taken down, all parts that are still serviceable are salvaged, and the batteries assembled and recharged, ready for service. Fig. 5 shows this portion of the shop.

Autogeneous welding plays an important part in the repair of damaged automobiles and several portable outfits are maintained in the shop to be taken to the points where they are needed. In Fig. 6 the torch is shown at work upon a truck chassis.

As a large portion of the repair work that falls to the lot of the city service station consists of the large trucks that are in constant service about the streets, it is necessary to make provision for handling the tires of solid rubber with which these heavy vehicles are usually equipped. Fig. 7 shows the massive tire press and the rack of iron bands for confining the tires while pressing them into place on the rims of the wheels.

A feature without which few successful machine shops are conducted is the toolcrib shown in Fig. 8. In this picture may be seen the racks and drawers of tools and supplies that are needed to carry on the work in hand. Each workman is provided with a set of checks which he hands in in exchange for tools needed and thus enables the man in charge of the crib to know just where any tool is that is not in its appointed place.

A stock parts storage is not usually required in a machine shop that is devoted solely to repairs, but in this station all small parts for several makes of cars as well as many parts which are standard to all cars are carried in stock, so that in many cases a substitution can be made that will save much time and expense



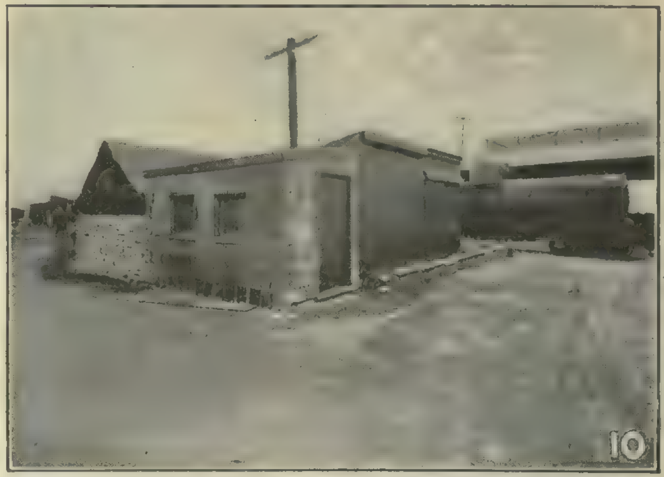


FIG. 9. A BAY IN THE STOCK STORAGE DEPARTMENT. FIG. 10. OIL AND GAS SUPPLY IN THE YARD.

that would otherwise be involved in replacing a broken part with a new one made from raw material. The number of parts in stock runs to many thousands and the view shown by Fig. 9 is but one of the many bays needed to hold them.

Oil and gas are as necessary to the automobile as wheels and where there are at all times so many cars under repairs as well as the increasing number that, in passing, are compelled to stop to replenish their tanks, it is necessary to have a large supply from which to draw. This oil and gas storage capacity is provided at the Howard station by tanks in isolated buildings at the rear of the yard, many feet distant from other parts of the shop and adjacent to the railroad sidings so that supplies may be unloaded directly from cars to tanks to save the expense of rehandling. The remoteness of the storage buildings, shown in Fig. 10, from any part of the plant where fire and light are necessities, helps to reduce the fire hazard.

FIG. 11. A WELL APPOINTED SALESROOM

A service station does not necessarily sell cars but the salesroom is always a profitable adjunct to the business of repairing and maintaining them, especially in the smaller cities, and therefore a well-appointed salesroom is usually considered to be a part of a similarly appointed service station. In Fig. 11 may be seen a portion of the floor space which the Howard company devotes to that part of the business.

British Motor Ship

A motor ship has been ordered by Hunting & Sons, of Newcastle, from the Tyne Iron Shipbuilding Co. The vessel will be 365 ft. long, with a beam of 57 ft. and a draft of 25 ft. The Werkspoor engines will be built under license by the Northeastern Marine Engineering Co., of Wallsend. Two sets, each of 1,200 indicated horsepower, will be installed, the bore and stroke of the six cylinders to be 560 millimeters and 1,000 millimeters, respectively. The engines will run at 120 r.p.m., giving the vessel a speed of approximately 10½ knots loaded. The Northeastern Marine Co. has under construction Diesel engines totaling 5,400 indicated horsepower. On June 30, 1921, Hunting & Sons owned four vessels, aggregating 16,400 gross tons, three of which were tankers. It is of interest to note that, while no steamer has been ordered in months, a shipowner has faith in the economies of a motor ship, even in a period of very low rates.

Specifications for Steel Forgings

Among the eleven standards of the American Society for Testing Materials now before the American Engineering Standards Committee for consideration and approval are: Specifications for carbon-steel and alloy-steel forgings; specifications for quenched and tempered carbon-steel axles, shafts and other forgings for locomotives and cars; specifications for carbon-steel forgings for locomotives; specifications for quenched and tempered alloy-steel axles, shafts and other forgings for locomotives and cars; specifications for carbon-steel car and tender axles.

Specifications for carbon-steel and alloy-steel forgings are general specifications covering the various classes of carbon-steel and alloy-steel forgings, on which the other specifications have been based with the addition of special requirements to suit the conditions of use. The preparation of these four specifications for forgings dates back to the earliest history of the American Society for Testing Materials. The predecessor of these specifications was the "Standard Specifications for Steel Forgings," which were first proposed in 1900 and adopted in 1901, previous to the organization of the present A. S. T. M. by what was then the American Section of the International Association for Testing Materials. Since 1901 there have been several revisions of the work, notably in 1914 with the co-operation of other technical societies and associations, including the former Master Mechanics Association and the Master Car Builders Association, now the Mechanical Section of the American Railway Association. The work on alloy-steel forgings other than nickel steel was developed in 1915 as an extension of the previous work.

SPECIFICATIONS REVISED IN 1917

The specifications for carbon-steel car and tender axles, while not included in the forgings series, were developed in connection with this work. In 1914 the committee of the American Society for Testing Materials in charge of these specifications entered into a co-operative investigation with the Master Carbuilders Association, which led to a revision of the specifications in 1917 that harmonized the requirements in the two organizations.

In submitting these specifications for approval by the American Engineering Standards Committee, the American Society for Testing Materials has presented data listing the companies, etc., that use them in their entirety or as general specifications upon which have been based other specifications suited to the particular needs. These specifications have been translated by the Department of Commerce into French and Spanish in connection with the development of foreign trade.

The specifications are submitted to the standards committee in accordance with the special procedure of the committee, under which important standards in existence prior to 1920 may be approved without going through the regular process followed in new work.

The A. E. S. C. would be very glad to learn from those interested of the extent to which they make use of these specifications and to receive any other information regarding the specifications in meeting the needs of the industry.

The revised specifications are contained in the 192 volume of "A. S. T. M. Standards." Copies may also be obtained from the American Engineering Standards Committee, 29 West 39th St., New York City.

The Economics of Production

VII. PRODUCTION AND WAGES

BY PROF. D. A. MCCABE, PH. D.

WE HAVE already discussed the nature of *the employer's* interest in production. We have seen that it is to his advantage that the *total volume* of production in his line be kept down so that the price may be high. On the other hand we have seen that it is also to his advantage that *his own* production be kept up to as great a quantity as he can sell at a profitable price. In as much as he is unable to control the *total* production of his kind of goods and so is unable to keep the price up merely by limiting the quantity produced, he has to make his profit by keeping his costs down below the price that competition forces him to accept. And one way of keeping costs down is to get the largest production possible from each workman during the time that he is at work.

Reduced costs of production are to the interest of the employer. They are also to the interest of the public. They are to the interest of the workman also, if they are not gotten through unfair methods of speeding-up the workman and not accompanied by reductions in wage-rates. What we need are systems of ascertaining outputs that both employer and employee recognize as fair, and systems of payment that give a man wages in proportion to his output. Only when production and wages stand in that relation to each other are the interests of the employer, the public and the workman at one in the matter of production.

What of the workman's interest in production? Is it to his interest that *his* production be as large as possible during the time he is at work? It is up to a certain point, but there may be circumstances under which it apparently is not. Let us look into this more closely.

The employee's primary interest in production is from the standpoint of employment and wages. He likes to see a large volume of production undertaken in lines that call for his class of labor. That makes for a good demand for his kind of labor and that means plenty of employment and good rates of wages. He has the same interest in a good demand for his labor that the employer has in a good demand for his kind of goods. From his own selfish standpoint he is interested in increasing *his own* production only in so far as it tends to *increase* rather than decrease the demand for *his* labor and to *increase* rather than decrease the wages he gets for *his* production.

When I say "from his own selfish standpoint" I mean to pass no unfavorable judgment upon the motives of the worker. He is working primarily for monetary returns for himself just as the employer is. I wish merely to emphasize that it is to *his* interest to increase *his* employment and wages just as it is to the employer's interest to increase *his* profits by reducing *his* costs. Each is in it for his own gain.

The problem is to reconcile these two interests, to harness both to increased production in the plant. To a certain extent the two interests do move together, so long as the worker wishes to work *in that plant*. Increased production per man does reduce costs and lower costs do enable the employer to sell more goods and to give more employment. It is not merely a matter of keeping costs down to those of competitors. Whatever the competitors' costs are, the lower the price at which the goods are offered, the greater the quantity the public will take. Keeping down costs is one way of increasing the volume of production that will be undertaken. On that point the workman's interest and the employer's interest in production are together.

But we must not forget that the workman is interested in *wages* as well as in employment. He is interested in employment as a means to wages. If the increased production is made the occasion of a reduction in wage rates, the workman's interest in it is killed. Not only that, his active opposition to it is aroused. Any wage policy that uses increased production on the part of the worker as a lever by which wage rates are forced down, sets the interest of the employer and the interest of the workman in opposition on the matter of individual production.

It is unfortunately true that the output to be expected from the workman is often a bone of contention. Instead of agreeing on the output after a fair trial in the first place and taking that output for granted in fixing the wage for the average man, so that individual workmen will get proportionately more or less wages for outputs greater or less than the one agreed upon as normal, the output for a given wage is too often established for the moment by jockeying and is known to be subject to change with individual earnings. This puts the workman's interest in wage-rates in opposition to increased individual production. It is not difficult to see that under a system of this kind the wage-earners are not going to pull with the employer for increased individual production.

Reduced costs of production are to the interest of the employer. They are also to the interest of the public. They are to the interest of the workman also if they are not gotten through unfair methods of speeding-up the workman and not accompanied by reductions in wage-rates. What we need are systems of ascertaining outputs that both employer and employee recognize as fair and systems of payment that give a man wages in proportion to his output. Only when production and wages stand in that relation to each other are the interests of the employer, the public and the workman at one in the matter of production.

It should be clear from these articles that production is carried on by co-operation and not by force. What is to be produced and how much is a matter of agreement and accommodation between the producer and the buying public. If the producer asks a high price, he can sell only a small quantity; if the buyers offer a price below the costs of production, they cannot for long get the goods. Similarly there must be agreement between the workmen and the employer as to the terms on which they are to join in production. If the workers ask too much in wages for the production they give, the employer cannot give them their terms and full employment at the same time. If the employer tries to exact too great production for the wages he offers, he will not get the production.

The employer must accommodate himself to the demands of the public and to what others are willing to do to meet those demands. He must also enlist the co-operation of his employees in production. The employees must make it possible for the employer to produce for costs that will enable him to accept the price he can get for a fair volume of production. The employer, the employee and the demanders must all agree if the game of production is to be kept going. Their interests differ when it comes to the terms to be accepted. But their interests are one to the extent that unless *some* agreement is reached the modern game of producing for sale and buying the products of others with the earning from our own production cannot be played.

A New Practice in International Trade

By Joseph Kucera

One of the main causes of sluggishness in the international machine-tool market is the unstable money exchange. The customer in Europe is never certain whether he is going to lose or make money on a deal, for by the time he receives the goods ordered from the United States, his country's money may either have gained or lost several points in relation to the dollar, thereby making his purchase a gamble.

On the other hand, the American manufacturer is not very keen to do business in countries where the money may not be worth the paper it is printed on by the time the bill falls due.

During the past two years much has been said, and many attempts have been made toward the stabilization of international exchange, but so far the evil has not been overcome, for all theories and programs were found lacking when applied in practice. In the meantime a new practice in internatonal trade has slowly been developing, or rather, a medieval method has been revived—barter, as a means of international commerce. It flourished particularly during the business boom of 1919 and it was recognized and practiced by the governments of Central Europe in order to overcome the obstacles placed in the way of business by the pyrotechnics of unsettled finance. But the very governments who have done the most business by means of the barter method were glad to see it disappear in the general slump of 1920. They complained that its heavy overhead, due to maintenance of a vast clerical organization connected with it, was an item which Central Europe could ill afford.

Strangely enough, though the business of Europe is just beginning to revive from last year's depression, the problem of barter is again forcing itself to the fore and getting really serious consideration in many quarters in the United States as a medium for international business transactions. This is being deplored as a bad sign for it requires adaptation to methods new to the American manufacturer who feels as if he is making a hundred-year-long step back into history.

"But where does the machine-tool manufacturer come in on barter," asked one of them recently, "is he to load a ship with machine tools and send the skipper out with the goods to look for markets abroad? And supposing he is offered a shipload of sugar for his cargo of machinery, how is he to know where to place the sugar to make a profitable deal?"

This, more than anything else, expresses the curious situation the American manufacturer would face, in case barter in Europe, despite its unpopularity, should work itself into international exchange. You may tell the machine-tool people not to bother about barter and follow their pre-war custom of placing their product in the hands of one or two reliable representatives who will meet their bills in American dollars. Yet, if barter should become an active business method in Europe, the European representatives of the American machine-tool interests will be obliged to carry on selling transactions in this method, which means a higher overhead, and consequently a smaller market than there is at present. The European consumer would have to pay the extra overhead, and while he balked at prices of American machine tools before the war, he may now try to get along without our labor-saving machinery.

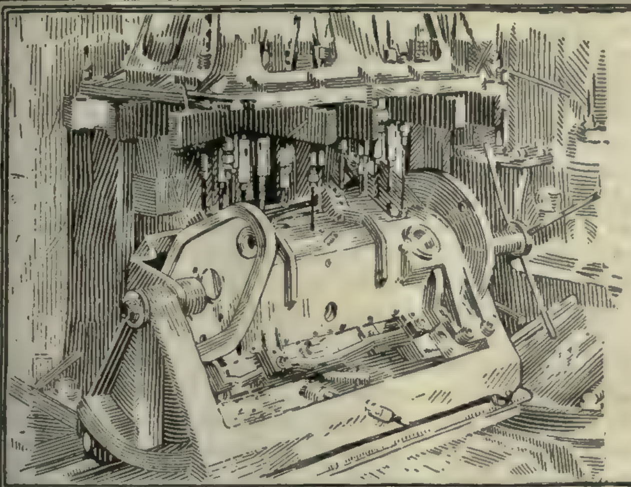
But here we come from theory to practice again. One manufacturer, discounting the above, pointed out the profitable Baldwin locomotive deal whereby the company delivered engines to Roumania in exchange for oil which was sold in England at a good profit, making money coming and going. "This may be all right for a big international organization like the locomotive works," objected another, "what I want to know is, how we, the machine-tool manufacturers, are going to solve the problem of doing business with Europe by barter, if it should prove inevitable in order to do business at all?"

It seems to the writer that we will have to face the the problem. Europe, besides other reasons for not doing business with us, is confronted with the disadvantage of low exchange on the dollar. Modern business, built up on money, sees such monetary disadvantages almost subconsciously and feels them very keenly, whereas, if carried on by barter, it is less conscious of giving more in goods than it would in money.

Such is the situation in Europe. Money in the present transition period, is not regarded internationally as a very desirable commodity. A Czechoslovak is not very keen to possess paper liras, whereas Italians are not anxious to be loaded up with paper marks. The invariable question in international transactions in Europe these days is: what can we get for our corn, or whatever other product we may have in excess?

This psychology in European business is the aftermath of devaluation of money through the war. To this psychology it seems, American business has to adapt itself to some degree.

Since we are considering barter in the interest of the machine-tool trade of the United States and find it such a cumbersome method we may feel inclined, if it should prove to be the only means left for the revival of trade in Europe, to look to other quarters for markets for our goods rather than enter into a proposition so complex that it would require the reorganization of our entire foreign sales department. The fact is, however, that no matter how unwieldy it may seem, we will probably be forced at least to consider barter as a method of trade revival for the simple reason that our domestic markets are overstocked.



Tool Engineering

By

Albert A. Dowd and **Frank W. Curtis**

President and *Chief Engineer*

Albert A. Dowd Engineering Co., New York City

Turret and Engine Lathe Tooling—Methods of Holding Work—Locating and Supporting Work—Designing for Economy—Factor of Safety

A NUMBER of important matters affecting the design of tools and fixtures for the turret lathe have been mentioned in the previous chapter. The subject is a broad one and the different types of tools considered in connection with their operation on various kinds of work make it necessary to deal with specific cases as they may be illustrated. In every machining operation we must consider first the work and the method of holding it; second, the tools used; third, the machine movements and operation. We shall take up first the method of holding work of various kinds because it is logically the first step in design.

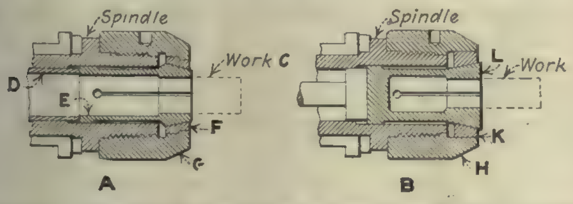


FIG. 216. PUSH-OUT AND DRAW-IN TYPES OF COLLETS

Chucks and Collets

When a piece of work is of regular form it is usually held in chuck jaws or by means of collets. In either case the work is gripped by means of jaws which are contracted or expanded by means of the chuck or collet mechanism. On automatic and hand screw machines production work from the bar is commonly held in collet jaws. If the work is a forging or casting or if it is "cut-off stock" it may be held by means of chuck jaws. For the purpose of discussion we need not consider in detail the many varieties of chucks and collets which are in use. It is, however, necessary to understand something of the working of both devices in order that the design of special jaws may be made clear.

Strictly speaking there are two forms of collets, one of which operates with a "push-out" movement and the other with a "draw-in" motion. These two forms are illustrated in Fig. 216. The example at *A* shows the push-out type while that at *B* is the draw-in type. The work shown at *C* may be a bar of stock which extends entirely through the spindle or it may be a short piece, according to the conditions of manufacture. In operation, the sleeve *D* is moved forward by means of a lever at the head end of the machine, thus forcing the collet *E* forward into the taper bushing *F*, which is mounted in a nose-piece *G* on the end of the spindle. As the collet is moved forward it contracts and grips the work firmly.

In the example *B* the operation is just the reverse. It will be seen that the nose-piece *H* is furnished with a bushing *K* into which the collet *L* is drawn back, thus contracting it on the work. In each of the cases shown the collet is of one piece which has been split in several places to permit it to expand and contract as controlled by the taper at the end. Both of the collets shown in the preceding illustration have a certain amount of end movement which may possibly affect the holding of work which has been previously finished. In other

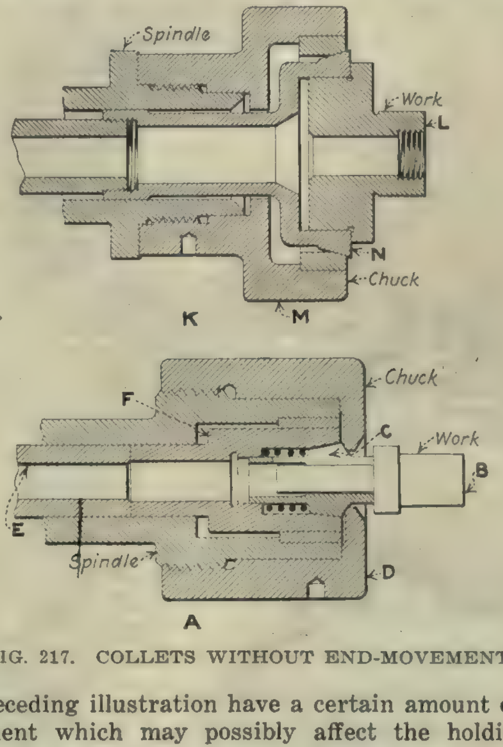


FIG. 217. COLLETS WITHOUT END-MOVEMENT

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words slight variations in the diameter which is being held will cause a variation in the position of the work with respect to the end of the spindle.

A type of collet which does not have any end movement is shown in Fig. 217 at *A*. In this type the work *B* is held by means of three loose jaws *C* which are provided with retainers in the chuck body so that they will not drop out A nose-piece *D* fits the end of the spindle and keeps all of the parts in place. The collet is closed by means of a sleeve *E* which pushes forward a tapered member *F*, thus closing the jaws. The construction of the chuck is such that there is no appreciable movement forward or backward when the device is operated. It is therefore possible to locate work accurately against the end of the collet so that it will always be held in a certain relation to the end of the spindle.

In the example *K* the work *L* is a casting of such size that it can not normally be held in a collet. However, it is possible to grip work of this kind in a special oversized type such as that shown. This device is operated in the same manner as the draw-in type shown in Fig. 216. The nose-piece or chuck *M* is larger than the standard form and the collet *N* is split in several places so that it will contract and expand as controlled by the tapered portion.

There are other forms of collets adapted to particular kinds of work but as these are more or less specialized they will not be illustrated here but will be taken up in detail later. It is possible to form out a set of collet jaws for a given piece of work and it may be profitable to do so when work is made in large quantities. As a general thing, however, pieces which are slightly irregular are more likely to be adapted to a two-jaw chuck in which the jaws are formed to fit the contour of the work.

STEP CHUCKS

In Fig. 218 is shown another application of the collet principle to work which is so large that it cannot be held in the regular form of collet. Devices of this kind are called "step chucks" because they are frequently "stepped out" to various diameters so that several sizes of work can be held in the same chuck. Although used largely for second operation work where pieces have been partly finished, they are also useful in holding rough work, when castings or forgings do not vary greatly in diameter. Two types are shown in the illustration, one of which *A* has a soft spring collet *B* which is "stepped out" to hold the work *C*. It has also been bored out at *D* and *E* for two other sizes of collars. The collet *B* is split in several places so that it will expand and contract readily when it is controlled by the movement of the sliding closer *F*. This is operated by a lever at the end of the machine in the same manner as a collet of the ordinary type. The rod *G* extends through the spindle and holds the portion *B* in a fixed position endwise. Therefore chucks of this nature are very desirable for second operation work as it is possible to always locate the piece so that it is in a certain relation to the end of the spindle.

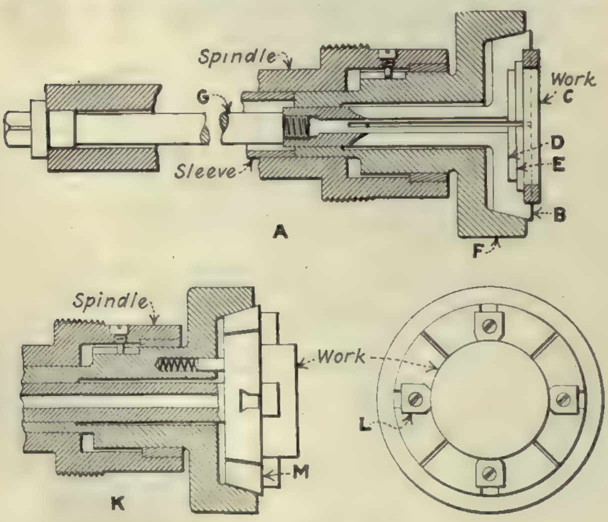


FIG. 218. STEP-CHUCKS

Another type of step chuck is shown at *K*. This type is somewhat more flexible than the one which has just been described because it is provided with loose adjustable jaws as indicated at *L*. These jaws are soft, so that they can be bored out to fit a given piece of work, and as they are easily replaced with others, the up-keep of the device is excellent. The general construction and operation are similar to the one shown at *A* but for some classes of work it is not as good as the former type. For example, if a piece of very thin work were to be held with considerable pressure it would undoubtedly be distorted due to not being properly supported. It is possible, however, to make up special jaws for a condition of this kind so that the jaws will act as large segments of a circle and thus envelope the work so that it will not tend to distort, even if it were quite thin. If necessary, special jaws of this kind can be so made that they will form segments of nearly 90 deg., although when this is done it is advisable to provide them with extra setscrews to hold them securely on the face of the portion *M*. The tool designer is not usually called upon to design special jaws for step chucks, but the methods used are interesting and should be thoroughly understood so that special forms may be applied when necessary.

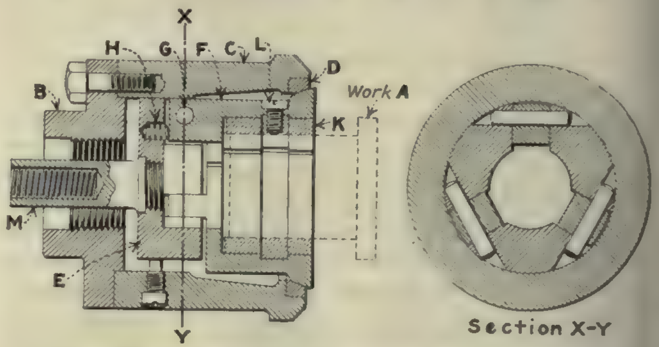


FIG. 219. SPECIAL COLLET WITH ROCKING JAWS

In Fig. 219 is shown a special form of collet designed for the work shown at *A*. This device is quite different from any of those previously shown, yet its functions are somewhat similar. A special nose-piece *B*, is screwed to the end of the spindle as indicated, and a chucking ring *C* is suitably mounted on the nose-piece. A hardened ring *D* is inserted as shown, this ring being bored out to a taper of 15 deg. The inside of the chuck is fitted with a holder *E* in which are three jaws *F* pivoted on pins at *G* and held open normally by means of stiff coil springs *H*. Special inserted jaws *K* are held in place in the movable members by means of screws shown at *L*. These jaws are bored out to suit the work that is to be held. The entire mechanism is operated by means of a rod which passes through the spindle and connects with the sleeve *M*, the latter being screwed into holder *E*. The chuck is operated by means of the collet mechanism usually provided on screw machines.

There is a slight objection to this type of holding device on account of the rocking action of the jaws. In holding finished work this would not be likely to cause trouble, but on rough work where considerable variation may be found, the holding might not be uniform unless a slight float were to be permitted at the pivot point *G*, so that the jaws could align themselves with the work and take care of normal inequalities or variations.

INSIDE HOLDING BY MEANS OF COLLET MECHANISM

Work is occasionally found which requires holding by the inside and in many cases a two- or three-jaw chuck is used for the purpose. There are cases when another method may seem advisable if the work is small so that it cannot be easily adapted to a chuck. An example of this kind is shown in Fig. 220, in which the work *A* is a ring having an angular inside surface. In order to provide a rapid method of handling, the device shown was applied with good results. The spindle of the machine is fitted with a sleeve *B* which is slotted in three places to receive the special rocking jaws *C*, which are three in number. A steel collar *D* is fastened to the outside of the sleeve *E* in such a way that it covers the slots and also provides for the thrust of the coil springs at *E*. The jaws *C* are pivoted on pins at *F* and they are tapered on the inside to conform to the angularity of the plug *G*. The operation is controlled by the collet mechanism in the usual manner, the tapered plug *G* forcing the jaws *C* outward so that they grip the inside of the work firmly.

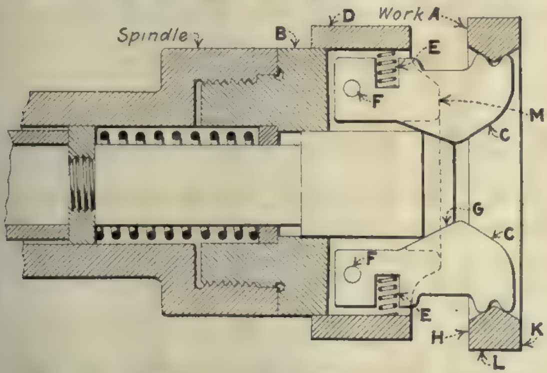
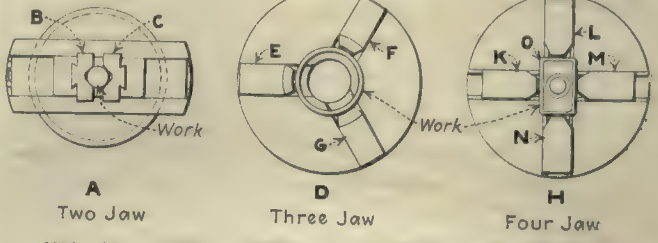


FIG. 220. SPECIAL INSIDE HOLDING DEVICE

An advantage of this type of holding device is that it permits facing the work on both sides *H* and *K* in the same setting, and also permits the turning of the outside diameter *L*. It would be possible to extend the sleeve *B* somewhat further than the point *M* if the nature of the work would permit it and this might be an advantage in that it would give the jaws a better support. It depends upon the nature of the work and its general construction and the designer must be governed accordingly.

TWO-, THREE- AND FOUR-JAW CHUCKS

Chucks having three jaws with a universal movement about the center are largely used in production. The fact that all three jaws operate simultaneously and with a uniform movement is an important item when work is to be centrally located. The two-jaw chuck is also a favorite in holding work of small size for production. This type of chuck is also commonly made so that the movement of the jaws is uniform about the center. A chuck having four jaws operating independently is not often used for production work, although there are cases when it may be found necessary. Fig. 221 shows a diagram of the three varieties of chucks mentioned. The two-jaw chuck shown at *A* is usually so made that special jaws can be inserted in a dovetail slide as shown at *B* and *C*. These are often called "slip-jaws." This variety of chuck is operated by means of a right- and left-hand screw which sometimes passes through the center of the jaws and at other times is at one side. For any work which is long it is necessary to select a chuck having an operating screw at one side of the center, so that the work can extend back and not interfere with the screw. The majority of manufacturers who deal in these chucks can supply them either way. The three-jaw chuck shown at *D* is a prominent factor in production work, as the three jaws *E*, *F* and *G* are uniformly arranged about the center so that when in operation they exercise a centering action on the work. Different methods of controlling these jaws are used, but a common method employs the use of a scroll ring which engages with grooves cut on the under side of the jaws. As the scroll is revolved the jaws are drawn in or out according to the direction of the movement.



A Two Jaw

D Three Jaw

H Four Jaw

FIG. 221. TWO-, THREE- AND FOUR-JAW CHUCKS

The four-jaw chuck shown at *H* has its jaws arranged at 90 deg. from each other as at *K*, *L*, *M* and *N*. Each of these jaws is operated independently by means of a screw. In using a four-jaw chuck for production work it is common practice to allow two of the jaws to remain fixed so that they act somewhat as a "V." In the case shown we can consider that the jaws *L* and *M* are stationary and the work *O* is located in position and clamped by the action of the two jaws *K* and *N*. When a chuck of this kind is used for other than production work, it is necessary to adjust the jaws separately and "indicate" the work until it is found to be in a central position.

There are various methods of operating both two- and three-jaw chucks, although those mentioned are commonly used. The air-operated chuck is used very largely for rapid production and there are other types which are operated by means of cams. The particular method of operating the chuck, however, does not concern the tool designer to a great extent except as he may be required to select the chuck for a given operation on a piece of new work. It is advisable for him to become familiar with the methods of operating and the advantages of the various types in order that he may be better able to judge which particular type is most suited to any given piece of work.

In the design of special chuck jaws there are a number of important points to be considered. The nature of the work, its general shape, the material of which it is composed, the thickness of the casting, the position of any letters or figures on the outside of the casting, the parting line, the angularity of the work caused by the draft and possibly some other matters, all have a bearing on the method of holding. In addition to these points, the cutting which is to be done and the various surfaces which are to be machined must be taken into consideration. No matter whether the work is to be held in a two-, three- or four-jaw chuck or whether the casting or forging is regular or irregular, the following points must be carefully noted:

(1) Chucking; in placing the work in the chuckjaws, care must be taken to see that proper provision is made so that two men will not be required to set up the work, viz.: one man to operate the chuck jaws and the other to hold the work in position. If a condition should arise such that the casting could not readily be placed in position and locked securely by one operator, it would be necessary to provide a special chucking device on the turret of the machine to hold the piece in its proper position while tightening the chuck jaws.

(2) Location and support; in locating the work in the jaws, attention must be given not only to a proper method of holding but also to the points that are to be machined so that a locating surface will be selected such that subsequent operations will be considered in their relation to the accuracy required in the product. It is advisable to select points both for holding and locating which will not be likely to be affected by patternmakers' figures or letters, and the gripping points must be so arranged that they will not strike directly on any seams or "fins" on the casting. In supporting the work, the pressure of the cut and its direction as well as the possibilities of pulling the work out of the chuck under very heavy cutting must always be thought of. When wide surfaces are to be machined, proper support should be given to them so that they will not "buckle" under the stress of the cut. Other matters connected with the location and support of the work will be taken up subsequently as hereinafter illustrated.

(3) Driving; if the piece of work that is to be held is thin or fragile, it is well to provide a means of driving so as to take the strain away from the jaws and not make it necessary to set these up too tightly. It is often possible to use a projecting lug on a casting as a driver, letting it rest against the side of one of the jaws. In exceptional cases it is permissible to drill a driving hole in some part of the work, the hole being so placed that a pin in one of the jaws will act as a driver in the hole. The method of "serrating" the jaws is an important factor in driving the work, but the serration must be proportioned properly in order that the points will grip the work and yet not become dulled too easily.

(4) Distortion; no matter what kind of work is being held in chuck jaws (except, of course, solid stock), there is always a possibility of distorting the work by applying too much pressure on the jaws. Careful consideration should therefore be given to this matter when designing chuck jaws. In very heavy work there is not much danger, but when pieces are thin, the greatest care must be used. The matter of distortion will be discussed more fully in a subsequent chapter.

(5) Economy; the cost of the fixture does not necessarily govern its economy; it is possible that although it appears costly, the saving in setting up and removing the work is sufficient to counteract the extra cost of the fixture. Naturally, it makes a great difference whether a small or a large quantity of pieces are to be machined. In the latter case any saving in the time of setting up will result in a greater production and consequently less unit cost. For high production tools, provision should be made for replacing worn or broken parts with the least possible expense. All locating points and other parts subject to great wear should be so made that they can be readily replaced.

(6) Safety of the operator; in turret and engine lathe work, the holding fixture or chuck revolves and therefore the greatest care should be taken that there are no projecting points or parts which might catch on the operator's clothing and endanger his life. Setscrews which project are very bad and can generally be avoided by the use of the hollow type of screw. Clamps should be properly guarded and any other parts should receive the same careful consideration. In some cases on large work, it is necessary to build a special guard in order to make sure that there will be no danger to the operator.

Abuse of Free Service

By C. J. Morrison

The question of abuse of free service which is treated editorially on page 361 of the *American Machinist*, is one that should not be difficult to handle. No reputable manufacturer wants to sell a machine containing a defect and then refuse to make it right. If he did, his business life would be short.

Although the automobile manufacturers hold themselves responsible only for defective parts and claim to charge the owners for the labor of tearing down and reassembling, few of them follow this practice in cases of real defects. However, the clause in the contract gives a good protection against unjust claims.

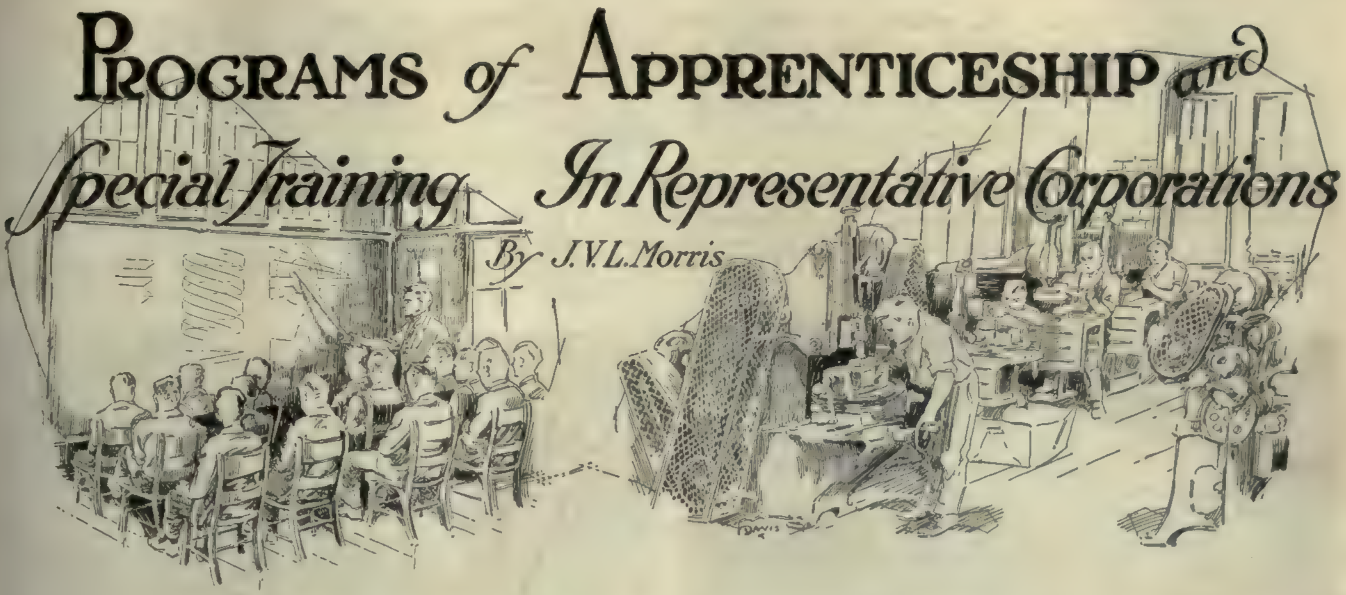
A few years ago one automobile manufacturer went so far as to ask his customers to bring in cars of a certain model in order that new rear axles might be applied at no expense to the owners. The factory had discovered a defect in the design and considered it better policy to replace the axles at once than to allow them to fail in service. Had they attempted to charge for the labor of replacing these axles, many owners would not have had them replaced and the reputation of the car would have been seriously injured.

This year one well-known automobile company had difficulties in the painting department and as a result is repainting, free of charge many of its cars. Had this company furnished the paint and charged for the labor the result would have been a number of very much dissatisfied owners and considerable bad advertising.

Machine-tool builders can scarcely do less than these automobile manufacturers and make good their own defects. However, they can and must protect themselves against unjustified claims. All that is necessary is to take a firm stand and refuse to give free service except where it is justified by defects in the machines. It is usually easy to determine whether trouble is due to a defect or to abuse or ignorance and as most machines are sold to honorable concerns, there should be little difficulty in determining who is to foot the bill. However, as almost everyone is willing to take all he can get for nothing, the abuse of free service will continue until the machine-tool builders stop it. The remedy is in their own hands and they can continue to give unjustified free service or stop the practice just as they choose.

PROGRAMS *of* APPRENTICESHIP *and* *Special Training In Representative Corporations*

By J.V.L. Morris



XV. The National Cash Register Co., Dayton, O.

Co-operative Apprenticeship for Boys and University Students—Upgrading Course for Salesmen and Repairmen—Health and Safety Instruction—Evening and Noon-Hour Classes

THE National Cash Register Co., has a country-wide reputation for its welfare work. Such phases of its work as may be considered as primarily employee training and education are not so well known. They will be discussed under the following headings: (1) Apprenticeship; (2) upgrading courses; (3) health and safety education; (4) evening instruction.

APPRENTICESHIP

An elaborate scheme of apprenticeship has been laid out, mainly on the co-operative principle, which may be extended by a university course in engineering. The plan calls for the completion of two years of high school work previous to entrance. The boy who has made normal progress should then be at least sixteen years of age, as required by the indenture agreement, and be well prepared to enter upon the apprenticeship which he is to pursue for two years on the co-operative basis, one week in school and the next at work in the factory. It is then expected that he will have completed high school. The alternatives are then open to him either to complete his apprenticeship in two years with part-time instruction one afternoon a week, or to follow a five years' course at the University of Cincinnati on a co-operative basis.

The co-operative high school in which the apprentices embark on their apprenticeship by attendance on alternate weeks has some unique features. It is in session throughout the year for fifty weeks so that the boys have twenty-five weeks of instruction with their twenty-six weeks of practical work at the plant, thus providing for only one week of vacation each year. Moreover, the school is in session for seven hours a day, five days a week. On Saturday mornings of their school weeks, except during the months of July, August and September, the boys report to the plant for special instruction in which they are addressed by company officials or shop foremen on shop methods, factory systems and like topics. As these meetings are in the factory school building, which is equipped with moving-picture apparatus and reflectoscope, the subjects presented can be very effectively and entertainingly developed. The instruction is intended to co-ordinate the school and shop work.

The course of study at the school seems well laid out for the purpose, providing instruction in mathematics, history and civics, drawing, English, shop practice, physics and chemistry. A class receiving instruction in shop work is shown in Fig. 61.

The work in the plant is supervised by a thoroughly experienced mechanic, who superintends the transfers from one department to another and sees that the opportunity is provided for all types of practice.

This practice has been laid out with a great deal of care and a printed chart drawn up which is practically a complete trade analysis, calling for a fixed number of months at each operation. This chart is placed in the hands of all the foremen concerned, with the requirement that it be rigorously followed in order to assure the complete acquisition of the knowledge

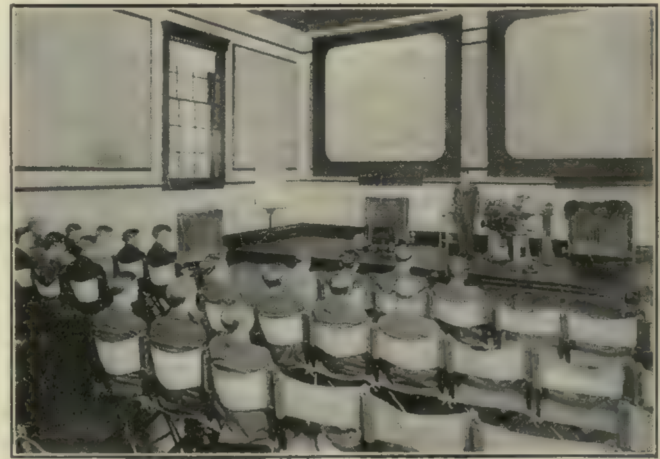


FIG. 61. CLASS OF APPRENTICES RECEIVING INSTRUCTION

of the respective trades. The system facilitates the handling of the apprentices, rather than making it more difficult, because a definite group of machines and operations can thus be set aside for instruction purposes and the apprentices progressed by orderly schedule.

Previous to the inauguration of the co-operative apprentice course, a survey was made of the toolmaking, machine, and modelmaking departments to discover how many apprentices could be satisfactorily provided for. Based upon this investigation, the following quotas were established:

Tool making department, 20 apprentices.
General machine department, 16 apprentices.
Model-making department, 16 apprentices.
Special machine department, 4 apprentices.

As there is a hierarchy of trades in this field, toolmaking being given chief place, an incentive to extraordinary effort is given by promising that any vacancies in the quota of that department will be filled by transferring from other departments. Also, as tool designing offers superior opportunities to the other branches, apprentices to that department are obtained by selecting the most promising young men from the four departments already mentioned.

Having graduated from high school and completed the first two years of apprenticeship, two courses are open—either to complete the acquisition of the trade upon which the boy has embarked or to go to the university, as already mentioned. If he chooses the first plan of continuing in the trade, one afternoon of part-time instruction is provided each week at the school in drawing, shop mathematics and machine tools and a quarter of an hour of health instruction.

The present enrollment based on the program is as follows:

40 co-operative half-time apprentices.
21 third- and fourth-year apprentices.
18 co-operative university students.

The apprentices are distributed as follows: Toolmakers, 46; draftsmen, 6; machinists, 5; electricians, 2; patternmakers, 1. Total 60.

The boys in the first group of co-operative apprentices are paid 27½ cents per hour for the time that they are working in the shop, with increases of 2½ cents per hour every six months up to their third year. After that, they are paid what they are considered worth. This was stated to be usually around 50 cents an hour, with a fifty-four hour week. There is no piece work throughout the course.

Careful records are kept of each apprentice on a record card, and regular reports are made to parents on a report card.

The eighteen university students are divided as follows:

Electrical engineers, 5; mechanical engineers, 9; chemical engineers, 2; commercial engineers, 2.

It was stated that only two or three had spent their whole five years in the plant.

Their pay starts at 35 cents an hour with gradual increases, so that for the third, fourth and fifth years it is 45, 47½ and 50 cents an hour, respectively.

Records were stated to show that so far 49 per cent of the apprentices, on completing the course, stay with the company.

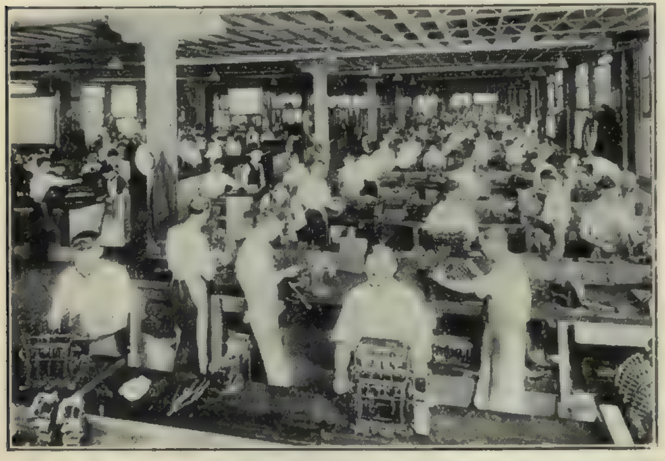


FIG. 62. LEARNING TO REPAIR DIFFERENT TYPES OF REGISTERS.

FIG. 63. CLASS OF SALESMEN

The provisions for training repairmen and salesmen offer interesting examples of upgrading or promotional training, being the second form of training provided. Of the repairmen there are at present 140 following the course, which is ordinarily ten months in length, although if any young man exhibits extraordinary adaptability he may graduate in as brief a time as five months. The system of picking the best trained to be transferred to regular work irrespective of the length of training acts as an excellent spur to attentive work.

Those chosen for the course are carefully picked, as the company is placed at considerable expense in bringing each one up to the desired skill. Many of them are chosen from the assemblers in the plant and some of them are sent in from the company's branch offices.

The age limitations are twenty-one to twenty-five and single men are preferred. The pay while learning is fixed at the uniform rate of $25 a week.

Instruction is provided by an instructor, an assistant instructior and an inspector for each group of twenty-five men. The work is sufficiently rigorous, so that it is expected that 50 per cent of the men will be eliminated before completing the course. Each separate device of the product is taught, and then the assembling of the various models. It adds considerably to the extent of the course that construction of discontinued as well as modern models must be learned as, of course, all types are met in actual practice. After the preliminary instruction is covered, the students spend their time, as shown in Fig. 62, in repairing and rebuilding machines sent in for the purpose. They do this until they are considered competent.

The supplementary instruction consists of an hour a day of motion-picture and stereopticon lectures. In them are presented all phases of the work as fully as possible by that means.

Of course there is a steady demand for the graduates, and many find the work a stepping stone to an appointment as salesman, so that an opportunity to take the course is eagerly sought.

Somewhat similar methods are followed in the school for salesmen, although the course is briefer. Men for the purpose are selected largely by the district managers and put into the field for three months, six months or a year. If the district manager then decides that a man is satisfactory material, he is admitted to the school.

Three sessions are held yearly, with the size of each group limited to fifty men and the length of the course to five weeks. Students' expenses except transportation are borne by the company. The school is in charge of one instructor who is an experienced salesman. There is a carefully prepared course of study which is closely followed. A class in session is show in Fig. 63. Written examinations are given to assure that the men work, while diplomas are awarded to show that they have completed the course. After completing this instruction the men return to the position they came from, with the expectation that improved sales will justify the time and cost of the course.

From 1903 to 1908 the policy of the company was to take new men who had made a success of their previous business, put them in school to teach them salesmanship of the company's products, and then put them in the field. As a result, but 26 per cent made good during that period. In 1908 the new policy was adopted of trying the men out in the field before putting them in the school. Some men do not like the business and quit before they get to the school. Others the sales managing force does not find desirable and they are allowed to go before getting into the course. Under this policy 78 per cent of the salesmen who have gone through the course are successful.

All progressive companies, particularly under the operation of employer's liability laws, are devoting increased attention to the installation of safety devices and to publicity campaigns to warn employees against dangerous or unsanitary practices, in all of which this company has been a pioneer.

The company has, moreover, realized that chronic or temporary ill health or low vitality of an employee represents a loss to the company through absences and reduced production when at work. Therefore, it has devoted a great deal of effort and money to health education as a means of reducing these losses. There is a health and safety committee composed of representatives in each department. Departmental safety committees hold regular meetings to discuss problems relative to this matter; and Fig. 64 shows the committee from the company garage talking over its own safety rules.

Twice a week there is provided a lecture or talk on health and safety which new employees are required to attend. The lectures are illustrated by moving pictures and stereopticon. In them are explained the assistance provided by the company toward promoting a healthful community and good working conditions: the visiting nurse, the free dental clinic and first aid facilities. As safety instruction, concrete cases are mentioned of instances which have occurred in the plant where serious results have attended the failure to utilize the accident prevention measures.

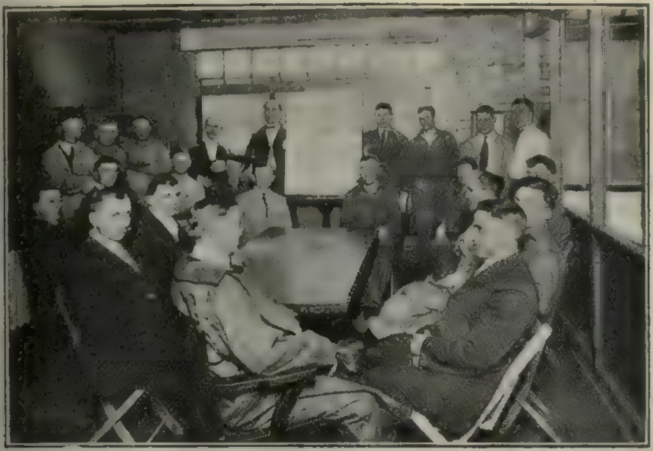


FIG. 64. A DEPARTMENTAL SAFETY COMMITTEE IN SESSION.

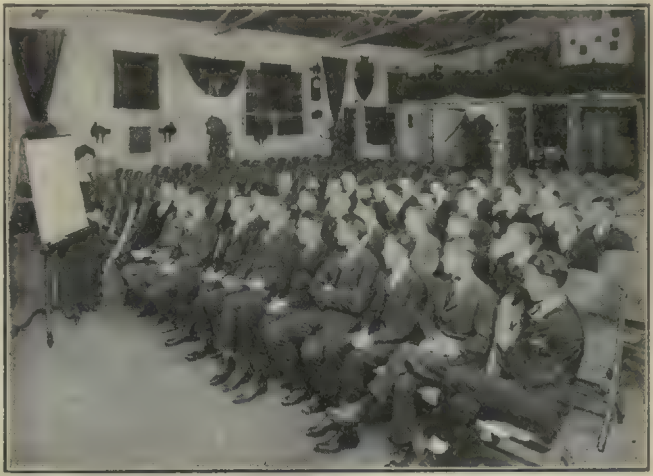


FIG. 65. A NIGHT SESSION OR "OWL CLASS"

The lecture is also considered a favorable time to present other aids to the health and comfort of employees. Among these are bathing facilities, dining halls, the company's extension educational facilities, relief associations and provisions for employees' social life.

Other lectures are frequently provided on special phases of hygiene as a part of the evening extension education of which a description here follows.

EVENING AND NOON HOUR INSTRUCTION

Evening instruction, the fourth form of training, has for a long time been provided under the caption of "owl classes," one being seen in Fig. 65. They are noteworthy, not so much on account of their variety or numbers in attandance, as for the definiteness and practicality of the instruction. Altogether there are twelve courses provided, with four to five hundred registering each year. There is a course on advertising and printing for the printers and pressmen, another is in accounting, a third is in agency office practice, while mechanical drawing and shop mathematics are provided for those who wish to advance themselves in the shops. Courses in salesmanship have been particularly useful in aiding employees to enter that field. Other offerings are public speaking, home economics and a Spanish class. A former residence of the company's president provides the down-town center for these classes.

At the plant a class for male stenographers has also been provided from four to five-thirty in the afternoon. This was attended by about forty.

Alongside of the factory there is the company's "schoolhouse," which contains an auditorium seating 1,200 people. Here noon hour or evening movies or lectures are provided daily. Probably the chief value of this entertainment is the diversion provided, but it has been a convenient means for reaching the employees in the matter of health, community improvement by landscape gardening and the like.

As regards the matter of intensive training in this plant no vestibule schools are maintained, but the idea is part of the recognized scheme of training on the departmental basis. Throughout the factory there are seventy-two "try-out" men or girls, who act as instructors as well. Each of them is a skilled mechanic or operative and part of their duties is to aid the operatives in bringing their work up to standard production.

Eye Accidents as a Cause of Waste in Industry

Eye accidents are revealed as a chief source of avoidable national waste in a special report of the Committee on Elimination of Waste in Industry of the American Engineering Council which has just been made public. The report embodies the results of an investigation conducted in many states in connection with the assay of waste in basic industries started by Herbert Hoover.

The total number of industrial blind in the United States is given as 15,000, or 13.5 per cent of the total blind population, "this type of injury being the leading causative factor of blindness," according to the report which was prepared by Earle B. Fowler. The eye, it is declared, is involved in 10.6 per cent of all permanently disabling accidents.

The continuing sacrifice is shown to be very large, asserts the committee, which blames irregularity in reporting the facts as to number, severity and time loss for incomplete knowledge of the situation.

Present protective methods as applied in large plants have effected a great reduction in injuries, it is stated. The use of goggles is one of the chief protective devices. In the plants of the American Car and Foundry Co. there has been a reduction of more than 75 per cent through the use of goggles. Experience has proved, it is declared, the falsity of the theory that the wearing of goggles by industrial workers in the event of accident only jeopardizes sight the more, on account of the liability of injury to the eyes from the broken glass of the goggles.

Not a single case of injury to the eyes from broken glass has been recorded since goggles were introduced into the shops of the New York Central Railroad. All employees of the Union Pacific Railroad Company are now required to wear goggles on eye dangerous work.

Striking reduction in eye accidents is shown by the American Locomotive Company. The number of accidents requiring medical attention in the company's plants was 52 in 1915, while during 1910-13 it was 448. In 1915 only two eyes were lost, while during 1910-13 the loss was 10.5. The number of injuries per 1,000 full-time men per year was 15.7 in 1915, while in the 1910-13 period it was 38.9. In the American Steel Foundries the proportion of eye accidents has been reduced 85 per cent.

"Basing judgment on the experiences of the concerns making these and similar reports," the report said, "it is evident that the continued loss is at least partially preventable and due to failure to apply protective measures rather than to any fault in the measures themselves as they have developed."

In spite of very definite and severe tests laid down by the National Code, the report says, the knowledge regarding the characteristics of adequate protection appears to be definitely limited to a few, mainly those responsible in the larger organizations. The report declares that "false statements or the sale of goggles under misrepresentation that they meet all of the specified requirements of the codes, introduces a grave menace." A certain number of accidents involving damage to the eye are still unavoidable, it is said.

The report also charges industrial waste to subnormal vision and faulty lighting.

The report stresses the importance of correcting subnormal vision among employees saying that excess eye fatigue results in conditions which must produce a time labor loss from reduction in quantity and quality production. One investigation showed that out of 2,906 garment workers only 743, or a little over 25 per cent, had bilateral normal vision, 17 per cent having normal vision in one eye, with the other defective.

An examination of more than 10,000 employees in factories and commercial houses found 53 per cent with uncorrected faulty vision. Of 675 employees in a typewriter company, 58 per cent were found to be in need of correction by glasses. An examination of the vision of 3,000 employees in a paper box factory in Brooklyn, N. Y., showed that the percentage of normal was only 28. In every group of workers examined there were a large number who fell below the line and this number becomes appreciably greater if those who have subnormal vision are taken into account.

One estimate, the report stated, placed the loss due to faulty conditions in this country as above the entire cost of illumination. In 446 plants investigated only 8.7 per cent were found to be in excellent condition, the other ratings being: Good, 32 per cent; fair, 29.1 per cent; poor, 18.8 per cent; very poor, 3.5 per cent; partly good, partly poor, 7.8 per cent.

The Committee on Elimination of Waste in Industry is composed of J. Parke Channing, chairman; L. W. Wallace, vice-chairman; L. P. Alford, George D. Babcock, William R. Basset F. G. Coburn, Morris L. Cooke, Harrington Emerson, Ira N. Hollis, Edward Eyre Hunt, C. E. Knoeppel, Robert Linton, Fred J. Miller, H. V. R. Scheel, Sanford E. Thompson, John H. Williams and Robert B. Wolf.

Special Fixtures in the Peerless Shop

Milling Fixtures for Continuous Work—Fixture for Grinding Ball Ends—Radius Milling and Threading—Drilling Connecting Rods

SPECIAL CORRESPONDENCE

A NUMBER of interesting fixtures used in machining various parts of the Peerless car are shown in the accompanying illustrations. In almost every case these ideas are capable of being adapted to many other kinds of work, the same principles lending themselves to various machining operations.

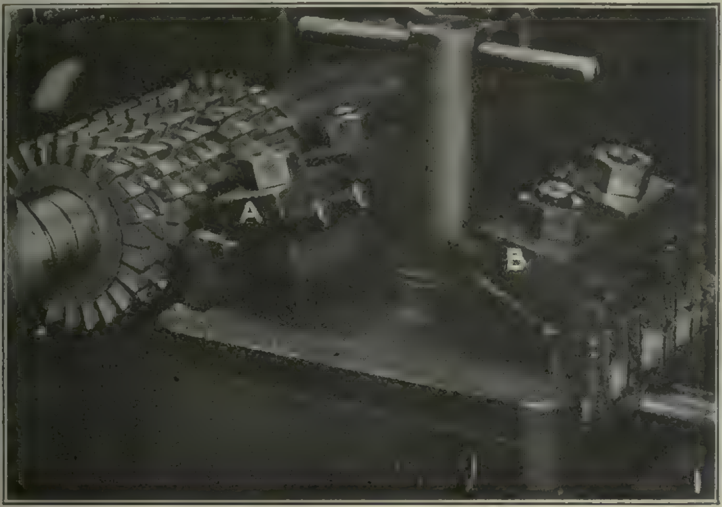


FIG. 1. MILLING BRAKE ROD CLEVIS.

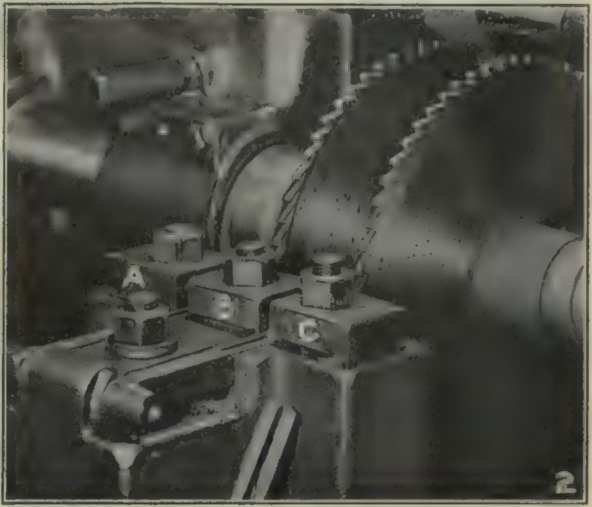


FIG. 2. SLOTTING PEDAL EXTENSION

A double-ended milling fixture which enables the cutters to be at work almost continuously, is shown in Fig. 1. This fixture is for milling the forked ends of clevises used in connection with the foot brakes. The total width of each clevis is ¾ in. and the width of the slot 11/32 in., which gives a good idea as to the size of the fixture and the cutters used.

Four clevises are held at each setting, each clamp holding two as at *A* and *B*. The fixture is arranged to be easily indexed after being run back out of the cut. It will be noted that both jaws of the clevis are firmly supported against the downward thrust of the milling cutters.

Another part of the brake, the pedal extension, is being milled in Fig. 2. This part is considerably larger than the clevis, being approximately 7 in. long and the slot over 3 in. in length by 3/16 in. in width. The length of the slot requires a comparatively large diameter saw or milling cutter as can be seen. These pieces are milled in pairs, being held by the three separate clamps *A*, *B* and *C*.

Grinding the ball for the steering knuckle arm is shown in Fig. 3. The stem is held in the draw-in chuck at *A* and is revolved by the small round belt shown at *B*. The head which carries the ball is pivoted at *C* and is moved around the track *D* by the handle *E* giving an easy and positive control in any position.

The milling fixture shown in Fig. 4 is used in finishing the round end on the lower portion of the change gear lever. The lever is previously drilled, the hole fitting over a pin and the end being supported by the stop *A*. The lever is clamped both at the end *B* and on the round portion *C* by means of the double-acting clamp shown. The cam *D* forces the block beneath it down on the rounded part at *C* and also clamps the end at *B*. This clamp is quick acting and equalizes the

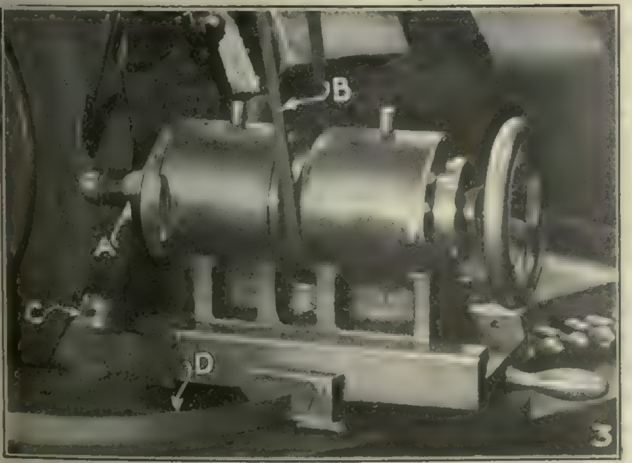


FIG. 3. GRINDING BALL END.

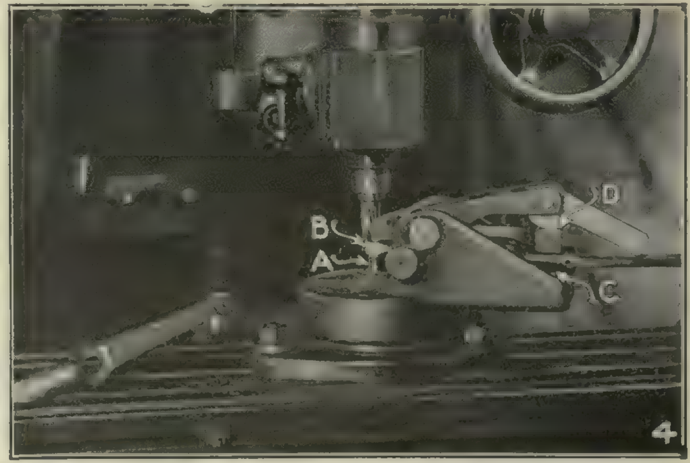


FIG. 4. MILLING CHANGE GEAR LEVER

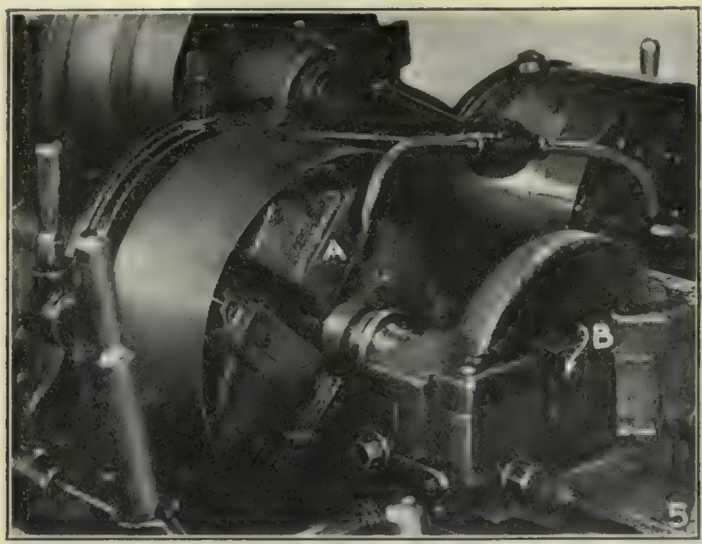


FIG. 5. THREADING REAR AXLE.

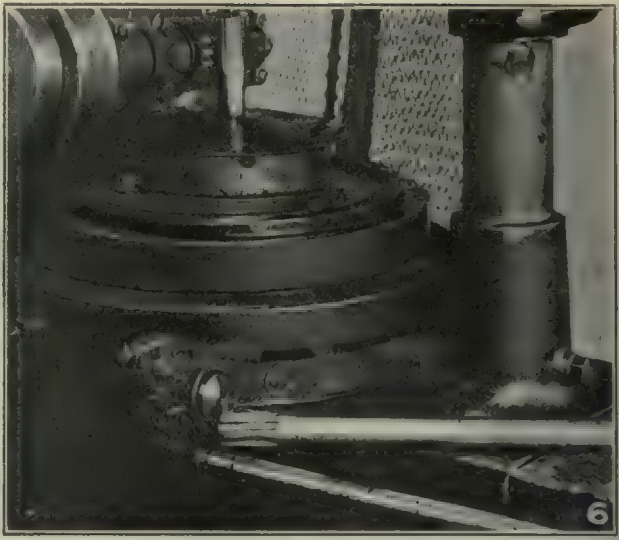


FIG. 6. SPLINING REAR AXLE

pressure at both points of contact. The fixture is then swung around its center by means by the change gear lever itself.

Threading the two diameters on the rear axle is shown in Fig. 5. As shown in the illustration, the thread is being cut on the large diameter which is inside the wheel when in use on the car. This part of the axle is $2\frac{1}{8}$ in. in diameter with 16 threads per inch. In this operation there is a support inside of the spindle of the machine to guide the axle while it is held at its outer end. The die head at *A* revolves around the axle. In threading the small end (which is $\frac{7}{8}$ in. with 14 threads per inch) for the nut that retains the wheel on the axle, the axle is reversed, the large end being held by the jaws at *B*.

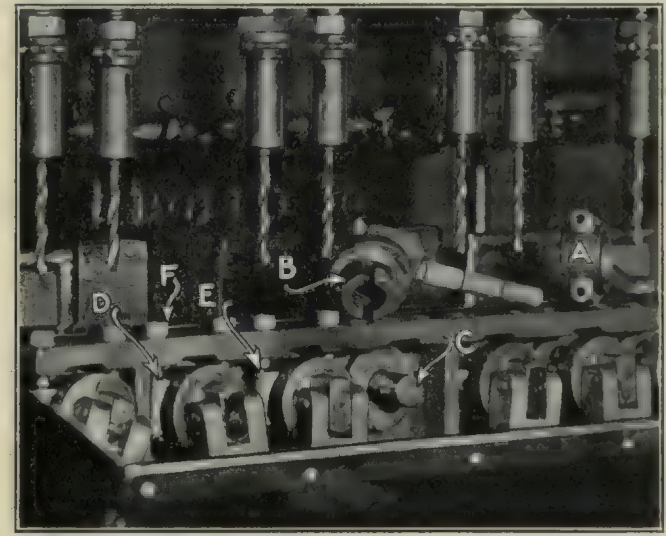


FIG. 7. DRILLING CONNECTING ROD BOLT HOLES

The set-up for hobbing the splined end of the rear axle is shown in Fig. 6. Here one end of the axle is held in a hollow spindle while the other end is guided by a center on the inside of the machine. There are six splines 2 in. long at the full depth of the slot, the slot being hobbed in the usual manner.

The method of drilling connecting-rod bolt holes is shown in Fig. 7. The rods are held in an unusual way but it is one that has much to commend it. The large end of the rod *A* is slipped over the holder *B*. The holder *B* carrying the rod is then slipped over the stud *C*. The slot in the holder fits over the pin shown in stud *C* and a partial turn locks the rod in place by means of the inclined slots in the holder. Rod bosses can be seen in place at *D* and *E*. The drill bushings which guide the drills during this operation are shown at *F*. It will be noted that there are twice as many fixtures as there are drilling spindles which enables one set of rods to be loaded while the drills are at work on the other set.

Aeronautics in Peacetime

In spite of the depressing conditions under which the aeronautical industry is laboring, the technical development of the flying machine is not by any means being neglected. On the contrary, experimental and research work of a bold and ambitious nature is being actively prosecuted in many quarters. Ideas are changing and advancing rapidly, almost if not actually as rapidly as they did in the war period. During hostilities the progress made was great outwardly but, in point of fact, it was very largely indeed composed of a refinement of detail, a growth in the absolute size of machines, and a development of the country's capacity to build them, their engines and accessories. Of genuine technical evolution, the war period showed much less than is ordinarily supposed. The airplanes at the end of it, with one or two exceptions, were substantially the machines of 1914 with increased performance and added powers. None of the belligerents could afford to spend much time in developing radically new and untried ideas. The progress effected was truly remarkable, but it was practically all made within the lines of the earliest machines to take the field. Today, with the leisure enforced by the dullness of constructional activity, the country's aeronautical designers and research workers are exploring fields that, although visible during the war, were by force of circumstances all but forbidden to them. The evolutionary tendencies in play at the present moment are powerful and widespread, and if the industry can be granted survival for a space, they will almost certainly result in the near future in practical developments, besides which the progress made during the war will assume considerably less importance than we have been accustomed to accord to it in the past.

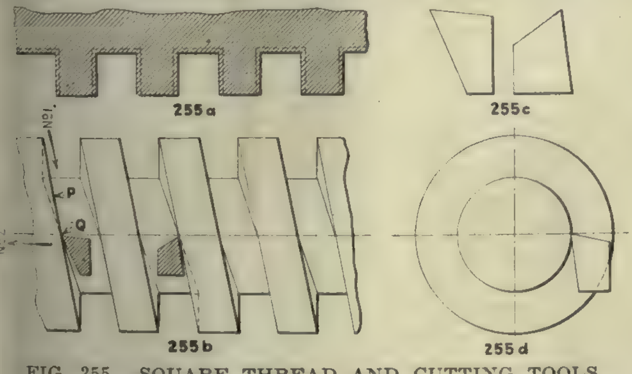
Metal Cutting Tools

By A. L. DeLeeuw

XVI. Thread Cutting Tools—Analysis of the Cutting of a Square Thread—Acme and V Threads—Single and Multiple Threading Tools—Thread Milling

THE cutting of threads is such a common operation in a machine shop that but few people realize how difficult it is to cut a thread theoretically correct. The great majority of threads cut do not require a high degree of accuracy and the ordinary methods in use in the machine shop are good enough to produce such threads. On the other hand, many pieces must be threaded in a way which will secure good fits, and when this is the case the methods and tools employed in thread-cutting should be so chosen as to meet the requirements of a very complex problem. For this reason we should analyze the action of a thread cutting tool somewhat in detail, and we will start with the cutting of a square thread.

The square thread is the most difficult to produce correctly, because all the problems which one meets in cutting other kinds of threads are emphasized and magnified when a square thread must be cut. Fig. 255a shows a portion of a square thread already cut. The problem is to cut the gap somewhat wider and deeper. This problem is a very simple one. All one has to do is to cut out the left side of the gap with a left-hand side cutting tool, the right side with a right-hand side cutting tool, and the bottom with a square nosed tool. Fig. 255b shows the same piece in side view, and shows the left-hand tool in position. A point *P* travels in the direction of arrow No. 1, whereas the tool travels in the direction of arrow No. 2; the result being the same as if the point *P* traveled in the direction *PQ* while the tool is standing still, or what is the same again, as if the tool were traveling in the direction *QP* while the work is standing still. Under those conditions the tool as shown has the proper rake and clearance. In the same illustration the right-hand tool is also shown, and it will be noticed that both in regard to rake and clearance the right-hand tool has an entirely different shape from that of the left-hand tool. To bring this out somewhat stronger the two tools are shown side by side in Fig. 255c.



255a 255c
255b 255d

FIG. 255. SQUARE THREAD AND CUTTING TOOLS

There is, of course, no difficulty in making these two tools the way they should be, nor is there any difficulty in making the square nosed tool as it should be and as it is shown in Fig. 255d. The difficulty lies in the fact that in ordinary practice these three tools are combined into one, and that it is not well possible to give the tool such a shape that its left-hand side, its right-hand side and its front side all have the proper shape and angles for cutting in the correct manner. It would be possible to give the three cutting edges clearance, but it would be very difficult indeed to give all three edges rake. Fig. 256 shows what the cross-section of such a tool would be. It will be seen at once that it would be extremely difficult to make or maintain such a tool.

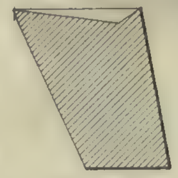


FIG. 256

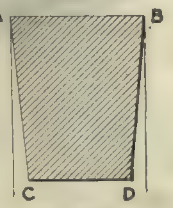


FIG. 257

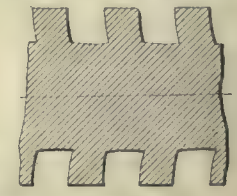


FIG. 258

FIG. 256. THEORETICALLY CORRECT CUTTING TOOL. FIG. 257. TOOL FOR CUTTING SQUARE THREADS WITH SMALL LEAD. FIG. 258. WHAT HAPPENS WHEN TOOL IS SET AT AN ANGLE

For square threads with small lead a tool is used such as shown in Fig. 257. For a right-hand thread there would be rake at the point *A*. negative rake at the point *B*, little clearance along *AC* and excessive clearance along *ED*; while the front edge *AB* would have neither positive nor negative rake. If a left-hand thread were to be cut there would be positive rake at *B*, negative rake at *A*, scant clearance along *BD* and excessive clearance along *AC;* whereas the line *AB* would be working under the same conditions as before. The difference in clearance of the two sides and the amount of negative rake at one edge remains small as long as the angle of the thread is small. But when the angle of the thread becomes of some magnitude the negative rake causes the thread to be torn on that side and unfit where smoothness and accuracy are required. A common method of overcoming this difficulty is to set the top of the tool at right angles to the spiral. Right here we meet our first difficulty, because there is, correctly speaking, no such thing as "the angle of the spiral" of a screw thread. As we go from the outside of the piece

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toward the bottom of the thread the angle of the spiral changes continually; it is a minimum at the outside and a maximum at the bottom. The difference in angle is quite considerable as will be seen from the following example:

Outside diameter of screw	2 in.
Pitch of thread	½ in.
Depth of thread	¼ in.

This makes the diameter of the core 1½ in. The outside circumference is 6.2832 in. and the inside circumference is 4.7124 in. The cotangent of the spiral angle at the outside is 6.2832 ÷ ½ = 12.5664; and the cotangent of the spiral angle at the inside is 9.4248 in., so that the angle at the outside of the thread is 4 deg. 30 min. and at the inside of the thread 6 deg. 10 min. The difference in angles becomes correspondingly larger as the pitch becomes greater in proportion to the diameter.

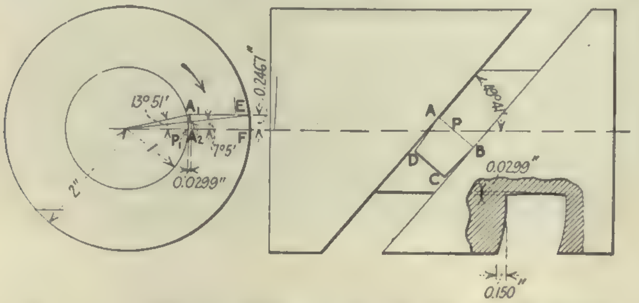

FIG. 259. SQUARE THREADED SCREW WITH STEEP LEAD

As a compromise it is customary to set the top of the tool at right angles to the direction of the thread halfway between top and bottom.

This method seems to be a simple way of getting out of trouble, but as a matter of fact it is a way of getting out of one trouble and into another one which may be quite serious if the screw has a very steep thread, such as in screws used for screw presses. The result of settting the tool at an angle with the axis of the work is that neither the right nor left side nor the bottom of the thread will be a straight line. If such a screw were cut along a plane going through the axis the appearance would be as shown in Fig. 258 in a somewhat exaggerated form. It may seem at first as though it would not be possible to make a thread with curved sides by using a tool with straight sides, but a little analysis will show this to be the case nevertheless.

In Fig. 259 are shown the elements of a screw with very steep lead. The outside diameter is supposed to be 4 in., the lead 8 in., double thread; so that the core diameter is 2 in. *ABCD* is a cross section of the tool of which the top is set at right angles to the direction of the thread. This causes point *A* to be above and point *B* below the center. The point *P* is supposed to be the center of the front edge of the tool. Looking at the end view of the screw we will find that *P* cuts at the point P_1, and that therefore *A* cuts to the point A_1.

The line *AB* was set at right angles to the slope of the thread at the pitch line. At this point the diameter is 3 in. From this diameter and the lead, which is 8 in., we find that the thread makes an angle of 49 deg. 41 min. with the axis. Allowing this angle and the length of the line *AP*, which is equal to one-fourth of the pitch times the cosine of 49 deg. 41 min., we find that the line A_1P_1 is 0.2467 in. With these elements we can calculate angle A_1OP_1 which we find to be 13 deg. 51 min. We can also calculate the angle *EOF* which we find to be 7 deg. 5 min.; so that angle A_1CE is 6 deg. 46 min.

In order that the screw thread which we are cutting shall be a square thread, all points which lie on the thread and also on a plane going through the axis must be in a straight line and at right-angles to the axis. The line *OE* represents the intersection of such a plane with the cross section of the screw. On the other hand, the line EA_1 represents a straight line, because it is the cutting edge of the tool; so that all points between *E* and A_1 lie on a straight line and at right-angles to the axis. The point A_1 travels in the direction of the arrow and when it has reached the point A_2 it should be so located that A_2E is a straight line and at right angles to the axis. In traveling from A_1 to A_2 the point A_1 has gone through an arc of 6 deg. 46 min. If this point had gone through an angle of 360 deg. it would have advanced a distance of 8 in. As it has gone through an angle of 6 deg. 46 min. it has advanced a distance of

$$\frac{6^\circ 46'}{360} \times 8 \text{ in.} = 0.150 \text{ in.}$$

The important point which we get out of the foregoing is that the cutting edge of the tool must be on the center in order to get a straight line outline of the thread in an axial plane. Though we took as example a square thread and one with a very large lead, the principle remains unaffected whatever the shape of the thread or the amount of the lead. The error may become quite small; in most cases so small that we can disregard it. But we must keep it in mind whenever we want accurate threads. For instance, we must either correct the shape of the milling cutter or else finish chase the thread of a screw made on the thread miller if we want a very accurate job, especially when we have to deal with a coarse lead. There is no objection to using the tool as indicated in Fig. 259 for roughing, provided we finish the sides and bottom of the threa individually. In many cases it is immaterial whethe we have a fit at the bottom or not, or rather we shoul say, a fit at the bottom is not wanted. And in that even

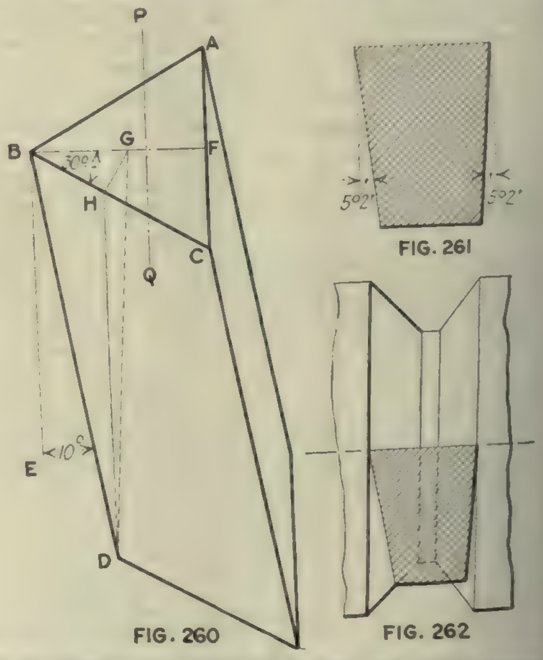

FIG. 260
FIG. 261
FIG. 262

FIG. 260. THREAD CHASING TOOL. FIG. 261. SECTION ALONG PQ. FIG. 262. SECTION IN PLACE ON WORK TO SHOW CLEARANCE

it is not necessary to finish the bottom. The sides, however, should be finished. We may read in handbooks in regard to the cutting of square thread screws that it is good practice to make the gap between the threads in the nut a little larger than the thread of the screw, and very wisely it is not stated how much that little is. If both screw and nut are finished with the proper side cutting tool there is no more need for clearance in square thread screws than in any other kind of screws.

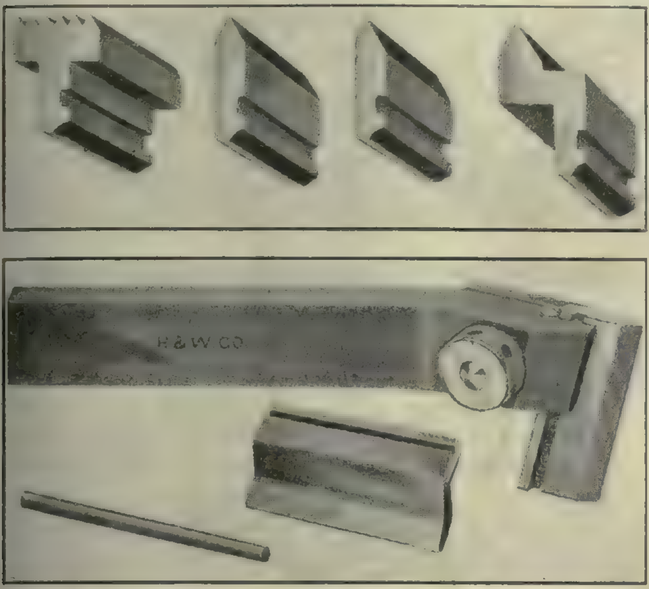

FIG. 263. THREADING TOOLS AND HOLDER OF PRATT & WHITNEY CO.

The great majority of screw cutting produces screws with V-thread, that is, threads of which the section is a complete equilateral triangle or a part of one. Some threads, particularly those used in other countries, may be of a different cross-section, but they sufficiently resemble the threads used in this country so that the principles of thread cutting, which will be mentioned in the following paragraphs, apply equally well.

Threads are cut by three methods: (1) Chasing; (2) milling; (3) hobbing.

For the chasing of a thread a single-point tool is used, having the same cross-section, broadly speaking, as the cross-section of the gap between the threads. The chasing tool is therefore a form tool, and all remarks we have made about form tools for screw-machine work apply here. The tool should be so constructed that it can be ground on the face and will preserve its contour.

In Fig. 260 *ABC* is the top of the chasing tool and is made in the form of an equilateral triangle. The tool is set at an angle with the vertical line. This angle serves the purpose of giving clearance to all points of the tool; the greater the angle *DBE*, the greater the amount of clearance. However, there is a limit beyond which one cannot go without weakening the front part of the tool. Suppose the angle *DBE* were 10 deg., then the two angles of clearance at the points *C* and *A* would be different from 10 deg. In order to find what this clearance angle is we will drop the perpendicular *EF* on the base of the triangle. If we now draw the line *DG* at right angles to *BF* we will have an angle *BDG* which is also 10 deg. If we should make the line *BD* equal to *one*, then *BG* would be equal to sine 10 deg. = 0.17365 in. We would obtain the angle of clearance of a point along the line *BC* by drawing a perpendicular from *G* to *BC*. The angle *GDH* will be the angle of clearance.

As $BG = 0.17365$ in. and $\angle GBH = 30$ deg. GH will be one-half of 0.17365 in. = 0.08682 in. As $BD = 1$, $GD = \cos 10$ deg. $= 0.98481$, $\tan HGB = \frac{HG}{DG} = \frac{0.08682}{0.98481} = 0.08816$; so that $\angle GHD = 5$ deg. 2 min.

This calculation was carried out here because the same method applies if any other shape of tool is used. A simpler method may be followed when the angle of the tool, that is the angle of the thread to be cut, is 60 deg., as it was in our example. In that case, assuming the clearance angle at the point to be α we have:

$$GB = BD \sin \alpha,\ GH = \tfrac{1}{2} BD \sin \alpha,\ GD = BD \cos \alpha$$

$$\tan GHD = \frac{GH}{GD} = \frac{\frac{1}{2} BD \sin \alpha}{BD \cos \alpha} = \tfrac{1}{2} \tan \alpha$$

so that we see that for a 60-deg. tool the tangent of the clearance angle at all the points equals one-half the tangent at the apex.

If the point of the tool is cut off so as to make it flat at the root the clearance at the flat will be the same as the clearance at the point. The clearance angles we have found here would be the true clearance angles if the tool were used to cut a groove around a cylindrical piece; but they are not the clearance angles between tool and work when a spiral groove must be made. If we should take an infinitesimally thin slice along the line *PQ* and going vertically down the tool, we would obtain such a piece as is shown in Fig. 261. If we had also cut part of the thread away, along the same line, we would find this slice resting against the thread as shown in Fig. 262, and it will clearly be seen that the true clearance angles at the points *A* and *B* are the clearance angles of the tool plus or minus the spiral angle of the thread. This spiral angle is a maximum at the root of the thread and that is the point where we will have to work with the minimum clearance.

Taking for example a 1-in. bolt which has eight threads to the inch and of which the root diameter is 0.838 in., the angle of spiral will be 2 deg. 43 min. at the root; so that the actual angle of clearance on one side will be 5 deg. 2 min. — 2 deg. 43 min. = 2 deg. 19 min., which is too small for a proper cut. It would therefore be necessary to increase the clearance angle at the point, and this means a weak and delicate tool. Here we have the first difficulty we meet in trying to cut a V-thread.

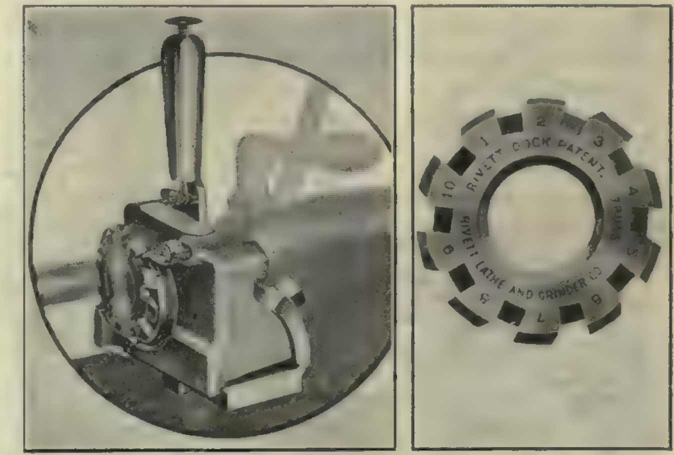

FIG. 264. RIVETT-DOCK FORMED CUTTER TYPE OF THREADING TOOL

Fig. 263 shows a tool and toolholder for cutting V-thread, as made by the Pratt & Whitney Co. The holder assures the setting of the tool in the proper way in relation to the holder. The tool is made so that when it is set on center and with the top of the tool horizontal, it will do its work as it is intended to do.

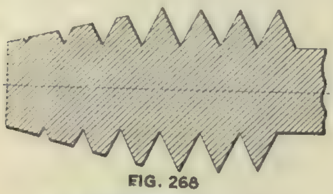
FIG. 268

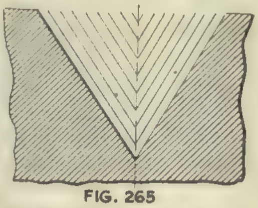
FIG. 265

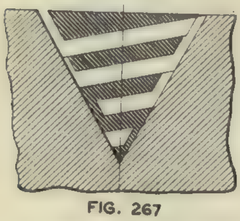
FIG. 267

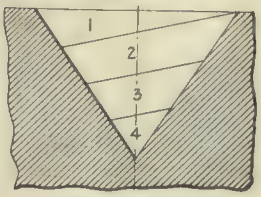

FIG. 266

FIG. 265. SUCCESSIVE CUTS BY SINGLE POINT TOOL.

FIG. 266. SUCCESSIVE CUTS BY TAP. FIG. 267. EFFECT OF IMPERFECT TAP. FIG. 268. CONSTRUCTION OF ORDINARY TAP

As the front edge of the tool is set to an angle of 15 deg. with the vertical, it was necessary to make the contained angle of the tool slightly different from 60 deg., so that the horizontal section is 60 deg. The tool should be ground on the top surface only, and this ground surface should be at an angle of 75 deg. to the front edge.

In chasing a thread a cut is taken the length of the thread, the cross-slide is pulled out, the carriage returned, and then the cross-slide is set forward a certain amount beyond its original position, in order to take a second cut. This process is repeated until the proper depth of thread is reached. It requires considerable skill to divide the cut evenly and always to have the same depth of cut when the work is finished. Besides, the same tool is doing all the roughing as well as the finishing. To meet these conditions tools have been brought out such as illustrated in Fig. 264, which is the Rivett thread cutting tool. In this tool the cut is divided up into ten cuts, leaving a very small amount for the last cut. The ten tools are part of a disk where each individual tool is treated like a formed milling cutter so that it can be ground on the face and still retain its shape.

The great majority of threaded parts are not cut with a single-point tool. Internal threads are cut with taps, external threads with dies. Taps and dies are a modern development of the oldest method of cutting threads, which was by means of a chaser. Before the modern lathe had been developed, there were no means of assuring a proper lead of a screw except the skill of the workman. Where threads of some slight degree of accuracy were required, such skill could not be relied on, and the workman would make himself a tool which would insure the proper lead. Such a tool was the chaser. It is nothing but a number of single-point tools set side by side and the proper distance apart.

Fig. 263 shows such a chaser, though not exactly in the form it was used on hand lathes. If this chaser is to cut a thread from right to left, then the left-hand cutting point is the one active part of the tool. The workman would try to move the tool toward the left so that one lead would be generated with one revolution of the work. If he missed it more or less, he could correct it the moment the second part of the tool would strike the work, and correct it still further with the third and fourth tool. As he went over the work a second time he would start with practically no cutting pressure, guiding the first section of the tool in the previous cut and waiting until the second section struck the work before he forced the tool in deeper. In this manner he would proceed until he had reached the full depth of the thread to be cut. The chaser, then, was a cutting tool and also a guide which permitted him with a relatively small amount of skill to produce a thread with a reasonably high degree of accuracy. As chasers are used now there is no skill of the workman needed to manipulate them or to correct an error made in the previous cut. Besides, chasers nowadays as a rule cut a complete thread in one pass, or at the most, two passes, so that, no correction is possible.

A tap is in all respects a chaser. In other words, it is a thread-cutting tool combined with a device for assuring the correct lead. A tap is made out of a screw by cutting grooves in it and thus producing cutting edges. If nothing else were done to the screw then there would be only a single cutting point in a tap. If we make a tap with four gashes it might seem that there would be four cutting points, but such is not the case; because all four points of one convolution follow the groove cut by the first point, and as this first point could not have proceeded in the groove unless it had provided sufficient clearance for itself, it follows that there is no metal left in that groove which the succeeding point must cut away. For that reason the entering part of the tap is made conical. This brings every succeeding cutting point to a somewhat larger diameter, and in this manner each point will do part of the cutting. However, these succeeding cuts do not resemble the cuts taken with a single-point chasing tool. With such a tool each cut is of V shape.

Fig. 265 shows how a cut is taken with a single-point tool. The groove made is at all times a V-groove, becoming a deeper and wider V with each successive cut. Fig. 266 shows the nature of the succeeding cuts taken by the various cutting points of a tap. It will be seen that every cutting point finishes part of the completed thread. If the various cutting points of a tap should not lie on a perfect spiral, it might be that some of these cutting points will cut more or less to the right or left, producing a result as shown in Fig. 267. Such a condition would cause a rough thread, besides making the groove too wide. As every cutting point finishes part of the thread it follows that no matter where dulling occurs the tap will stop functioning properly as soon as any point is dull.

Fig. 268 shows the construction of the ordinary tap in much exaggerated form. The portion beyond the taper simply serves as lead screw.

A tap as shown in Fig. 268 can be used where a tapped hole must go through the entire thickness of the metal, or where it is not necessary that the full thread shall be generated the entire depth of the hole. But where a thread is required all or nearly all of the full depth of a blind hole, such a tap would not produce the proper results. In that case, more than one tap must be used. The second tap will have a shorter taper and perhaps a somewhat larger diameter, the third tap a still larger diameter and practically no taper at all.

(Continued in next week's issue.)

Making Drag Saws in the Big Timber Country

By Fred H. Colvin

EDITOR, AMERICAN MACHINIST

A Portable Power Saw for Big Timber—Boring and Grinding Motor Cylinders in a Milling Machine—A Pair of Unique Brass Furnaces

THE cutting and handling of big timber has developed many mechanical devices which are unknown in the Eastern woods. This is because of the different problems presented in handling timber from one to two feet in diameter, or having it run from four to ten feet in diameter and of proportionate length. While the actual felling of trees differs very little in the various sections of the country, the method of handling them after they are on the ground has been developed in an interesting manner. One of these devices is known as the drag-saw, which takes the place of the old two-man cross-cut saw and eliminates hours of hard work as well as the accompanying backaches.

The drag-saws illustrated herewith are manufactured by the Beaver State Motor Co. in the little town of Gresham, Oregon, just outside of Portland. The modern and attractive plant is shown in the headpiece. The drag-saw itself is shown in Figs. 1 and 2 and as can be seen is a very simple little device which does almost unbelievable work on logs up to 10 ft. in diameter. The logs shown are approximately 5 ft., the sawing time for a 4-ft. log being 4 min. and for a 5-ft. log, 7 minutes.

As can be seen, from the illustrations, the machine itself consists of a small gasoline motor, mounted between a pair of substantial skids, the motor driving a large sprocket by an extra heavy 1-in. Whitney roller chain, this giving the cross-cut saw a stroke of about 2 ft. The arrangement of the fuel tank and the water tank is clearly shown. The whole machine can be easily carried by two men and can be moved along the log by a single operator. Two steel dogs at the upper end of the skid are driven into the log and hold the whole thing firmly in place.

BORING AND GRINDING CYLINDERS

The shop itself is interesting, as well as the methods used in building the motor. One of the features of the motor is that the force of the explosion is taken on a solid bearing, in place of the usual construction where the cap is bolted in place. The machining operations are not unusual, the quantity not being sufficient to install special machinery for the different operations.

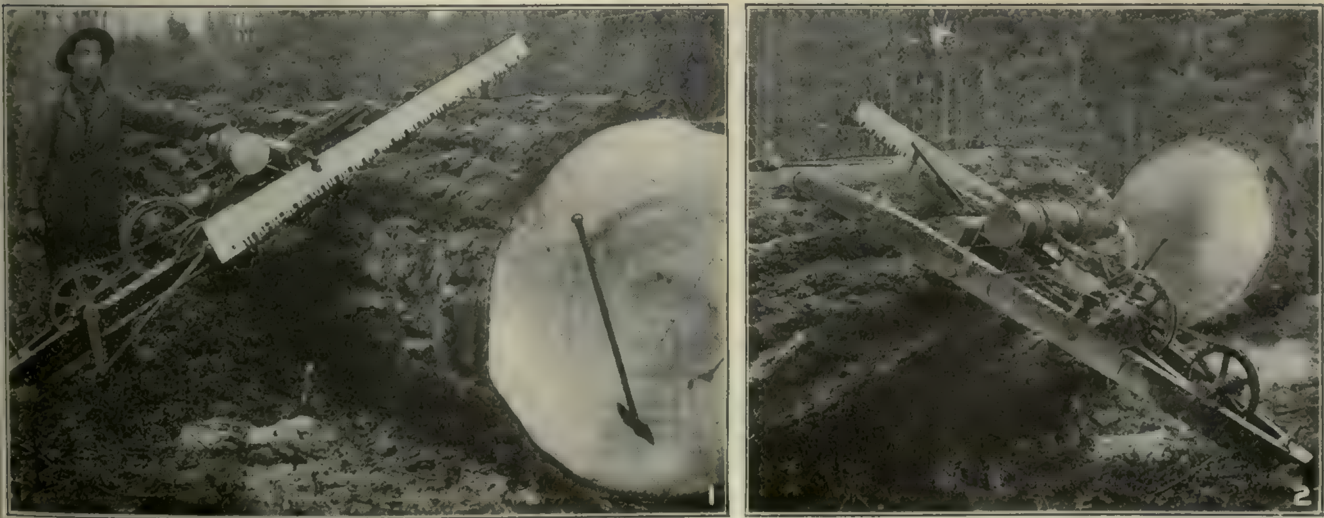

FIG. 1. DRAW SAW AT WORK. FIG. 2. SEEN FROM THE OTHER SIDE

The cylinder is bored on a knee type milling machine using the fixture shown in Fig. 3, which bolts the cylinder firmly in place and is easily located on the milling machine table by means of a suitable tongue on its base. After the cylinder is bored the whole thing, cylinder and fixture together, is removed to the milling machine, shown in Fig. 3, and similarly mounted on its table.

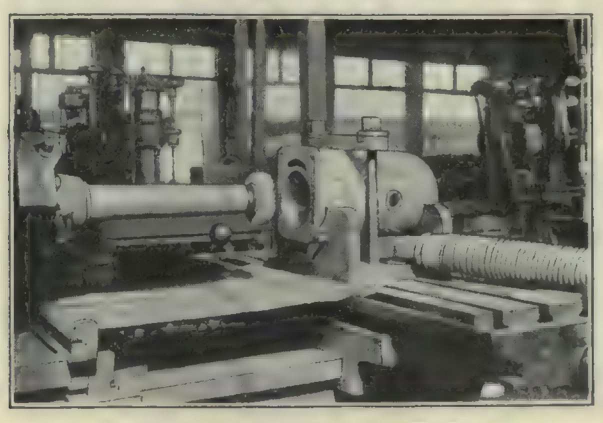
FIG. 3. GRINDING CYLINDERS

The spindle of the machine carries the special grinding head shown, this being given a rotating motion by means of the regular spindle of the machine, while at the same time the grinding spindle is driven at its proper speed from an independent source. Grinding devices of this kind are also used in automobile repair shops, the interesting feature of this operation being the changing of the fixture and cylinder from the boring operation to that of grinding.

FIG. 4. THE IRON FOUNDRY

The smaller building at the right of the headpiece is the foundry, of which an interior view is shown in Fig. 4. Here are made all the iron castings for the shop. Through the open door is the brass foundry which contains a pair of interesting furnaces, designed by the president, P. A. Combs, and built in the plant.

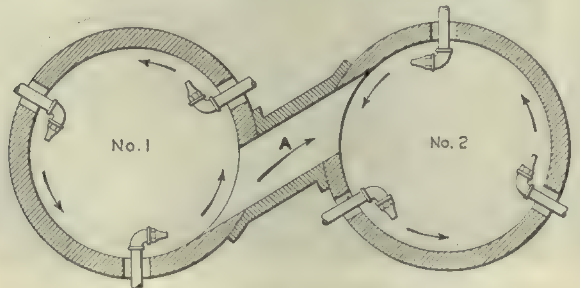

FIG. 6. HOW THE FURNACES WORK

An idea as to the construction of the furnaces can be had from Fig. 5, showing them sunk into the ground near the outer wall. Gas is used for fuel, the piping being shown against the wall. The design of the furnaces, however, is very unique, as can be seen from the plan view in Fig. 6. The furnaces are circular and hold crucibles containing 180 lb. of brass and use a pressure of 4 oz. of air in connection with city gas. The furnaces heat up in from one and a half to two hours and after that will melt 180 lb. of metal in 30 minutes. It will be noticed that the furnaces are so set that the gas jets give a rotary motion to the flame, and that there is a tangential passage *A*, between furnaces Nos. 1 and 2.

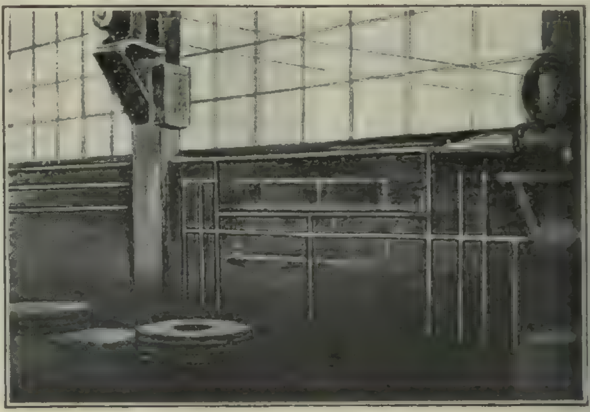
FIG. 5. THE BRASS FURNACE

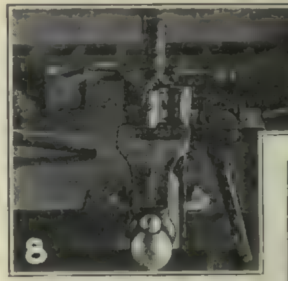

FIG. 8. COMPLETED BEARING

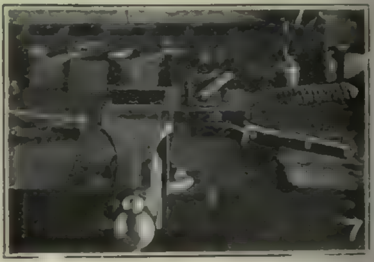

FIG. 7. MOLD FOR BEARINGS

The plan is to use furnace No. 2 for pre-heating a second crucible of metal, utilizing the heat which escapes from furnace No. 1. However, gas is not turned on to No. 2 until the crucible in No. 1 has been removed for pouring. As soon as the crucible has been removed from No. 1, the gas is turned on in No. 2 and shut off in No. 1. A new pot of metal is then placed in No. 1 which becomes the pre-heating furnace, receiving heat from No. 2 in addition to utilizing that already stored in the fire brick of its walls. By using this method it is possible to melt 360 lb. of brass with 12,000 cu.ft. of gas, which at 45 cents per thousand, makes very cheap fuel. This same furnace has been used to melt steel but in that case an air pressure of 16 oz. was found desirable and 16,000 cu.ft. of gas was necessary.

An unusual casting process is shown in Figs. 7 and 8 in which bearings for a special machine are cast in a very convenient mold.

Deflecting a 4½-inch Bar With a Visiting Card

Measuring the Amount of Deflection by Bands of Light—How and Why the Bands Are Used—Making the Apparatus

By RUSSELL W. PORTER, M.S.
Jones & Lawson Machine Co.

ONE of the spectacular, if not directly useful, applications of light in the machine shop is that of the deflection bar. To actually see the bending effect on a massive bar of steel by a slight pressure of the finger, and to know conclusively that one is measuring with considerable accuracy so small a quantity as one millionth of an inch—or less—is, to say the least, sensational. It is only the knowledge that an extremely minute flexture has been observed, that prevents the experiment becoming somewhat disquieting.

The device is not difficult to make; any mechanic with a little care and patience can put one together. The purpose of this article is to describe a simple form of the deflection bar, and to explain from the undulatory theory of light, how the instrument functions.

As seen in Fig. 1, the apparatus consists of the bar itself, a solid cylinder of steel 4½ in. in diameter by 20 in. long, supported at its two ends, and having a suitable support for holding the optical elements fastened to it by means of studs. The support in the instrument illustrated is an angle iron: a channel iron would do as well. To the under side of the angle iron is fastened (see Fig. 2) one of two bars of ordinary commercial plate glass. The other and lower bar of glass is held against the upper bar by the adjustable thumbscrew *B*. The adjacent glass surfaces are not in actual contact but are separated by a thin strip of tinfoil at *A*. *C* is a hole bored in the angle iron directly over the glass bars near the end.

Deflection Shown by Light Bands

In using the device with a suitable light source, one looks down through the hole *C* at the glass, when, by turning screw *B* until the plates are approximately parallel, one will see alternating light and dark bands crossing the glass, like the teeth of a fine tooth comb. These bands are due to interference between light reflected to the eye from the two glass surfaces nearly parallel to each other and nearly in contact. If a slight downward pressure is now brought to bear upon the steel bar, these bands will move to the left. If the finger is placed under the bar with an upward pressure, the bands are displaced in the opposite direction—to the right. By pressing on the extremities of the bar, top or bottom, the mass of steel may be made to buckle down or up, and the bands will move in the directions expected.

The explanation of these interference bands rests on the generally accepted undulatory theory of light. If attention is given to Fig. 3 where for clearness the departure from parallelism of the glass bars is exaggerated, and considering only the two glass surfaces in near contact, it will be seen that part of ray *A* is reflected to the eye from the upper surface *C*, and part from *D*. Of these two reflected rays (*a* and *b*) *b* must have traveled a little farther than *a*, since it was obliged to traverse the air space *E* twice. If this increased path retarded *b* by a half wave length, the two beams would be out of step as it were, from crest to trough, and they would destroy each other. In other words, there would be extinction here and we would see a dark band. With ray *B*, however, the increase of path *b* is enough to permit its gaining a whole wave length over *a*, when it emerges in step with its partner, crest to crest, trough to trough, and the amplitude is doubled. There would be intensification here and we would see a bright band.

These interference bands can best be seen by using a one color light. The easiest way of producing such a light source is to burn sodium chloride (common table salt) in the flame of an alcohol lamp. Mount the lamp as in Fig. 4 and fix a piece of asbestos saturated in brine in the lamp flame by means of a twisted wire. The light of the mercury vapor, or Cooper-Hewitt lamp is also very satisfactory.

FIG. 1. A SIMPLE DEFLECTION BAR

A wave length of sodium light is approximately one fifty thousandth of an inch. It follows, therefore, that the difference in the thickness of the air film, measured from band to band, will be about one hundred thousandth of an inch.* By using a little care in adjusting the glass, these bands may be broadened or narrowed at will. As they broaden out, the surfaces are becoming nearer parallel; as they crowd together the angle of the wedge of air is increasing. In this respect the bands may be interpreted very much as contour lines on a map. And so, if the bands move sideways a distance equal to the width of one band, there is only one possible deduction—the lower glass has dropped away 1/100,000 in. This is not quite exact, due to the fact that we are looking at the glass at an angle, and not straight down upon it. For the complete formula, see the *American Machinist*, Vol. 53, page 631. If the leverage, due to the setscrew being near the left end of the glass bar, is say 10, then the steel bar itself has bent $\frac{1}{10}$ of 1/100,000 or 1/1,000,000 in. By using broad bands, one-tenth of this displacement may be easily observed. I have detected an appreciable flexture to the 4½-in. bar 18 in. long in Fig. 1, by applying a pressure to the middle of the bar with a visiting card held on edge.

Applying 1 lb. weight on the middle of this bar, the amount of the shift of the bands, taking into account the leverage of the lower glass bar, called for an approximate bending of the steel bar of 0.00000025 in. This was checked by deriving the theoretical flexture from the modulus of elasticity of structural steel. The result was 0.00000027 in., in good concordance with the value derived from light interference.

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*See Wood's "Physical Optics" (McMillan & Co., N. Y.), pp. 155 and 159.

A few cautions are to be observed should any one attempt one of these extremely sensitive pieces of mechanism. Adjusting screw *B* should have a fine pitch thread and fit well in its tapped hole. The opposing glass faces must be kept free of lint and dirt. The glass to be used should be at least ¼ in. thick. Pieces of a broken windshield or mirror are serviceable. Lay one piece of glass on the other and observe the interference bands under the sodium flame, and select a region giving the straightest and at the same time broadest bands. After cutting out the bars, their edges may be smoothed up by grinding on any flat glass or metal surface, using as an abrasive either emery or carborundum with water.

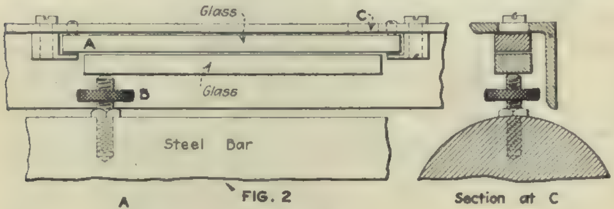


FIG. 2

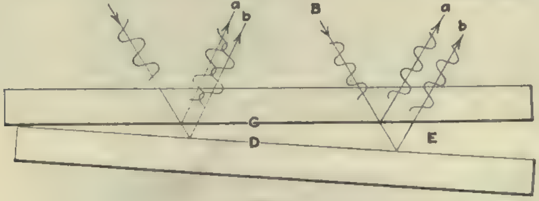


FIG. 3

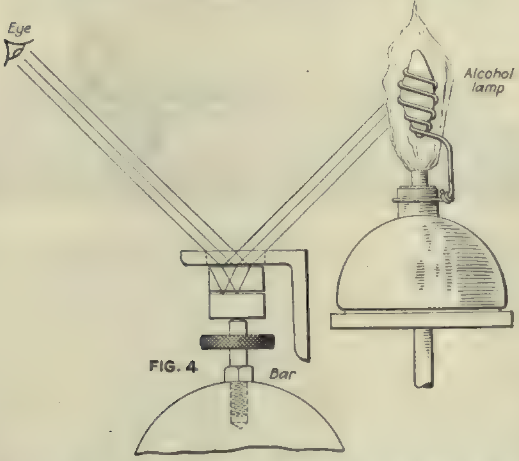


FIG. 4

FIG. 2. HOW THE TWO GLASS PLATES ARE HELD. FIG. 3. HOW LIGHT INTERFERENCE BANDS ARE PRODUCED BETWEEN TWO GLASS SURFACES IN NEAR CONTACT.

FIG. 4. THE DIRECTION THE MONOCHROMATIC LIGHT TAKES FROM THE ALCOHOL LAMP TO THE EYE

Getting More Out of Labor

By J. E. Bullard

Payrolls have gone steadily up, or at least the wage rate has, but production on the whole has gone down. The great question today is how to get more out of labor. There are as many answers to this question as there are employers. But none of the answers seems to be entirely correct. One man says shut down the plant until the men beg for work. Another says adopt some profit-sharing method. Some other man believes in scientific management, while still another thinks that giving the men a share in the management will solve the problem.

Talk with the men and get their point of view and we hear something like this: "Why should we produce all we can? These times aren't going to last forever and the more we produce the sooner we'll be out of work." Profit-sharing methods are often looked upon with suspicion. It is not an easy matter to convince a wage earner that scientific management is not just a scheme to drive the worker faster, get more out of him without paying him in proportion and discarding him as soon as he is worked out. Giving the men a share in management may work and it may not.

It is evident that there is no panacea. Each and every plan suggested has defects of its own. It may prove a success and again it may prove an absolute failure. There is always danger that only one side of the question will be considered or at least that too great an importance will be given to one side. In the past the labor question has not been of such vital importance. If a man didn't prove satisfactory it was an easy matter to fire him and replace him with someone else. The supply on the whole was as great or greater than the demand. People were continually flocking here from Europe, they were willing to work and in many cases at lower wages than men already on the job. From 1820 to 1919, 33,200,000 aliens entered this country, a number equal to about 22 per cent of our total population.

Shortage in Labor Ranks

The war, however, has changed all this. Our last census shows this to be the case. There are not so many people in the United States today as everyone thought there were before the census returns came in. There is scarcely a city that does not show a smaller population than it had thought it contained. The war did it. In every European country there was a great loss of life. A good part of this loss was confined to the laboring classes. A great many of our foreign born returned to their native countries during the war to join the colors. A great many more have returned since the end of the war to search for their friends and relatives. As a result it is estimated that the United States is now 4,000,000 men short.

Conditions in all the foreign countries are not such as to hold very great promise for the future. Labor conditions are more different there than they were before the war. The recent troubles in Italy show that fact very clearly. No longer is there promise that the United States will continue to be able to hold out the advantages in wages and labor conditions that it has in the past.

It seems to be a case of studying conditions and making the best of them. Shutting down the plant and waiting till the men beg for work will not solve the problem permanently. The time will come when it is necessary to start it up again. The same old fight will then be on. Neither the manufacturer nor the wage earner can afford to have the plant idle for any great length of time. In fact, with the present labor supply the wage earner may have the advantage. The man who owns the machinery and the plant can't afford to allow his investment to lie idle and he can't make it produce without labor but the laborer may be able to find something else to do. All the other methods also have their defects. In all cases the trouble lies in the fact that all factors are not considered. To a greater or less extent each system is something of a fad.

When high-speed tools were first introduced into the machine shop they were not always an unqualified success. They did not increase production to the extent that they were expected to increase it. They did not lower the cost to the extent that it was hoped they would. This was due to the fact that the new tools were used on old machines. The lathe or drill press designed for carbon-steel tools was not sturdy enough to stand up under the heavier cuts and greater speeds suitable to tungsten steel. It became necessary to redesign the whole machine. Today with new machines designed for the purpose, the new tool steels meet all expectations.

In much the same way a great many ideas put forth and adopted for increasing production fail of their purpose for the reason that they are tools that are all right in themselves but for which the organization is not adapted. We need a little more data on the actual reaction of labor, on the mental attitude of labor. Sufficient progress in production cannot be made until the man himself is studied.

It would have been a great mistake to have condemned high-speed tool steel simply because the old style machines were not adapted to its use. It is likewise unwise to condemn any system of securing better results from labor because the organization in the plant is not adapted to the new system.

To a very great extent failure in the working out of some new plan is due to overlooking some factor that has a vital bearing upon the success of that plan just as many a machine shop in the early days failed to give sufficient consideration to the fact that its machines were not strong enough for these tools. However, it is not a difficult matter to solve the labor problem if it is gone about in an intelligent and scientific manner. In the field of both electricity and mechanics much more difficult problems have been solved during the past thirty years. It is just a matter of getting at the actual facts and not being satisfied with mere opinion.

The scientist in the laboratory when carrying on experiments keeps the most detailed records of all that takes place and the conditions under which the experiments have been performed. If he did not do this he would never be able to duplicate them in such a way as to secure again a result that he has once found to be desirable. Every shop and factory is a laboratory in which labor may be studied. In some very desirable results have been secured but in nearly every case not sufficiently detailed records have been kept to make it possible to duplicate these results in another shop or factory. As a result the plan may be condemned. If a detailed record had been made of all the conditions and causes that led to the final results there would be no more difficulty in getting the same results from the same plan in two different plants than there is in duplicating parts in different factories. To duplicate parts it is necessary to have the metal of the same composition and the jigs and the gages the same. Should there happen to be any great degree of difference between the expansion of the metal used and the gages, it may be necessary to keep the temperatures the same.

Some of the things that have a direct influence upon the results secured from labor are temperature and humidity of the room in which the men or women work, lighting, cleanliness, purity of the air, safety precautions, facilities for securing good meals, attitude of the foremen, superintendents and men higher up, the continuity of work and the like. Far too often these, or at least some of them, are overlooked. A firm that is steadily growing and has a continuous market for its product constantly adds to its force. It never lays men off because there is lack of work. This firm may adopt some system that secures excellent results from labor. Some other firm with a seasonable demand adopts this system and finds it very disappointing. In fact, it may make matters worse instead of better. The reason is simple. The conditions are so different that the system could not be expected to work.

If a system really works well in one plant and is transferred to another, every condition of the first plant being conformed to, even to the point of view of the man at the top, the plan will have to work just as well in the second plant as in the first. It can't help doing so. Change a few of the conditions, however, and the chances of making it a success are about as great as fitting Packard parts into a Ford car. The results are sure to be rather disappointing. What is needed more than anything else today is a gathering together of more facts and a reduction of the propaganda on the part of both employers and employees. Until we actually get these facts we can't hope to make much progress in permanently bettering conditions.

The Fokker Commercial 'Plane

The first of the Fokker F-3 monoplanes, which has been christened the "Half Moon," after the tiny Dutch ship in which Hendrick Hudson came to this country and sailed up the Hudson River in the year 1609, has now carried over 700 passengers since its appearance at Hazelhurst Field on July 21.

Very successful demonstrations, during which hundreds of people were introduced to the delights of a real commercial aeroplane as a means of travel, were held at Washington, D. C., Hartford, Conn., and Camp Vail, New Jersey. Bert Acosta piloted the machine.

From the point of view of economical transportation, the Fokker machine is believed to have made a record, gasoline consumption during all this flying working out at an average of 8 gallons per hour.

The Netherlands Aircraft Manufacturing Co. believe that by interesting the public in aviation in this way and showing what modern commercial planes can do, they will pave the way for the establishment of air transportation as a recognized means of traffic in this country, as it already is in Europe.

A Substantial and Convenient Tool Storage Rack

Taking Care of Shop Tools and Heavy Fixtures—A Strong and Permanent Structure Built by the Men in the Shop—Keeping a Record of Tools Issued

SPECIAL CORRESPONDENCE

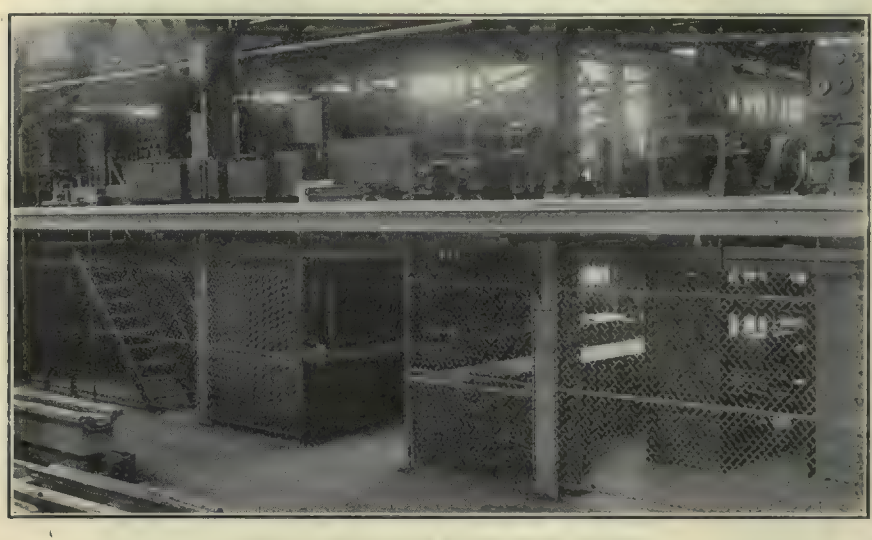


FIG. 1. STORAGE RACK FOR TOOLS

IN COMMON with many other shops, the end of the boom period found the Lodge & Shipley Machine Tool Co., Cincinnati, O., with an urgent need for tool storage facilities. Unlike some of the other shops, however, it did not put off the building of the racks but considered it as part of its preparation for the return of good business. After securing estimates which seemed abnormally high, it was finally decided to design and build a rack from standard shapes, and the results have been most gratifying both as to usefulness and cost.

As can be seen from the data on the different plans, very substantial angles and plates are used, the angles including 1¼ x 2 and 2½ x 3½ in. with ¼-in. metal, and there are channels and tees, as well as substantial plates, all of which go to make up a construction which will hold any ordinary load, and is not only convenient but presents an attractive appearance. It is quite probable that somewhat lighter material might have been used, but as it was desired to have this a substantial and permanent institution, it was decided to take no chances. The general appearance of the construction is shown in Fig. 1, which shows how the racks reach up to the beams in the side bay of the shop, and also how fixtures are stored on a projecting platform so that they may be easily picked up by the crane which travels in the central bay. A closer view of one of the racks is shown in Fig. 2, this view showing the counter over which the tools are given out. As can be seen, there is a large counter space so that a number of men may be served at the same time and avoid delay. The illustration gives something of an idea of the appearance of the racks after completion and also shows the drill gage at *A* by which the drills in the sections at *B* may be sorted, or the size verified without delay.

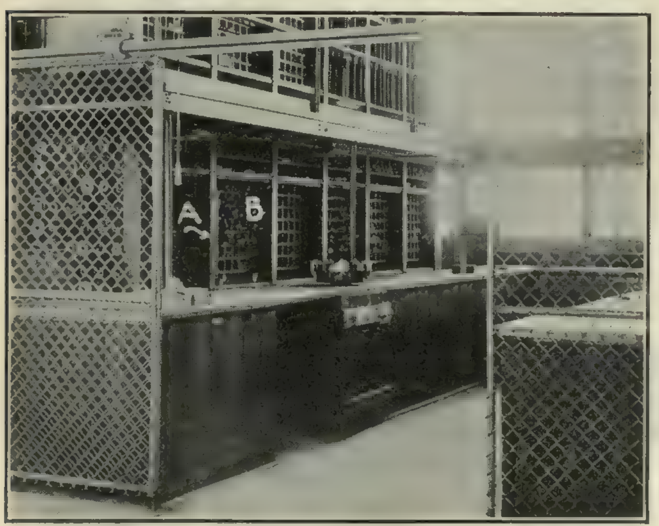


FIG. 2. THE DISTRIBUTING COUNTER

The general construction drawing, Fig. 3, shows the platform for heavy fixtures, which has already been referred to, at *A* and the stairs at *B* for reaching the upper section of the rack. These stairs are half hidden by the column *C* and are in reality of ample width, as can be seen in Fig. 1. In Fig. 3 is also shown the arrangement of shelves and pigeon holes, the dimensions of the latter being about 6 in. square.

A plan view of the tool storage department is shown in Fig. 4 and an elevation in Fig. 5, showing the shelf arrangement of the nine racks, the counters with their shelving and the platform above, which is reached by the stairway shown in previous illustrations. Figs. 4 and 5 give an excellent idea of the large storage capacity which has been secured, the total floor space occupied being approximately 30 x 70 ft.

Details of one of the racks are shown in Fig. 6, together with the kind and amount of material required. The total height is 14 ft. divided into two stories 7 ft. and 6 ft. 7 in. respectively. The racks are 3 ft. deep.

One of the features of the toolcrib is the use of the McCaskey register, located near the tool counter.

The names of all persons or firms borrowing tools from the tool-crib will be listed on the index leaf of the McCaskey register in alphabetical order and with each name will be a number. In the case of a Lodge & Shipley workman, the number will be his check number. An outside firm will have a register number assigned by the foreman of the toolcrib.

Each number has a space alloted to it in the register, the number being fastened to the spring clip, which holds the slips in place. The spaces are arranged in numerical order.

When tools are issued at the toolcrib, a tool register slip is made out in triplicate, one being shown in Fig. 7. These slips are used as follows:

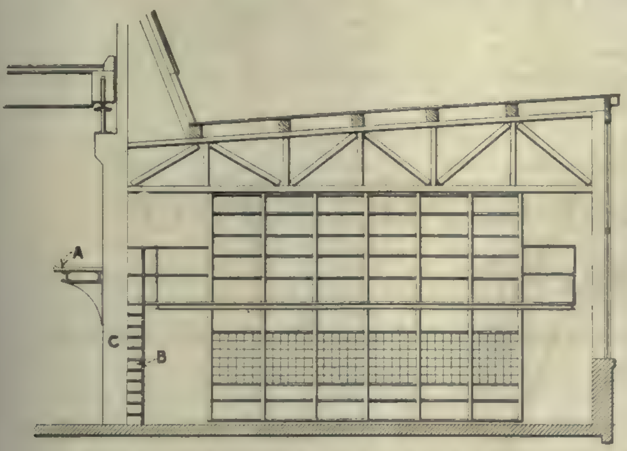
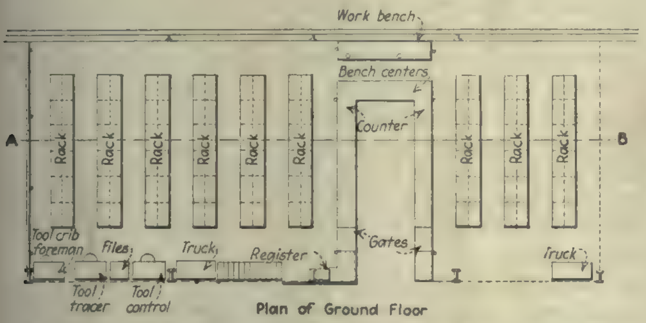


FIG. 3. ELEVATION OF STORAGE RACKS



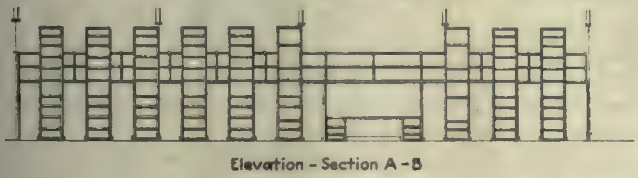
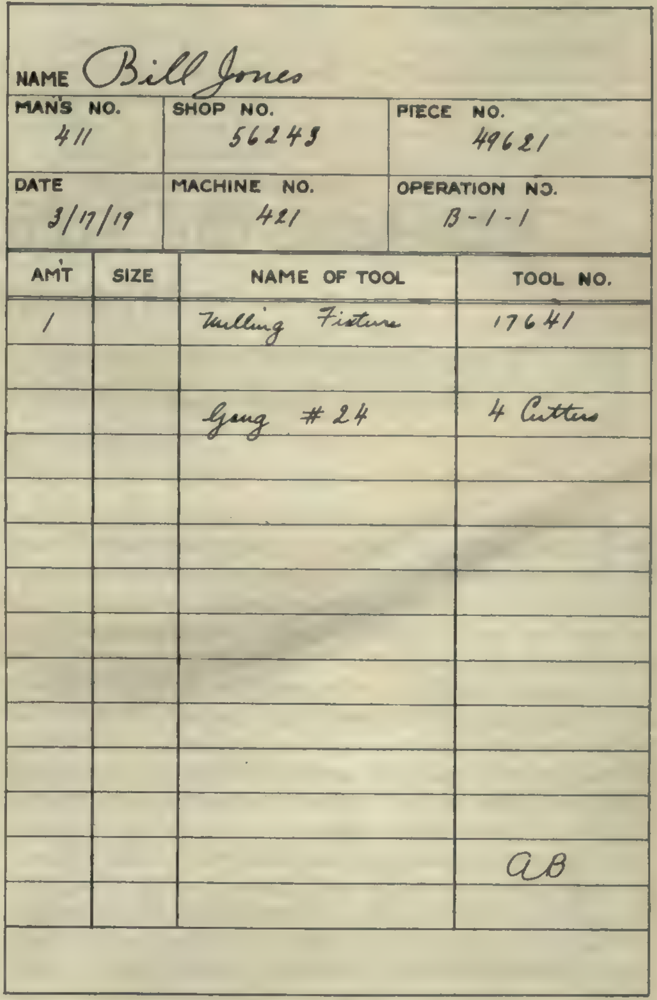


FIG. 4. PLAN OF RACK LAYOUT (ABOVE). FIG. 5. SIDE ELEVATION OF RACKS

When a tool is issued to a workman the original copy (pink) is given to the one to whom the tool is issued, the first carbon copy (yellow) is put in the register and the record carbon copy (manila card) is sent to the tool control desk for use in maintaining the tool inventory. When the tools are returned to the toolcrib, the first carbon (yellow) is taken from the register and sent to the tool control desk where it is used in maintaining the tool inventory; then it is destroyed. In order that the tool register slips may be of maximum use it is most important that the spaces calling for man's number, shop number, piece number, date, machine number and operation number be filled in as completely and clearly as possible.

When tools are issued for use outside the shop it is the duty of the toolcrib foreman to see that they are properly charged out and have them delivered to the purchasing department which takes care of delivering them to the person or firm to whom they are issued.



NAME *Bill Jones*

MAN'S NO. 411	SHOP NO. 56243	PIECE NO. 49621
DATE 3/17/19	MACHINE NO. 421	OPERATION NO. B-1-1

AMT	SIZE	NAME OF TOOL	TOOL NO.
1		Milling Fixture	17641
		Gang # 24	4 Cutters
			aB

FIG. 7. A TOOL REGISTER SLIP

It is the duty of the toolcrib foreman to look through the register at least once a week to find out which slips are two weeks or more old, and to check the tools to see that they are not lost or broken.

When a slip is checked up a record should be made on the slip: (1) Of the fact that it was checked; (2) by whom it was checked; (3) the date on which it was checked.

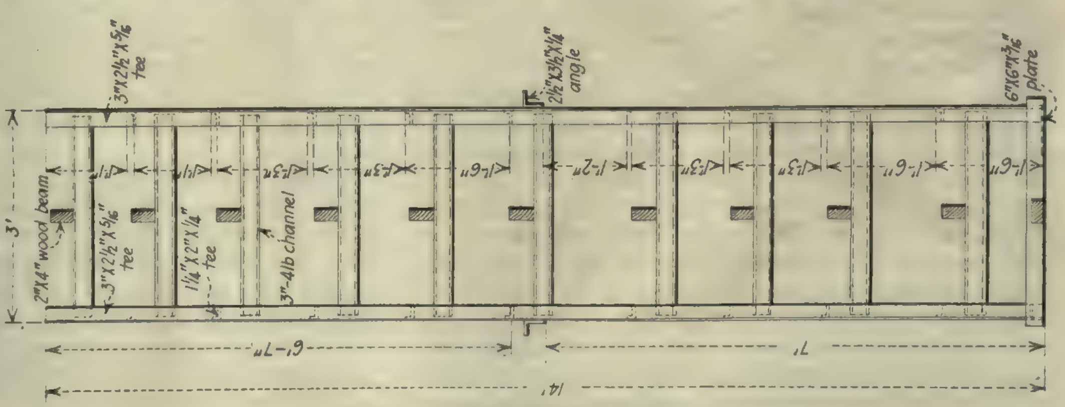


FIG. 6. CONSTRUCTION DETAILS

If, in checking up, the toolcrib foreman finds that tools are lost or broken, he gets a requisition for them from the foreman of the department in which they were lost or broken. If the tools need sharpening or repairing the toolcrib foreman takes the necessary steps to have them made right.

When a tool is broken, lost or misused the workman obtains a requisition from and signed by his foreman, on the toolcrib for a new tool. The toolcrib foreman passes these requisitions to the tool tracer at once for use in keeping up the tool inventory. When the tool tracer has finished with these requisitions he will keep them on file until the end of the month. At the end of each month the tool tracer prepares a report known as the "broken and wornout tool report" and sends it to the tool engineer.

When a workman leaves the employ of the company it is the duty of the toolcrib foreman to see that all tools loaned to him are returned before signing his tool release.

Checking the Accuracy of Micrometer Measurements

Close Measurements with the Micrometer—Possibilities of Error Due to Mechanical Defects—Micrometers Should Be Checked at Frequent Intervals

By ELLSWORTH SHELDON
New England Editor, *American Machinist*

HOW close can you measure with your micrometer, assuming that the micrometer itself is free from error? How sure are you of the accuracy of the tool, and that the measurements you get with it will conform to the standard set by the precision measuring machine?

We speak of tenths of thousandths today as lightly as the toolmaker of a generation ago would speak of "thirty-seconds," and we take our measurements to the fourth place of decimals as confidently as our elders would set their spring calipers to the nearest "sixty-fourth" on their steel scales.

But can we be sure that we are right? Are we certain that there is not the same proportionate departure from accuracy in our finer instruments as existed in the various "scales" that were once the basis of accurate measurement? Dare we assume that there will be no difference between the measurement that we get today from a given piece of work and one that we may take tomorrow or next week from the same piece and with the same micrometer?

By far the greater number of fine measurements taken in tool and gage shops are primarily dependent upon the micrometer; for, though measuring machines and precision gage blocks are of inestimable value upon such work, they are tools rather of reference than of determination, and a faulty micrometer may cause the hopeless spoilage of a piece of work long before the stage is reached where the more precise tools are applicable.

There are two principal causes for error in micrometer measurements; mechanical inaccuracy due to wear, abuse, incorrert adjustment, or faulty work in the original construction of the tool; and difference in "feel," or misreading, which is entirely a matter of temperament with the individual user. Error from the first cause may be practically eliminated by the exercise of proper care in selecting the tools and a rigid system of checking. The second cause will always remain, but its possibilities for error may be greatly reduced by the application of corrective, or rather counteractive, measures.

The solution of the problem of eliminating the variables in the tools themselves is the comparatively simple one of establishing a system of checking by which every micrometer is tested at frequent intervals with standard test pieces of known accuracy. This would not be a very difficult proposition for a shop that maintained a testing laboratory, while in the smaller shops, or shops without such equipment, the requirement might be met by supplying the workmen with test pieces and requiring them to state the condition of their micrometers at given periods to their foremen or to someone selected for his skill in the matter of making accurate measurements.

An experiment was recently conducted in one of our large Eastern tool shops for the purpose of determining the amount of variation that might reasonably be expected from the various causes, and of securing data upon which to base a system of checking that would meet all conditions and eliminate error and uncertainty as far as is humanly possible.

For the purpose of the experiment a new micrometer, previously tested for error in the measuring room of the factory where the most scientific methods of making accurate measurements are available, was taken into the shops along with several Pratt & Whitney "mikechecks" and presented to selected workmen in the machine, tool, gage, and grinding departments with the request that the mikechecks be measured.

The man who conducted the experiment was himself a toolmaker, well known and constantly associated with the men from whom the readings were asked, so that there could be no feeling of embarrassment upon the part of the men that might have existed had the test been conducted by a stranger or an official. The mikechecks chosen were in metric sizes while the readings were asked in tenths of thousandths of an inch, so that the men could not subconsciously make allowance for error because of knowing what size the pieces *ought* to be.

Besides taking the reading with the new micrometer carried by the investigator, each man was asked to measure each piece with his own micrometer to determine the amount of variation there might be between individually owned tools. All the readings were carefully noted and tabulated for comparison.

The result of the experiment showed, as might have been expected, that the principal source of error was to be found in the mechanical defects of individually owned micrometers. Many of the men, when confronted with the task of making a measurement involving "tenths" were frankly in doubt as to the dependability of their own tools, while others professed to know the amount and direction of error and would make mental compensation for it. Errors from this cause were found amounting to as much as one thousandth of an inch, while the greatest error due to personal "touch" when using the new micrometer was less than one-half of one-thousandth.

As might have been expected, the nearest approach to uniformity was found in the toolroom, where ability to make accurate measurements is one of the primary requisites. In this department the greatest variation in the readings taken by twenty men was 0.0001 in., or one ten-thousandth, when each man measured the mikechecks with the new micrometer. When each man used his own micrometer a variation of 0.0004 in. was recorded.

As the investigator carried with him the recorded findings of the measuring machine, giving the exact length of each mikecheck to six places of decimals, a glance at the figures would show how nearly each man's measurement corresponded to the correct one.

The majority of the men over-read; that is, their measurements exceeded the actual lengths of the pieces by amounts up to one-quarter of one-thousandth. A lesser number underestimated the lengths (the safer way on tool work, for then the pieces upon which you are working is really larger than you think it is) from one-quarter to three-quarters of one ten-thousandth.

The gage-making department, where an equal degree of skill in measuring is required, ran the toolroom a close second; but in this department, as well as in the grinding room, the under reading was slightly greater. In the machine room the variation was somewhat increased; both with the new tool and with individually owned micrometers; some of the latter showing errors as high as one-and-one-half thousandths.

PERIODIC CHECKING OF MICROMETERS

Though no definite system of checking has as yet been worked out it is the general opinion both in the shops and the engineering office of the company that every micrometer should be subjected to a uniform and periodic checking against known standards. Compensation for personal error—error due to a too light or too heavy "touch"—would be effected by having each man test and adjust his own micrometer; for if a man were to measure a piece of known dimension and adjust his micrometer to give the correct reading, he would try to secure the same "feel' upon other pieces that he did upon the test piece, and therefore the reading in each case would be correct. It would not do, however, under these circumstances to exchange, or "borrow," micrometers; for in such case readings obtained would show the relative personal error of user and owner.

An alternative method would be to have all micrometers, irrespective of ownership, tested and adjusted by one competent individual, and then try to teach all the men to acquire the same "touch," or sense of feel.

To make either test of real value, readings must be taken at frequent intervals over the entire length of the measuring screw instead of the usual method of testing at zero and again at full opening, for in this latter way a quite considerable error, due to the wear of the screw at intermediate points, might easily remain undetected.

Non-Productive Costs

By F. O. Wells

We have been hearing for a long time now the cry of "Prices must be reduced," and shop managers and production experts in the machine tool and kindred trades have been feverishly going through the shop costs with a fine tooth comb trying to find some way to bring them down to as near the absolute minimum as possible.

Efficiency engineers are all right in their way, but it is a fact that many of them in course of time become so obsessed with the idea of reducing everything to a detail that they lose their sense of perspective entirely.

Nearly every company at some time or other has been bitten and bitten badly by this "system-bug," and if the truth were known, many a promising firm has been systemized out of existence or gone into the hands of the receiver as a result. The writer knows of one factory where it was found that there was one official to every employee.

HOW TO OVERCOME LEAKAGE

In about seventy-five out of one hundred cases the secret of making price reductions to meet the present business conditions, lies not so much in reducing shop costs, as in reducing the cost of the red tape or non-productive expenses.

The nearer the modern machine shops can get to the simpler methods of the cotton mills, the better it will be for their business. Cotton mills are generally controlled by a treasurer and a superintendent, and the goods sold through a broker who handles the products of a number of mills. Why, a mill has to be of a certain capacity before it can attain the dignity of a superintendent of its own, and in some cases several mills are grouped together under one superintendent. As you will see the overhead is not top heavy with a multitude of high salaried officials and innumerable clerks, and the bulk of the money is invested in buildings, machinery and stock.

Of course the machine tool business cannot be conducted on quite such simple lines as this one product, but there are several ways by which much overhead time and money can be saved.

One way is in curtailing the practice of bringing out a new model every year. By this the writer does not mean that improvements are not to be made, but the heavy expense of new designs, patterns, jigs and fixtures is not justified except the improvement be a radical one.

Another economy which some firms do not yet realize is in confining the manufactured article to as few sizes as possible, and avoiding overlapping.

This brings us to another cost-saving idea of making a complete article in one department, the advantages of which procedure are numerous.

In cases where the different operations on an article or machine are scattered through about ten different departments, it means that ten foremen are needed with probably a clerk to each foreman. This means that each foreman is jealously watching out for his own department. He is not particularly interested in the other departments and so it follows that no two departments are alike in interest on account of the duplication of effort.

When an article is made in one department, which is in charge of a capable foreman who is solely responsible for everything from machining rough castings to assembled product, the following economies have been accomplished:

(1) Closer interest of employees in product as they can see it from start to finish.

(2) Increased sense of responsibility of each workman as he knows that on the accuracy of his work depends the proper assembling of the completed job, under his own foreman—not in some other department.

(3) Ease in locating and correcting faults in workmanship or in raw material, as goods in process are not stored away for six months, but are continuously worked on.

(4) Elimination of 90 per cent of inspection, as the men themselves are responsible to their own foreman and each other and work more on honor.

(5) Reduction of large amount of capital in stored goods in process—consequently quicker turnover.

(6) Cost kept by departments instead of on individuals, and eliminating a vast amount of unnecessary clerical work.

Have Confidence in Men

With regard to having confidence in your workmen and letting them know it, the writer knows by personal experience that by this method, confidence begets confidence, and when an employer has the confidence of his workmen, he has an asset worth a dozen efficiency systems in increasing production and reducing overhead costs.

Another thing is that even in the best regulated of machine shops mistakes will happen and while the delinquent workman should bear some of the blame, he should not carry it all. His position at the bench or machine tends to narrow his vision and he cannot be expected to see things in as broad a way as his employer, who has a chance of a wider outlook on things in general.

If present-day employers would remember that their place is to lead and work with their men, enlightening them on various phases of the business which will be of interest to them, they would find that there would be less necessity for employing driving methods to increase production and lessen overhead charges.

One of the most common faults that inventors and manufacturers have, is to hold to the idea of getting the highest price possible for their article and then to spend large sums of money in selling campaigns to get the article over, whereas a better method is to sell at as low a figure as possible, and increase efforts to manufacture more economically, thus giving larger production and quicker turnover, as the low price helps the goods to reduce selling expense by selling themselves.

This method of low price, fast sales and quick returns is well illustrated by Ford, and in a different way by Woolworth's chain stores.

One method of turning the searchlight on the nonproductive costs of overhead or fixed charges, as the writer prefers to call them, is to see that every possible charge should be entered direct and not lumped together, and also entered in such a way as to be intelligible. Some of the cost sheets made out by these efficiency experts are so weird and wonderful that even our statistical friend Babson would be at a loss to interpret them.

While on the subject of fixed charges it would be well to impress upon employers the wisdom of explaining to the men the reason for applying the fixed charges to the actual shop cost and what they consist of. The employee will then see the necessity for economy in the use of tools, waste, lights, etc., and if the costs are figured by departments as previously recommended, one department can compete with others in friendly rivalry to keep down the fixed charges.

Relative to this subject of waste on the part of employees, we might remind the employers to be very cautious not to give the workmen just cause to criticize the management for wild extravagance, either in the business or in the personnel of the executive. There is nothing that will upset the morale of the workmen more than this, and they will immediately remark, "Aw, what's the use of my working my fool head off and avoiding waste, when those higher up are squandering money right and left in other ways."

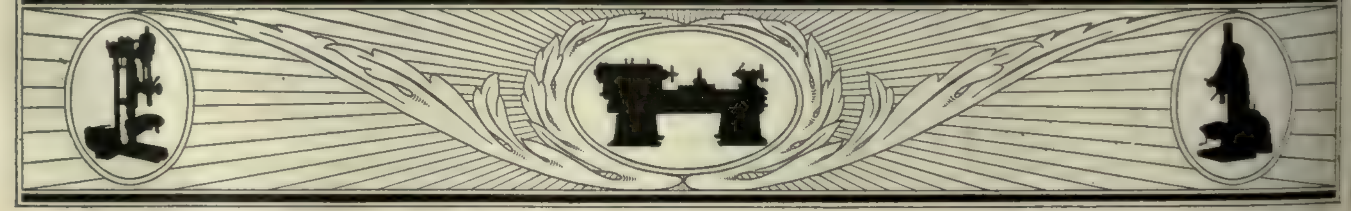
While American manufacturers on the whole are ahead of their European rivals on account of the American habit of specializing in small lines and large sales organizations, as compared with the European idea of a large line and small sales force, yet they will do well not to forget some of the old-fashioned principles of human relationship between master and man, as the further the employer recedes from it, the costlier it becomes to keep up production, and the nearer he approaches the blight of labor troubles.

We are always hearing a lot of talk about vocational tuition for employees being a splendid incentive to increased production, and so it is—but why not try vocational tuition for executives also.

In conclusion the following suggestions for true economy might be summarized:

1. Cut out elaborate cost systems.
2. Analyze fixed charges intelligently.
3. Specialize on few lines, models and sizes.
4. Complete each article in one department—keeping goods moving.
5. Cut out 90 per cent of inspection—establish honor system.
6. Keep price as low as possible—quicken sales.
7. Cultivate friendship and confidence of employees —be human.

If more of the perplexed manufacturers of machine tools and kindred lines, who are struggling in the throes of the present readjustment, will follow on the lines laid down in this article, there will be less need for drastic wage reductions and the consequent friction with the employees, which seems to be the first thought when contemplating a lowering of selling prices to get much-needed business, and the result will be more economical.



Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

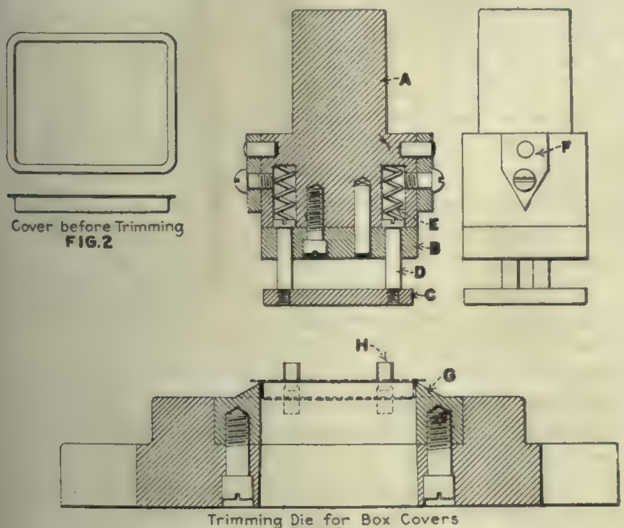
Press Tools for Trimming a Box Cover

By S. A. McDonald

The tools illustrated in Fig. 1 are for trimming the box cover shown in Fig. 2.

Their construction is as follows: *A* is a machine steel punch holder to which is secured, by screws and dowels, the tool-steel hardened trimming plate *B;* a pressure and locating plate *C* is attached to the punch by the screws *D,* which are held in the down position by the springs *E;* on the side of the punch are fastened, by means of screws and dowels, two hardened steel scrap cutters *F;* the trimming die *G* is of tool steel, toughened so that it will not wear quickly, yet soft enough that it can be upset and sheared by the punch to retain its size. It is a snug fit in the cast-iron die shoe, and is secured in place by the screws as shown.

The operation is as follows: The cover slides down a chute (not shown) and falls on the die where it rests on the trimming edge; two pins *H* prevent the cover from sliding over the die. When the punch descends, the pressure pad locates the cover in the die, and as the punch continues downward, the springs are compressed until the trimming edge shears off the flange, then the pressure pad forces the cover through the die so that it falls into a box below. The flanges sheared off stay on the punch until a sufficient number of them accumulate to fill the space between the shearing cutters *F* and the top of the die. Then as more covers are trimmed the flanges are compressed until the scrap cutters cut through the top ones. The wedge shape of the cutters spreads the scrap so that it falls off the punch. As the press is inclined about 45 deg., the scrap does not fall on the die but is caught in a chute that leads to a scrap box behind the press.



Cover before Trimming
FIG. 2

Trimming Die for Box Covers
FIG. 1

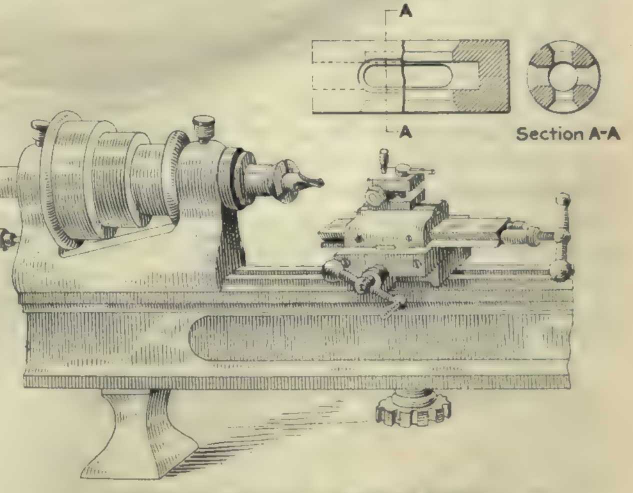
FIG. 1. THE TRIMMING TOOLS. FIG. 2. BOX COVER TO BE TRIMMED

A Center Drill Used as a Cotter Drill or End Mill

By G. G. Little

We had several hundred pieces as shown at *A* in the sketch, to be made of brass. Brass rod $\frac{5}{16}$ in. in diameter was the stock used, and each piece had to have a hole drilled longitudinally through its center from one end, passing to within $\frac{1}{8}$ in. of the other end. This left a closed end tube with walls $\frac{3}{32}$ in. thick.

At four places equidistantly spaced the walls were pierced with slots $\frac{3}{32}$ in. wide by $\frac{3}{8}$ in. long and the corners of these slots were rounded on the outer surface of the tubes. At first all parts made were drilled in a jig and hand finished with file and scraper requiring 40 to 45 minutes each. Owing to the number required for this order, a quicker means of slotting the pieces was sought.



SLOTTING WITH A CENTER DRILL

Punching was out of the question; our milling machine was too slow and not sufficiently sensitive; the drilling machines were not adaptable to the purpose. As a last resort a 6-in. bench lathe was fitted with a block on the cross-slide in place of the toolpost.

The block was of cold-rolled steel shaped into a jig for securing the pieces one at a time, in such a manner that they could be fed up to a center drill held in a draw-in collet; this feed or movement causing the drill to bore its way into the hole in the center of the piece.

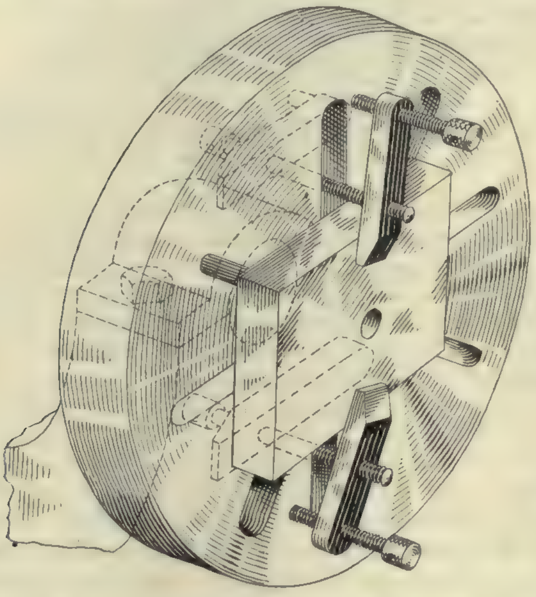
The piece was then fed farther in till the lips of the countersink served to chamfer the corner as the piece was fed across to make the slot. Suitable stops were arranged to limit the movement which saved time in handling the work.

The center drill being two-lipped is adaptable to work of this kind, and if properly stoned for cutting relief will withstand considerable crowding of the work. I milled many of these small slots at 15 sec. per slot (1 min. per piece including changing to next piece ready to cut). One center drill outlasted the entire job.

Handy Use of Parallel Clamps

By H. Willey

Recently the *American Machinist* published several kinks showing the handy uses of a pair of parallel clamps. I am submitting another way in which I have utilized my clamps for holding die work on the faceplate. The sketch seems almost self-explanatory. One jaw of the clamp, the one with the clearance hole for the clamp screw, is used in back of the faceplate. The other jaw acts as the strap on the work. It, of course, is set off at an angle from the slot in the plate to permit the screw being used. The arrangement permits quite an adjustment for different thicknesses of work and does not require any bolts, washers or blocking.

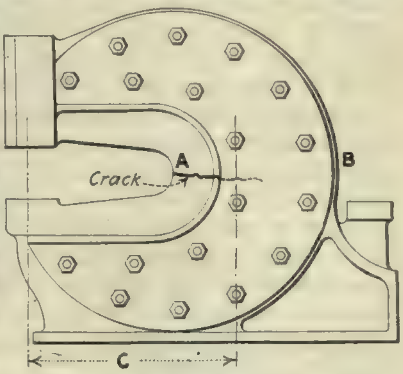


USING TWO PARALLEL-JAW CLAMPS TO HOLD WORK ON FACEPLATE

Repairing a Broken Shearing Machine Frame

By John S. Watts

Some time ago the frame of our shearing machine was cracked by accident, as indicated in the sketch accompanying this article. While it is the fashion to repair such breaks by one or other of the welding processes, I decided that in this case, at least, a stronger job could be made by patching, at a lower cost, and with the further advantage of absolute dependability. Having two circular plates in stock $\frac{3}{4}$ in. thick, of flange quality, we cut an opening in each, and flanged them to fit over the throat of the shear frame, as shown in the sketch. The plates were then fastened to the shear frame by studs, and to insure that the plates would prevent any opening of the crack when the load was on, the stud holes were carefully drilled so that each stud was a tight fit in its hole. This was accomplished by drilling the plates in place on the frame, running the tapping drill right through both plate and frame, and then removing the plate and running a full size drill through the holes already drilled out to tapping size.



REPAIRING A BROKEN SHEAR FRAME

The reason for flanging the plates around the throat opening was to get a sufficient sectional area of plate to resist the bending moment. The area of steel required was determined by calculating the stress by the beam formula. The bending moment at section *A B* will be equal to the load on the shear knives, multiplied by its distance from the neutral axis of the plate section *C*, the section modulus of the plate being *Z*, and taking f = safe stress, say 15,000 lb. per square inch, we have

$$Zf = LC$$

$$Z = \frac{LC}{f}$$

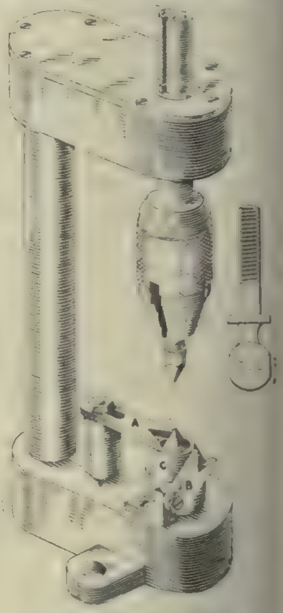
Double Countersinking Fixture

By R. Grant

Some years ago when work was plenty, large quantities of small brass knobs were coming off the automatic screw machines and piling up in the drilling department. Where a hole was to be drilled through the ball at right-angles to the axis and then both sides countersunk deeply to allow a ring to turn freely in the knob. An example of the work is shown in the cut.

The drilling had for years been done in jigs which were slow and unsatisfactory at best, but this condition had been changed by the development of universal compressed air drill jigs that have been described at various times in the *American Machinist*, so that the countersinking could not keep pace and required attention. The fixture shown in the illustration was the result.

The fixture body is cast iron about a foot high and remains permanently clamped to the table of a light, sensitive drill press. The drill press spindle passes through a hardened and ground quill gear in the upper part of the fixture and, by means of a vertical gear shaft and lower gears, drives the lower countersink.



FIXTURE FOR COUNTERSINKING BOTH SIDES AT ONCE

The slotted and notched bar *A* at the rear serves as a stop to locate the work centrally; the adjustable stop *B* in front prevents the work from turning with the cutters, and the vertically adjustable sleeve *C* inside of which the lower countersink revolves, determines the depth of cut for this tool. The depth of the upper countersink is regulated by the stop on the spindle quill.

We kept the lower countersink a little sharper than the upper one so as to insure the work being carried down onto the lower stop before the upper tool should have cut to depth. To leave both hands of the operator free to handle the work, we replaced the usual feed lever with a treadle.

EDITORIALS

Hits—One Hundred per Cent

LAST week we commented on the possibilities inherent in the bombing tests on the old "Alabama" and tried to point out the effects on future warfare. The Alabama has gone to her grave, but in the going she left behind evidence worth far more than her cost.

As reported by the press the final ærial attack with demolition bombs resulted in one hundred per cent of hits, the first "egg" dropping at the foot of the mainmast and turning the doomed ship over on her side. The other bombs fell either on the target or within thirty feet, close enough to cause serious damage by reason of the tamping effect of the water.

Successful as this part of the test was, its significance is dwarfed by the achievements of the preliminary tests with poisonous gas and liquid fire. Even though very dilute gases of the least dangerous type were used, it was clearly shown that it is entirely within the range of probability to annihilate the entire personnel of a ship with ease in this way. One or two small smoke bombs dropped by fast pursuit planes which are almost impossible to hit by anti-aircraft fire would render the target helpless to stop the attack of the heavier, slower bombers. Then either demolition bombs or the more deadly of the modern gases would finish the job.

It may seem that we have devoted an undue amount of space to this particular set of tests, but we feel that it has been justified in view of the probable effect on American industry of the information thus brought to light. Plants building warships will look forward to a less promising future but builders of airplanes and engines should be encouraged. The stimulus to aviation in general, in which the commercial branch will share with the military, will be a factor of prime importance in our national advancement. All in all, we look for important developments to come from the passing of the "Alabama."

The Department of Commerce Survey of Current Business

THE Department of Commerce is certainly to be congratulated on its new monthly supplement to "Commerce Reports" known as the *Survey of Current Business*. We heartily recommend those of our readers who have not seen one of these bulletins to write for sample copies to the Superintendent of Documents at Washington.

The August issue contains seventy-three statistical tables and a four-page summary. Many of the tables are supplemented by small graphs showing relations between quantities, values or index numbers depending upon the commodity. So far as we can determine, every primary statistical record of any importance which is readily available within a reasonable period has been included, from the cost of living to the foreign trade record of the United Kingdom. Figures that would take hours of digging to get together if everyone had to assemble them for himself are placed side by side so that they can readily be compared.

Big business is used to reading such statistics and to making its plans on the general trends indicated by them. It should welcome this convenient form of displaying them.

The little business man should benefit even more for he now gets in one booklet at a nominal price all the statistics he can use and which he could not afford otherwise. His job is to so educate himself that he can read them as readily as his big brother, and grow in business stature himself.

Exchanging Engineers and Their Experience

IT IS a common practice in colleges to exchange professors occasionally, or at stated periods, and with good results. It has been suggested that something of the kind might be a good thing if applied to engineers in various branches; that the information which each could impart to the different industries would be of great value when business again approaches normal.

Electric motor builders, for example, have engineers who have specialized on the various problems of applying motors to machine tools and to machinery of all kinds. This is a matter which interests every progressive builder of machinery. Positive, up-to-date knowledge on motors and motor drives enables the builder to design his machinery to better advantage and frequietly, to save money in the motor mountings or even in the motor itself.

The electric motor builders, in common with all the rest of us, are not burdened with orders at the present time. Their engineers are not busy and yet they do not want to lose the years of experience and training which they represent. They would doubtless be very glad to release some of them temporarily to act as advisers on motor drives to machine builders.

The electric motor builders on the other hand are large users of machine tools and it is hardly to be expected that they are using them all to the best advantage. Some of the experts in machine production could doubtless give much valuable advice as to the best machining methods and put the builders of electrical machinery into position to manufacture more economically when the time comes.

The same sort of exchanging might well be done in other lines to equally good advantage, and on some mutually satisfactory basis.

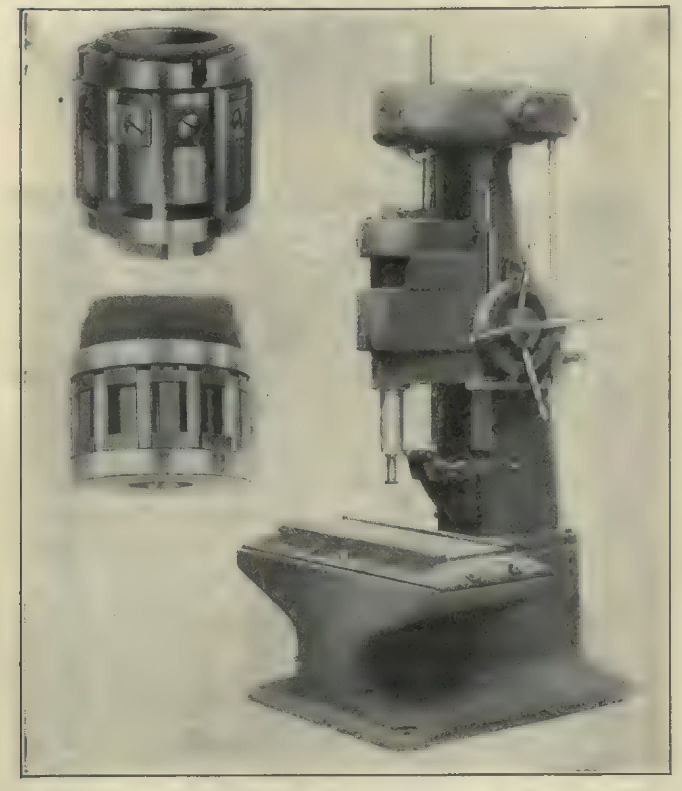
This exchanging of men does not, of course, reduce the expense in any way. But it does secure a decided advantage over the usual plan of retaining them until business returns. With the exchange suggested, the salaries paid become a direct investment in special engineering information and in better machining methods; an investment which can be cashed as soon as the bank (of trade) opens.

The plan has been proposed by one of our keen engineering friends and is worthy of careful consideration. It is not a one-sided proposition—nothing worth while ever is. But it is one which can be pondered to advantage and it is not a very large ball to start a-rolling.

Shop Equipment News

Foote-Burt Combination Ford and Fordson Cylinder Reboring Machine

The Foote-Burt Co., Cleveland, Ohio, has recently adapted its No. 2 Ford cylinder reboring machine to the handling of the cylinders of Fordson tractors. The accompanying illustration shows the combination machine, which is of the single-spindle type and intended for heavy duty. The machine was designed in co-operation with the engineers of the Ford Motor Co., it is said, so as to fit it for the use for which it is intended.



FOOTE-BURT NO. 2 CYLINDER REBORING MACHINE

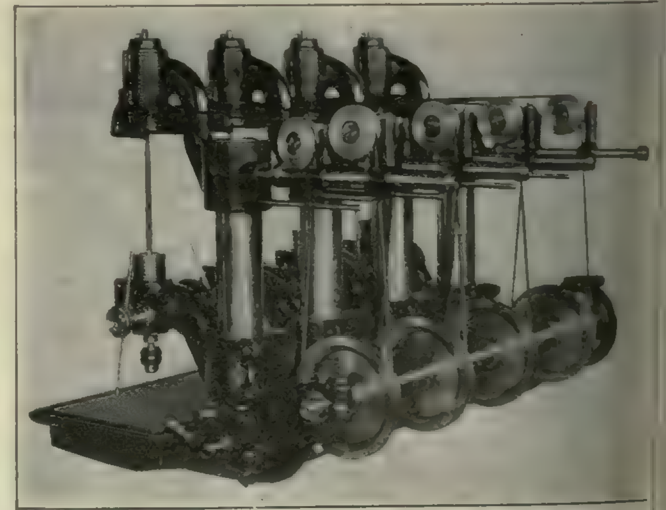
Quick-acting clamps are provided to hold the cylinder block in place while the reboring is being performed. An adapter plate is furnished to permit of the holding of both styles of cylinder blocks. The spindle runs in bronze bearings, the lower bearing being tapered to provide for adjustment, and a ball thrust bearing is used. The spindle is driven through a hardened steel worm and a bronze worm gear, the final drive being through double-pitch spur gears. This driving mechanism is enclosed in an oil bath in the housing of the head. To provide the feed for the cut, the entire head slides on the column, having a vertical travel of 16 in. and being counterweighted. It is stated that there is no necessity for the use of a pilot on the lower end of the boring bar. The machine is driven by belt on a pulley at the top of the head. Only one speed and one feed are provided, these being chosen to suit the type of work to which the machine is adapted. The pulley runs at a speed of 475 r.p.m., the spindle at 28 r.p.m., and the feed is 0.065 in. per revolution. An automatic stop is provided, and a quick-return is obtained by means of a hand lever.

As shown by the insert in the illustration, the cutter used is of the adjustable-size, ten-blade type. It is stated that it can be operated at high speed without producing chatter marks, even though hard spots be encountered in the cylinder bore. The burnishing tool used is stated to give a very good finish to the inside of the bore. The rollers are so mounted that their positions are adjustable. On the down stroke of the spindle they take an angle of approximately 3 deg., which gives the feed for the stroke. After the limit of the cut has been reached, the positions of the rollers are reversed by feeding the spindle upward with the handwheel, so that the angle is 3 deg. in the opposite direction. The feed for the up stroke then continues automatically. The machine has a floor space of 44 by 43⅝ in., and an over-all height of 98¾ inches.

Henry & Wright Class-O Bench Drilling Machine

The illustration shows a high-speed drilling machine recently placed on the market by Henry & Wright, Hartford, Conn., and intended for driving 13/64-in. drills to their full capacity. The machine is equipped throughout with ball bearings of standard design, and careful attention is said to be given by the maker to the proper alignment and adjustment of all parts, to insure smooth running at the maximum speed of 12,000 r.p.m.

Two-step pulleys on the spindle and rear shaft provide for four changes of speed. Belt tension is maintained through the medium of spring-loaded idler pulleys, which are capable of adjustment to give the proper tension in accordance with the size of the drill in use. The driving belt used is round and ¼ in. in diameter. The rear shaft is provided with tight and loose pulleys and a belt shifter that is easily accessible to the operator without changing his position. It is driven from the



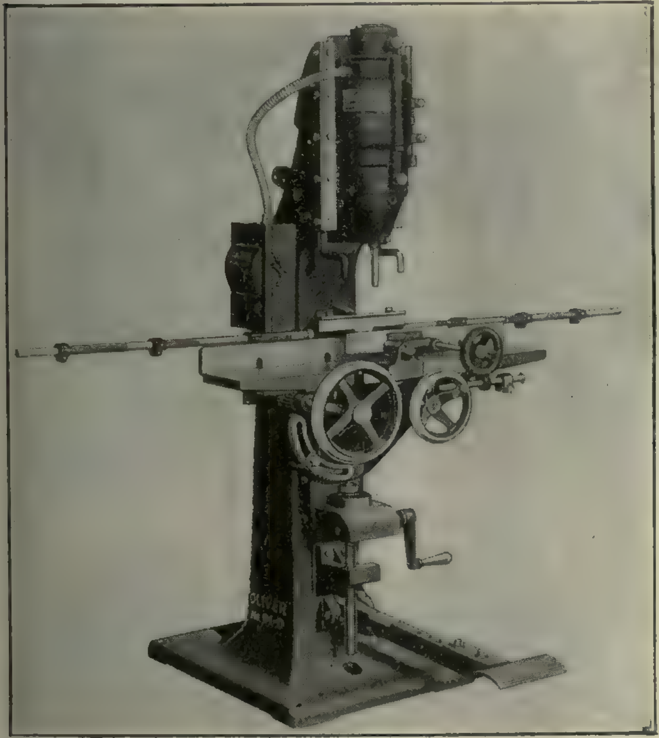
HENRY & WRIGHT HIGH-SPEED BENCH DRILLING MACHINE main lineshaft or countershaft by a 1-in. flat belt, and is intended to run at a speed of 2,820 r.p.m.

The weight of the spindle is over-balanced by a short coil spring on the pinion shaft, thus providing for a quick return and serving in a large measure to overcome the breakage of drills when "breaking through" the work. The lower arm has a vertical adjustment of 6¾ in. on the column, and the rack and pinion feed movement has a range of 2½ in. The distance from the table to the nose of the chuck ranges from 0 to 7⅞ inches.

The machine is ordinarily built with four spindles, but a greater or lesser number may be provided. The spindles are 7 in. apart and the distance from each column to the center of its spindle is 5¼ in. The working surface of the table of the four-spindle machine is 8x29 in.; bench space occupied, 26¼x33 in.; height 22¾ in.; and weight 345 lb. Though designed primarily as a bench machine, it may be placed on a pedestal if desired.

Oliver Motor-on-Spindle Vertical Hollow-Chisel Mortising Machine

The accompanying illustration shows a vertical-spindle, hollow-chisel mortising machine recently placed on the market by the Oliver Machinery Co., Grand Rapids, Mich. The principal feature of the device to which the maker calls attention is the fact that the motor is mounted directly on the spindle of the machine, being enclosed in the same housing with the spindle and the mechanism of the head.

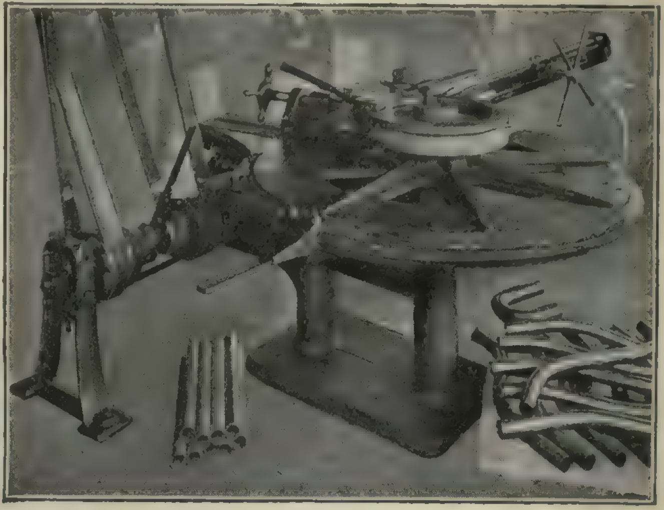

OLIVER MOTOR-ON-SPINDLE MORTISING MACHINE

The motor operates on either two- or three-phase, 60-cycle alternating current at a speed of 3,600 r.p.m. It is called a shaftless motor, because the rotor is mounted directly on the machine spindle, which runs in ball bearings. The position of the motor eliminates the use of countershaft, pulleys and belts, and it also saves floor space. Since it is self-contained, the machine may be given any position in the shop desired, regardless of the position of the line shafting. The maker claims that the drive is very economical in the consumption of power.

An enclosed starting switch with fuses is mounted on the machine and connected by a flexible conduit to the motor. The machine is equipped with a compound table having a feed operated by a handwheel through a rack and pinion and provided with a clamp for the work. The necessary bushings, wrenches and other equipment are provided.

Wallace No. 5-B Pipe-Bending Machine

The Wallace Supplies Manufacturing Co., 420 Orleans St., Chicago, Ill., has recently placed on the market the type of pipe-bending machine shown in the illustration. The machine is known as the No. 5-B, being adapted especially to the bending of pipe and tubing. It is very similar in design to the No. 5-A machine previously described in the *American Machinist* on page 87, Vol. 53. The machine is known as the No. 5-C when equipped with dies for the bending of angles, channels, tees and other structural shapes.


WALLACE NO. 5-B PIPE-BENDING MACHINE

One of the features of the machine is the hand-operated device for the quick insertion and removal of the mandrel which supports the walls of the tubing from the inside during the process of bending. This mechanism can be seen in the rear in the illustration. The samples of work shown in the foreground are lock-seamed tubes of 0.028 gage steel. The seams are prevented from opening up during bending by supporting the outside wall of the tube by means of the follower bar, which exactly fits the tube on one side. The other half of the circumference is supported by the grooved forming head or die. The walls are supported on the inside by the mandrel, which remains stationary while the tube slips over and away from it as it is bent around the forming head to which it is clamped.

Forming dies or heads up to 50 in. in diameter may be set into the machine. An adjustable bracket having two rolls supports the outside follower bar, and it may be moved back and forth to suit the size of the form. When bending tubing heavier than $\frac{1}{16}$ in. wall thickness, the mandrel for supporting the tube from the inside may be dispensed with, and the forming done by means of the outside follower bar only. Short-radius bends may be made in ordinary iron pipe, such as the piping for refrigeration or steam coils.

The machine can be belted directly to the line shaft, no countershaft being required. It is equipped with friction clutch pulleys, operated by means of a lever to provide both forward and reverse movement. Two movable stops are provided on the edge of the rotating table, so as to automatically disengage the clutch at the end of the bending operation, and again when the machine has been reversed and returns to its starting position. The machine requires a floor space of about 52 x 66 in. It weighs approximately 1,200 pounds.

Ingersoll-Rand "Imperial Type-XCB" Air Compressor

The illustration shows an air compressor recently placed on the market by the Ingersoll-Rand Co., 11 Broadway, New York, N. Y. The machine is known as the "Imperial Type-XCB" and is belt driven. The principal features to which the maker calls attention are the plate valves for both the air intake and discharge, and the 5-step clearance control for regulating the output.

The method of clearance control has been used in the past on large direct-connected, electric-motor-driven compressors manufactured by the concern, and is said to secure very efficient operation at partial loads. It is especially advantageous for use in installations where the demand varies greatly throughout the day. The compressor is automatically loaded and unloaded in five successive steps through the reduction of or the addition to the clearance space of the air cylinders. The machine can operate at either full, ¾, ½, ¼ or no load, it being stated that at any one step the reduction in the input power is practically proportional to the reduction in the output.

The entire control is automatic, so that if the demand falls off, the machine automatically drops to a lower load point until the demand for air increases. It then automatically assumes the load in the successive steps. The process is controlled by the variation in the receiver pressure. The clearance pockets are integral with the compressor cylinders and the entire regulation is obtained by the control of the volume of air taken in and compressed. With the compressor operating at partial capacity, a portion of the air is compressed into the added clearance space instead of passing through the discharge valves. On the return stroke this air expands, giving up its stored energy to the pistons, so that the power input can be kept proportional to the output.

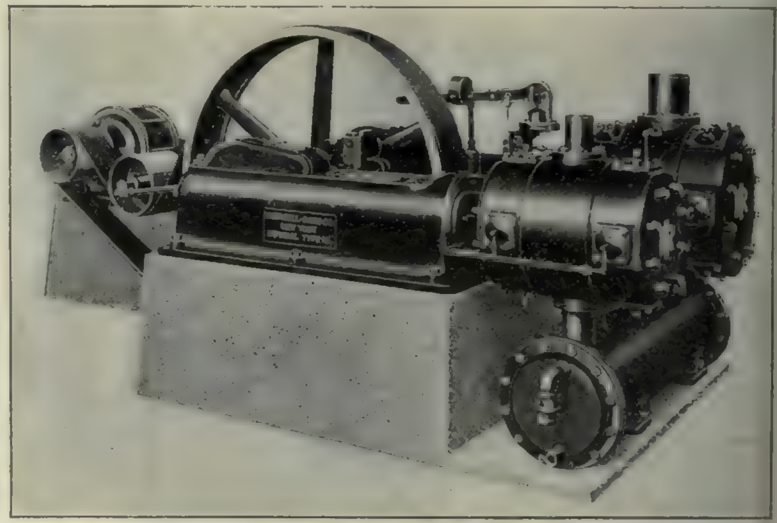
The inlet valves remain closed on the return stroke until the cylinder pressure equals the intake pressure, at which point the inlet valves are automatically opened and free air is taken into the cylinder for the remainder of the stroke. On the two-stage compressor, clearance space is added for both the high and the low pressure cylinders to give a constant ratio of compression. A maximum demand stop is provided, to prevent the compressor from being operated at any higher maximum load than desired, since the stop can be set for any amount of load desired.

The machine can be furnished single-stage for low pressures and two-stage for higher discharge pressures. The piston displacement capacity for 100 lb. discharge pressure measures from 610 to 1.505 cu.ft. of free air per minute. The stroke of the machine shown is 12 in., the cylinder diameters being 9¼ and 12 in. The compressor can be furnished with a short-belt driving attachment employing a floating idler. By this means the length of the belt and the floor space required can be decreased, while permitting of a greater arc of belt contact.

Marquette Even-Pressure Spring Cushion

The view at the left of the illustration shows the even-pressure spring cushion recently brought out by the Marquette Tool and Manufacturing Co., 319 W. Ohio St., Chicago, Ill., for giving a uniform pressure during the entire length of the stroke when drawing a shell on a punch press. With this device, it is said, sufficient pressure is obtained at the beginning of the draw to eliminate the wrinkling of the metal and the unnecessary wear on the dies resulting therefrom; and this pressure is maintained uniformly throughout the drawing of the shell, thus avoiding the straining of the metal to the breaking point toward the end of the stroke.

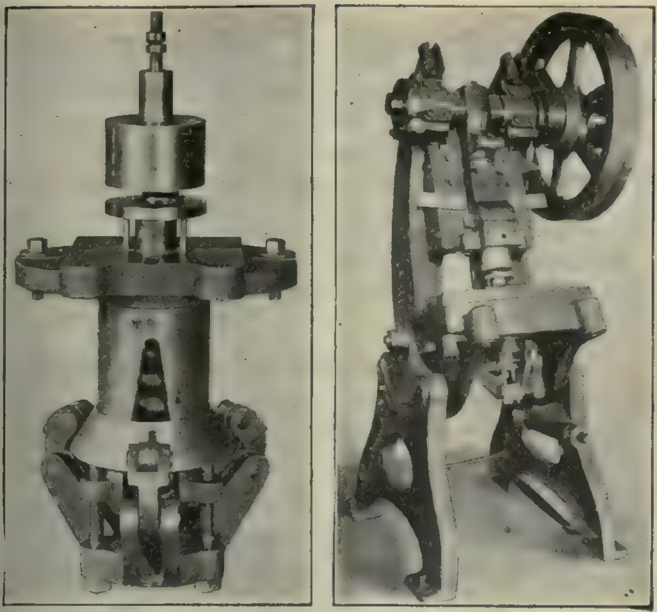
By doing away with the increased pressure toward the bottom of the stroke, back-lash of the press is eliminated, it is claimed, which avoids the hammering against the clutch of the press that frequently results from the use of ordinary coil springs in connection with drawing dies. Also the metal is not stretched so much and more even edges on the shell are the result. In many cases, the edge is said to come straight enough to eliminate the trimming operation entirely, and consequently permit a smaller blank to be used.



INGERSOLL-RAND "IMPERIAL TYPE-XCB" AIR COMPRESSOR

The cushion is so constructed that the adjustment is left undisturbed when the attachment is removed from the press, which saves time when again setting the dies. The device is made entirely of steel. It is attached to the press by means of a single bolt which screws into the bolster plate, or in the die itself, in the same manner as rubber bumpers or coil springs are fastened. No special drilling of the press or bolster is required and the device will fit in any ordinary drawing die. On the right of the illustration the cushion is shown in place on a press. The attachment takes up very little room under the bed of the press, so that it is not in the way of the operator when he is operating the press in a sitting position.

When operating, the punch in descending on the blank forms the shell over the center-block. The die-pins



MARQUETTE EVEN-PRESSURE SPRING CUSHION

resting on the pinplate force the spring housing down, compressing the spring against the spring washer carried by the lower ends of the equalizing levers. When the spring housing descends, it carries along with it the adjusting screws, which allow the equalizing cam to descend by yielding to the pressure of the rollers at the upper ends of the equalizing levers. The angle on the cam, causing the equalizing levers to rotate about their journals and permitting the spring washer to descend, allows on a long draw only a slight compression of the spring. On a 1½-in. draw the compression of the spring is ⅝ in. During the return stroke, the same actions take place in inverted steps, preventing the hammering on the back stroke.

It is stated that in many cases where two or more drawing operations were formerly used, the attachment enables the performing of the job in one operation. The cushion is of special value in drawing lithographed metal, eliminating scratching of designs.

"Brute" Heavy-Duty Trailer

The Sharon Pressed Steel Co., Sharon, Pa., has recently added to its line the heavy-duty trailer shown in the illustration. The trailer can be pulled by an industrial tractor or motor truck. It is intended for carrying heavy loads, and it is said that it will not tip even though heavily loaded at only one end.

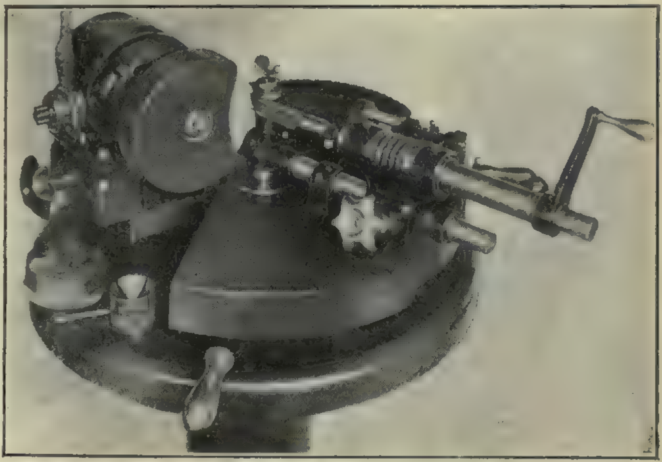
BRUTE HEAVY-DUTY TRAILER

The frame is made of pressed steel, the outer members being 4⅜-in. channels of ⅛-in. steel. It can be made to any length up to 72 in. and width up to 50 in. The side rails fit into a pressed-steel corner channel, which has a 6-in. radius with a hole in the top flange for a stake pocket. The two cross members running lengthwise are made of 3-in. channels, as are the rear wheels and front caster supports.

The rear wheel bracket is a stamping of ¼-in. steel. The rear wheels are made of malleable iron, and have six double-web spokes, 3½-in. face, 3-in. Hyatt roller bearings and a 1-in. hardened and ground shaft. The front casters are bolted to pressed-steel stampings, which are riveted to the side rails and two front cross members. They are equipped with ball and roller bearings. The top is of 1¾-in. seasoned oak, with the edges placed under the side and end rails. The truck can be equipped with one or two couplers, which are ⅝-in. steel forgings. The outfit weighs 362 pounds.

Bickford-Switzer Tap-Grinding Machine

The accompanying illustration shows a tap-grinding machine recently placed on the market by the Bickford-Switzer Co., 50 Norwood St., Greenfield, Mass. The machine is similar in appearance to the company's drill grinding machine described on page 573, Vol. 54, of the *American Machinist*. It is intended to sharpen any style of tap having any number of lands or flutes from two to six, by grinding an eccentric relief on top of the cutting land. The limit of the capacity is 1½ in. in diameter for hand taps, 1¼ in. for tapper or machine nut taps, and 2 in. for pipe taps.



BICKFORD-SWITZER TAP-GRINDING MACHINE

The machine grinds the different lands of the tap consecutively, a cam on the main or work-carrying spindle riding against a shoe, and thus causing the tap to approach and recede from the wheel as it is revolved on its own centers. The squared end of the tap is driven by a bell center, while the point is supported by a male or female center as required, these two centers being mounted on a revolving plate. The different cams are made together in a single shell and mounted on the work spindle in such a manner that when the spindle is turned in a backward direction the cams do not revolve, but will start forward from any position when the spindle is turned forward. This arrangement assists in setting the tap to bring the proper relative position between the land and the cam. It is only necessary to turn the tap backward until the contact-point of the wheel is in a position between two lands, and then turn the tap forward.

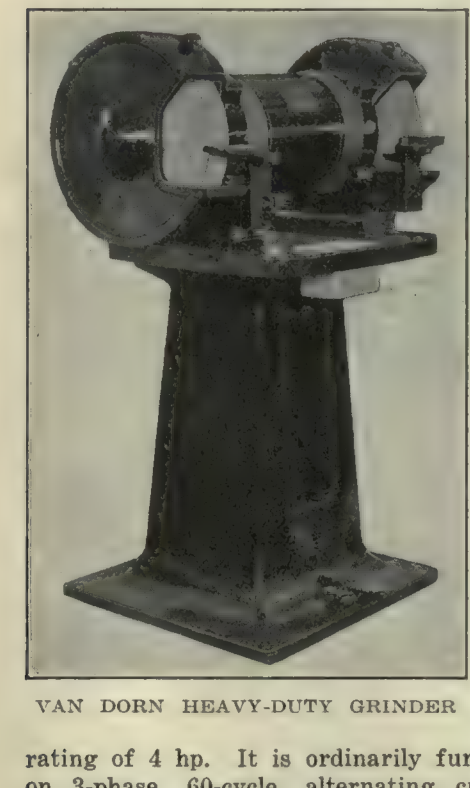
The head which carries the main spindle is arranged to clamp in the desired position on the rocker shaft, a flat spring underneath holding the head over to keep the particular cam in use in contact with its shoe. A lever at the left feeds the work forward to a position opposite the wheel, when a lever at the right sets it to the desired angle, and the wheel is fed in as the work is revolved by means of the crank.

The angle of the work is changed as it passes the wheel, giving a rounded contour where the angle of the bevel near the end of the tap approaches the parallel sides. This feature is said to prolong the life of the tap. It is also valuable when sharpening chucking reamers, saving the use of a hone to take off the sharp corner. The machine can sharpen countersinks and chucking reamers having not more than six flutes.

The machine is self contained, and is equipped with a ¼-hp. motor for either alternating or direct current. It is mounted on a column and weighs 300 pounds.

Van Dorn Heavy-Duty Grinder

The Van Dorn Electric Tool Co., Cleveland, Ohio, has recently put on the market the heavy-duty, ball-bearing electric grinder shown in the illustration. The machine is equipped with two 14 x 2½-in. face-grinding wheels mounted directly on the 1¼-in. motor shaft. They are enclosed in heavy wheel housings, the ends of which are removable. If desired, an eye shield and exhaust ducts can be attached to each guard. The tool rests have both horizontal and vertical adjustments. An aluminum water pot is set in the table in front of the motor. The motor has a normal continuous rating of 4 hp. It is ordinarily furnished to operate on 3-phase, 60-cycle, alternating current, of either 220 or 440 volts, although motors for special conditions can be furnished. The speed is ordinarily 1,200 r.p.m. The motor housing is smaller in diameter than the grinding wheels, so that long pieces can be ground without interference from the housing. The housing is completely enclosed and dustproof, a fan within the motor furnishing ventilation. Where excessive dust is encountered, fresh air can be piped to the intake end of the housing.

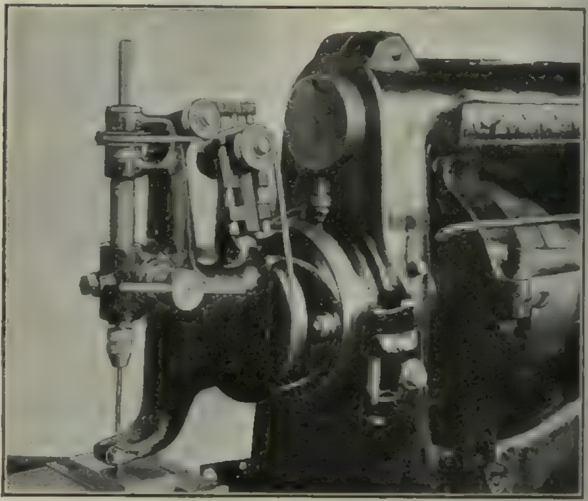

VAN DORN HEAVY-DUTY GRINDER

The armature is mounted on ball bearings, and lubrication is accomplished through the grease ports located directly above the bearings. The switches, fuses and connections are mounted on the inside of the pedestal. The cable conduit enters through a hole in the back, so that no wires or electrical appliances are exposed. By means of a pedal at the base, the motor is started and stopped.

The center of the spindle is 39 in. above the floor, and the grinding wheels are set 25 in. apart. The floor space required is 22¼ by 24 in., and the net weight of the machine is about 700 pounds.

K-N Spotting and Routing Attachment

A spotting and routing attachment for use on milling machines has recently been placed on the market by E. L. Krag & Co., 50 West Randolph St., Chicago, Ill., the device being made by Franz K. Krag, Chicago, Ill. The attachment, which is shown in the accompanying illustration, is intended for the laying out and drilling of holes up to and including 3/16 in. in diameter in dies, jigs, templates, master plates and similar work that requires great accuracy. The method of performing the work is intended to replace that of locating holes by means of buttons, and it is said that the work can be done very much more quickly and cheaply by the use of the attachment. The device can be supplied for all standard makes of milling machines, being ordinarily attached to the No. 1, 1½ and 2 sizes.


K-N SPOTTING AND ROUTING ATTACHMENT

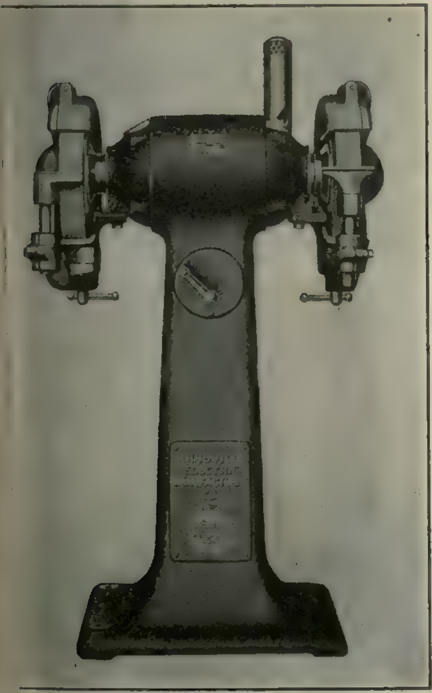
The attachment is mounted on the milling machine by means of one swinging clamp, using only one locking screw. The locating screw in the base, when once adjusted to the machine on which the device is used, is locked in place and serves for aligning the attachment whenever used. The driving arbor, which is inserted in the spindle of the milling machine, has a spring dog that engages automatically when the machine is started. The spindle is driven by mean of a round belt kept at a uniform tension by a compensating spring idler, the ratio of the speeds being seven to one with the spindle of the milling machine.

The spindle is fed by hand, and a locking device is provided so that it can be securely fastened at any height for use when routing work. The spindle pulley and idlers are fitted with ball bearings, as is also the thrust bearing for the spindle. The lower part of the head carries the guide bushing for the drill, the bracket being cast in the same piece with the spindle housing. The attachment is ordinarily furnished with one routing bushing, one intermediate bushing and five drill bushings ranging in size from $\frac{1}{16}$ to $\frac{3}{16}$ in. in diameter, for steadying the drill.

When in use, the knee of the milling machine is ordinarily locked in place, the vertical adjustments being made by means of the spindle of the attachment. The work is moved under the attachment by the use of the feeds on the table of the milling machine. For work on scientific instruments where absolute accuracy is required, the attachment can be used in conjunction with the Johansson compound slide, thus permitting of great precision in laying out work.

"Pioneer" Electric Floor Grinder

The Louisville Electric Manufacturing Co., Louisville, Ky., has recently placed on the market the "Pioneer" electric floor grinder shown in the accompanying illustration. The machine is of a symmetrical design, so as to prevent the accumulation of dirt in so far as possible. The motor is ventilated, the air intake being so located that clean air is drawn through it. It can thus be operated continuously without exceeding the safety limit of temperature. For intermittent duty, it is stated that the motor will operate satisfactorily with the air intake closed.



IONEER ELECTRIC FLOOR GRINDER

The machine is provided with ball bearings having housings so constructed that the bearings will be kept free from dirt. Steel safety hoods are provided, with hinged side walls so that the wheels can be easily changed. The toolrests are adjustable, and their positions can be easily changed. The starting switch for the motor is enclosed in the column, and a water pot can be attached to the column if desired. The grinder requires a 2-hp. motor, which can be furnished for either direct current or 60-cycle alternating current, the no-load speed being 1,800 r.p.m. for either type. The heels used are 12 x 2 x 1 in. in size, and the arbor is in. in diameter between the flanges. The distance etween the wheel centers for the alternating current achines is 22 in., while it is 28 in. for the direct-rrent machines. The height to the center of the indle is 38 in., and the floor space required is 28 x in. for the alternating current machine and 34 x 19 in. r the direct current machine. The weight is 400 unds.

Pratt & Whitney No. 3 Bench Hand Milling Machine

A hand milling machine for bench use, now manufactured by Pratt & Whitney, Hartford, Conn., is shown in Fig. 1. This little machine is only 21 in. high and occupies a bench space of but 22 x 25 in., yet it has all the features of the larger floor type of machine and some additional ones.

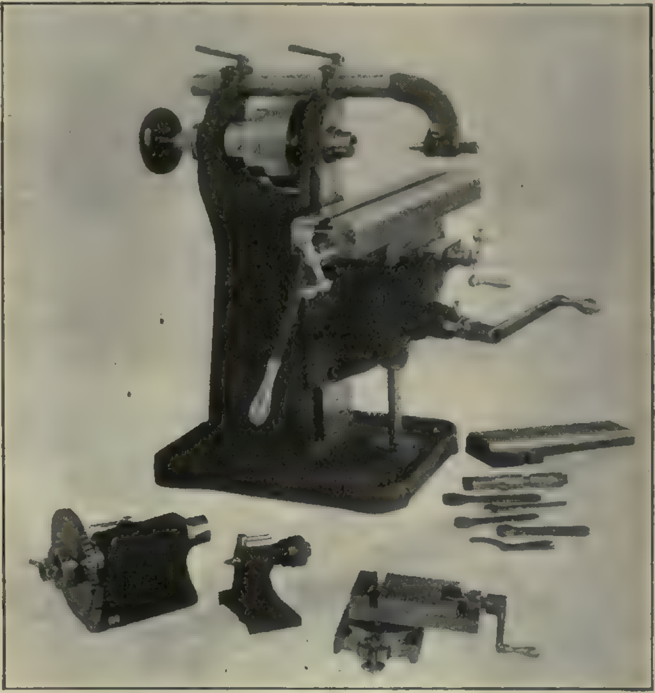


FIG. 1. PRATT & WHITNEY BENCH HAND MILLING MACHINE

The spindle is of tool steel, hardened and ground, as is also the double taper front bearing. The rear bearing is of non-gran bronze, and both bearings are adjustable to compensate for wear. The spindle and drawbar are the same as corresponding parts of the No. 3 bench lathe, hence all spindle attachments are interchangeable. Spindle speeds range from 153 to 1,510 r.p.m. A three-step cone is provided for a 1-in. belt.

The table has a working surface of $2\frac{3}{4}$ x $17\frac{1}{2}$ in. The sides of the table are beveled to an angle of 30 deg. for the purpose of locating accurately all attachments used thereon. It has both screw and rack movement, the former covering a distance of $8\frac{1}{4}$ in. and the latter 4 in. The rack movement may be locked in any position and the feed continued by means of the screw. The saddle has a crosswise move-

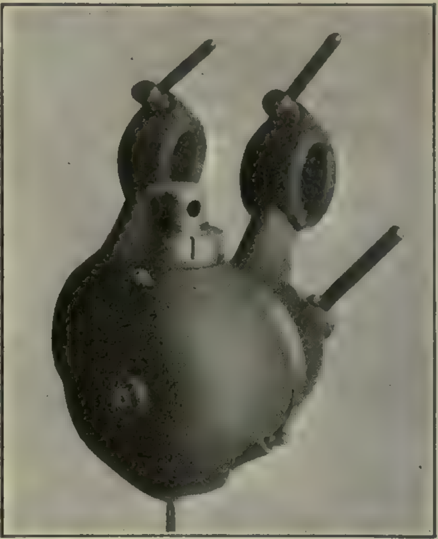


FIG. 2. VERTICAL ATTACHMENT FOR BENCH HAND MILLING MACHINE

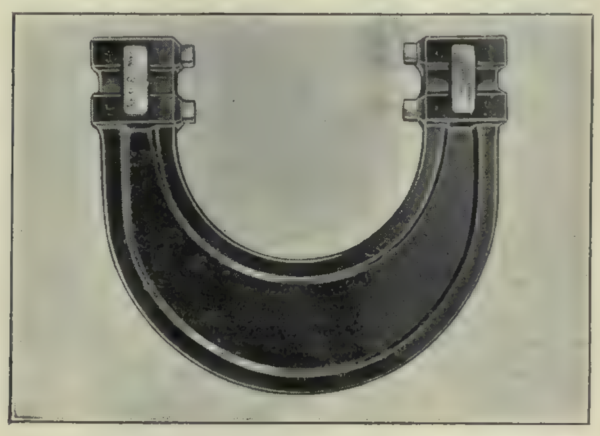
ment of $2\frac{7}{16}$ in. and the knee may be adjusted vertically through a range of $6\frac{1}{2}$ in. All screws are fitted with micrometer dials graduated to read to thousandths of an inch.

The machine weighs 185 lb., with an allowance of 50 lb. additional when boxed for shipment. It is regularly furnished with overhanging arm, drawbar, set of wrenches and a two-speed wall countershaft with 5-in. diameter pulleys for $1\frac{1}{4}$-in. belt. Additional equipment may be furnished as follows: Vise with graduated swivel base and jaws $2\frac{9}{16}$ x $1\frac{15}{16}$ x $\frac{19}{32}$ in.; index quill center to swing 5 in.; tailstock; arbors; right-angle adapter, and vertical milling attachment as shown in Fig. 2.

Syracuse Adjustable-Limit Snap Gage

The Meldrum-Gabrielson Corporation, Syracuse, N.Y., has recently placed on the market the Syracuse adjustable-limit snap gage, Style A of which is shown in the illustration.

The chief feature of the gage is the locking device for the measuring pins, which are square in section. The shape of the pins prevents them from turning, and eliminates the necessity for the use of keys for this purpose. The square pins present a straight edge to the work, and, having a greater wearing surface, are said to maintain parallelism better than the round pins. The pins are made of hardened tool steel, ground to a tight friction fit, and have sufficient adjustment to permit of several regrindings and lappings. The pins of the Style-B gage are equipped with rectangular anvils for use when measuring against shoulders. The Style-C gage employs, instead of the usual "go" and "no-go" pins, three pairs of pins. The middle pins are set to the exact size of the work and the other two pairs to the upper and lower limits, respectively, so as to enable the rapid selection of under- and over-side pieces of the work from the same lot.



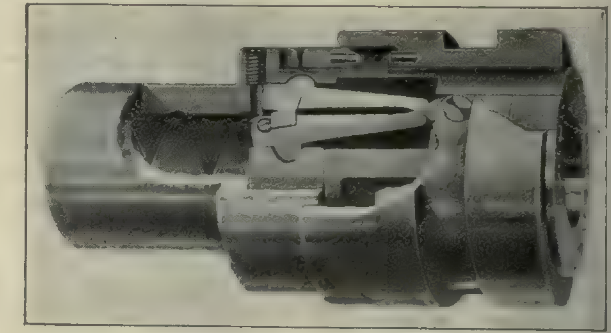
SYRACUSE ADJUSTABLE-LIMIT SNAP GAGE

The gage is adjusted by turning an adjusting screw at the rear of each measuring pin. The small conical headed locking screw is then turned, so as to expand the split adjusting screw and lock both it and the pin in place. The head can be filled with sealing wax, leaving no screws exposed.

The frame is of fine gray iron, and is said to be very rigid. It is provided with two ground surfaces on which to place the necessary markings. The tool is made in twenty-four sizes to fit work up to 12 in. in thickness, although larger gages can be furnished.

Johnson Friction Clutch With Positive Lock

The Carlyle Johnson Machine Co., Manchester, Conn., has recently provided the friction clutch which it manufactures with a positive locking feature, so that slippage can be prevented after the clutch is completely engaged. When first thrown into engagement, the action of the device is the same as on the standard clutch. The outside shifter sleeve forces the sliding wedge between the two toggle levers to expand the friction ring, so as to grip the inside surface of the cup member. When the clutch has been completely engaged, and the speed of both parts is the same, pins on the outside shifter sleeve move up so as to engage those on the clutch itself, there being six pairs of pins spaced around the clutch.

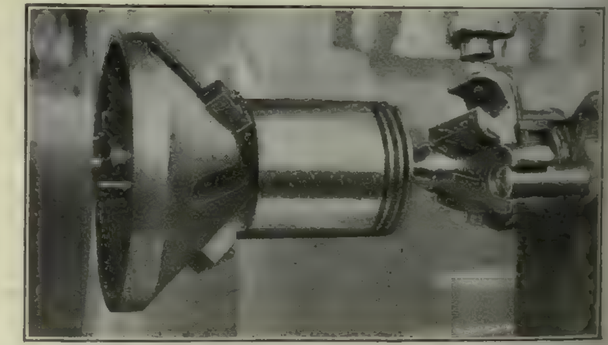


JOHNSON LOCKING FRICTION CLUTCH

The illustration shows the pins in the disengaged position, but it should be noted that they will overlap when the clutch is completely engaged. It is thus possible to gradually pick up to full speed when engaging the clutch, and then lock the unit so that slippage cannot occur. When disengaging the clutch, the pins are first brought out of contact, and then the clutch can be slipped or disengaged entirely. The maker states that the clutch is adapted to a variety of uses on mechanical drives under conditions where it is desirable that no slippage occur after units have been engaged.

Norton Piston-Grinding Attachment

The Norton Company, Worcester, Mass., has recently developed a piston-grinding attachment for use on its autopart regrinding machine, which was described on page 1017, Vol. 54, of the *American Machinist.* The accompanying illustration shows the attachment in place on the machine and holding a piston. The attachment is universal in that it is adapted to the holding o all sizes and styles of automotive pistons from $2\frac{3}{4}$ to 7 in. in diameter. It is stated that the time required fo



NORTON PISTON-GRINDING ATTACHMENT

changing from one size of piston to another is less than two minutes.

The fixture consists of a dead center, upon which revolves a cast-iron cone having three dove-tail slots. In each slot is mounted a hardened tool-steel slidable member, the upper surface of which is ground conically. In each jaw is turned a transverse groove, which permits the corner of the abrasive wheel to travel beyond the end of the piston without interference. The jaws are slotted longitudinally and locked in place by means of taper-pointed screws.

Since the surfaces upon which the piston rests are elements of a cone, an accurate setting of the jaws is not necessary. They are merely set by means of the eye to bring the clearance groove in the proper position. The cast-iron cone is driven by the regular drive pin extending from the faceplate of the machine into a cored slot. The piston itself is driven by means of a spline made of a small piece of sheet steel screwed to the side of one of the jaws. Ordinarily, a shallow slot is filed in the inside of the skirt of the piston to engage this spline. Where it is not desirable to slot the skirt, a special driver is furnished that is adjustable to fit all sizes of pistons.

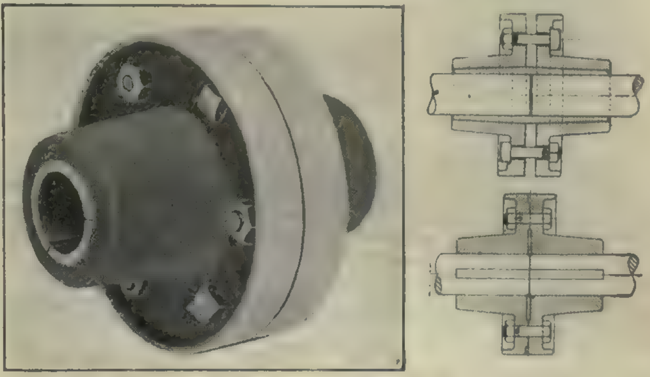
In case that the sliding jaws become worn, they can be dressed by setting the fixture in the adjustable center-grinding attachment furnished with the machine. The bearing of the cast-iron cone on the end of the dead center is tapered, and wear is taken up by turning a threaded collar back of the cone. Oiling facilities are provided by means of holes drilled to the inside of the bearing. The attachment is designated as No. 509.

Hilliard Shaft Couplings

The Hilliard Clutch and Machinery Co., Elmira, New York, has recently placed some shaft couplings on the market. On the left of the accompanying illustration is shown an assembled view of a keyless compression coupling. The interior construction of the device can be seen in the line drawing shown at the top and on the right side of the illustration. The coupling consists of two flanges bored tapered, and one slotted sleeve bored to the shaft size and turned on the outside with a double taper to match the flanges. When installing, the center of the coupling is located directly over the joint of the two shafts, and the flanges are drawn together by means of bolts. Due to the conical shape of the split sleeve, the shafts are gripped tightly so that slippage is prevented.

Couplings of this type can be supplied for reduced diameters, although it is stated that they should not be used to connect shafts varying more than ½ in. in diameter. The couplings are made in a range of sizes in 1/16-in. steps to fit shafts from 1⅜ to 3 in. in diameter. The outside diameters vary from 3¾ to 9¾ in. and the overall lengths from 4 to 11½ in. The coupling provides a means of very conveniently connecting shafts without machining them, and it will transmit considerable power.

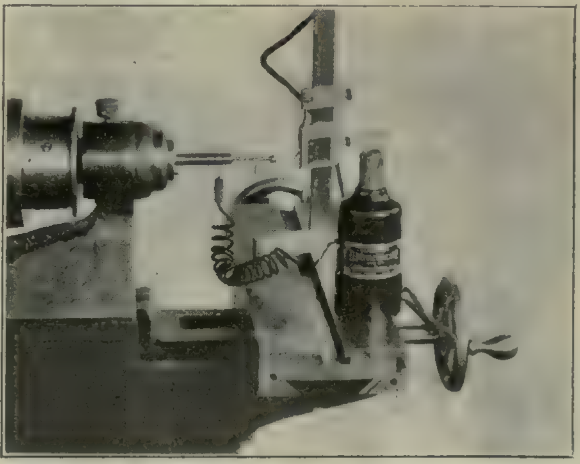
The line drawing at the bottom on the right of the illustration shows the construction of the flange coupling recently placed on the market. This coupling is made in sizes for shaft diameters from 1⅜ to 5½ in., being provided in 1/16-in. steps. The outside diameters of the flanges vary from 3¾ to 15 in., while the lengths of the couplings vary from 3½ to 15⅜ in. The coupling illustrated is of the male and female type, a flange being turned on the outside edge of one of the members to fit in the groove turned in the other member. This style, which enables the closer and more accurate fitting of the parts, is ordinarily used for couplings over 3 in. in diameter. For shafts smaller than 3 in., the plain type is used, the bearing surfaces of the members being plane. For connecting shafts of different sizes reducing couplings can be furnished.


HILLIARD COMPRESSION AND FLANGE COUPLINGS

Hansen "Electrocator"

A device intended to facilitate the exact location of a given point, as upon a jig or fixture to be machined, with reference to the center line of the revolving spindle of the machine which is to do the work, has been brought out by S. M. Hansen, 601 Washington St., Lynn, Mass., and is being marketed by the Bely Sales Co., of the same address.

This device, sold under the name of the "Electrocator," consists of a small electric transformer, an electric lamp, and a "ball wiggler" similar to that commonly used by toolmakers in centering up work. The wiggler, one end of which is insulated electrically from the other, is placed in a collet or attached by other means to the spindle of the machine to be used. Electrical connection is established with the free end by means of a small spring yoke at the end of the conducting wire, which yoke allows the wiggler to revolve without interrupting the flow of current. The circuit is completed through the lamp, the secondary coil, the base of the transformer resting upon the machine table, and any piece of metal that may establish electrical contact between the machine and the outer ball of the wiggler.


HANSEN "ELECTROCATOR"

The manner of using the instrument is shown in the accompanying illustration. The shank of the wiggler is held in the draw-in collet, and a vernier height gage set to the required distance is placed on the table of the machine. Upon starting the machine the ball at the outer end of the wiggler will describe a circle the center of which is the exact center of rotation of the spindle.

After placing the height gage or size block on the table of the machine approximately under the center of the gyrating ball, the table is raised until the ball strikes the gage, causing the lamp to flash at each revolution. As the table continues to rise, the circle described by the ball becomes smaller, until the true center of rotation is reached and no movement of the ball is apparent. At this position the lamp will burn steadily. A further upward movement of the table will cause the ball to roll off the gage, and it is claimed that the amount of movement between the point where the lamp flickers perceptibly and where the ball rolls off the gage is less than 0.0002 in.

The device is strongly built and will withstand any ordinary amount of abuse. The only fragile part is the bulb of the electric lamp, which is the standard 6-volt dash lamp commonly used on automobiles. The device is furnished with a cord and a plug for attaching it to a lamp socket. Alternating current must be used.

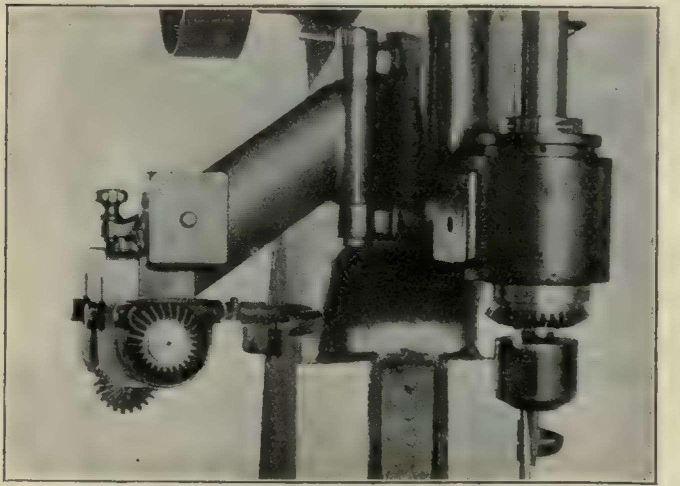
Cherrying Attachment for Pratt & Whitney Die-Sinking Machine

The Pratt & Whitney Co., Hartford, Conn., is supplying for its die-sinking machine an attachment by means of which a formed cutter may be sunk in the metal to be worked, to a depth practically equal to its own radius. The attachment is in the form of a swinging bracket permanently attached to the side of the column of the machine, and when not in use is swung out of the way as shown in the illustration. It may be quickly swung into the operating position, where it is fastened by means of a bolt and dowels to a pad or boss upon the side of the lower spindle bearing.

The peripheral teeth of the cutters are made of such form that the back of each tooth corresponds to the working face of an involute gear tooth; and the cutter is thus driven from its periphery by means of a pinion which is a part of the attachment. The cutter revolves upon adjustable sliding centers, employing either the usual 60-deg. point for small cutters or cylindrical plugs for supporting the larger sizes. The slides are so made that they do not come in contact with the surface of the work until the cutter reaches one-half its diameter in the work.

Different sizes of pinion are furnished for the various cutters that may be used. The drive is through a pair of miter gears from the spindle of the machine, and these gears are covered by easily removable guards when the attachment is in use. The end of the machine spindle is threaded to receive the driving gear, and the driven gear is mounted upon a friction device which permits the gear to slip before the limit of resistance of the cutter is reached, thereby reducing the chance of breakage of the cutters.

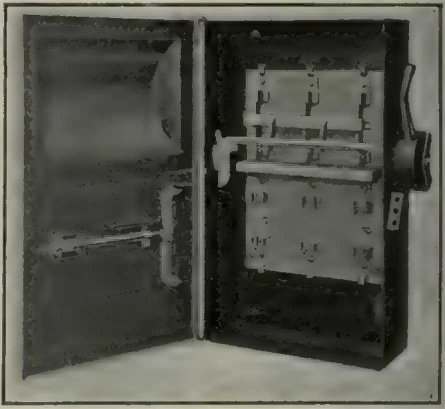
The device is not intended for use in sinking an impression in solid metal, though it may be so used if sufficient care is exercised and time allowed, but is rather for the purpose of bringing such an impression to exact size and form after the bulk of the metal has been moved by a chisel or other means. Cutters from 1 to 6 in. in diameter may be used.



PRATT & WHITNEY ATTACHMENT FOR "CHERRYING" DIES

Westinghouse Small Motor Starter

The type of motor starter shown in the illustration and known as the type WK-30, and which is said to provide complete protection to both the operator and the motor, has been recently placed on the market by the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa., for starting small alternating-current motors by connecting them directly to the line. The starter consists essentially of an enclosed quick make-and-break knife switch, which is operated by an exterior handle. It protects the motor from overloads both when starting and when running, because it is equipped with thermal cut-outs which open the circuit on dangerous sustained over-loads, but which do not operate under harmless momentary over-loads. The cut-outs resemble cartridge fuses, but are not interchangeable with fuses. They operate by fusing a special washer, which can be quickly replaced at small cost.



WESTINGHOUSE SAFETY STARTING SWITCH

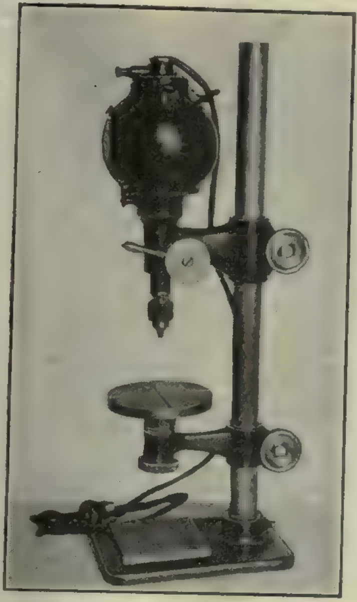
All parts are enclosed, so that the operator cannot touch live contacts. A door gives access to the cut-outs, but is interlocked with the switch and cannot be opened unless the switch is in the off position, when all accessible current carrying parts are dead. If desired, the door can be padlocked. It is also possible to lock the handle in the off position with three separate padlocks, for the protection of those working on machinery controlled by the switch.

These starters are made in sizes for a.c. motors up to 3 hp. and 110 volts; 10 hp. and 250 volts; and 10 hp. and 600 volts. The type WK-55 starter is similar to the WK-30 just described, but it is made for rough service.

The capacity and arcing arrangements enable the switch to break the locked current of an alternating-current motor when operating with a full-load current equal to the rating of the switch.

"Model" Bench Drilling Machine

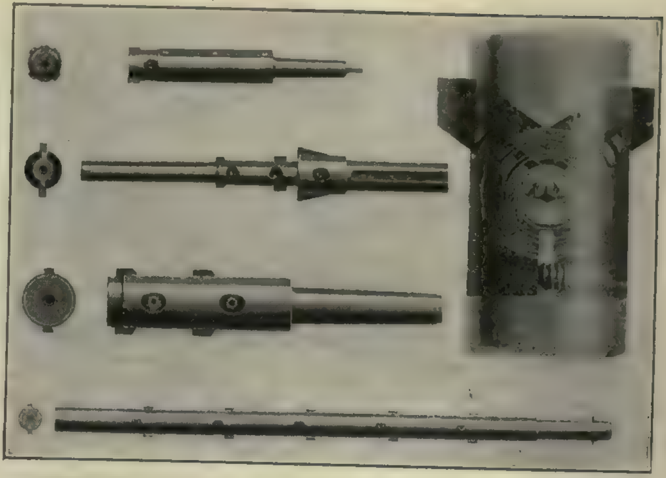
The Model Specialty Co., 401 East 19th St., New York, N. Y., has recently placed on the market the small portable bench drilling machine shown in the accompanying illustration. The machine is intended for accurate work and for all-around shop use where a small bench drill is adaptable. Due to its light weight, the machine is very easily carried, as it weighs only 34 pounds.


MODEL BENCH DRILLING MACHINE

The base of the machine is 9 x 6 in. in size, with a 4 x 4-in. elevation finished on it. The round column fastened to the base is high enough to permit of drilling objects 18 in. in height from the base of the machine. The table is provided with V-grooves, to eliminate the use of V-blocks, and it can be adjusted vertically on the column. The table can be tilted to any angle desired, and then locked in position by means of a screw. Its shank permits of revolving the table, and then of locking it in position by means of a knurled nut underneath the arm. The table is 5 in. in diameter, and when lowered provides a maximum space of 14 in. between the bottom of the chuck and the table surface. The head carrying the spindle and motor can be positioned at any point of the column. The spindle is driven directly from the motor, and it slides vertically in the hollow armature shaft. Bronze bearings are employed, except the thrust bearing, which is of the ball type. The feed is actuated by a small lever through a rack and pinion. The spindle travels 1¾ in., and a long slide is provided to give rigidity. The motor is of the direct-current, inclosed shunt type, operating at 1,800 r.p.m. on 110 volts. It is said to be large enough to drill holes up to ¼ in. in diameter in steel. Motors for alternating current and for special voltages can be supplied. A Jacobs chuck and an extension cord with a socket are furnished with the machine.

Detroit Adjustable Boring Bars

The Firmhil Machine Supply Co., 602 Kerr Bldg., Detroit, Mich., has recently placed on the market the Detroit adjustable boring bar manufactured by the Power-Vosberg Co., also of Detroit. The bars are made in three types, the angle adjustable, the straight adjustable, and the removable block, to bore holes from ⅞ to 5 in. in diameter. They are intended for both rough and finish boring and for reaming, and it is said that they can be furnished for all shapes and sizes of work, for use on a drill press, lathe, boring mill, or any other machine tool.


DETROIT ADJUSTABLE BORING BARS AND METHOD OF ADJUSTING

The phantom view shown in the accompanying illustration gives an idea of the construction of the angle type of bar. The position of the cutters is adjusted by means of the micrometer screw, and the cutters are then locked in place by the wedging action set up when turning the locking setscrew. It is said that the bars are very strong, as only a small section is cut out for the cutters and the operating mechanism. The cutters are heavy, so that the tool can be used for roughing work. For rough boring, dull cutters may be replaced with sharp ones and adjusted to size without removing the bar from the machine. A special grinding fixture can be provided for sharpening the cutters separate from the bar, if desired. The bar can thus be kept in use with one set of cutters while the other set is being sharpened.

Various combinations of standard cutters may be incorporated in the same bar for boring different diameters, counterboring and facing, all in one operation. The angle type of cutters is particularly adapted to facing and counterboring operations, because the cutters adjust forward when increasing the diameter. Continual setting out and grinding leaves the forward cutting edge in its original position, a necessary feature for some bars.

The bar shown at the top of the illustration is commonly used for drill press and boring machine work, and strip pilots are employed to obtain contact in the pilot bushing. The bar below it is intended for turret lathe use and holds a combination of cutters for boring and facing, as well as having a hardened pilot. The next view shows a bar for the boring of cast-iron and steel car wheels. The bottom view shows a line boring and reaming bar, having removable block-type cutters. The roughing blocks, finishing blocks and reamer blocks are interchangeable in the same slots, the changes being accomplished without removing the bar from the fixture. In addition to this, the blocks may be set to float ream, a play of 0.008 in. being allowed.

A Correction

In the article, "A Cover Curling Die," by S. A. McDonald in our issue of Sept. 22, an error was made in the illustration. In place of the capscrew under the washer *E*, there should have been shown the threaded end and part of the body of a stud for holding the rubber pad, lower washer and nut referred to in the text.

NEWS SECTION

Supply and Machinery Dealers to Meet in New York

L. H. Swind, chairman of the Machine Tool Section of the National Supply and Machinery Dealers' Association, has arranged a meeting of that body to be held at the Hotel Astor on Wednesday, Oct. 19.

The National Machine Tool Builders' Association is now in the process of selecting a speaker who will address the meeting.

Arrangements have been made for a discussion of the subject of "Terms of Payment" by dealers' customers, because of the tendency during the past six months to request unduly long terms of payment which, if the dealer gives, must be financed by him because of the short terms of the manufacturers.

The subject of trading in old machines at too high a price because of the present situation will also be considered with a view to improvement in the situation. The matter of the cost of securing orders under present condition of low demand and poor finances on the part of customers, as well as their desire to obtain all possible concessions of every character and description will be brought before the members at this time.

There will also be considered the matter of satisfying manufacturers with constructive sales efforts at this time of slow business when the manufacturer does not need to devote much of his time to questions of production, but turns all his attention to the sales department of his business at a time when sales are most difficult to make.

Massachusetts Courts Restrain Molders' Union

Pursuant to a decree of Judge Edward P. Pierce, of the Massachusetts Supreme Court, the Iron Molders' Union and its members are enjoined from any interference with the business or employees of the Springfield Foundry Co., Springfield, Mass. The decree finds that the defendants are in combination for an illegal purpose. They are specifically prohibited from carrying on a conspiracy to compel the company to conduct a closed shop. The defendants must not conspire to compel the company to abrogate the system of employing persons only under individual contract, must refrain from picketing the plant and from attempts to induce employees to break their contracts; also from the payment of strike benefits or other emoluments for the purpose of furthering the conspiracy. The decree is the outcome of equity proceedings brought last spring as a result of labor difficulties.

More Boxing and Crating Courses

Notice has just been received of another series of courses in boxing and crating at the Forest Products Laboratory, Madison, Wis., under the direction of the United States Department of Agriculture. These courses run for five and one-half days and will begin on Nov. 7, 1921; Jan. 9, March 6 and May 1, 1922.

The object of this course is to demonstrate the principles that underlie proper box and crate construction and to supply information which will be of assistance in developing economical containers that will deliver the contents in a satisfactory condition at a minimum cost.

The course lasts 5½ working days. Only a limited number are accepted in a class. This makes possible the exchange of ideas and experiences with men from different organizations and with the research men of the Laboratory.

Machinists' Union to Fight Navy Yard Wage Cut

Methods used by the Government in establishing wages were criticised by N. P. Alifas, president of District 44, International Association of Machinists, which comprises all machinists employed in the federal service, at the opening session of a six-day convention of the organization at Washington, D. C. Twenty-five delegates, representing all navy yards and arsenals and the Panama Canal Zone, were in attendance.

Mr. Alifas laid particular emphasis on the recent drastic pay reduction in the navy yards, and declared that some system must be adopted by the Government to set a fair wage scale for its employees. The present system, he said, is entirely unsatisfactory because the Government is following the "unfair" methods of private employers. He further declared that the policy of the Government as exemplified in the case of the navy yard wage cut is delaying the resumption of normal business activity by creating the impression that the low level of labor costs has not yet been reached.

Plans to have the navy yard wage award reopened, with a view to having the pay scale of the employees returned to the higher scale until the cost of living is "actually reduced," were discussed by the delegates.

If the administration authorities refuse to reopen the wage controversy it is the intention of the machinists' association to carry the fight to the capitol, and if the plan meets failure there, a nation-wide educational campaign will be launched to inform the people of the full meaning of the recent action of the Government in ordering the navy yard wage reduction.

Carriers Select November as Perfect Package Month

All trades and industries have been asked to co-operate in the perfect package movement to be inaugurated by the railroads, steamship lines and express companies in the United States and Canada, in November, which has been designated as "Perfect Package Month."

The purpose of the movement is to stimulate further public interest in good packing of shipments and to enable the carriers to improve the transportation service of the country. During November, an examination of all shipments sent by freight or express, will be conducted, to obtain information as to the best shipping methods carried on by the various trades and industries.

In every city and town, the railroad and express people will form campaign committees, to co-operate with local shippers' associations, in carrying out the plans announced for "Perfect Package Month." "Exception reports" will be made out for all faulty shipments discovered and these reports will be sent to the shippers' association for tabulation, to ascertain how high a percentage for "perfect packages," the shippers of that city have attained.

Comparisons of the records made by the various cities during November will be announced at the conclusion of the drive. The entire working forces of the railroad and express carriers, comprising some 2,000,000 men, will aid in the movement. The railroads, through the American Railway Association, composed of practically all of the railroads in the country, are pushing the campaign as a means of raising the standard of the service, while the express agents are also getting ready to interest shippers in the undertaking.

Program for Gear Manufacturers Meeting at Rochester

The semi-annual fall meeting of the American Gear Manufacturers Association will be held in the Powers Hotel, Rochester, N. Y., Oct. 13, 14 and 15.

Interesting reports will be offered by the various committees on standardization, and a program has been prepared including "Gear Tooth Wear," by S. O. White, chief engineer of the Warner Gear Co., Muncie, Indiana; "Duraluminum as a Material for Worm and Other Gearing," by R. W. Daniels, Bausch Machine Tool Co., Springfield, Mass.; "The Grinding of Gear Teeth and Its Future in the Industry," by J. F. Barr, secretary, the Gear Grinding Machine Co., Detroit, Michigan; "Tooth Forms," by E. W. Miller, chief engineer, Fellows Gear Shaper Co., Springfield, Vt.; and "First Hand Impressions of Europe," by E. S. Sawtelle, assistant general manager of the Tool Steel Gear and Pinion Co., who has recently returned from an extensive trip through Europe studying conditions there.

A feature of the meeting will be an inspection of the plant and luncheon of the representatives, as guests of the Gleason Works who will also be hosts at a clambake at Corbett's Glen.

The usual informal banquet will be held Oct. 14, in the Powers Hotel, with J. E. Gleason acting as toastmaster. Addresses will be delivered by the Hon. Arthur E. Sutherland, ex-judge of the Supreme Court of New York, on "Capital and Labor," and by Ernest Paviour, formerly President of the Rochester Advertising Club, whose subject will be "Advertising."

F. W. Sinram, of the Van Dorn & Dutton Co., Cleveland, is president of the Association, and F. D. Hamlin, of the Earle Gear and Machine Co., of Philadelphia, is secretary.

Lehigh Machine Co. Plant to Be Sold at Auction

By virtue of an order of the District Court of the United States for the Middle District of Pennsylvania made September 12, 1921, in the case of Lehigh Stove and Manufacturing Co., Complainant, vs. Lehigh Machine Co., defendant No. 296 October Term, 1920, there will be sold at public vendue or outcry on the premises the plant of the Lehigh Machine Co., in the Borough of Leighton, Carbon County, Pennsylvania, commencing on Thursday, Oct. 20, and continuing from day to day until the sale has been completed,

Besides the buildings and yard equipment, a great quantity of machinery will be sold. Lathes, grinding machines, shapers, drilling machines, tapping and chucking machines are included in the sale. William C. McConnell and Eugene N. Sanctuary are the receivers.

General Electric Reduces All Salaries

A reduction of 10 per cent in the salaries of all officers and employees of the General Electric Company has been announced by President E. W. Rice, Jr., in the following brief statement:

"In accordance with an order of the Board of Directors, a reduction of 10 per cent will be made as of Oct. 31, 1921, in the salaries of all officers and employees of the company.

"Heads of departments are requested to notify all those affected."

Publishers' Statement

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

Of American Machinist, published weekly at New York, N. Y., for Oct. 1, 1921.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared James H. McGraw, Jr., who, having been duly sworn according to law, deposes and says that he is the Secretary of the McGraw-Hill Co., Inc., Publishers of American Machinist, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, McGraw-Hill Co., Inc., 10th Ave. at 36th St., New York, N. Y. Editor, K. H. Condit, 10th Ave. at 36th St., New York, N. Y. Managing Editor, L. C. Morrow, 10th Ave. at 36th St., New York, N. Y. Business Manager, Mason Britton, 10th Ave. at 36th St., New York, N. Y.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.) McGraw-Hill Co., Inc., 10th Ave. at 36th St., New York, N. Y. James H. McGraw, 10th Ave. at 36th St., New York, N. Y. Arthur J. Baldwin, 10th Ave. at 36th St., New York, N. Y. John McGhie, 10th Ave. at 36th St., New York, N. Y. Fred Low, 10th Ave. at 36th St., New York, N. Y. Henry W. Blake, 10th Ave. at 36th St., New York, N. Y. Leonard D. Baldwin, 10th Ave. at 36th St., New York, N. Y. F. S. Weatherby, 10th Ave. at 36th St., New York, N. Y. Arthur J. Baldwin, Trustee for Estate of John A. Hill, 10th Ave. at 36th St., New York, N. Y. Arthur J. Baldwin, Trustee for Donald Baldwin, 10th Ave. at 36th St., New York, N. Y. Arthur J. Baldwin, Trustee for Franklin Baldwin, Grace Baldwin & Cynthia Haselton, 10th Ave. at 36th St., New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is (This information is required from daily publications only).

JAMES H. McGRAW, JR.

Sworn to and subscribed before me this 20th day of September, 1921.

[Seal.] MARTIN J. WIEMER.
Notary Public Kings County Certificate No. 92. Certificate filed in New York County No. 202.
(My Commission expires March 30, 1922.)

◆

American Cars in Belgium

Belgian cars are dominating the Belgian market, American-made cars being the hardest hit. Belgian cars have increased 45 per cent; French still hold their own, with an increase of about 40 per cent. The fluctuation in the market seems due to the demand for the lighter cars of French and Belgian make.

Black & Decker Establishes National Credit Service

The Black & Decker Manufacturing Co., Baltimore, Md., has recently put into effect what they term "The Black & Decker National Credit Service." The company's products are sold entirely through jobbers and the new service enables customers to buy through their regular jobber by paying 23 per cent of the regular price of the item in cash, and the balance in six equal monthly payments. Jobbers have been supplied with printed forms to be used for orders taken under this plan. These order forms are conditional sale agreements which make the item sold its own security until entirely paid for. The jobber forwards these orders to the company which discounts them for the jobber so that every sale made under this plan is in effect a cash sale for the jobber. The company shares fifty-fifty all responsibility with the jobber for the fulfillment of the sale agreement.

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Metric Hearings in October

Hearings on Senator Ladd's metric system bill are expected to begin about the middle of October. The fixing of a definite date is awaiting the return of Senator McNary of Oregon, who as chairman of a subcommittee of the Committee on Manufactures will conduct the taking of testimony. Senator Ladd states that it is not the intention at this time to conduct extended hearings. An opportunity will be given to the proponents and to the opponents of the measure to make a concise presentation of the major points of their respective contentions. These preliminary statements will comprise a single record that is to be distributed widely with the idea of acquainting the public with the principal reasons for and against the adoption of the metric system as the single standard of weights and measures for the United States.

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No Import Duty on Cars to Mexico

By an earlier decree of Jan. 7, 1919, automobiles had been exempted from import, and recent consular advise (Vice Consul Knox Alexander, San Luis Potosi, Aug. 22, 1921) confirms the understanding that there is no Mexican import duty collected now on an entire assembled automobile or on a shipment of all parts of an automobile, though unassembled. Separate automobile parts and accessories are, however, dutiable.

China Orders Coin Machinery in Philadelphia

The Fisher Machine Co. of Philadelphia has been awarded a contract for supplying coin-weighing machines and other mint equipment for the new mint of the Government of China.

The mint is being erected at Shanghai under the supervision of Clifford C. Hewitt, of Philadelphia, formerly an expert in mint building under the United States Treasury Department.

The Philadelphia-made machinery was chosen in competition with British and German companies. The order includes 120 coin-weighing machines, several coin selectors and other mint equipment. It will take the company eight months to fulfill the contract.

A. Leslie Lambert of Philadelphia, designer of the coin-weighing machines used in the United States mints, is to represent China as a proving expert. The machines are electrically operated and weigh 36,000 coins an hour within the refinement of one-sixteenth of a grain.

China is erecting the largest mint in the world. Its new coins are to be similar to the American silver dollar and fifty-cent piece.

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Victor Bearings Co. in New Merger

Announcement has been made of the formation of the Victor Bearings Co., a corporation with a capital stock of $300,000 which will take over the properties of the Modern Die and Tool Co., Indianapolis, Ind., and will immediately start a program of increasing the productive capacity of the factory. W. L. Sandage, formerly president of the Modern Die and Tool Co., and president of the new company, has announced that work will begin at once on the erection of a $50,000 factory building in Indianapolis. Mr. Sandage said the plant will be moved into the new building within the next three months.

The officers of the company, besides Mr. Sandage, are R. G. Wolcott, vice-president, and H. A. Schlotzhauer, Jr., treasurer. Directors of the company in addition to the officers are H. W. James, Frank Olive, George Olive and Mrs. W. L. Sandage. The Modern Die and Tool Co. has been in existence sixteen years and in that time has been engaged principally in manufacturing Victor bearings for automobiles, trucks, racing cars and airplanes. The factory is now running day and night at full capacity, Mr. Sandage said. Mr. Sandage also owns the Automotive Bearings Co., of Los Angeles, Cal.

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Exports of Metal Working Machinery Declining

Exports of metal working machinery during August established a new low record. The total value of all lathes, other machine tools, sharpening and grinding machines and all other types of metal working machinery was valued at $931,563. This is a decline of nearly one million dollars, as compared with August, of 1920, and is more than one million dollars under the monthly average for the first seven months of 1921. It is less than one-fifth the monthly average in 1919 and less than one-fourth the monthly average of 1920. Detailed figures for the month of August, 1921, compared with August, 1920, as given out by the Bureau of Foreign and Domestic Commerce, are as follows:

	Aug. 1920	Aug., 1921
Metal-working machinery:		
Lathes	$414,604	$51,569
Other machine tools	972,247	209,630
Sharpening and grinding machines	278,864	61,711
All other	1,242,778	608,653
Total metal-working machinery	2,908,493	931,563
Exported to:		
Belgium	117,892	8,704
France	259,789	365,403
Italy	144,695	5,026
Norway	6,543	8,637
Spain	30,069	7,026
Sweden	12,637	950
United Kingdom	883,882	67,453
Canada	527,622	70,663
Mexico	31,482	27,810
Cuba	87,570	16,988
Brazil	33,728	45,997
Chile	10,033	8,907
China	33,893	8,373
British India	127,881	119,064
Japan	290,541	51,481
Australia	17,420	13,357
Netherlands	....	5,049
Argentina	....	14,239
Dutch East Indies	....	8,452
Other countries	292,816	77,984
Mining machinery:		
Oil well machinery	463,623	710,915
All other machinery	608,222	495,653
Pumps and pumping machinery	959,113	484,400
Road-making machinery	44,673	48,709
Imports:		
Machine tools	126,330	16,101

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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The attention of American business is again focused upon Washington. Much is expected from the unemployment conference and Congress. Disappointment will probably follow the action taken. The use of a "Treasury tonic" as a cure for the unemployment evil has been wisely inhibited by President Harding, and the conference can hardly do more than resolve and recommend. As to Congress it is impossible to pass a tax bill that will please any very large proportion of those who are separated from their money. It is, however, reassuring to learn from Mr. Hoover that the unemployment has been exaggerated and that not more than 3,500,000 persons are out of work. The conference will probably hasten the automatic readjustment of our industrial machinery by which they will be provided with jobs. The real trouble is the overgrowth of our city population and unemployment will probably be a recurring phenomenon until people are driven back to the country. In this aspect it is not an unmixed evil.

But as dissatisfaction with Washington is normal in the United States, it is hardly pessimistic to anticipate it and the outlook otherwise is quite as cheerful as it was last week.

If optimism in the index could make prosperity we should have nothing to complain of for the newspapers are still unanimous in proclaiming the advent of better times.

Of the facts as far as they are ascertainable it may be said that in the main they support the optimistic predictions. The prices of some articles are up and others have declined, but the volume of trade is increasing. Bank clearings show this. So do the "individual debits" reported by the Federal Reserve Banks. The dollar value of the August sales in the department stores of the New York Federal Reserve district is only 5.2 per cent below last year, whereas prices show an average decline of fully 30 per cent, and the number of individual sales in August was 18.2 per cent greater than in August 1920. The great mail order houses report a better business and the savings banks of the State of New York opened 80,000 new accounts and increased their deposits by about $252,000,000, or nearly 10 per cent, during the year ending June 30, 1921.

This accumulation may partially explain the growing ease of money and the advance in Liberty Bonds which have continued to move upward during the week and are now an average of nearly 5 per cent over the low prices of the year. When it is considered that it means an appreciation of about 1¼ billion dollars in the value of the issues outstanding some idea of its significance may be had. Other bond issues have been correspondingly strong.

The Government has now sold nearly $100,000,000 of railroad equipment trust notes it held on a 6 per cent basis, and they are being resold to the public at a price which yields the ultimate buyer about 5.80 per cent. There are about $200,000,000 more of these obligations in the Treasury vaults. If they are disposed of the War Finance Corporation will be in a position to give the railroads nearly all the financial help they require.

Mr. Meyer deserves commendation for the skill with which he has managed the financial operations incident to this liquidation. Railroad net earnings are meantime improving. Traffic is increasing and in the stock market railroad shares are at last commencing to reflect the better outlook for the transportation industry. Enthusiasm has been somewhat repressed by the threats of labor trouble and the attitude of the Pennsylvania Railroad toward the Labor Board, but a strike seems improbable and years of peaceful litigation will probably be necessary in order to determine whether the Labor Board can enforce its decrees or not. While the question is in the courts the railroads will be called upon to determine whether they will accept Professor Ripley's plan for railroad consolidation which was formally submitted for their consideration by the Interstate Commerce Commission last week.

It contemplates the creation of nineteen super systems and the complete remaking of the American railroad map. Its acceptance is not compulsory but the Interstate Commerce Commission intimates that Government ownership may follow if it or some other similar plan is not ultimately accepted.

Had the speculative imagination been normally responsive to the mergers suggested and the increase in earning power which will follow a sharp advance in many railroad stocks would no doubt have followed the promulgation of the plan. It may be that it will be made the basis of an upward movement in railway shares when the market "wakes up."

The conditions which favor a speculative revival are all present. The bond market has been swept clean. Money is daily growing more plentiful. The weekly statement of the Federal Reserve Banks shows a further gain of $14,000,000 in the gold reserves and a reserve ratio of 69 per cent as compared with 68.7 last week. The continued accumulation of gold in the United States is coming to be the subject of general discussion and many economists are now predicting that it may bring about the secondary inflation that I have for some time foreseen.

Of the commodity markets not much need be said. Cotton waits upon the Government report with a confidence that has been reinforced by the action of some Japanese merchants who took up the October tenders in New York. The dry goods market follows reluctantly in the footsteps of the raw material. Coffee is distinctly firmer and the bullish predictions to which I alluded last week seem likely to be realized. Wheat and corn have been perversely weak, disappointing the experts who explain their error of judgment upon the theory that the phenomenal exports have been "over discounted." Rubber is higher. So are hides. Sugar is lower because the Cuban Commission has reduced its selling price. Silk is up again, on a rumored failure of the autumn cocoon crop. Copper is higher on large trade buying, one sale of 5,000,000 lb. at 12⅜ cents being reported. The outlook in the steel industry is much brighter and prices are higher all along the line. Mr. Lamont has started on his visit to Mexico City and from now on a quickened American interest in Mexican investments is to be expected.

A trade revival in East India is reporte concurrently with a further advance o 2d. in silver which sold at 43⅜d. per ounc in London last week. Lloyd George ha finally agreed to a conference with th Irish at which the ancient feud will probably be settled. The foreign outlook i generally more auspicious except for th decline in marks which sold as low as 7 cents per 100 on Wednesday last. Th value is now negligible and as the outstanding circulation in Germany has be increased by a further billion and a hal during the week, being now 82,178,365,000 marks, there seems to but little chanc of any permanent recovery.

This is the only fly in the ointment o optimism and it is not at present seriousl regarded in the United States as it is offset by so many evidences of real domesti prosperity that people refuse to be alarme This is a condition that makes for "bette times."

Edgar T. Ward, Steel Merchant, Dead

Edgar Temple Ward of West Newton, Mass., a native of Sheffield, England, and long a steel merchant in that city and in Boston, died in his seventy-ninth year at his summer home in Needham, Mass., on Sept. 28.

As a young man he engaged in the steel business in Sheffield, and came to the United States about 1880. Two years after his arrival in this country, Mr. Ward became American agent for the establishment of Seebohm & Dieckstahl, steel manufacturers of Sheffield. Later he was a founder of the Union Twist Drill Co., of Athol, Mass., now a $6,000,000 corporation. He was treasurer of that concern for ten years, and resigned as a director only last year.

In March, 1894, he founded the firm of Ward & Nash Co. of Chicago and Boston. George Nash, a well known steel and iron merchant of Chicago, was Mr. Ward's partner in this combination, which partnership was dissolved in 1899, the latter continuing as American representative for Seebohm & Dieckstahl. The same year the business house of Edgar T. Ward & Sons, steel merchants, was formed. Mr. Ward continued active until his retirement in 1912, after which the firm continued under that name until 1918, when the business was reorganized as the Edgar T. Ward Sons Co.

Mr. Ward's three sons, John, Edgar and Asline, are engaged in the steel business under the firm name of Edgar T. Ward & Sons.

H. P. Parrock Resigns

H. P. Parrock, for many years general manager of the Lumen Bearings Co., in charge of the Buffalo, N. Y., and Youngstown, Ohio, plants, has resigned. He will engage in professional engineering work, specializing in the design, construction and operation of foundries.

Mr. Parrock has had extended experience in the mechanical engineering field. At different times he has been superintendent of the foundry departments of the Penn Steel Co. and the Youngstown Foundry and Machine Co. He is also a director in these companies. Mr. Parrock's offices will be at 164 Lancaster Ave., Buffalo, N. Y.

Fordney Claims Increased Revenue Under American Valuation Plan

Speaking before the national conferen of the State Manufacturers Association i the Congress Hotel, Chicago, Ill., on Sep 27, Congressman Joseph W. Fordney d clared that the American Valuation Pla a feature of his impending tariff bill, w increase the government revenue on imports, protect American industries a exert a beneficial influence on the unemployment situation.

Under his plan the duty on import articles will be based on the Americ value of the goods, instead of the forei valuation as is the present practice. Du on imports will not fluctuate with the d preciation of foreign currency and valuation will be based on the Americ gold dollar.

Walter Camp, president of the Americ Valuation Association, addressed the co ference on "Exchange and American Val ation." He pointed out that Canada charging seven and one-half times the du figured on foreign valuation of Germ goods. This makes it possible for them sell Canadian goods in the Canadian ma ket in competition with German me chandise. He stated that the unemplo ment records showed twenty-nine per ce in the United States compared to four Germany, and whereas German curren has depreciated to one-thirtieth of its fo mer value, living costs in Germany ha only increased seven times. This makes possible for German manufacturers to p good wages and still sell their goods at price below the American production co

Other speakers were William Butt worth, president of the conference; Wil F. Wakeman, American Protective Ta League, of New York; E. B. Leigh, pre dent, Chicago Railway Equipment C Hon. Ira C. Copley, member of the W and Means Committee of the Senate; M. Felton, president of the Chicago Great Western Railroad Co.; J. B. R nolds, of the Treasury Department, Wa ington, D. C.; A. C. Davis, Gurney B Bearing Co., Jamestown, N. Y.; Clare E. Bement, president Novo Engine C Lansing, Mich.; W. L. Allen, Laclede St Co., St. Louis.

Resolutions were adopted by the c ference endorsing the American valuat plan and the Fordney Tariff Bill.

Practical Suggestions from the Unemployment Conference—Four Million Out of Work—Suggest Emergency Commission To Act as Employment Agency

Those who are responsible for the providing of proper machinery by which the Unemployment Conference was able to get to work promptly, are to be congratulated. Credit for most of this, we understand, should go to Herbert Hoover, who not only provided clerks, stenographers, etc., but had a mass of information on the subject of unemployment so as to be readily available for the various committees.

The following summary of its recommendations for an emergency program for immediate adoption and prosecution, deserves the careful study of every thoughtful person who desires to be a good citizen:

(1) The conference finds that there are about 4,000,000 unemployed, as shown by payrolls, and there is a much greater number dependent upon them. There has been an improvement, but pending general trade revival this crisis in unemployment can not be met without definite and positive organization of the country.

(2) The problem of meeting the emergency of unemployment is primarily a community problem. The responsibility for leadership is with the Mayor and should be immediately assumed by him.

(3) The basis of organization should be an Emergency Committee representing the various elements in the community. This committee should develop and carry through a community plan for meeting the emergency, using existing agencies and local groups as far as practicable. One immediate step should be to co-ordinate and establish efficient public employment agencies and to register all those desiring work. It should co-ordinate the work of the various charitable institutions. Registration for relief should be entirely separate from that for employment.

(4) The personnel of the employment agencies should be selected with consideration to fitness only, and should be directed to find the right job for the right man and should actively canvass and organize the community for opportunities for employment. The registry for employment should be surrounded with safeguards and should give priority in employment to residents. Employers should give preference to the emergency employment agencies.

(5) The Emergency Committee should regularly publish the numbers dependent upon them for employment and relief that the community may be apprised of its responsibility. Begging and un-coordinated solicitation of funds should be prevented.

(6) Private houses, hotels, offices, etc., can contribute to the situation by doing their repairs, cleaning, and alterations during the winter instead of waiting until spring, when employment will be more plentiful.

(7) Public construction is better than relief. The municipalities should expand their school, street, sewage, repair work and public buildings to the fullest possible volume compatible with the existing circumstances. That existing circumstances are favorable is indicated by the fact that over $700,000,000 of municipal bonds, the largest amount in history, have been sold in 1921. Of these, $106,000,000 were sold by 333 municipalities in August. Municipalities should give short time employment the same as other employers.

(8) The Governor should unite all State agencies for support of the mayors' and, as the superior officer, should insist upon the responsibility of city officials; should do everything compatible with circumstances in expedition of construction of roads, State buildings, etc.

(9) The Federal authorities, including the Federal Reserve Banks, should expedite the construction of public buildings and public works covered by existing appropriations.

(10) A Congressional appropriation for roads, together with State appropriations amounting to many tens of millions of dollars already made in expectation of and dependence on Federal aid, would make available a large amount of employment. The conference under existing circumstances, notwithstanding various opinions as to the character of the legislation and the necessity for economy, recommends congressional action at the present session in order that work may go forward.

(11) The greatest area for immediate relief of unemployment is in the construction industry, which has been artificially restricted during and since the war. We are short more than a million homes; all kinds of building and construction are far behind national necessity. The Senate Committee on Reconstruction and Production, in March of this year, estimated the total construction shortage in the country at between ten and twenty billion dollars. Considering all branches of the construction industries more than two million people could be employed if construction were resumed. Undue cost and malignant combinations have made proper expansion impossible and contributed largely to this unemployment situation. In some places these matters have been cleaned up. In other places they have not and are an affront to public decency. In some places these things have not existed. In others costs have been adjusted.'

Some materials have been reduced in prices as much as can be expected. Where conditions have been righted, construction should proceed, but there is still a need of community action in provision of capital on terms that will encourage home building. Where the costs are still above the other economic levels of the community there should be searching inquiry and action in the situation. We recommend that the governors summon representative committees, with the co-operation of the mayors or otherwise as they may determine, to (a) determine facts; (b) to organize community action in securing adjustments in cost, including removal of freight discriminations, and clean out campaigns against combinations, restrictions of effort, and unsound practices where they exist to the end that building may be fully resumed.

(12) Manufacturers can contribute to relieve the present acute unemployment situation by:

(a) Part time work, through reduced time or rotation of jobs.

(b) As far as possible, manufacturing for stock.

(c) Taking advantage of the present opportunity to do as much plant construction, repairs, and cleaning up as is possible, with the consequent transfer of many employees to other than their regular work.

(d) Reduction of the number of hours of labor per day.

(e) The reduction of the work week to a lower number of days during the present period of industrial depression.

(f) That employees and employers cooperate in putting these recommendations into effect. A large number of employers have already, in whole or in part, inaugurated the recommendations herein set forth, and for this they are to be commended, and it is earnestly urged upon those employers who have not done so to put same into use, wherever practicable, at the earliest possible opportunity.

(g) Specific methods for solution of our economic problems will be effective only in so far as they are applied in a spirit of patriotic patience on the part of all our people.

During the period of drastic economic readjustment, through which we are now passing, the continued efforts of anyone to profit beyond the requirements of safe business practice or economic consistency should be condemned. One of the important obstacles to a resumption of normal business activity will be removed as prices reach replacement values in terms of efficient producing and distributing cost plus reasonable profit.

We, therefore, strongly urge all manufacturers and wholesalers who may not yet have adopted this policy to do so. But it is essential to the success of these measures when put into effect that retail prices shall promptly and fairly reflect the price adjustment of the producer, manufacturer, and the wholesaler.

When these principles have been recognized and the recommendations complied with, we are confident that the public will increase their purchases, thereby increasing the operations of the mills, factories and transportation companies, and consequently reducing the number of unemployed.

The Electric Foundry and Engineering Co. has been incorporated at Philadelphia, Pa., with a capital stock of $100,000 to manufacture metal castings and machinery.

The National Pump Co., Philadelphia, Pa., has been incorporated with a capital of $250,000. Pumps and pumping machinery will be the principal products.

The "Superpower" report made under the direction of the U. S. Geological Survey, is now in proof form and was released for publication Oct. 1.

Business Items

T. A. Jones has been elected president of the W. A. Jones Foundry & Machine Co., Chicago., Ill., to take the place of William A. Jones, deceased. Mr. Jones has been for many years associated with the company as secretary and treasurer. Other officers elected were W. T. Jones, vice-president and treasurer; J. A. Sizer, secretary; G. W. Page, assistant secretary. The general policy of the company is in no way altered by these changes and W. T. Jones continues as general manager in addition to his new position as vice-president and treasurer.

Reorganization of the Mercer Motors Co., Trenton, N. J., has been completed by the private sale of $2,000,000 in 7 per cent four-year notes, and $500,000 in twenty-year first mortgage bonds. In addition, 100,000 shares of voting trust certificates have been disposed of, making 200,000 shares of these certificates outstanding. The corporation's balance sheet shows current assets of $2,265,767 and current liabilities of only $334,107.

The Garden City Spring Co., maker of the Stanley self-oiling spring, has opened a branch factory at Harrisburg, Pa. T. B. Wildermuth, president of the Front-Market Motor Co., will be general manager of the new plant.

Employees of the Scranton Bolt and Nut Co., Scranton, Pa., some of whom declined to accept a cut in wages and quit, have voted to return and the plant is again in full operation.

The Crane Company has announced that it will soon transfer the manufacture of its brass valves and other products to the plant in Chicago, Ill., leaving the Bridgeport, Conn., plant free to handle the iron production. The Bridgeport plant recently went on a four-day-a-week schedule, instead of three days.

Removal of the plant and equipment of the Stevenson Gear Co., Indianapolis, Ind., from its old quarters to its new factory building at Eleventh St. and Cornell Avenue, has been completed and the company is now in position to resume active manufacture of its product—the Stevenson multiple gear shaper.

The Lyons Manufacturing Co., Providence, R. I., has recently taken over the business of the Metal Products Co., 195 Eddy St., Providence. E. A. Willemine, formerly with the Metal Products Co., has been made superintendent of the metal products department of the Lyons Company.

The Silverman Manufacturing Co. of Providence, R. I., manufacturer of metal goods, etc., has recently removed from 415 Richmond St., to 40 Bassett St., that city.

The Whitlock Coil Pipe Co., of West Hartford, Conn., coil pipe manufacturers, has recently added $50,000 to the capital stock of the company.

The Universal Shuttle Spring Co. of Fall River, Mass., has just been organized and incorporated with a capital stock of $99,000, to manufacture shuttle springs, etc. The president is Isaie Laplante; treasurer, Louis A. Cadoret.

The Safe Auto Lock Co. of Boston, Mass., has recently been organized and incorporated under the laws of the Commonwealth of Massachusetts, to manufacture automobile locks, etc. The capital of the company is $150,000, and the officials are Stanley B. Andrews, president, and Charles F. A. Smith, treasurer.

The Bausch Machine Tool Co., Springfield, Mass., has placed a $1,000,000 mortgage on its property with the State Street Trust Co., Boston. The transaction is in the form of 15-year, 8 per cent, sinking fund, convertible first gold mortgage bonds. Recently the company bought the plant of the Huron Metals Co., adjacent, which it had previously operated under a lease.

The Air Compressor and Equipment Co. has been incorporated at Portland, Ore. Air compressors will be manufactured and assembled. Guy S. Malcolm, George Larrabe and W. E. Thomas are directors.

The Curran-Devitt Motor Co. has been incorporated at Philadelphia, Pa. Capital stock is $350,000.

The Hendee Manufacturing Co., manufacturers of motorcycles and bicycles, Springfield, Mass., has been incorporated to do business in Illinois. The capital stock is $12,500,000, of which $191,625 is to be employed in Illinois. It is said that this is done to make legal, under Illinois laws, the company's sales office at 1229 So. Wabash Ave., Chicago.

The Scholtz Tool Gear and Machine Works, Inc., Waterloo, Iowa, has recently enlarged its machinery equipment by adding $10,000 worth of new machinery. The total machinery equipment is now valued at $30,000. O. A. Scholtz, manager, has recently invented an "auto ambulance" for hauling broken down cars to repair shops and it will be manufactured and marketed by his factory.

The Stein Metal Co., Springfield, Mass., has moved its plant from 54 Taylor St. to 291 Chestnut St.

Personals

Saunders Jones, vice-president for several years of the Atlanta Stove Works, of Atlanta, Ga., resigned his position recently and left for Dallas, Tex., where he will be connected with the Dallas branch of the White Company, manufacturers of motor trucks.

The W. A. Jones Foundry & Machine Co. announces the appointment of Robert B. Moir as manager of the New York branch. He will assume his new duties immediately, making headquarters at the present sales office and transmission warehouse of the company at 20 Murray St. Mr. Moir has been actively connected with the home office and factory for a number of years and is well qualified to assist in power transmission and general engineering problems.

Count Frederick Moltke, of Denmark, chairman of the Danish Steel Industries, Ltd., arrived in this country from Copenhagen on Sept. 27. He said he had come with the expectation of business talks with a number of American industrial heads, particularly those in the steel industry. In Denmark, he said, the steel industry had practically closed down, with more than 60,000 out of employment because of the dislocation of trade with Russia. Resumption of business with Russia, he said, was something for the far distant future to contemplate.

Obituary

Alexander Mason Gibbes, president of the Gibbes Machinery Co., of Columbia, S. C., and a prominent member of the Southern Metal Trades Association, died recently at Columbia, at the age of 44 years. Mr. Gibbes visited his office as usual the day of his death and was apparently in the best of health. He died suddenly while sitting in a chair before his desk.

Henry J. Kimman, manager of the Cleveland plant of the Chicago Pneumatic Tool Co., died in Cleveland, Ohio, on Sept. 7. He was born in Haarlem, Holland, in 1863, and emigrated to America with his parents and settled in Chicago in 1870. Being of a mechanical trend of mind he served his time with the Adams-Westlake Co. and other manufacturing concerns in Chicago and the West. In the manufacture of air drills he became associated with E. N. Hurley and they formed the Standard Pneumatic Tool Co. in 1898. Later he became associated with the Chicago Pneumatic Tool Co. in the consolidation of pneumatic tool interests. He was appointed manager of the Cleveland plant of the Chicago company and remained in active charge of the plant until his death.

Alexander Fleck, president of the Alexander Fleck, Ltd., Vulcan Iron Works, Ottawa, Canada, died at his home there on Sept. 22. He was 54 years old. He was prominent in the foundry and machine industry in Canada and the United States.

Allan Ransome, for many years identified with the machine-tool trade in this country, died in San Francisco on Sept. 21. He was 61 years old. At one time he was connected with the Lodge & Davis Machine Tool Co., and also with the Prentiss Tool Company.

Book Reviews

Drawing Room Practice. By Frank A. Stanley, editor *Western Machinery World* and Consulting Mechanical Engineer. Two hundred fifty-three 6x9-in. pages, 487 illustrations. Published by the McGraw-Hill Book Co. Inc., 370 Seventh Ave., New York City.

A volume which deals with the making of drawings, from the simplest details of mechanism to complete assembly. The material has been drawn from experience gained in a number of the leading drafting rooms of both America and Europe, and in class work in connection with the instruction of students, machinists and toolmakers. The chapters on the laying out of jigs and fixtures, punches and dies and other special tools are as comprehensive as the space allotted will permit of. This and the chapter on limit dimensions or drawings should be of benefit to many of the older draftsmen as well as those of more limited experience over the drawing board. Following are the chapter headings, which will give an idea of the scope of the work: Drawing Instruments and Their Uses; Projection; Practical Applications of the Principles of Projection; Development of Surfaces; Intersections; The Helix and Its Applications; Screw Threads in Their Conventional Forms; Showing Detail Parts—Sections; Parts and Sections in Assembly Drawings; Working Drawings; Working Drawings of Small and Medium Sized Parts; Tool Drawings; Limit Dimensions or Drawings; Isometric and Oblique Drawings; Shop Sketches.

The Working of Steel: By Fred H. Colvin and K. A. Juthe. Two hundred thirty-seven 6 x 9-in. pages, green cloth boards. Many illustrations and tables. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York City.

This book is a treatise on annealing, heat treating and hardening of carbon and alloy steels. It supplies information from the authors' experience and from other reliable sources as to the most approved methods of working the various kinds of steel now in commercial use, including low carbon, high carbon and alloy steels of various kinds. The automotive industry has been drawn upon freely as has practice in government arsenals on steels used in firearms. There is included information on the making of different steels.

Chapter headings are: Steel Making; Composition and Properties of Steels; Alloys and their Effect Upon Steel; Application of Liberty Engine Materials to the Automobile Industry; The Forging of Steels; Annealing; Case-hardening or Surface Carburizing; Heat-treatment of Steel; Hardening Carbon Steel for Tools; High-Speed Steels; Furnaces; Pyrometry and Pyrometers.

The book is well and carefully written. The authors have expended much time and work in preparing this volume, which will be found of value to all who use steel.

The Elements of Specification Writing. By Richard Shelton Kirby, C. E., assistant professor in the Sheffield Scientific School of Yale University. Second edition, revised. One hundred fifty-three 6x9-in. pages. Published by John Wiley & Sons, Inc., New York City.

In this edition the manuscript has been revised for the purpose of widening the field of usefulness of the book for those outside the civil engineering profession; to emphasize the practical connection between the content and phrasing of specification clauses and their application to working conditions, and to bring the book up to date. The increased number of concrete illustrations and the questions for discussion following certain chapters are intended to contribute to more effective teaching. Much new material has been added and chapters I and II have been largely rewritten. The chapter headings in the order of presentation follow: Introduction; Contract and Bond; Advertisement (or Notice to Contractors) and Information for Bidders; Proposal; The Composition of Specifications; General Clauses—Specifications and Plans; General Clauses—The Engineer During Construction; General Clauses—The Contractor and His Workmen; General Clauses—The Contractor's Miscellaneous Responsibilities; General Clauses—Progress of Work; General Clauses—Terms of Payment; Specific Clauses: Outlines of Specific Clauses.

Official report of the Eighth National Foreign Trade Convention. Six hundred and twenty-eight pages, 6 x 9 in., published by the National Foreign Trade Convention Headquarters, India House, New York City.

This is a stenographic report of proceedings, discussions and speeches at the eleventh group session and the addresses of the general sessions, together with a list of the delegates present, the organizations and companies represented, and the personnel of the convention. This convention was held in Cleveland, May 4 to 7, inclusive, and, as may be imagined, covered a wide variety of the different phases of foreign trade. It is obviously impossible to give an adequate review of proceedings of this kind, as this would require copious extracts from the addresses delivered at the various sessions. All who are interested in foreign trade prospects, will do well to study the various suggestions made, not omitting the addresses of Paul H. Cromelin and Rowland Rogers, pointing out the value of the motion picture in this connection. Pictures speak a universal language and cannot be misinterpreted nearly so readily as translations into a foreign language.

Foreign Commerce and Navigation of the United States, 1920: Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C. Copies may be purchased from Superintendent of Documents, Government Printing Office, Washington, D. C., at $1.25 per copy.

A voluminous collection of statistics covering the export and import trades of the United States with foreign countries for the calendar year 1920. This data is mostly in the form of tables which are grouped according to kind of merchandise, use and degree of manufacture. Two tables summarizing the number and tonnage of vessels entered and cleared in the foreign trade are also included.

Personal Selling. By Wesley A. Stanger. Twelve 5 x 8-in. paper covered pamphlets of from 18 to 30 pages each, with a paper container for the group. Published by the Biddle Publishing Co., 19 W. 44th St., New York City.

The pamphlets take up: Personality of the Salesman; Meeting Competition; Requirements for Success; Meeting Objections; Resistance; Solicitation; Prospects; Price; Closing the Deal; Compensation, etc. Each treatise is concluded by a list of questions which the careful reader should be able to answer to his own satisfaction.

This set of pamphlets will be of benefit to salesmanager, salesman and prospective salesman. The pertinent points in selling are listed and discussed in a competent and thorough manner. The pamphlet form makes it possible to study any one subject any time without carrying a large volume.

Forthcoming Meetings

A joint meeting of the American Society of Mechanical Engineers, the Society of Automotive Engineers and the Army Ordnance Association will be held at Aberdeen, Md., Friday, October 7.

The annual meeting of the National Association of Purchasing Agents will meet in the Claypool Hotel, Indianapolis, Ind., on Oct. 10 to 13, inclusive. L. F. Boffey, 19 Park Place, New York City, is secretary.

The American Gear Manufacturers Association will hold its semi-annual meeting at Rochester, N. Y., October 13, 14 and 15. F. D. Hamlin, 4401 Germantown Ave., Philadelphia, Pa. is secretary.

The National Machine Tool Builders' Association will hold its fall meeting at the Hotel Astor, New York City, October 18, 19 and 20.

There will be a meeting of the Machine Tool Section of the National Supply and Machinery Dealers' Association in the Hotel Astor, New York City, on Wednesday, Oct. 19, at ten o'clock in the morning. Thomas Fernley, 505 Arch St., Philadelphia, Pa., is secretary.

The annual convention of the Industria Relations Association, of America, will be held in the Waldorf-Astoria Hotel, New York City, on Nov. 1, 2, 3 and 4.

The National Conference of the Industrial Cost Association will be held at Pittsburgh, Pa., on Nov. 2, 3 and 4.

The third annual convention and exhibition of the American Gas Association will be held in the Congress and Auditorium Hotels, Chicago, Ill., on Nov. 7 to 12.

NEW *and* ENLARGED SHOPS

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Conn., Norwich—The United Metal Mfg. Co., Inc., R. S. Chisolm, Pres.—one planer with 5 ft. bed and 2 No. 4 Warner & Swasey turret lathes.

Mass., Adams—H. C. Kaiser, Main St.—equipment for auto repair shop.

Mass., Dedham—The Dedham Motor Mart, Eastern Ave.—equipment for garage.

Mass., Holyoke—The New England Tire & Rubber Co., South Main St., E. Kerns, Vice-Pres.—small machine tools including engine lathe, power drill press, etc.

Vt., Wallingford—The Wallingford Mfg. Co., manufacturer of hand tools for farm and garden—No. 0 Stiles power punching press, similar to Bliss, and one riveting or rivet spinning machine.

N. J., Mt. Holly—W. A. Jones, Washington and King Sts.—tools for garage and service station.

N. Y., New York—The Cornesh Wire Co., 30 Church St.—one 11 in. x 5 ft. lathe, complete with regular equipment including compound rest, large and small face plates and countershaft with 12½ in. swing over bed.

Pa., Philadelphia—J. Meyer Glenwood Tile Co., 1944 North 20th St.—tools for repair shop and garage.

Pa., Williamsport—H. A Sterner, Secy. School Dist., 229 West 3d St., will receive bids until Oct. 19 for 3 motor driven engine lathes, 11 x 36 in. between centers.

La., New Orleans—The Estate of R. G. Holzer, 317-329 Burgundy St. (manufacturers and sheet metal workers), J. E. V. Holzer, Asst. Sales Mgr.—one 10 ft. 6 in. G. A. Ohl power press brake ½ equal; Ives & Lamberson 2½ in. x 26 in. turrent lathe, (used machines, late models).

S. C., Greenville—Harris-Brockman Mfg., Co., Inc., manufacturers of pumps, etc., J. O. Brockman, Secy.—one 6¼ in. hollow spindle turret lathe, vertical turret drilling machine, special tools to be made to order. Would like to get in touch with die casting works.

Va., Richmond — The Stewart Products Service Station, 1615 West Broad St.—calibrating machine (new or used), drill press and small lathe.

Ill., Chicago—Hess Warming & Ventilating Co., 1219 South Western Ave.—one No. 4 punch press.

Ill., Galesburg—The Rowe Mfg. Co., Holton and West 3rd Sts.—one spot welding machine.

O., Buffton—Burns Products Co., W. H. Wallace, Purch. Agt.—shop equipment for machinery manufacture.

O., Columbus—Lowe Bros. Machine and Eng. Co., 200 West Mound St., W. D. Lowe, Purch. Agt.—one 20 in. press without back gears, and a motor driven emory stand.

Wis., Milwaukee—W. A. McElroy, 656 Astor St.—one drill press 15 in table, one small lathe, one bench drill press, one arbor press, one tool post grinder and one 10 in. emery wheel.

Wis., Milwaukee—The Natl. Fdry. Co., 24th Ave. and Park St.—punch press and tinners brake.

Wis., Milwaukee—The Smith Eng. Wks., 1154 32nd St., C. F. Smith, Pres.—drill presses.

Wis., Milwaukee—The Standard Sheet Metal Wks., 1184 24th St., J. Madis, Purch. Agt.—8 ft. brake, also square shear with 8 ft. opening.

Mo., Joplin—Rogers Fdry. Co., 11th and Pearl Sts.—tools for machine shop.

Tex., Wichita Falls — Superintendent of Missouri, Kansas & Tex R.R. Co., Wichita Falls—machinery and lathes, drills, etc., for car shops.

Ore., Klamath Falls—The Klamath Iron & Steel Wks., Inc.—catalogues for founders and machinists.

Que., Montreal—Bramsons Auto Service, Ltd., Phillips Sq., L. Bramson, Purch. Agt.—machinery for proposed auto repair shop.

Que., Montreal—L. J. Phaneuf, 201a Christopher Columbus St.—equipment for garage and auto repair shop.

C. A., Honduras, San Pedro—J. E. Barrett—one 13 in. lathe, 8 in. swing over bed and a 15 in. lathe.

Mass., West Springfield (Springfield P. O.)—P. Fossa, New Bridge St.—machinery for making ice cream, shafting, hangers, etc.

N. Y., Buffalo—Planing Mill. 15 Layer Ave., J. M. Holland, Purch. Agt.—one 12 in. jointer.

N. Y., Poughkeepsie—H. C. Gaul, Dir. of Industrial Arts High School—Universal woodworker.

Pa., Mt. Carmel—The Shamokin & Mt. Carmel Ry. Co.—One band saw machine not less than 36 in. One jointer not less than 12 in. One Universal wood machine.

Pa., Philadelphia—F. W. Tunnell & Co., 15 North 5th St.—machinery for proposed fertilizer plant.

Pa., Philadelphia—C. Wacker Co., 1304 West Cumberland St.—wood-working machinery.

S. C., Florence—The Florence Gas Co., S. W. Brown, Vice Pres. and Mgr.—Steam driven compressor for artificial gas requiring a maximum pressure of 40 lbs. and having a capacity of 15,000 ft. per hour.

S. C., Lena—H. L. Lawton—two saw trimmers, 16 ft. or over, (used if in good condition).

Va., Damascus—The Damascus Lumber Co., C. W. Bondurant, Purch. Agt.—band re-saw, niggers, kickers, edger, carriage, trimmer, live rolls and all equipment for band mill, including engine large enough to run entire equipment.

O., Columbus—Madden-Atkinson Auto Co., 399-401 East Main St., R. P. Atkinson, Purch. Agt.—several air compressors.

Wis., Fond-du-Lac—Latex Tire & Rubber Co., East Scott St.—one tubing machine, two rubber mills and two building machines.

Wis., Merrill—The Merrill Wood Products Co.—woodworking machinery to manufacture boxes.

Wis., Milwaukee—C. N. Caspar Co., 454 East Water St.—one medium size steel paper baling machine.

Wis., Milwaukee—The Holeproof Hosiery Co., 41 4th St.—knitting machines.

Wis., Milwaukee—The Moon Beverage Co., 207 Pereless Bldg., T. W. Webb, Purch. Agt.—capping machines, fillers, etc.

Wis., Milwaukee—The National Distilling Co., 27th St. and St. Paul Ave.—distillery apparatus.

Wis., Nelsonville—H. J. Kaukrud—machinery for proposed saw mill.

Wis., Racine—Horlicks Malted Milk Co., Holicksville, W. Horlick, Purch. Agt.—barley separators and graders, malt cleaning machines and conveyors.

Cal., Los Angeles — Keeler-Comey C., c/o G. W. Eldredge, Archt., 226 Pacific Finance Bldg.—machinery for making ice cream.

Que. Montreal—W. Taylor, 2454 Chalvt St.—machinery and equipment for foundry.

Metal Working Shops

NEW ENGLAND STATES

Conn., Putnam—The New York. New Haven & Hartford R.R., New Haven, has awarded the contract for the construction of a 1 story, 45 x 170 ft. roundhouse at the freight yard here.

Mass., Adams—H. C. Kaiser, Main St., will soon award the contract for the construction of a 1 story, 70 x 100 ft garage and service station on Main St. Estimated cost, $40,000. Private plans.

Mass., Dedham—The Dedham Motor Mart, Eastern Ave., will soon award the contract for the construction of a 1 story, 80 x 130 ft. garage on Eastern St. Estimated cost, $40,000.

Mass., Malden—Potter Bros., 339 Main St., have awarded the contract for the construction of a 2 story, 80 x 115 ft. garage and service station on Main St. Estimated cost, $100,000. Noted March 24.

Mass., Northampton—F. Girard, King St., will build a 1 story, 100 x 125 ft. garage, etc., on North St. Private plans. Noted Sept. 15.

The Weekly Price Guide

This Week's Market

While quotations as low as $1.60@$1.70 on structurals have been reported, the official Pittsburgh base of $1.75 stands except for very large orders. Bars are $1.65. For sheets the Pittsburgh mill prices are: No. 28 black steel at $3 as against $2.75 and No. 10 blue annealed at $2.50 as compared with $2.25 per 100 lb., one week ago. Mill shipments, New York, of structural shapes and plates are quoted at $1.98@$2.03; soft steel bars at $1.88@$1.98 per 100 lb.

Slight advances in metal prices are reported in New York and St. Louis warehouses. Copper has advanced ⅒c., lead ½c. and zinc ¼c. per lb. in quantities under car-load lots. Cleveland quotes aluminum at 25c. as against 25@26c. per lb. Brass rods have declined 50c. and brass tubing 2c.; while a reduction of 1c. per lb. on brass sheets and copper tubing, respectively, is reported in Cleveland warehouses.

Linseed oil is quoted in New York at 76c., as against 80c. per gal. (5-bbl. lots).

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	†$24.50
Northern Basic	†22.52
Southern Ohio No. 2	†23.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	†30.26
BIRMINGHAM	
No. 2 Foundry	†20.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	†22.76
Virginia No. 2	†28.74
Basic	†20.75
Grey Forge	†21.75
CHICAGO	
No. 2 Foundry local	†22.70
No. 2 Foundry, Southern, sil 2.25@2.75	†26.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	†22.96
Basic	†21.96
Bessemer	†21.96

*F. o. b. furnace. † Delivered.

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50	3.28	3.10	3.38
No. 12	2.60	3.33	3.15	3.43
No. 14	2.70	3.38	3.20	3.48
No.16	2.80	3.48	3.30	3.58
Black				
Nos. 17 and 21.	2.85	3.80	3.55	3.95
Nos. 22 and 24.	2.90	3.85	3.60	4.00
Nos. 25 and 26.	2.95	3.90	3.65	4.05
No. 28	3.00	4.00	3.75	4.15
Galvanized				
Nos. 10 and 11.	3.00	4.00	3.75	4.15
Nos. 12 and 14.	3.10	4.10	3.85	4.25
Nos. 17 and 21.	3.40	4.40	4.15	4.55
Nos. 22 and 24.	3.55	4.55	4.30	4.70
No. 26	3.70	4.70	4.55	4.85
No. 28	4.00	5.00	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of Sept. 16, 1921:

Steel			Iron		
Inches	Black	Galv.	Inches	Black	Galv.
BUTT WELD					
1 to 3	68½	56	¾ to 1½	39½	24½
LAP WELD					
2	61½	49	2	34½	20½
2½ to 6	65½	53	2½ to 4	37½	24½
7 to 8	62½	49	4½ to 6	37½	24½
9 to 12	61½	48	7 to 12	35½	22½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66½	55	1 to 1½	39½	25½
2 to 3	67½	56			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59½	48	2	35½	22½
2½ to 4	63½	52	2½ to 4	38½	26½
4½ to 6	62½	51	4½ to 6	37½	25½
7 to 8	58½	45	7 to [illegible]	30½	18½
9 to 12	52½	39	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded.	60%	46%	60½%	47½%	68½%	56%
3½ to 6 in. steel lap welded.	51%	37%	58½%	44½%	65½%	53%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (heavy)	5.00	6.00	8.25
Spring steel (light)	6.00	6.00	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.03
Hoop steel	3.88	3.29	3.48
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	4.85	2.74	5.23
Cold finished shafting or screw	4.03	3.50	4.00
Cold finished flats, squares	4.53	4.00	4.50
Structural shapes (base)	2.88	2.74	2.88
Soft steel bars (base)	2.78	2.64	2.78
Soft steel bar shapes (base)	2.78	2.64	2.78
Soft steel bands (base)	3.43	....	.....
Tank plates (base)	2.88	2.92½	2.88
Bar iron (mill 2.25)	2.78	3.52	2.78
Drill rod (from list)	55@60%	55%	50%

Electric welding wire.......... New York 3/32, 8½c. per lb. ⅛—7.15c.; 5/32 to ¼—6.75c. Swedish iron sells at 18½c. per lb. in Chicago

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	13.10
Tin, 5-ton lots, New York	27.25
Lead (up to carlots), St. Louis, 4.60; New York	5.00
Zinc (up to carlots), St. Louis, 4.85; New York	5.25

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.00	25.00	21.00
Antimony (Chinese), ton spot	5.25	6.00	6.00
Copper sheets, base	19.75	20.50	19.50
Copper wire (carlots)	15.50	15.50	14.00
Copper bars (ton lots)	18.00	22.00	17.50
Copper tubing (100-lb. lots)	19.50	22.00	19.50
Brass sheets (100-lb. lots)	15.25	17.00	15.25
Brass tubing (100-lb. lots)	18.00	18.00	18.00
Brass rods (1,000-lb. lots)	13.25	15.00	13.25
Zinc sheets (casks), (8% dis. carlots)	11.00	11.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ½), (case lots)	19.50	23.50	17.50
Babbitt metal (best grade)	70.00	37.50	32.00
Babbitt metal (commercial)	30.00	13.50	8.00

—Shop Materials and Supplies

MONEL METAL—Base price in cents per lb., f.o.b. Bayonne, N.J.:

Shot	35.00	Hot rolled machine rods (base)	53.00
Blocks	35.00	Hot rolled rods (base)	42.00
Ingots	38.00	Cold rolled rods (base)	56.00
Sheet bars	40.00	Hot rolled sheets (base)	55.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

OLD METALS--Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	9.50	9.00	10.00
Copper, heavy, and wire	9.00	9.00	9.00
Copper, light, and bottoms	7.00	7.00	8.00
Lead, heavy	3.25	3.00	3.75
Lead, tea	2.00	2.00	2.75
Brass, heavy	5.00	5.00	7.50
Brass, light	4.00	3.00	4.50
No. 1 yellow brass turnings	4.50	4.00	5.00
Zinc	2.50	2.00	2.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

			New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:					
IC,	20x28,	112 sheets	21.50	......	....
IX,	20x28,	112 sheets	24.00	......	....
IXX,	20x28,	56 sheets	13.75	......	....
IXXX,	20x28,	56 sheets	15.50	......	....
IXXXX,	20x28,	56 sheets	17.00	......	....
"A" Charcoal Allaways Grade:					
IC,	20x28,	112 sheets	18.50	......	....
IX,	20x28,	112 sheets	21.50	......	....
IXX,	20x28,	56 sheets	12.25	......	....
IXXX,	20x28,	56 sheets	14.00	......	....
IXXXX,	20x28,	56 sheets	15.75	......	....

Coke Plates, Bright

Prime, 20x28 in.:			(56 sheets)	
80-lb,	112 sheets	13.60	......	....
90-lb.,	112 sheets	13.80	......	....
100-lb.,	112 sheets	14.00	6.50	....
IC,	112 sheets	14.30	6.65	....
IX,	112 sheets	16.30	......	....
IXX,	56 sheets	9.15	......	....
IXXX,	56 sheets	10.15	......	....
IXXXX,	56 sheets	11.15	......	....

Terne Plate

Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.50	6.25	6.25
IC,	14x20	7.75	6.50	6.50

SHOP SUPPLIES

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	—50%	−60%	—60–5%
1⅛ and 1¼x3 in. up to 12 in.	—40%	60–10–10%	—55%
With cold punched sq. nuts	—30%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	—40%	....	.....
Up to 1-in. diameter, with cold punched hex. nuts (plus std. extra of 10%)	—30%	....	.....
Button head bolts, with hex. nuts	—20%	$3.90 base	.....
Hex. head and hex. nut bolts	—20%	....	.....
Lag screws, coach screws	—50–10%	....	.....
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	50–10–10%	50–5%
Bolt ends, with hot pressed nuts	—50%	....	.....
Tap bolts, hex. heads	—20%	....	.....
Rivets, $\frac{7}{16}$ in. dia. and smaller. *New list*	−50-10%	60-10-10%	-60-10%
Rivets, tinned	-50-10%	60-10-10%	—45%
Semi-finished nuts, all sizes	—70%	75%	50%
Case-hardened nuts	—60%	....	.....
Washers, cast iron, ½ in., per 100 lb.	$5.00	$5.50 off	$4.50
Washers, cast iron, ⅝ in. and larger, per 100 lb	4.25	3.75 off	4.50
Washers, round plate, off list per 100 lb.	3.00	....	.....
Nuts, hot pressed, sq. Off list	2.00	3.00	3.25
Nuts, hot pressed, hex. Off list	2.00	3.00	3.25
Nuts, cold punched, sq. Off list	1.50	3.00	3.00
Nuts, cold punched, hex. Off list	1.50	3.00	3.00
Rivets:			
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb	$4.40	3.50	3.68
Cone heads, ditto	4.50	3.60	3.78
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	....
⅞ in. diameter *EXTRA*	0.15	....	....
½ in. diameter *EXTRA*	0.50	....	....
1 in. long, and shorter *EXTRA*	0.50	....	....
Longer than 5 in. *EXTRA*	0.25	....	....
Less than 200 lb. *EXTRA*	0.50	....	....
Countersunk heads *EXTRA*	0.35	....	....
Copper rivets	50–10%	40–10%	50%
Copper burs	25–10%	15%	20%

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb.	.055@.09	.09	.10
Wiping cloths per M., 13¼x13¼	....	55.00	55.00
Wiping cloths per M., 13¼x20½	....	65.00	65.00
Sal soda, 100 lbs	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb	2.55	3.25	2.75
Linseed oil, per gal., 5 bbl. lots	.76	.88	.87
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 100 lb.		.80	.80
Coke, prompt furnace, Connellsville	per ton	$3.25@3.40	
Coke, prompt foundry, Connellsville	per ton	4.25@4.50	

Mass., Springfield—The Connery Machine Co., 56 Harrison Ave., plans to build a small shop.

R. I., Pawtucket—The Bd. Educ. plans to build a manual training and industrial arts school on Fountain St. Estimated cost, $1,200,000. Architect not selected.

MIDDLE ATLANTIC STATES

N. J., Mt. Holly—Folsom & Stanton, Archts., 10 South 18th St., Phila., Pa., will receive bids until Oct. 20 for the construction of a 1 and 2 story, 100 x 200 ft. garage and service station on Washington and King Sts., for W. A. Jones. Estimated cost, $70,000.

Pa., Philadelphia—The city plans to build traffic and van stables, also repair shops for the police department. Estimated cost, $250,000. F. C. Dunlap, City Hall, Engr.

Pa., Philadelphia — Egnal & Motusan Bros., 3d and Berks Sts., will build a 2 story, 74 x 120 ft. garage on Woodstock and Berks Sts. Estimated cost, $70,000.

Pa., Philadelphia—S. W. Evans & Co., 4623 Paul St., manufacturer of metal products, has awarded the contract for the construction of an addition to its factory. Estimated cost, $50,000.

Pa., Philadelphia—C. Goldman, 725 Walnut St., is having plans prepared for the construction of a 1 story, 54 x 200 ft. garage at 406-8 South Front St. Estimated cost, $60,000. H. B. Weldon, 10 South 18th St., Archt.

Pa., Philadelphia—A. Sabet, 3133 Frankford Ave., will receive bids until Oct. 15 for the construction of a 1 story, 41 x 185 ft. garage on Allegheny and Frankford Aves. Estimated cost, $40,000. Private plans.

MIDDLE WEST STATES

Ill., Cicero—J. M. Host has awarded the contract for the construction of a 1 story, 64 x 125 ft. garage. Estimated cost, $50,000.

Ill., Peoria—The Peoria Sheet Metal Co., c/o J. Freid, 2815 Main St., plans to build a 1 story factory. Estimated cost, $50,000. Architect not selected.

O., Cleveland—M. A. Gleason, 1625 Williamson Bldg., is receiving bids for the construction of a 1 story, 90 x 109 ft. garage at 6815 Superior Ave. Estimated cost, $40,000. Private plans.

O., Cleveland—Sobel & Elder, 416 Guardian Bldg., are receiving bids for the construction of a 1 story, 100 x 100 ft. garage at 2719 East 55th St. Estimated cost, $50,000. E. A. Curtiss, 605 Republic Bldg., Archt.

O., Cleveland—O. Uterhardt, 12203 Farrington Ave., has had plans prepared for the construction of a 1 story, 40 x 90 ft. garage at 3308 East 116th St. Estimated cost, $40,000. Private plans.

Wis., Green Bay—The Bd. Educ. plans to build a vocational school to include a fully equipped machine shop. Estimated cost between $250,000 and $300,000. A. W. Burton, Secy. Architect not selected.

Wis., Kilbourn—D. A. Colby plans to build a 2 story, 60 x 95 ft. garage and machine shop on Bway. Estimated cost, $45,000. Architect not selected.

Wis., Milwaukee—J. Wollaeger Co., 417 Wells St., is having plans prepared for the construction of a 4 story, 90 x 120 ft. garage on 28th and Grand Sts. Estimated cost, $95,000. M. Fernekes, 97 Wisconsin St., Archt.

Wis., Oshkosh—The Oshkosh Tractor Co., c/o A. D. Paine, 22 New York Ave., has awarded the contract for the construction of a 1 story, 150 x 375 ft. tractor factory. Estimated cost, $170,000. Noted Sept. 29.

Wis., Racine — The Harvey Spring & Forging Co., has awarded the contract for the construction of a 2 story, 58 x 60 ft. factory on 17th St. and Murray Ave. Estimated cost, $40,000. Noted Sept. 8.

Wis., Racine—The West Racine Garage & Implement Co., 3218 Washington Ave., has awarded the contract for the construction of a 1 and 2 story, 60 x 90 ft. garage and machine shop on Washington Ave. Estimated cost, $40,000.

Wis., Saukville—A. Horn has awarded the contract for the construction of a 1 and 2 story, 65 x 110 ft. garage and repair shop on Main St. Estimated cost, $40,000. Noted Sept. 29.

WEST OF THE MISSISSIPPI

Kan., Parsons—The Missouri, Kansas & Texas Ry., Ry. Exch. Bldg., St. Louis, Mo., is having plans prepared for the construction of a 1 story reclamation plant, here. Estimated cost, $166,000. A. L. Sparks, care of owner, Archt.

Mo., St. Louis—The Plymouth Garage Co. 5909 Plymouth St., has awarded the contract for the construction of a 1 story, 75 x 80 ft. garage on Plymouth and Hamilton Sts. Estimated cost, $50,000. Noted Sept. 8.

Mo., St. Louis — The St. Louis & San Francisco Ry. Co., Frisco Bldg., will receive bids until Oct. 11 for the construction of a 1 story, 40 x 123 ft. machine shop at Chateau Ave. yards. Estimated cost, $55,000. R. C. Stephens, care of owner, Archt.

WESTERN STATES

Mo., Joplin—Rogers Fdry. Co., 11th and Pearl Sts., has had plans prepared for the construction of a 1 story, 80 x 100 ft. foundry on West 10th St. Estimated cost, $30,000. Private plans.

Mo., St. Louis—J. Forshaw Stove & Heating Co., c/o J. Forshaw, Pres., 111 North 12th St., plans to build a 7 story, 25 x 100 ft. factory at 109 North 12th St. Estimated cost, $75,000. Architect not selected.

Ore., Klamath Falls—The Klamath Iron & Steel Wks., Inc., plans to rebuild its foundry which was recently destroyed by fire. Estimated loss, $15,000. B. M. Hall, Mgr.

Utah, Salt Lake City — The Utah Steel Corp. has increased its capital stock from $750,000 to $5,000,000 and plans to build additions to present mills, new blast furnace and sheet steel mill. M. S. Rosenblatt, Genl. Mgr.

CANADA

Que., Montreal—Bramsons Auto Service, Ltd., Phillips Sq., has awarded the contract for the construction of a 6 story, 50 x 90 ft. garage on Ontario St. Estimated cost, $100,000.

General Manufacturing

NEW ENGLAND STATES

Conn., Cheshire—The Connecticut State Reformatory has awarded the contract for the construction of a 1 story industrial school at reformatory, here. Estimated cost, $45,000.

Me., Richmond — The Damariscotta Leather Co. will build a 3 story, 65 x 201 ft. mill. Estimated cost, $100,000. Private plans.

Mass., Adams—The Renfrew Mfg. Co., manufacturer of ginghams, is receiving bids for the construction of a 1 and 2 story, 83 x 107 ft. picker, storage and office building. Estimated cost, $75,000. A. F. Gray, 53 State St., Boston, Archt.

Mass., Waltham—The Elastoid Fibre Co. has awarded the contract for the construction of a 1 story, 72 x 181 ft. factory. Estimated cost, $60,000.

R. I., Woonsocket — The Lafayette Worsted Co., Hamlet Ave., has awarded the contract for the construction of a 6 story, 136 x 246 ft. worsted factory on Hamlet Ave.

MIDDLE ATLANTIC STATES

Md., Baltimore—The Western Maryland Dairy Co., Linden Ave., has awarded the contract for the construction of a 4 story, 100 x 165 ft. dairy plant on Linden and Dolphin Sts. Estimated cost, $500,000. Noted Aug. 1.

Pa., Philadelphia—F. W. Tunnell & Co., 15 North 5th St., has awarded the contract for the construction of a fertilizer plant on Wheat-sheaf Lane and Gual St. Estimated cost, $150,000.

Pa., Philadelphia—C. Wacker Co. will build a 1 story, 43 x 77 ft. wagon factory at 1304-6-8 West Cumberland St. Estimated cost, $15,000.

SOUTHERN STATES

N. C., Asheville—The Asheville Power & Light Co., has awarded the contract for the construction of a gas generating plant. Estimated cost, $200,000.

MIDDLE WEST STATES

O., Canton—Schory & Schellhase Co., 6th St. and Harrison Ave., S.W., plans to build a 2 story, 60 x 200 ft. ice plant on Harrison and 6th Sts., S.W. Estimated cost, $250,000.

O., Cleveland—The City Ice & Fuel Co., Cadillac Bldg., has awarded the contract for the construction of a 1 story, 52 x 75 ft. ice plant on Addison Rd. Estimated cost, $100,000. Noted Sept. 29.

O., Youngstown—The Distilled Water Ice Co., 523 West Federal St., has awarded the contract for the construction of a 1 story, 70 x 160 ft. ice plant on Federal St. Estimated cost, $100,000. Noted Sept. 29.

Wis., Kansasville—The Spring Valley Sanitary Milk Co. has awarded the contract for the construction of a 2 story addition to its pasteurizing plant. Estimated cost, $15,000.

Wis., Milwaukee—The Holeproof Hosiery Co., 41 4th St., has awarded the contract for the construction of a 3 story, 58 x 150 ft. factory on 30th St. Estimated cost, $100,000.

Wis., Milwaukee—E. R. Liebert, Archt., 432 Bway., will open bids about Oct. 10, for the construction of a 1 story, 35 x 42 ft. addition to the still house of the Natl. Distilling Co., 27th St. and St. Paul Ave. Estimated cost, $10,000.

Wis., Nelsonville—H. J. Kaukrud is having plans prepared for the construction of a 2 story, 48 x 130 ft. saw mill. Estimated cost, $55,000. Private plans.

Wis., North Milwaukee—J. Greenebaum Tanning Co. has awarded the contract for the construction of a 2 story, 45 x 70 ft. addition to tannery. Estimated cost, $35,000. Noted Sept. 1.

WEST OF THE MISSISSIPPI

Kan., Coffeyville—F. R. Lawson, Nowata, Okla., is having plans prepared for the construction of a 2 story ice plant here. Estimated cost, $100,000. Architect not announced.

Mo., Kansas City—The Superior Ice Co., c/o A. L. Williams, Lee Bldg., is having plans prepared for the construction of a 3 story ice storage plant on 2nd and Main Sts. Estimated cost, $150,000. B. B. Ryan, care of owner, Archt.

Okla., Oklahoma City—The Smith Baking Co., 437 West Park St., is having plans prepared for the construction of a 2 story, 100 x 150 ft. bakery on 39th and Oklahoma Aves. Estimated cost, $150,000. Noted Sept. 15.

WESTERN STATES

Cal., Los. Angeles—Keeler Comey Co., c/o G. W. Eldredge, Archt., 226 Pacific Finance Bldg., has awarded the contract for the construction of a 2 story, 125 x 240 ft. ice cream plant on San Pedro St. Estimated cost, $600,000.

CANADA

N. B., Bathhurt—The Bathurst Co., Ltd., is having plans prepared for the construction of a lime plant, including 2 Meade kilns equipped with automatic stokers and induced draft. R. K. Meade & Co., 11-13 East Fayette St., Baltimore, Md., Engrs.

Que., Montreal—The Dominion Oxygen Co., Burgess St., has awarded the contract for the construction of a 1 story, 82 x 101 ft. plant on Liber and Burgess Sts. Estimated cost, $40,000. Noted July 21.

Que., Montreal—Molsons Brewery, 906 Notre Dame St., plans to build a 6 story, 91 x 124 ft. brewery on Notre Dame St., E. Estimated cost, $119,000.

American Machinist

Volume 55 NEW YORK, OCTOBER 13, 1921 Number 15

Production in Pictures

THE appeal of pictures has always been a strong one to the human race. Before the dawn of civilization paleolithic man developed a very creditable ability to portray his animal contemporaries in color. Some few of his achievements still remain. Ages later when what we now call civilization was in its infancy, men recorded their thoughts and their deeds by pictures long before an alphabet was conceived. As boys, probably every one of you studied the picture writing of the American Indians and even tried your own hand at it.

The power of the printed word is mighty, but it has a long handicap to overcome in supplanting the picture as a means of carrying a message to the mind of man. Witness the growth of our pictorial newspaper sections, our illustrated weekly and monthly periodicals, which are mostly pictures, and last, but not least the motion picture.

Art, as we know it, has long since lost interest in current events, excepting that branch of its devotees who earn a living by drawing caricatures and cartoons for the press, but with the invention and development of the photographic camera this defection is not serious.

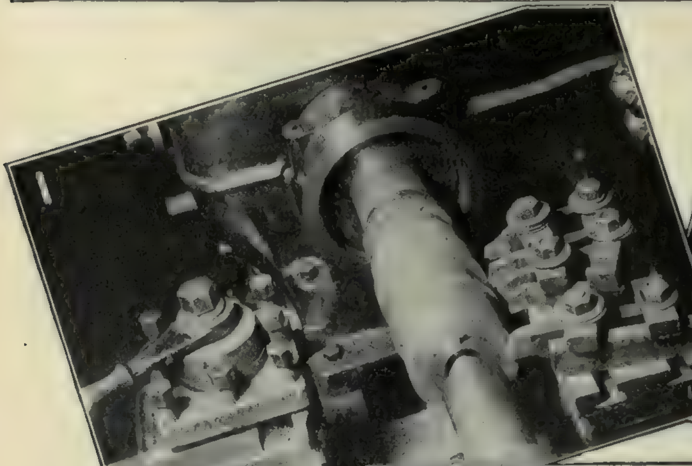
The *American Machinist* of a generation ago, like its contemporaries, was largely illustrated with line drawings. There are still, of course, many articles which can only be illustrated in this way, but an analysis will show that the photograph is being used more and more to illustrate machinery and machining operations.

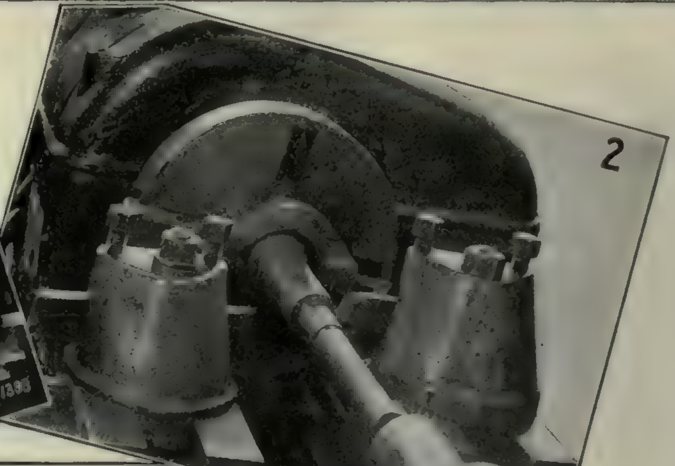
All this is but to lead up to the announcement that on the following pages we have grouped a number of photographs of modern production operations, with no descriptive matter except a brief account of the actual performance record of the process and machine or tool illustrated. Recent strides in the removal of metal from work have been so rapid and so long that few men, no matter how close their contact with the industry, are familiar with them all. We have tried to show some of them here so that they will be evident at a glance. Other groups will be included from time to time, as circumstances permit.

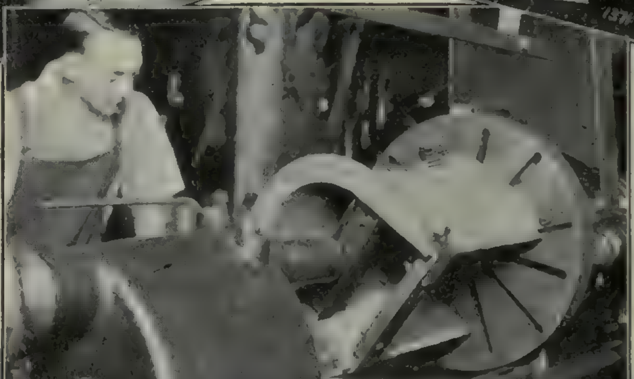
Large scale production is a distinctively American development, and one in which we take great pride. Our continued ascendancy in this field of endeavor, however, will not be possible unless we keep constantly striving to improve our present methods and to invent new ones. A free interchange of ideas and information between makers and users of production machines is essential to such development.

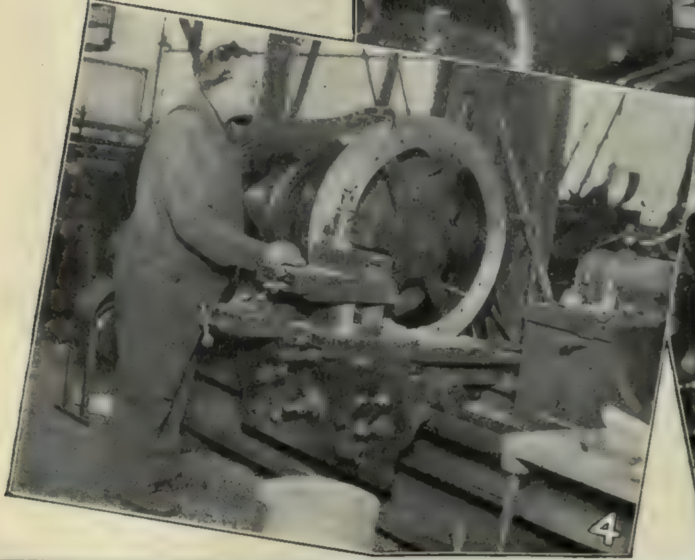
At the present time the important feature of producing parts in quantities is its ability to reduce unit costs. After all, this is the principal aim of the manufacturer, to make his product equal to or better than that of his competitor, and to keep his costs so low that he can undersell the other fellow and still make a fair profit. Modern machinery plays a part, ever increasing in importance, in this contest. You will find pictures of it at work on the following pages.

PRODUCTION









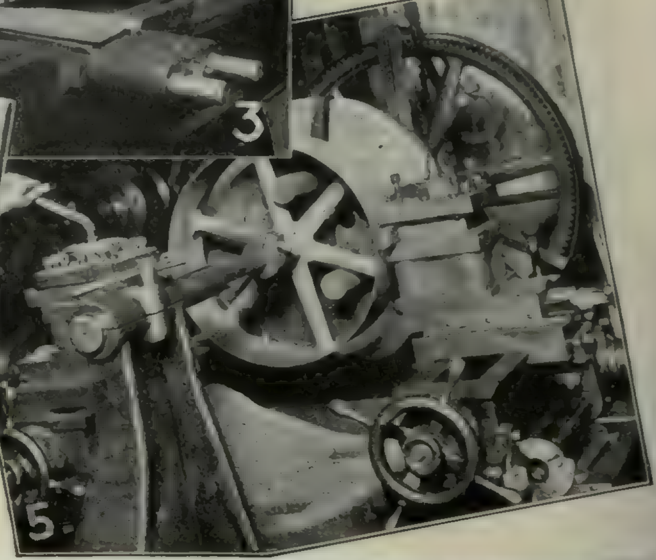


Fig. 1. Machining clutch sleeves in a Lodge & Shipley manufacturing lathe. The eight tools in use make possible the completion of one piece every 18 minutes. The work could scarcely be done in an hour on an ordinary lathe. Manufacturing methods require the use of manufacturing tools.

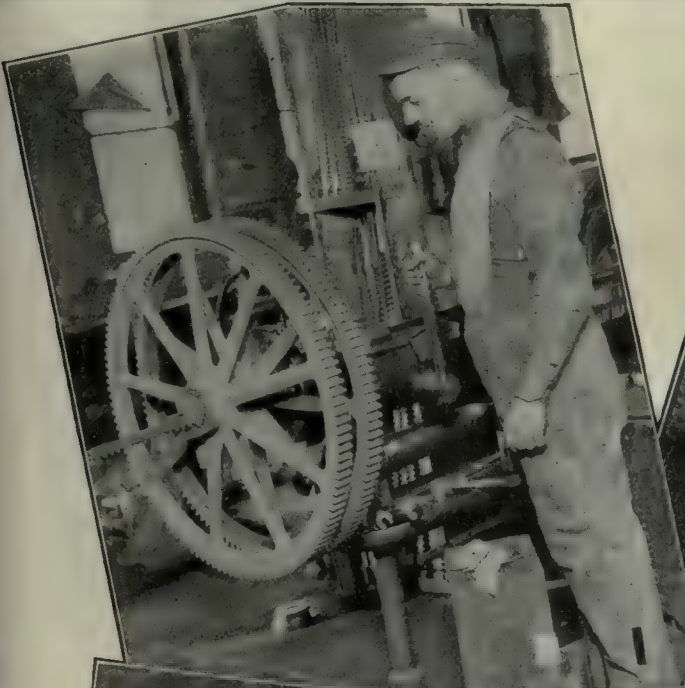
Fig. 2. Turning a shaft for the selective head of a lathe on a Lodge & Shipley manufacturing lathe in 12 minutes. Diameter and length stops used. Without these stops it required 26 minutes to complete a shaft. Time required to do this work on an ordinary lathe using a single tool would be about 1 hour.

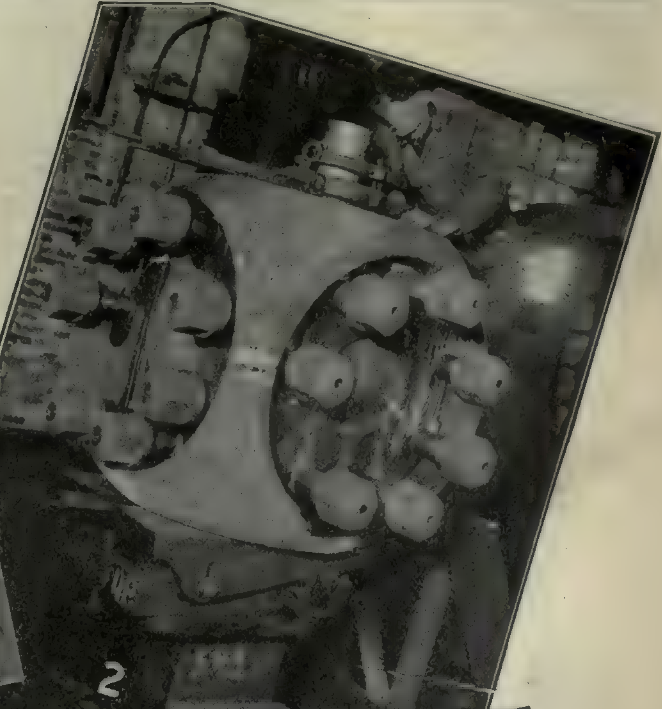
Fig. 3. Facing cast-iron water troughs (both ends) at the rate of four per day in a 25-in. Le Blond lathe.

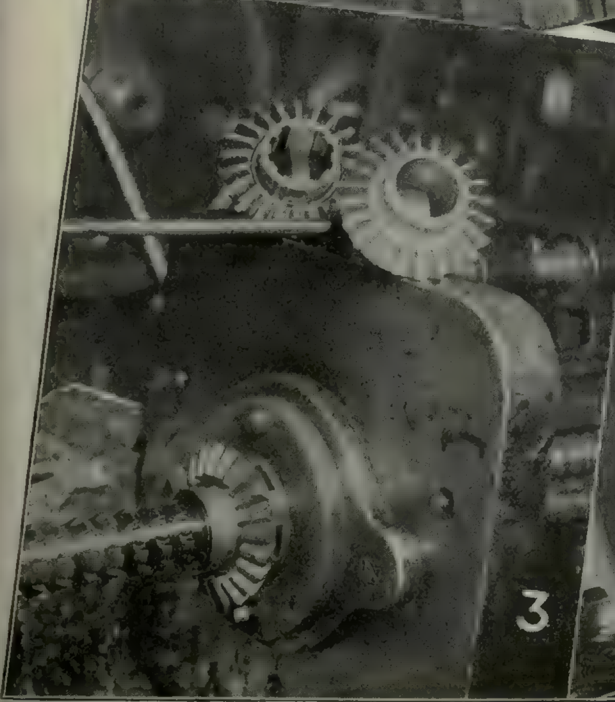
Fig. 4. Turning, facing and boring two special gear blanks per day in a 22-in. Putnam lathe.

Fig. 5. Turning and facing 18 pulleys per day in a Cincinnati pulley lathe. Double the production of an ordinary lathe.

IN PICTURES







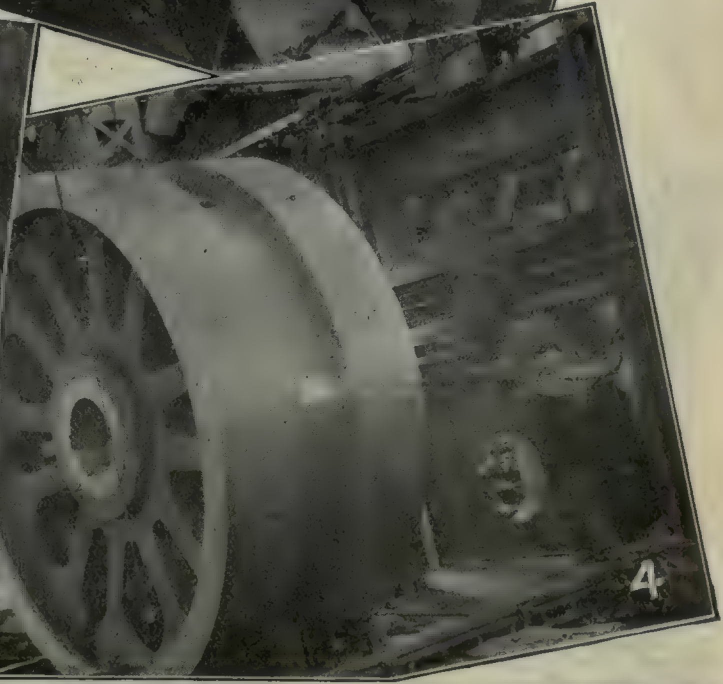


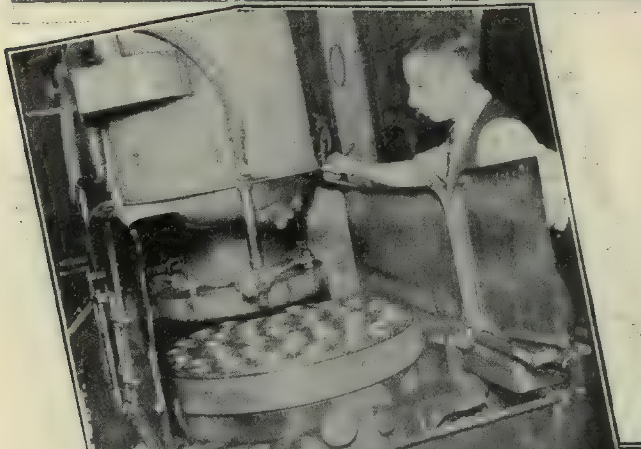
Fig. 1. For quantity work of medium weight there is no better method of keyseating than broaching. 125 of the gears shown have been keyseated on a La Pointe broaching machine in a day. Accuracy is dependent on the broach, not on the operator.

Fig. 2. A keyway 3¼ in. wide, ⅞ in. deep and 3 ft. 4 in. long was cut in this 10,000-lb. propeller hub in 1 hour on a Mitts & Merrill keyseating machine. Long keyways of this kind would be an awkward job on a planer with its long overhanging tool.

Fig. 3. When multiple keyseats must be accurately cut the broaching method is at its zenith. Broaching 10 keyseats in each of 125 bevel gears, as shown, is only a day's work for the J. N. La Pointe broaching machine.

Fig. 4. A Betts 96-in. planer keyseating a heavy piece of work is shown herewith. This method of keyseating is all right for heavy work or where there is not enough work to keep a single-purpose machine profitably busy.

PRODUCTION



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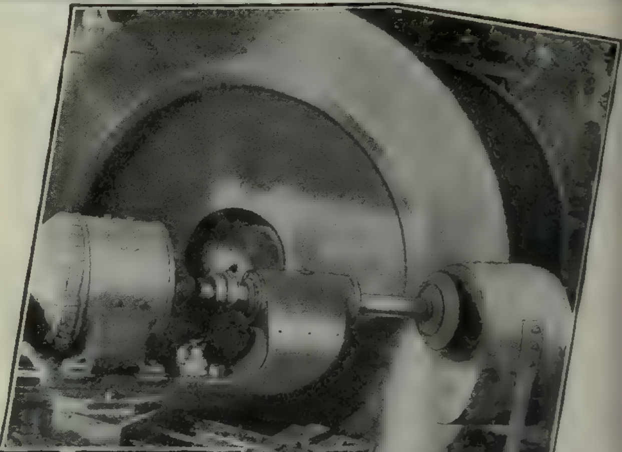

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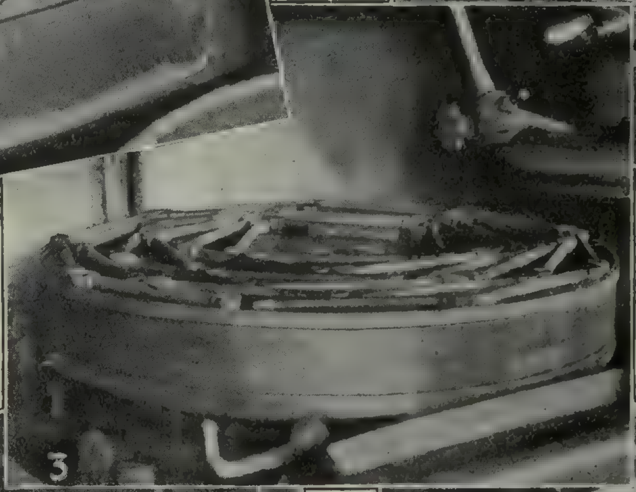

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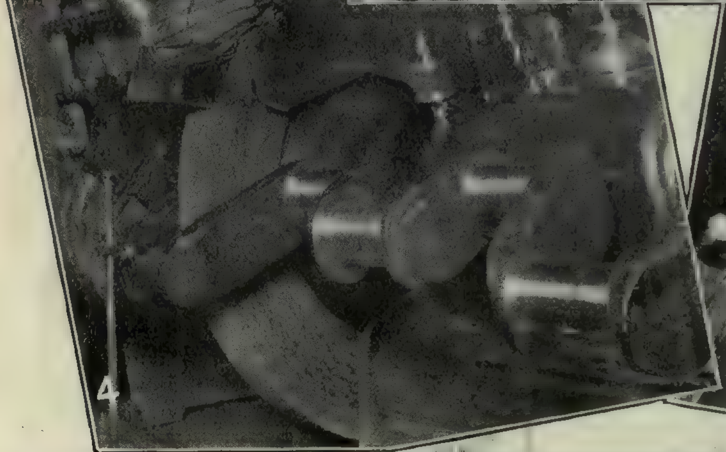

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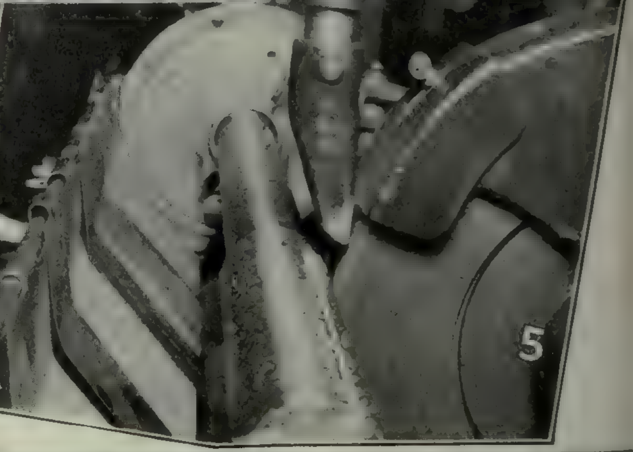

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Fig. 1. Small parts are surface ground in large quantities in machines such as the Blanchard rotary surface-grinding machine shown herewith. The work is held on a magnetic chuck.

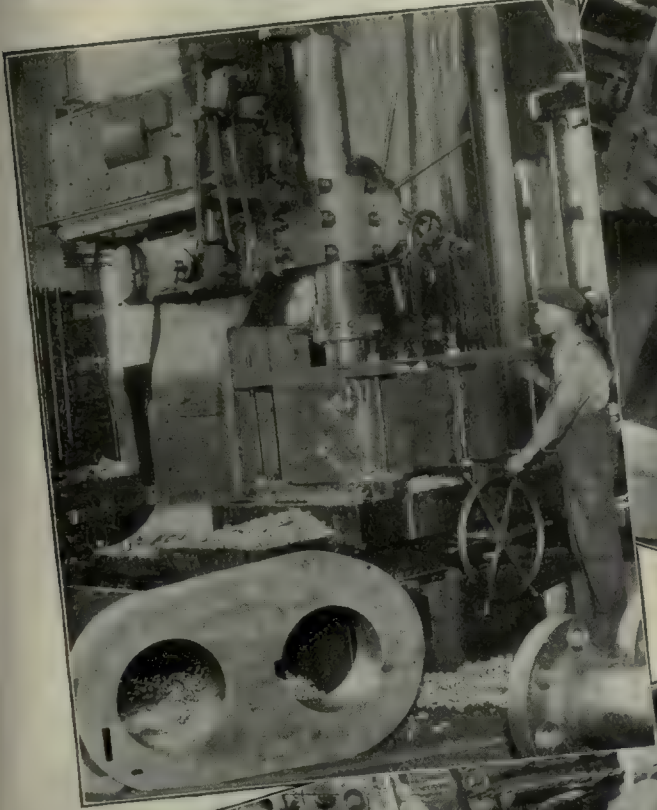
Fig. 2. The work shown in the illustration is being finished from the rough by grinding. The material is manganese steel and grinding is the only method by which it can be finished.

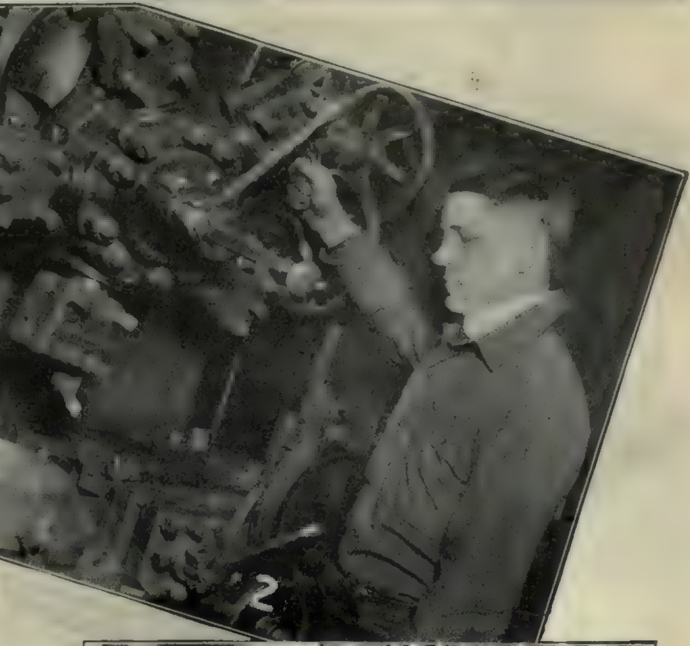
Fig. 3. Connecting rods can have the flats on the ends finished from the rough by grinding. The Blanchard rotary surface grinding machine grinds both sides at the rate of 110 pieces per hour.

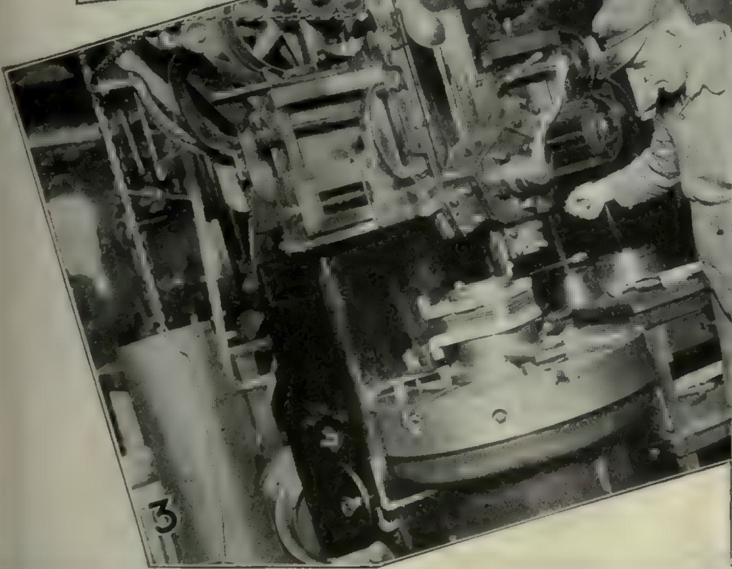
Fig. 4. Finishing fourteen, 4-throw crankshafts per day is average production on this Landis grinding machine. Such a quantity would require a week if done in a lathe.

Fig. 5. Plain round work used to be finished in a lathe by turning, filing and polishing. Now it is rough-turned and ground. Shafts such as are shown here in a Landis grinding machine are ground to a tolerance of 0.001 in. in a few minutes.

IN PICTURES







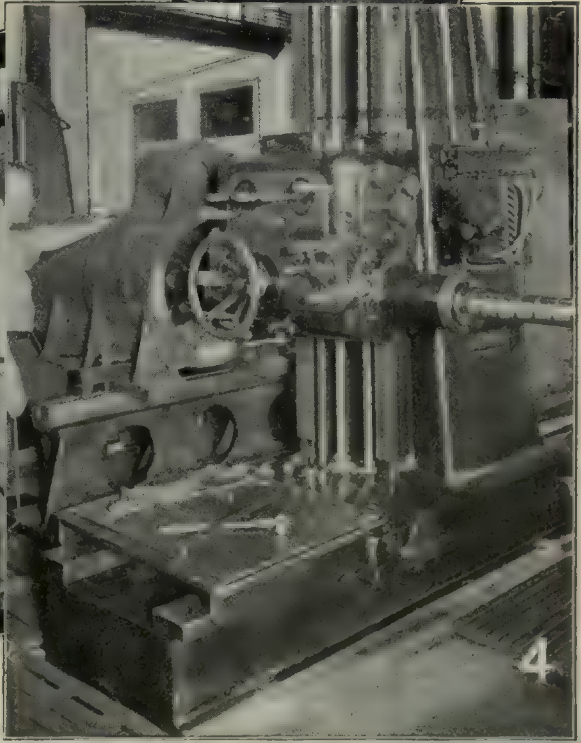


Fig. 1. Boring crank webs for marine engines on a Baker heavy duty boring machine. The holes are 16 in. in diameter, and 1¼ in. of metal is removed from each side with a feed of 0.020 in. per revolution. The webs are bored in pairs, one above the other.

Fig. 2. Boring and turning motor parts on a Bullard vertical lathe at the rate of five pieces per hour. Two pieces per hour would be rapid work if machined in an ordinary lathe.

Fig. 3. Counterboring motor frames for end plates on a King vertical boring mill, turning out seven pieces per hour. Ease of mounting the work added to the absence of tool changing makes possible a production of 25 per cent or more greater than if done in a lathe.

Fig. 4. Boring and facing an hydraulic cylinder for a ship's steering engine in 10 hours on a Landis horizontal boring mill. Before the days of boring mills, where such work had to be done in a lathe, this job would have required 15 to 18 hours.

PRODUCTION

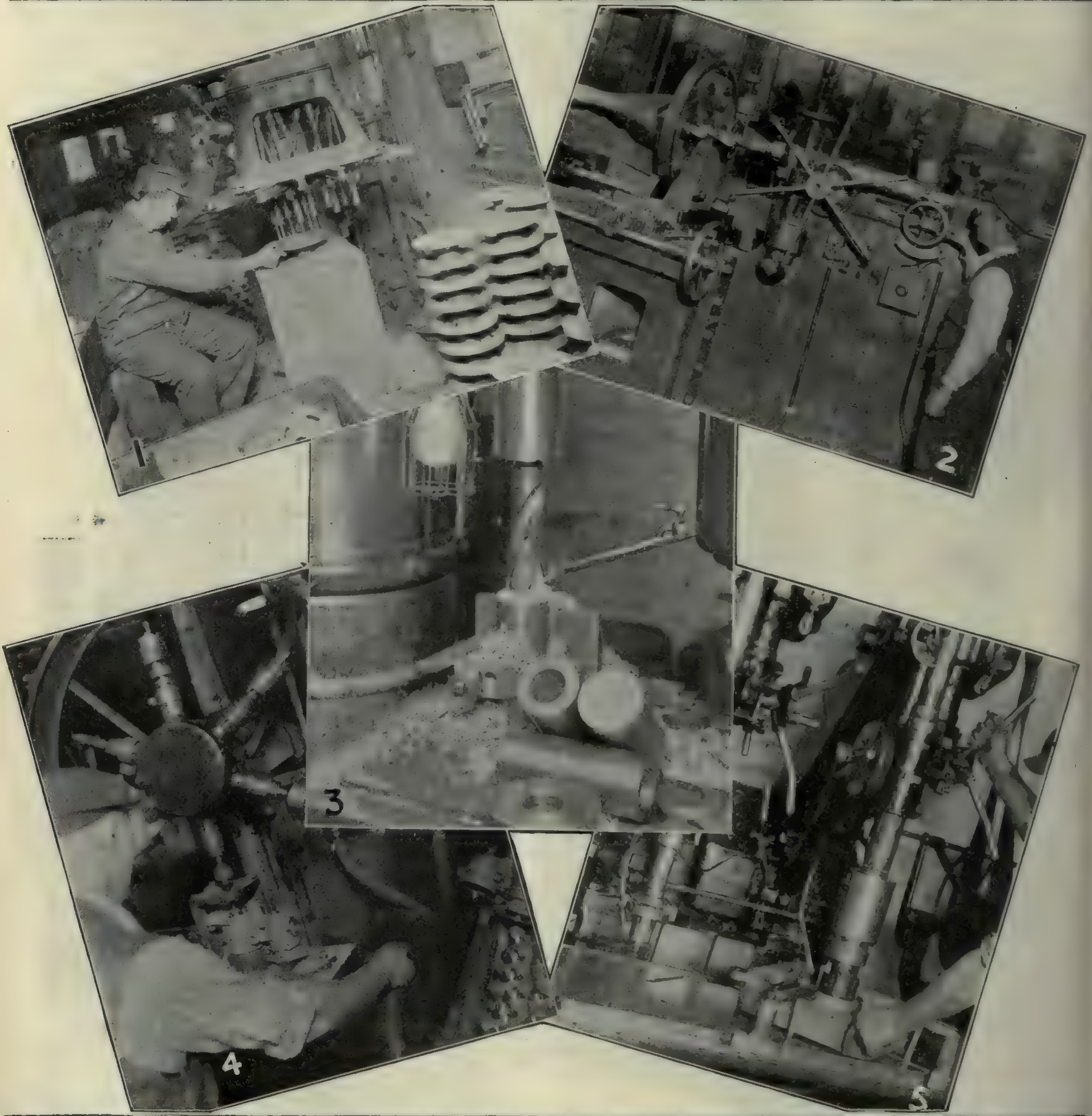


Fig. 1. Drilling gear-case castings in a Baush multi-spindle drilling machine at the rate of 200 per day. Spindles are adjustable as to center distance and pattern. The production is at least six times more than could be turned out on a single spindle machine.

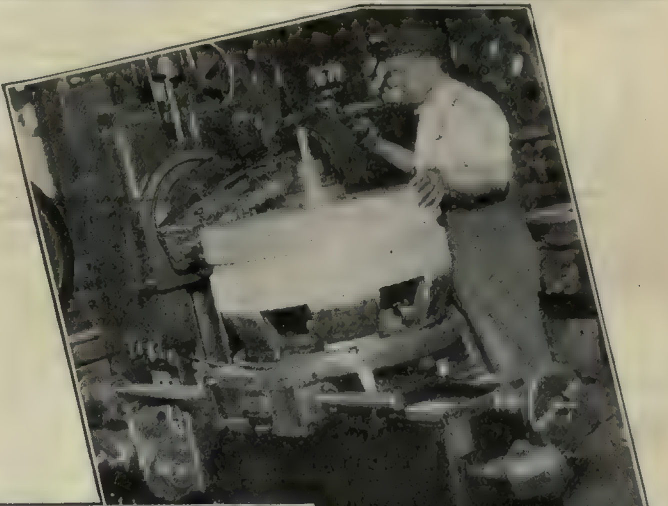
Fig. 2. An awkward piece to handle in an ordinary drilling machine is being machined in this Baker horizontal drilling machine at the rate of two hours per piece.

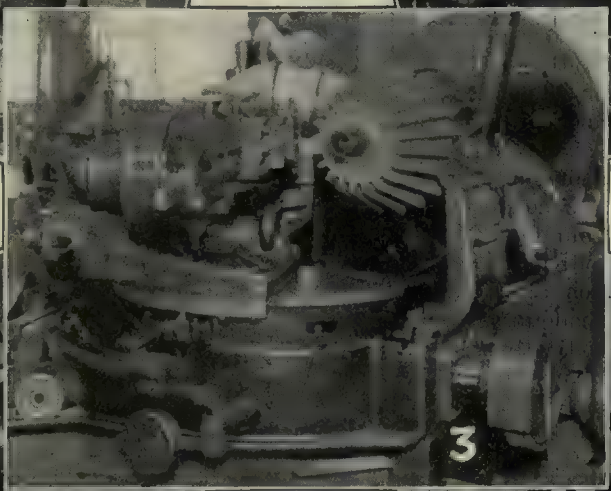
Fig. 3. Steel sleeves being drilled from the solid in a Fosdick radial drilling machine at the rate of four per hour. The hole is 1½ in. in diameter and 6 in. deep. Before the advent of high-speed steel drills and machines strong enough to handle them advantageously, this job would have taken from two to three times as long.

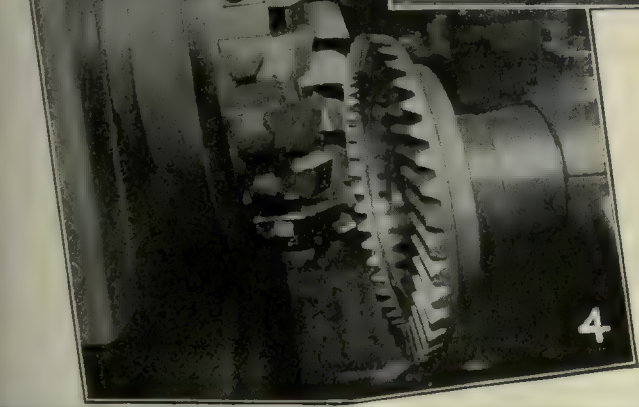
Fig. 4. Machining a carbureter body on a Quint turret drilling machine at the rate of 45 per hour. If this work was done in a single-spindle machine, six changes of tools would have to be made and the production would be cut at least in half.

Fig. 5. Drilling machines are used for a variety of work other than drilling. The Barnes all geared drilling machine is tapping 20 pieces per hour, using a 4½-in. pipe tap in cast iron. It would take two men to do this work by hand and the production would not be more than ten per hour.

IN PICTURES







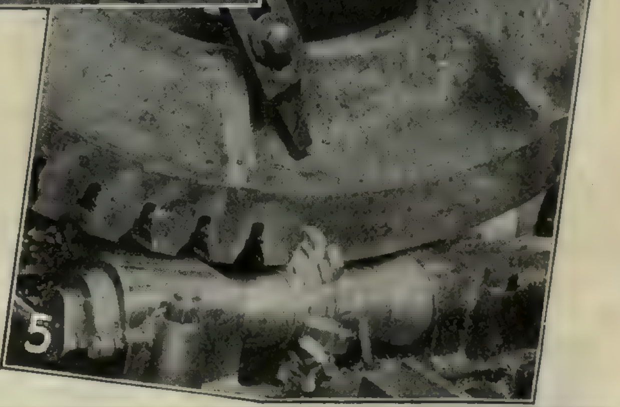


Fig. 1. Generating a 54-tooth, ¾-pitch internal gear on a Fellows gear-shaping machine. Production, four per day. Work of this kind used to be done on a slotting machine with a single tool and one gear per day of 10 hours was considered fast production.

Fig. 2. Hobbing a 71-tooth, 2¾-pitch herringbone gear on a Gould & Eberhardt hobbing machine at the rate of one per day. Prior to the advent of such machines, but few shops would undertake such a job.

Fig. 3. Cutting a bevel gear on a Gleason bevel gear planer. Two cutting tools are used and the action of the machine is entirely automatic. To cut bevel gears with a single rotary cutter, from two to three cuts and as many settings are required.

Fig. 4. Generating a spiral bevel gear on a Gleason special type machine. It would be almost impossible to produce gears of this kind without a machine designed for the purpose.

Fig. 5. It pays to take a roughing cut with a special cutter on gears of coarse pitch. A 1¼-in. pitch cast steel gear is being roughed out on this Newark gear cutting machine. The finishing cut will be made on the same machine and the total time for roughing and finishing will not exceed 8 min. per tooth.

Crowbars and Economics

The Crowbar Artist and Theoretical Physics—Economic Laws Govern Business and Must be Studied and Followed to Gain Success

By E. F. DuBrul
General Manager, National Machine Tool Builders Association

A MAN bought one of those stony, New England, Berkshire hillside farms, and proceeded to clear it, preparatory to turning it into a summer estate. He engaged a foreman, who in turn hired a lot of laborers to get the boulders out of the fields and take them to the top of the hill, where they were to be used to build a wall.

The laborers were each given a crowbar, and each told to get out a boulder. Some of these men were crowbar artists; others were crowbar dubs. The crowbar artists got their boulders out with far less tugging and sweating than the crowbar dubs used to do the same work.

If the foreman gave any of the men the wrong kind of a crowbar, even the crowbar artists had to work harder and with less efficiency than should have been necessary to get their boulders out. If the crowbar artists were assigned to boulders that were too big for any one man to get out they soon made it known to the foreman that they had been put to an impossible job. If the foreman insisted, the crowbar artists either laid down on the job or quit it. The crowbar dubs perhaps wrestled with some boulders in utter futility, even trying to do the impossible, and the wages paid them were simply waste of the proprietor's money. The boulders being irregular in shape, the improper use of the crowbar perhaps brought disaster on the user. If his stone was in a peculiarly balanced position, and he set his crowbar in the wrong place, he perhaps toppled the stone over on himself and was carried off the field on a shutter—crippled or dead.

Whichever way they used the crowbars, whether well or ill, they did nothing but apply the fundamental principles of physics. They may not have known anything about the theory of physics, but it was the practical application of crowbar physics that they engaged in when they worked on that job.

Now knowing the theory of physics is not so essential for one who merely uses a crowbar to move a boulder, but it is well to know that theory if one sets out to design derricks for quarries. If the theory of physics is not properly built into those derricks, somebody puts on too big a load and the derrick goes down, causing some money loss, and possibly causing loss of human life. The more complex the structure is, the more a man has to know about his physics. The Quebec bridge went down because of incomplete knowledge, or very bad application of the laws of physics.

The workman uses physics with his crowbar, though he may know nothing about the term. He might hoot at the idea that there was any such thing as physics, but his hooting would not change the laws of physics, and if he violated these laws he would suffer in some way.

But just as most men who are using physics in their daily occupation probably know very little about the theory of physics, very few people who are earning their living know much about the fundamental science underlying business. There are many business men who insist on their machine designers and their bridge designers being thoroughly well grounded in the theory of physics, yet these same men may hoot at the idea that there can be any sense to economic theory. They look on economics as nothing but a lot of fine-spun notions existing only in the heads of college professors. Even a good crowbar artist in a quarry might look on physics in the same way.

The business man is using economics every day. He may be a real artist with his economics, and not know much about fundamental theories of economics. But to the extent that he is successful in his business he has applied economic theory properly. To the extent that he has misapplied it he has failed to reap the full benefit of his tugging and sweating on his own crowbar, and even may roll his business boulder over onto himself.

Roger Babson has been quoted as saying that he investigated the common report that 90 to 95 per cent of those who enter business of all kinds fail before they die, and that he found this impression to be exaggerated—that only 87 per cent fail.

Every year Bradstreet's publishes figures classifying failures according to the cause of failure, and these figures show that only from 11 to 14 per cent of all these failures are due to causes over which the men who fail could have no control. Most failures were due to causes which lay in the control of the men who failed. They used their crowbars wrong and toppled their business boulders over onto themselves. It would seem that for the 87 per cent who fail some better use of the theory of economics would no doubt be of assistance.

Failures destroy wealth as much as fires do. Our failure loss runs considerably ahead of our fire loss in a year. Between the two of them it is estimated that we Americans are destroying at the rate of nearly a billion dollars worth of wealth per annum right now. This waste of essential capital absolutely destroys the accumulation that had been previously made of that amount of wealth. We talk about stopping the fire waste, but when it comes to stopping the enormous failure waste there is not much being done.

There is only one way to stop the failure waste, and that is through business or economic education. Under a free competitive system, which seems to be about the only one the world can work under, every man is free to take his chance—and he should remain free, but others should not be called on to pay the cost of his ignorance. A large amount of futile effort is wasted by ignorant men in getting out their business boulders. Many who do not completely fail waste a tremendous amount of business effort in their work. Economic education is the only palliative for this waste. It has been said that we all learn by experience, but the wise man learns from the experience of someone else while the boob learns only from his own.

Mr. Hurley, when he was connected with the Federal Trade Commission, made a statement to the effect that out of 250,000 corporations in the country at that time 100,000, in round figures, earned no net income whatever; 90,000 earned less than $5,000 a year, and only 60,000 reported earnings of $5,000 or more per year. He also made the statement that not over 10 per cent of American business men had a cost system of any kind; and certainly what are called cost systems in many cases are not worthy of the name. One could well say that even the corporations that reported $5,000 earnings or more, could well be questioned as to their actual earnings, in view of their lack of knowledge of costs.

A lot of corporations according to those figures were using their crowbars to very poor advantage.

Whenever a workman talks about his job, or a business man about his business they are talking economics, though most of them don't know it, and judged by the final results, in failures, they either use very bad economic crowbars or use good ones very badly. The bigger the bridge to be built the better physicist must the designer be, or stupendous loss results. The world is shocked at the incompetence that caused the loss of two Quebec bridges. But is it shocked at the loss in the rubber tire, the automobile, or other similar industries, due to business incompetence? Not only do stockholders lose, but the workers' loss and the whole business system's loss in one tire concern was far more than the monetary loss from the two Quebec bridges.

What are we going to do about it? Well, for one, I should say that it might be very good for the present capitalistic system to favor some regulation that will permit only properly educated, qualified, tested, and tried executives to have charge of other people's money. Every small stockholder whose savings are lost in a rotten failure feels the injustice of the loss. He has a real kick coming, and unless the real, thinking leaders get busy pretty soon, they may find that many ex-stockholders will gladly turn to something else than capitalism, convinced that the whole system is wrong, just because they had an unfortunate experience with one incompetent or crooked exponent of it.

A stationary engineer is examined and certified as a matter of public welfare before he can engage in an occupation where security of life and property depend on his qualifications. Is it too much to ask that business engineers who manage other people's property should also be required to demonstrate their fitness before going on with the job?

Is that a revolutionary idea? Well, perhaps; but after all, isn't it a good one?

Getting Primed on Shop Methods

By John R. Godfrey

Old man Johnson has a new hunch and, as usual, there's a good-sized hunk of horse sense tucked away in it. I knew he had been away for a spell and as I had also been out of my usual haunts, helping to play chambermaid to several brands of automobiles and auto-be-automobiles, we'd missed each other for quite a bit.

So I dropped in the other day and ran into Johnson and a man from Cincinnati holding a farewell confab in Johnson's office. After he'd gone, Johnson told me what he'd been doing all summer.

"Been learning a lot this summer, Godfrey," was his opening salute. "I'll let you tell me your adventures later, 'cause I know you had 'em, but just listen to me first.

"I've always thought I was a pretty fair mechanic, John R., and I'm not just willing to take a back seat even now, but its amazing to find there's a lot you don't know, even about some of the simple machines in your own shop.

"Take my cutting-off saws as an example. I happened into the shop where they make 'em, up in York state, and it surely opened my eyes. They were running the saws 50 per cent faster than we did and having less trouble from broken saws, or from heating.

"One of the troubles with us older men, Godfrey, is the fact that we were brought up on carbon steel when 16 ft. a minute was fast cutting. Of course we used Mushet steel a little, but when it comes to the newer steels, we're back numbers. We think we know about what they will do but we don't, unless we actually handle them ourselves.

"Then too, we hadn't been particular enough to keep the saws sharp. I surely was plumb disgusted with myself when I found how much we'd been behind the times. But the saw man sort of salved my ruffled pride by telling me of a big machine-tool builder who was a bigger jack than I, for he hasn't found out yet.

"The whole thing set me to thinking and I wondered how many other machines I had in the shop which were working away below par.

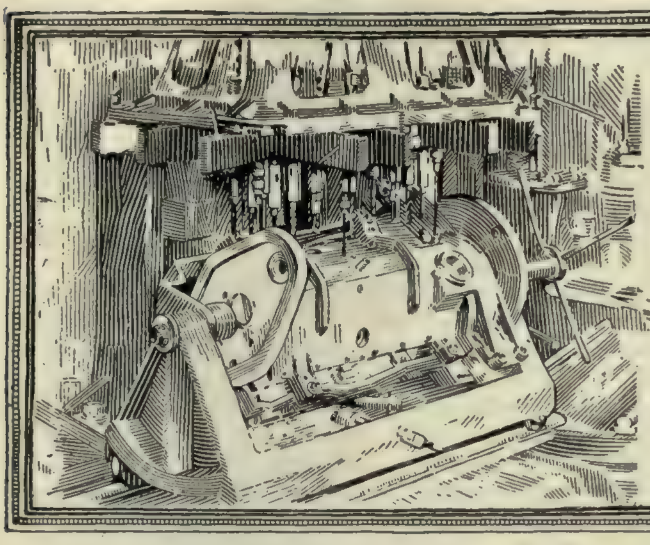
"So I made a sort of survey of the shop—found the different types and makes of machines we had and began a study of production and production methods. Then I visited most of the shops where the machines were made to get pointers on the work they ought to do. It gave me a dern good excuse to go to a lot of shops I've always wanted to see—even though it wasn't an especially good time to see 'em.

"Well I've gathered a good-sized bunch of dope on the work we ought to get from various makes of machines, and I'm tallying up to see how it compares with what we've been actually getting.

"But I'm going further than that. I've arranged with several of the worth-while makers to borrow one of their demonstrators or service men whenever they happen to be in this neighborhood. No need of their making a special trip, particularly as I'm going to pay for their services. Wouldn't take 'em any other way. I want them to come into the shop and do the 'consulting engineer' act for me at so much a throw. We used to jump at the chance to pay some fellow, with a slide rule and stop watch, fifty bucks a day to give us the once over. And dern few of 'em ever had any real shop experience either.

"So I figure it's a whole lot cheaper to pay a thoroughly practical man, who knows our machines, to show us all the kinks and short cuts he knows, than to go on wasting time and money in the old way. And if it happens, which it probably won't, that we are already up to the mark in our machining practice, its worth real money to know it. Then we can save our time and energies for other places where some savings may be possible.

"I'm going to try and have things so that every order means a fair profit, as well as work for the shop, even at the price competition which we'll probably all have to meet. Of course it will cost a little money to do this but it will cost less than to wait and we probably wouldn't have time then anyway. But if no one spends any money how can we ever expect to get business started? You can't eat your cake and keep it too—as the old saying goes."



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Albert A. Dowd Engineering Co., New York City

Jaws for Two-Jaw Chucks—Holding Tapered Work—Principles of Chuck Design—Serrated Jaws—The Use of Supports—Special Jaws for Fitting Work

WHEN jaws are to be designed for a two-jaw chuck it must be remembered that as a general thing these jaws are of the "slip" variety. They are usually dovetailed, as shown in Fig. 222 at *A*. This dovetailed portion fits the solid jaw in the chuck and must be made in accordance with the standard of the chuck in which they are to be used. One of the common forms of chuck jaws is the V-jaw used for holding round pieces. It is possible to buy jaws of this kind from the manufacturer or they can be made up in sizes to suit the conditions. Two-jaw chucks are usually applied to work of comparatively small size and frequently the jaws are formed to fit a forging or a casting of a certain particular shape. The jaw in this case then acts as a "nest" into which the piece is dropped and its location in the jaw is determined by the shape of the "nest." In the example *B* the work *C* is a cock which is to be machined on the tapered portion *D*. The jaws therefore are made so that they will grip the ball end as shown at *E*, and at the same time locate the piece centrally by means of the two projecting points at *F*. It is customary in work of this kind to furnish samples of the parts to the toolmaker with a sketch showing the method of location but without giving many dimensions. Instructions are then given to fit the jaws to the model.

In holding tapered work, if the piece is smooth such as that indicated at *G*, it may be difficult to hold it by making two tapered jaws as shown at *H* and *K*. It depends a great deal on what the taper is, but if it is over 15 deg. included angle, jaws of this kind should not be made, as the pressure of the cut on the work is likely to pull it out of the jaws. This is particularly noticeable if the direction of the cutting is such that it presses outward away from the jaws even in the slightest degree. It is sometimes possible to hold work of this kind by notching the jaws so that they will bite into the work, but even this is rather unreliable as the taper of the piece may vary somewhat so that it does not make good contact all along the taper. In order to be sure that no trouble will be caused by an improper method of holding, it is much better to make one of the jaws with a "rocker" like that shown at *L*. This jaw is mounted in a "slip" jaw *M* which is held in the regular way in the standard jaw. The opposite jaw *N* is tapered according to the angularity of the work. When the piece is placed in position the swivel jaw rocks in its seat and adapts itself to variations in the taper. In the design of a rocking jaw the pin *O* should only be considered as a retainer and the thrust of the jaw should be taken on the solid portion *P*.

TWO-JAW METHOD FOR INSIDE HOLDING

Fig. 223 shows at *A* a counterbalanced flywheel which is to be finished as marked, in one operation. The flywheel was cast with heavy portions at *B* and therefore it cannot be held in a three-jaw chuck. Two special jaws *C* and *D* are fitted to a standard two-jaw chuck body, one jaw *C* being fixed while the other *D* is provided with a rocker or swivel jaw *E*. This rocking jaw is relieved at the center so that it makes a contact automatically at *F* and *G* on the inside surface of the flywheel. The portion *H* is cut on a slight angle in order to assist in keeping the jaw in position under the pressure of the gripping action. Attention is called to the manner in which both jaws touch the work and also the way in which they are relieved to permit the facing tool *K* to operate without interference. Incidentally, tools *K* and *L* are used on the cross-slide of

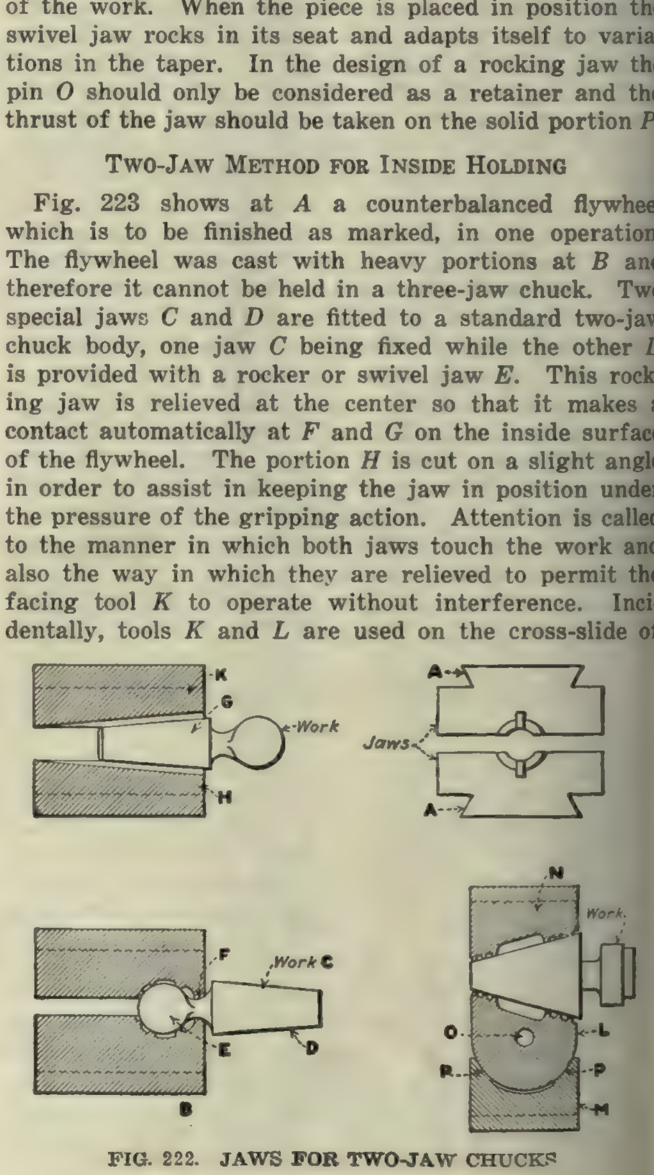


FIG. 222. JAWS FOR TWO-JAW CHUCKS

For the authors' forthcoming book. All rights reserved.

the lathe. The other operations are performed by turret tools with the exception of the surfacing of the hub *L* which is done by a back-facing attachment through the spindle of the machine. The tooling for work of this kind will be taken up in a subsequent chapter.

The work *M* is an angular ball-end lever which has been previously machined at *N*. A two-jaw chuck is used for holding this piece while finishing the ball *O*. The face of the chuck is provided with a locating pin which is a loose fit in the hole *N*. The jaws are of the "slip" variety and are formed to grip the neck of the work at *P*. A small amount of "float" allows the work to adjust itself in the jaws so that the ball portion can be held without difficulty. This example is an instance of a set of jaws which is formed from the model. The drawing would be made with some of the dimensions left off and instructions given on the drawing to "fit to model."

Swivel Jaw Application for Two-Jaw Chuck

An example is shown in Fig. 224 of the application of a combination swivel and special jaw to a two-jaw chuck. The work *A* is roughly rectangular in shape at one end but irregular on the other end. The jaws *B* and *C* are standard chuck jaws on a special form of two-jaw chuck. On one of these jaws a member *D* is mounted. This is provided with hardened points at *E*, *F* and *G* so that the work rests against the points. The setscrew *H* holds it in place. The other jaw *K* is provided with a swiveling member *L*, having two points at *M* and *N*. These two points adapt themselves to the variations in the casting, thus holding it securely. This particular piece of work is a little out of the ordinary and the method of holding allows the work to be centered and held without distortion.

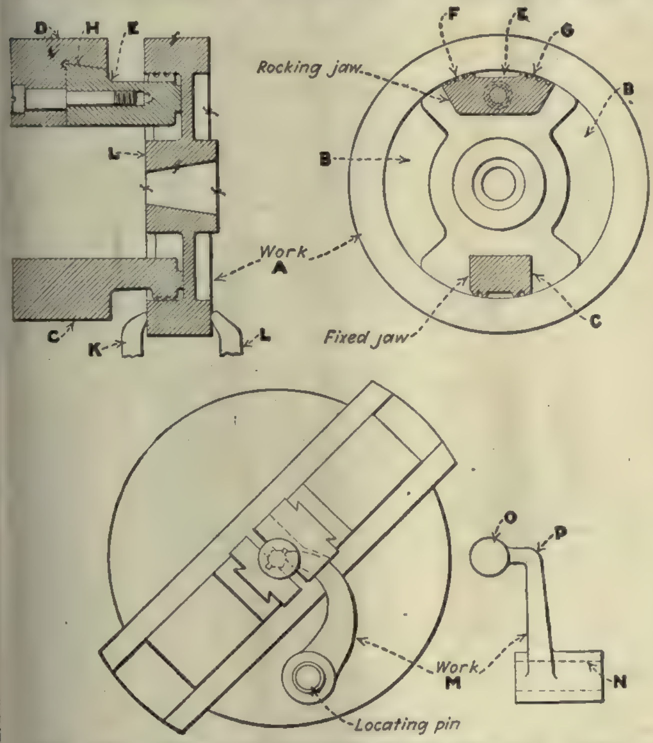


FIG. 223. TWO-JAW CHUCKS WITH SPECIAL JAWS

Principles Involved in Chucking

Errors are often made in designing chuck jaws by attempting to grip the work on too many points without any provision being made for equalization. In our discussion of drill jigs and milling fixtures we brought out the matter of the three point support quite carefully and it should be remembered that the same principle holds good in the design of chuck jaws. Unless care is taken in the design, there is a possibility of an error being made which will cause a piece of work to be held improperly. Let us consider the diagram shown in Fig. 225 in connection with the holding of a cylindrical casting *K* in a three-jaw chuck. The work can be held without difficulty by the three jaws *D*, *E* and *F* in the plane *AB* and it can also rest against one point as shown at *C*. Any other portions of the work which are to be gripped by the jaws must be taken care of by means of adjustable points or screws. If we wish to obtain additional support in the plane *HG* by extending the jaws so as to grip the work in this plane, the result would probably be something like that shown at *L* and *M*. In other words, the jaws would strike at *L* and not at *M*, or it might be just the reverse of this, according to the shape of the rough casting. It might even be that some jaws would strike at *M* and others at *L*, the result of which would be that when cutting tools were put into the work the piece would change its position or vibrate to a considerable extent. It is not necessarily objectionable to design a set of jaws having supports of equal height at *O*, because only one of these points will strike and the others may simply help in chucking the work in the first place to obtain the correct end location. In the example *P* therefore it would be possible to make a set of jaws so that they would bear at *Q* and *R* and although all the jaws would not strike at *R*, one of them would, which would be sufficient to obtain the location.

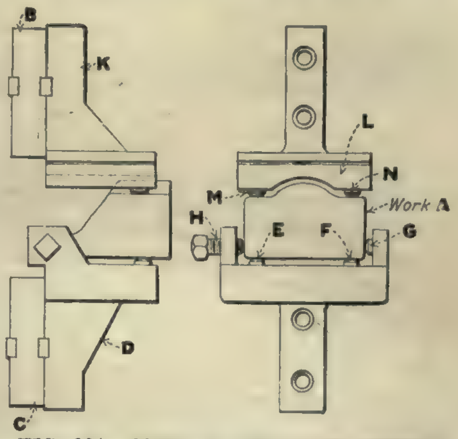


FIG. 224. SPECIAL TWO-JAW METHOD OF CHUCKING

Many kinds of work can be held in standard jaws either by the outside or inside. Fig. 226 shows an example *A* in which the work *B* is being held by the outside in the set of standard jaws *C*. The example *D* shows a piece of work *E* being held by the inside in a set of standard inside holding jaws *F*. Work of this kind seldom requires special jaws unless it is so thin that a facing operation cannot be done without running into the jaws, in which case special jaws might be made similar to those shown.

In production work it is advisable to standardize jaws as far as possible and avoid the changing of the entire jaw in any chuck. By means of standardization, jaw blanks can be made up like those shown at *G* and they can even be fitted to a master plate so that the only work necessary in making up special jaws will be the cutting of the jaw blank into the desired shape. Of course there are cases where special blanks are required, but in most cases certain standardized heights can be utilized if they are made up as indicated.

Fig. 227 is given in order to illustrate several important points in connection with the chucking of cylindrical work. The piece *A* is to be machined at *B*, *C*, *D* and *E* and it would normally be held for this purpose in a three-jaw chuck by the outside of the hub. A casting of this sort is likely to come from the foundry in about the shape indicated by the dotted lines at *F* rather than as shown on the blueprint. In other words the patternmaker will naturally allow some draft in order that the piece may be easily removed from the sand. If then an attempt is made to hold the work in a set of chuck jaws like that shown at *G* the result will be a contact only in the plane *HK* so that there will be very little gripping action to the jaws and the piece is likely to be considerably disturbed while the cutting action is going on.

In order to avoid such a condition, it is common practice to make up the jaws to correspond with the taper on the casting as shown at *L*. We wish to say a word against this practice because it is very seldom satisfactory on account of variations in the casting. Sometimes it will be found that the work will be gripped by the portion *M* which allows the front end of the casting to "wobble." At other times the portion *N* may hold the work and then there is not sufficient gripping action to hold the piece firmly. Trouble is usually caused by variations in the casting which may be caused by several different patterns being used or by the work being cast in several places. It is much better to use a set of jaws like those shown at *O* or *P*. In the case of the jaws at *O*, the work is gripped and centered at *Q* and it receives additional support from the screws *R*. The other method shown at *P* involves the use of two jaws with rockers as shown at *S* and one jaw formed to the approximate taper of the work. This latter is undoubtedly the best method of holding a piece of this kind although the method shown at *O* is considerably cheaper and will answer the purpose in the majority of cases. It is open to the objection that the operator may fail to tighten the screws sufficiently, or he may tighten them too much, thus distorting the piece and making it untrue.

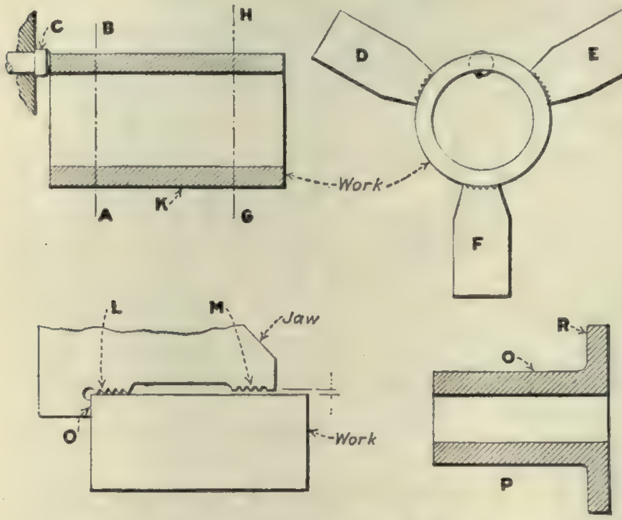


FIG. 225. PRINCIPLES INVOLVED IN CHUCKING

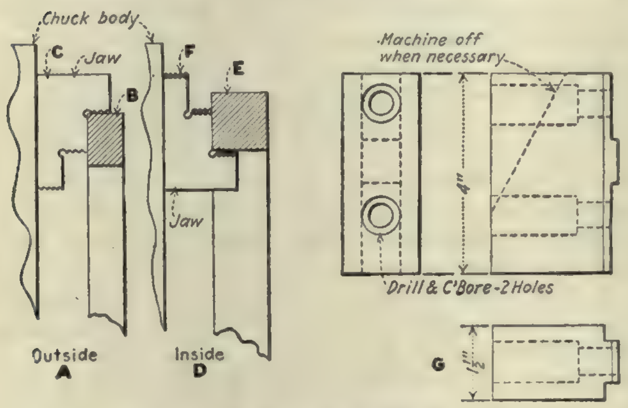


FIG. 226. STANDARD CHUCK JAWS

Method of Serrating Jaws

If a design for chuck jaws is made and sent to the factory or toolroom to be manufactured without specific instructions, the result is likely to be disastrous. It is seldom that a tool designer gives sufficient attention to this matter in making his drawing. It is a very good idea to examine some of the standard jaws that are put out by the chuck manufacturers and note the method used in serrating them. Fig. 228 shows the correct and incorrect methods of serrating jaws. In the case of the work *A*, which is to be held, the piece is cylindrical in shape and somewhat long so that in order to obtain a good bearing on both ends it would

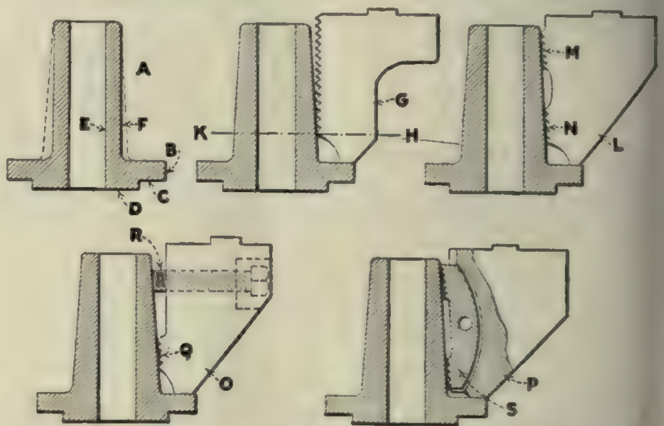


FIG. 227. SEVERAL METHODS OF CHUCKING A FLANGE

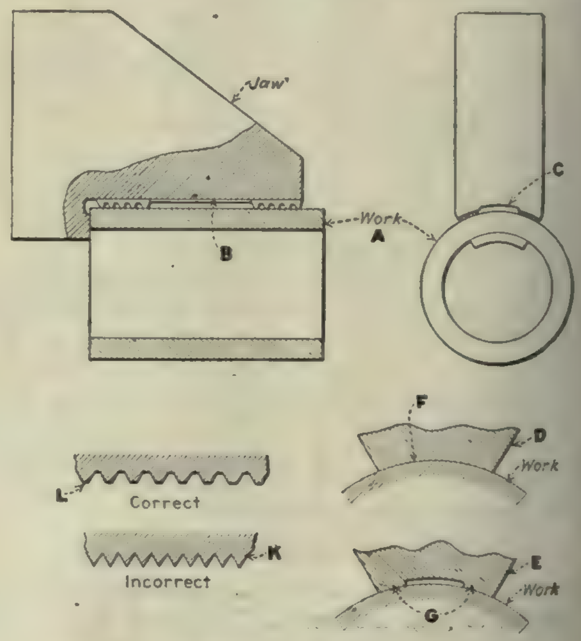


FIG. 228. METHOD OF SERRATING JAWS

be advisable to relieve the jaws at the point *B*. It is also advisable to relieve the jaw in the other direction as shown at *C* as this will give a better gripping action on the work than if the serrations are carried the full width of the jaw. The conditions obtained are shown at *D* and *E* in an enlarged view. If made as at *D* it is quite possible that a contact on the surface of the work will only be made at *F*, while if relieved as at *E* it is certain that a good gripping action will be obtained at both points *G*.

In the cutting of the serrations in the jaw, care should be taken never to bring these up to a sharp point as shown at *K*. If jaws are made in this way the points will soon become dull or broken and the gripping action will be injured. If made with a slight "land" as shown at *L* the surface will continue to be hard and there will be less chance of breakage. A "land" of 1/32 in. is sufficient and the angle of the cut can be any where from 15 to 30 deg. depending on conditions. It is customary to make lands wider where they grip the work as at *G* than they are in the other direction. They are often made 1/16 in. in this direction. Chuck jaws are usually made from machinery steel and pack hardened.

SUPPORTING SPIDER FOR CHUCKING

When work is rather large and fragile and must be held by the outside diameter there is a tendency to distort it unless some provision is made against it. Fig. 229 shows an example of this sort in which the work *A* is held in special jaws *B* by the outside of the flange. This work would be very much inclined to become distorted both in the chucking and also in the machining unless something were done to prevent it. There are three supplementary blocks *C* placed midway between the chuck jaws. Screw jacks *D* are set in each of the supporting blocks so that they can be adjusted to support the flange between the jaws. In addition to this, a loose spider *E* having three setscrews at *G*, *H* and *K* is utilized. These setscrews are set out until they support the work opposite to each one of the three jaws. A hole is provided in the middle of the spider so that boring bars and other tools can be used to machine the work. The use of a method of this kind makes it possible to machine this piece without either vibration or distortion.

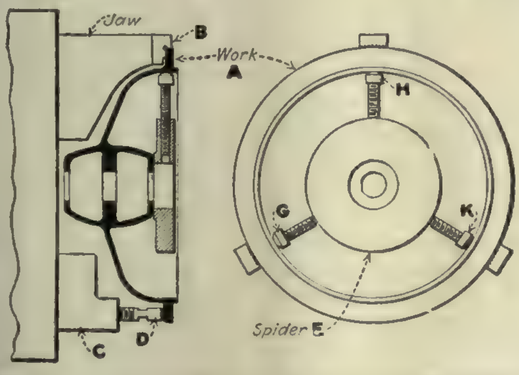


FIG. 229. SUPPORTING SPIDER FOR CHUCKING

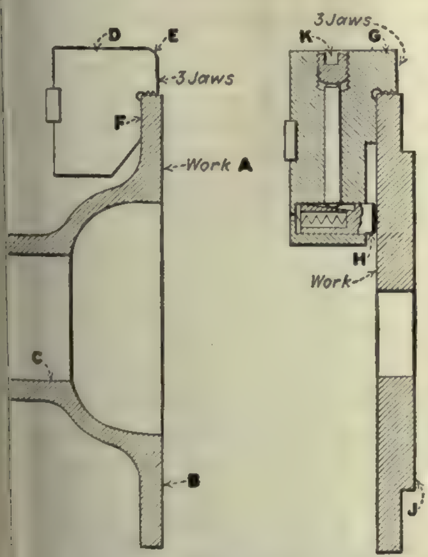


FIG. 230.
TWO TYPES OF SPECIAL JAWS

TWO TYPES OF SPECIAL JAWS

Fig. 230 shows a piece of work at *A* which is to be machined at *B* and *C*. A set of special jaws suited to it are shown at *D*. The jaws are so proportioned that the face *E* lies back of the machined surface *B* and the work rests against the jaw at *F*. This method of support would be sufficient for a piece of work like that shown, but if the work were larger and was to be machined on a broader surface like that shown at *J*, additional support might be necessary. To provide for this a set of jaws could be made like that at *G*. These would grip the work and locate it in much the same manner as those previously mentioned, but an additional support is provided in each jaw at *H*. This is a spring jack which bears against the surface of the work and which is locked in place by the pin and hollow setscrew at *K*. For work which is very thin and which requires considerable machining over a broad surface, a method of this kind would be found satisfactory.

Welding Broken Armature Shafts Without Removing Coils

Large armature shafts occasionally break at the junction of the journal and the pulley end. While recognizing the adaptability of the thermit welding process to the welding of all kinds of large steel shafts, operators sometimes in this case decide to scrap the old shaft, fearing that the heat of the steel produced by the thermit reaction might injure the armature coils and produce short circuits.

Where the armature coils, however, can be separated from the fracture by a few inches of molding sand (at least about 4 in. in the case of a 3 in. diameter shaft) a repair by this method is entirely feasible without injuring them, according to a statement by the Metal and Thermit Corporation, New York, if the following simple precautions are observed. There is no danger of damaging the armature windings through the effect of direct heat as the fracture is completely surrounded by molding sand and all preheating subsequent to heat from the thermit steel is confined within this molding sand. The heat which is conducted along the shaft is readily taken care of either by directing an air blast on the shaft or, where necessary, by means of a specially constructed water cooler box with packing box on the shaft to prevent the possibility of any water whatsoever coming in contact with the windings. The windings themselves are further protected by being totally encased in an oil cloth and burlap bag.

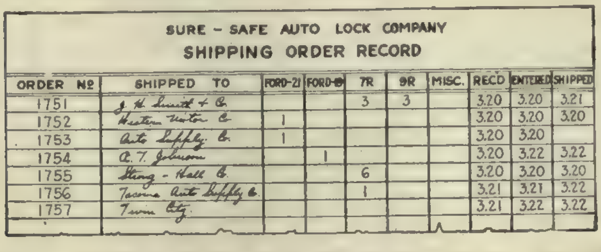
In case the keyway of the pulley end of an armature shaft becomes badly worn, this worn end can be removed and a new over size extension welded on and machined down. A large number of such extensions have been thermit welded in the past.

Organization and Management of the Small Shop

VII. Filling the Customer's Order—Necessity of Keeping Records—The Sales Value of Real Service—Efficiency in the Shipping Room

BY E. W. LEACH

THERE are two important reasons why you should give special attention to the various details in the process of filling the customer's order. One is for purposes of record. In the early days of your business career when you are most concerned with seeing it "over the hill," and when a great many things that you would really like to do are pushed aside until some later and more convenient time when you will not be so personally tied down with an active part in actual production work, there is an ever present tendency to be lax in taking proper care of office work and in keeping records that will be valuable to you later on.



SURE - SAFE AUTO LOCK COMPANY
SHIPPING ORDER RECORD

ORDER №	SHIPPED TO	FORD-21	FORD-[illegible]	7R	9R	MISC.	REC'D	ENTERED	SHIPPED
1751	J. H. Smith & Co.			3	3		3.20	3.20	3.21
1752	Western Motor Co.	1					3.20	3.20	3.20
1753	Auto Supply Co.	1					3.20	3.20	
1754	A. T. Johnson		1				3.20	3.22	3.22
1755	Sting - Hall Co.			6			3.20	3.20	3.20
1756	Tacoma Auto Supply Co.			1			3.21	3.21	3.22
1757	Twin City						3.21	3.22	3.22

FIG. 7. SAMPLE FORM FOR SHIPPING ORDER RECORD

You should be especially careful to keep detailed order records (Fig. 7.) from the time you make your very first shipment. After those goods have been in use for a time, replacements of parts will become necessary, customers will want to turn in old machines toward new ones, and in other ways requests will be made which will necessitate reference to the original shipment.

ADVANTAGES OF AVAILABLE RECORDS

Your product will change in details of design and construction. You will not want to be making exactly the same kind of goods a year from now that you are making today; you will be constantly improving them here and there in minor ways which will mean changes in the construction of certain parts. Possibly the construction of your machine included a certain shaft that was originally made from ¾-in steel. Later you strengthened your machine and changed this shaft to ⅞-in steel. If a customer writes in for a pulley or a bearing for his machine and you send him one with ⅞-in bore, you can imagine his disgust when he receives it and finds it does not fit his shaft. Possibly his machine has been idle while waiting for that new bearing. If he has to return the bearing you sent him and ask for another one, it will not be very easy for him to boost your company to his friends. And don't forget that the best sales force you can have is the men who are using your product.

Let your imagination pass over a period of ten years and carry you into your plant at that time. Maybe you will have fifty employees in your offices alone. If a customer writes in for some part that he needs for his machine and your order records date back to the time of his purchase years before, so that you can know with certainty that he will receive the correct part, those records will possess a value to you that you cannot measure.

The second important justification for careful attention to order records is that they can be an effective means of improving the service to your customers.

WHAT SERVICE CONSISTS OF

Service—the mere word—is almost threadbare with overuse. The expression, "We give service," has been used to cover such a multitude of sins that its effect on most of us is reactionary. You can *talk* service, or you can *practice* service. If you practice it honestly and whole-heartedly, you won't have to talk about it.

The best chance for you to give real service to your customers is in attending to the various details in connection with filling their orders. It is not sufficient to see that the goods are put into the mail or delivered to the railway company without a single moment of unnecessary delay. That is only one part of it. The success you experience in taking advantage of the opportunity to build business through filling orders depends upon the ability to put yourself in the other fellow's place.

Suppose you are located in Chicago and a customer in Seattle sends you an order. He knows that it takes three days and three nights for that order to reach you, and so he reasons in just a week after he mails the order he should get some word from you. If the word doesn't come the exact day he expected he thinks something is wrong. If a week more goes by and he hasn't heard from you, he wonders if his letter has gone astray, and so he writes to learn whether it reached you or not. Maybe the order was small and he sent a check with it. He gets his statement from the bank ten days later and finds you lost no time in depositing his money. Just put yourself in that fellow's place, and tell yourself truthfully whether you would ever send a second order to that company.

All of this time the order may have reached you and been filled and shipped that same day, so that from that one standpoint you acted admirably. But, oh, how you have fallen down when you consider the transaction as a whole.

Men, that's not giving service. It's falling far short of the mark you should aim at in every sale you make. A customer expects something more than the actual goods when he gives you an order. He has a right to expect something more, and often times your reputation with him and the possibilities of your ever receiving a second or a third order from him depend not so much on the actual thing he bought from you as on the manner in which the order was handled.

One of the first iron-clad rules that you should establish in your organization is this:

> Acknowledge every order the day it is received. If possible, tell the customer when and how his order will be shipped. If you need any further information before you can fill the order, go after it.

Your acknowledgment of the order need not be anything elaborate, a post card will suffice. Your customer is interested in the message itself, not in the fancy way in which it is presented to him. Some such wording as this on a post card will serve amply for acknowledging orders:

Chicago, Illinois,
...................., 19....

Gentlemen:
Thank you for your order..........................
ust received, for...............................
....
We expect to make shipment.......................
by.........................
Very sincerely yours,
BLANK MANUFACTURING COMPANY.

This will tell your customer when his order reached you. It will check his order number and the item or tems specified. It will tell him when the shipment will eave the shop, and if by parcel post, express, or freight. You should make some notation on the customer's original order to show that it has been acknowledged, either by a special stamp provided for that purpose, or a date stamp, or even a mere pencil note, "Ack'd 4-17-21, shipment promised 4-20-21."

A great many times, unfortunately, you will not be able to fill an order from the information it gives. It may be there are certain specifications lacking, or the prices may not be correct, or the items may be described n an unusual and confusing way. At any rate, filling he order from the information you have would be taking a chance on making a mistake.

In general, there are three types of orders; those direct from customers, those from jobbers or dealers for shipment to their own stock, and those from distributors for direct shipment to their customers. In he first two cases you are dealing with one party, in he third there are two parties to be considered. In ither event, don't leave the responsibility up to anyne but yourself if you are anxious to give service by voiding delays.

Where a dealer has ordered a certain item to be expressed direct to his customer in another city, if you eeded further information you might write to the ealer somewhat as follows:

entlemen:
Your order of the 17th for one Sure-safe Auto Lock to shipped to the Ford Sales Co. at Wichita, Kansas, has en received and entered for attention.
However, we cannot make shipment until we receive furer information from you, as your order does not state hether this lock is to be installed on a 1921 model car or older model.
If you will give us that information, the lock can go forard to your customer at once.
Very sincerely yours,
SURE-SAFE AUTO LOCK CO.

Here's where such a letter falls down; it puts the cision up to someone else, and in this case, offers three ances for delay. The jobber in Kansas City may not ite promptly to his dealer at Wichita, the dealer ay not reply immediately to the jobber, and then the bber may not get the information up to you promptly. ll this time someone somewhere is waiting for a lock r his car, and if that lock is to come direct from the anufacturer, it is the manufacturer who will be amed for any mistakes or delays.

How much better it would have been for you to write your jobber as follows:

ntlemen:
Thank you for your order of the 17th for one Sure-safe to Lock to be shipped to the Ford Sales Co. at Wichita, nsas.
our letter does not enable us to fill the order immediately l be certain of sending the correct lock; but we enclose copy of a letter we have sent your customer today explaining how the matter has been handled.
Very sincerely yours,
SURE-SAFE AUTO LOCK CO.

And then the following letter to the customer at Wichita:

Gentlemen:
Thank you for your recent order just received through the Auto Supply Co. of Kansas City for one Sure-safe Auto Lock.
The order does not state whether this lock is to be used on a 1921 or an older model Ford car. Ninety per cent of our locks are installed in new cars at the time the car is sold, and we presume that it is your intention to use this lock on a new car you have just placed with some customer in your city.
The order has been entered according to that presumption, and unless we receive contrary instructions before a week from today, the 27th, it will be expressed to you on that date.
Very sincerely yours,
SURE-SAFE AUTO LOCK CO.

See the difference? You will if you put yourself in the place of the distributor in Kansas City. If you received the first letter you'd probably say to yourself, "Oh Thunder, isn't that order taken care of yet? Now I've got to write a couple more letters about it." But if it were the second letter, you'd say, "Gee, those are fine people to do business with. Look at that; wrote to the customer themselves, and took care of everything for me. That's real service."

TAKING THE INITIATIVE

In handling orders from customers, don't leave things hanging fire. Make a decision one way or the other, tell the customer what you have done, and that you presume it's as he wished. If it is all right, the order will go smoothly through routine channels and be filled and billed. If it isn't all right, your customer will be sure to let you know in a hurry. You will put the proper spirit into your work if you keep before you the fact that every letter you write is a sales letter. Even a collection letter or a reply to a complaint can be made to sell goods if you put your message across in the right way.

Every action on your part calls forth some sort of reaction from your customers. Every detail of your service creates a good or bad impression, it either builds your business or tears it down. If you can get the men in your shop to realize that fact, and to sail into their work with the knowledge that whatever they may be doing individually is a necessary part of the main job —that of filling customer's orders—you will not have to worry about buyers' strike, labor turnover, or kindred problems which trouble so many manufacturers.

THE SHIPPING ORDER

Each order should be transferred onto a shop form which would probably be known as a "Shipping Order." The orders as they come in the mail from your customers will be written on a great variety of forms, letters or cards. Some of them will call for more or less interpretation, and quite often specifications will not be worded according to catalog terms with which the men in the shop are familiar. To eliminate the element of guesswork and the liability of mistakes in shipping, it will be best not to let these original orders go out into the shop. Then too, they should be available for reference, which would necessitate their being kept in the office files.

A large plant is just as much concerned as anyone in preventing unnecessary expense, but the element of economy is not taken into consideration in quite the same way as in a small shop. There, the addition of some new printed form quite often brings up a "where'll we get the money to pay for it" problem. While from some standpoints it might be desirable to have a separate form for a shipping order, the writer found in his small shop that a duplicate copy of the invoice served this purpose very well.

The invoice under those circumstances would be made out in triplicate at the time the order was received. The original copy is kept in some file according to your own convenience until shipment has been made. The duplicate copy is sent into the shop where it is used by the shipper as an order for packing and shipping certain goods. He will check the items as they are filled, and show the date that shipment is actually made. Copies for orders shipped should be turned in each day with bills of lading or express receipts. When the duplicate copy comes back to the office, it is then only necessary that you fill in the shipping date on the original and mail it to your customer. The duplicate copy is filed in a binder and acts as a copy of invoice from which postings will be made to the various accounts in your sales ledger. The triplicate copy need not be a ruled form like the first two,—just a plain sheet of manila paper will do. It is pinned to the customer's original order, and goes with the correspondence into the closed order file as a part of that record.

PACKING GOODS FOR SHIPMENT

In instructing your shipper as to the necessity for extreme care in packing goods for shipment, you can illustrate your lesson by telling him about the lady in New York City who brought a dilapidated suitcase to the expressman at one of the stations and asked, "Will you tell me if this suitcase will go by express to my son in San Francisco?" The agent dropped the suitcase on the floor and said, "That's for Chicago." The second time, "And that's for Kansas City." The third time, as he dropped it on the floor and said, "That's for Denver," the contents of the case spread out all over the floor, and the agent said pleasantly, "No ma'am, this suitcase would never have gone by express to Frisco."

A good way to test the security of your packing or crating is to send a shipment to some city on the other side of the country. When the express agent or the railway freight agent advises you that he is unable to locate the consignee, instruct him to return the shipment to the factory. After that box or crate has done double duty in that way, you will have a good opportunity to discover whether your machines are arriving at their destination in good condition.

Always mark each box or crate in some way so it can be easily identified by the customer. The simplest way is to show the order number under which the goods are being shipped. This will be especially appreciated by jobbers or dealers who may want to put the goods in warehouse stock or reship them to customers without unpacking them. If the dealer can identify each box by a number and know just what is in that box by looking up your invoice bearing that same number, he can save himself the expense of unpacking your goods, storing them on his shelves, and reboxing them again later. And when you can help your dealers to cut down their expense, you'll increase their desire to do business with you.

A record of delays is always desirable, although you may not feel that it is essential excepting at those times when you may be badly behind on deliveries. If the nature of your product is such that orders cannot be filled immediately from stock, such a record should surely be kept. This record can be kept in book form, and to be of complete value should show:

Order number,
Party to whom shipped,
Goods specified,
Customer's number or date,
Date received,
Date entered,
Date shipped.

When your volume gets up to the point where you receive several orders a day, this record will permit quicker reference to any particular order than if you had to search through filled and unfilled orders, or ask someone out in the shop. It shows what service you are giving on shipments, and enables you to select the oldest unfilled orders so that they will be taken care of first. It acts also as a sort of sales record to show what quantities of each product or item you are selling. And by listing the unfilled orders at any time you can figure the amount of unfilled business in the house at that time.

In a previous chapter I said we are all in business for the same purpose,—to sell goods at a profit. That is true, and yet it is not alone the selling of your goods that will build up your business. In order to meet your payroll and your accounts payable, you must have a steady stream of money coming in from your customers. Bear in mind that (excepting in the special cases of C. O. D. or cash with order shipments) your customer is not going to enter your invoice for payment until he has received your shipment and found it to be correct and satisfactory.

The money comes in exactly as the orders go out. If you have a superficial, half-hearted way of filling orders and if you bunch up invoices at the end of the month and then make a mad rush to get them out before the statements, you can expect collections to be poor. But if you jump onto every order with both hands and feet the minute it reaches you, acknowledge it, get the goods on the way, and mail the invoice, you've handled the whole transaction in a way that just about obligates your customer to prompt payment.

NECESSITY OF PLANNING FOR "REPEAT" SALES

If you only plan to sell each customer a single time, your business is only temporary. Even though every individual in the country might be a possible purchaser of your product, you could say right today how many prospects for sales you had. But that figure would not begin to mean that you would sell that many items. Somebody else might break into the same field with a little better proposition, and then all your calculations would sadly miscarry. But if you can bring the element of "repeat" into your business, you have gone a long way on the road toward sure success. A salesman may make a most unusual commission for selling your machines, but if he fears he will be thrown out the back door if he shows up a second time, he's not going to enjoy his position as your representative. When he knows that he can drop in on his customer six months later, find a ready welcome, and hear a story of satisfaction, he'll be tickled to death to boost your products at every opportunity.

SATISFACTION is something that you have to sell along with your product. That's the element that will make repeat customers of your purchasers. You sell satisfaction partly through the merit and dependability of your product, and partly through the good-will you can establish by the service you render. The service that really counts is not the sort of stuff you see emblazoned on billboards throughout the country.

Sometimes we read a book or see a play that we like, although we may not be able to explain just wherein we thought it was exceptionally good. And so it is with real service. Oft times the customer may not be conscious of each detail that has contributed to his satisfaction, but they have had a cumulative effect that has pleased him.

The various details of filling the customer's order offer unlimited opportunity for developing a real service that can be one of the most vital factors in the building of your business. It's a problem worthy of your best thought; and the effort you spend in making it pleasant and profitable for people to order goods from your shop will react many times over in the form of continual increase in the volume of your business.

In Favor of Uniform Cost Methods

BY J. BAINTER

Builders of machinery and machine tools would do well to follow the development of the idea of uniform cost systems. These systems call for the use of uniform methods of figuring costs in any industry where the work done in various plants is very similar, the costs being compared so that enlightened competition may result.

The Fabricated Production Department of the Chamber of Commerce of the United States, Washington, D. C., is endeavoring to further the growth of the idea, and has already accumulated information regarding seventy uniform cost systems. It recommends that trade lines not so equipped take immediate steps to develop some uniform systems. The department recently entered into correspondence with the Federal Trade Commission at Washington to determine the attitude of that body on the subject. Its inquiries were as follows:

"There is, however, one point we should like to be informed on, and that is your attitude toward 'uniform cost accounting' and its use by members of trade associations.

"We refer to a standard plan or methods which may be developed and used by the producers of a certain line whereby they figure their costs by the same rules, including in them the same elements and differing only in results because of the variance in size of plants, equipment and local conditions—uniform as to fundamentals.

"Is there, in your opinion, any reason why such a system may not be developed and used lawfully by an industry? Again, if conversion costs only be dealt with, is there any legal bar to the collective study of costs by the members of an industry using such a uniform cost system?"

The replies of the commission, given in part in the following paragraphs, show its friendliness toward the idea:

"There has been much misunderstanding and unfortunately not a little misrepresentation of the attitude of this commission on the subject of uniform methods of cost accounting. In fact it seems to be difficult to secure even from the most carefully worded statement a proper appreciation of the commission's position, yet it is really very simple, namely, that it is strongly in favor of such work, provided it is done scientifically and accurately and is not used for ulterior purposes in violation of the law.

"No governmental agency in this country except possibly the Treasury Department has had so much occasion to observe the existing defects in cost accounting methods, but the commission is glad to record its opinion that there has been on the whole a considerable improvement in recent years. The work of this commission would be greatly facilitated by further improvement in cost accounting methods and also in fact by a greater uniformity in methods, provided proper methods are chosen as the models.

"As long as the principles of cost accounting are sound and the methods used are adapted to secure accuracy of individual results, and provided that the results are not used directly or indirectly for ulterior purposes of an illegal character, the Federal Trade Commission is in favor of the study and development of uniform cost accounting by trade associations, or otherwise.

"There is evidently nothing illegal in such a practice, but it is always well to remember that though innocent in itself, it has sometimes been perverted to serve the ends of collusive price control; and, when it is so used, no matter whether directly or indirectly, then restraint of trade is involved."

In a later letter more is said regarding the value of uniform cost systems and the legal aspect of them, some of the chief paragraphs being:

"Stated in another way, the conception of the commission is that the efforts of a trade association to educate the individual member in the application of sound principles of cost accounting in his individual business, are proper. But that any subsequent effort of the association to reduce the individual costs to an average or uniform cost basis and to procure the use of the group standard as a basis of price making by each of the individuals in the group, is improper. The individual must fix his own cost and his own margin. The group may not attempt to substitute a group average or standard either of cost or margin for the individual's figures without being in peril of becoming an unlawful combination.

". . . it may be said that for a trade association to set up and induce the use by its members of a scientific and accurate plan of cost accounting is not only legal but highly beneficial to the individual members of the association. The use of this legal and highly beneficial information by each individual in establishing his own production cost and determining his own margin, is entirely proper. If thereafter the association attempts to induce its members to disregard their own varying figures and use a common average or uniform figure of cost or magin or both, it has departed from its proper position of instructor and may easily take on the appearance of a price-fixing combination in restraint of trade or in suppression of competition.

"How far the association can lawfully go in acting as the medium of exchange of cost data among its members can only be determined after the decision by the United States Supreme Court in the pending action against the American Column and Lumber Co. et al, in which this question is involved."

Structural Properties of Metals and Alloys

Applicability of Metals—Factors of Strength and Elasticity—Compression—Ductile and Brittle Materials—Fatigue—Thermal, Magnetic and Optical Properties—Corrosion

By R. W. WOODWARD
Physicist, Metallurgy Division, National Bureau of Standards, Washington, D. C.

FROM the standpoints of the machine user and the machine designer, the important properties of metals and alloys are those which will affect their applicability for structural purposes, for wearing surfaces, for cutting or forming tools and their machinability and adaptability to any of these uses. It is just as important that we know the structural properties of the cast iron in the bed of a planer as those of the alloy-steel crankshaft for the high-speed aviation engine; and it is especially necessary to know why the two materials cannot be used interchangeably. Similarly the properties that make a babbitt metal desirable for a roll-neck bearing would neither be required nor admissible for the shoes of a caterpillar tractor or for the piston packing rings in a locomotive cylinder. The hardened steel of a die would not have the flexibility demanded of a bandsaw, and so on. Yet between all these extremes and from one class to another we have gradation and combinations of the various properties which admit of and require care in the proper selection of a metal or alloy for any particular use. Besides having the desired properties as required by its service, the material must also be capable of being readily manipulated in the shop at a minimum of cost.

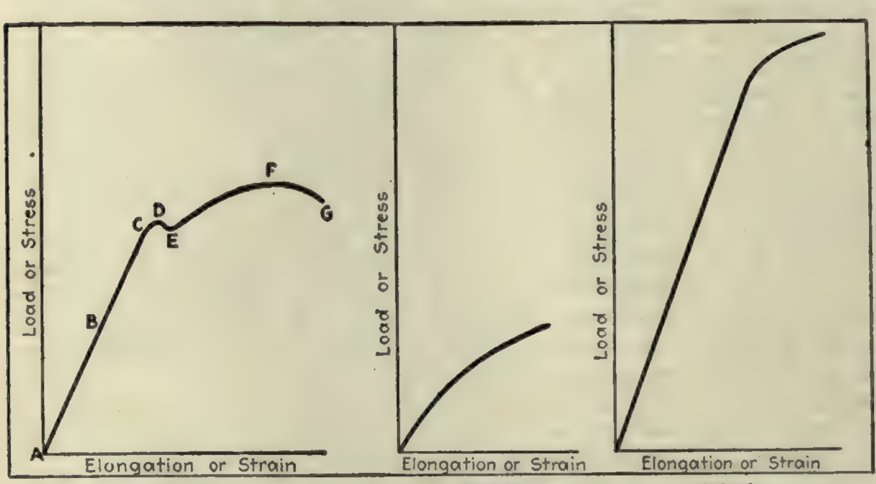


FIG. 1 FIG. 3 FIG. 4

FIG. 1. STRESS STRAIN CURVE OF A DUCTILE MATERIAL UNDER TENSION. (THIS CURVE IS DIAGRAMMATICAL ONLY AND IS NOT DRAWN TO SCALE.) FIG. 3. STRESS STRAIN CURVE OF A BRITTLE MATERIAL UNDER TENSION. FIG. 4. TYPICAL STRESS STRAIN CURVE OF AN ALLOY STEEL

In this paper an attempt has been made to point out some of the underlying points in the properties of metals and alloys and to interest the reader into seeking further information regarding the materials he is accustomed to handle. By no means have all the properties been touched upon, but only those in which it was thought the machinist would be interested. The appended table gives typical values that may be obtained for certain of the properties of representative metals and alloys and shows the wide variations possible in a given property. All the properties of metals and alloys are so influenced by secondary conditions such as composition, presence of impurities, mechanical and heat-treatment, etc., that these values must be considered as representative only and not adapted for design purposes.

The structural properties are probably given first consideration in most selections of material for a given purpose and will accordingly be discussed first in this paper. The engineer interprets the behavior of a structure from the mechanical properties of its component parts and among the properties that are considered are tensile strength, compressive strength, torsional strength, shearing strength and the elastic factors accompanying all of these: ductility; hardness; brittleness; and resistance to fatigue. Of those enumerated, tensile strength is by far the most important and best understood.

Practically all structures are subject to tension or a tendency to be pulled apart, which might be illustrated by the condition existing in a steel wire fastened at one end and from the other end of which is suspended a heavy weight. If the weight be gradually increased, a point will be reached at which the wire will no longer be able to support the load and will break. The total load carried by the wire just before rupture, divided by the cross-sectional area of the wire, is known as the tensile strength of the material. Obviously in a structure we cannot allow the various parts to be subject to stresses that would even approach the tensile strength of the material; therefore a "factor of safety" is applied by which the designed stresses are made a given fraction of the tensile strength such as one-fourth, one-fifth, one-tenth, etc., as the circumstances may be. There are also other reasons for introducing such a "factor of safety" which will be brought out later.

The illustration given above can be likened in a crude manner to the methods used in the testing laboratory for determining the tensile strength of a metal. In the latter case a relatively short length of the material is gripped in the jaws of the testing machine and pulled apart by a load applied by a lever system or other mechanical device for securing large loads. Let us now examine what is taking place in the specimen as it is being broken. Suppose the material is a piece of wrought iron, which we generally consider as being a soft material, and suppose that measurements of the elongation of the iron are taken as the load is gradually applied. If these measurements are then plotted graphically as shown in Fig. 1, we will observe that the first portion of the graph consists of a straight line *ABC*. If the load were only taken up to *B* and then again released, the specimen would return to its original length at *A*. Similarly, if the load were carried up to *C* the iron would likewise return to *A* upon release, acting through the range *ABC* exactly like a rubber band when stretched and then released. If, however, the load is taken up to *D* and then released we will find that the length will not return exactly to *A* but will have a small permanent set showing that the limit of elasticity of the iron has been reached. Further stretching of the specimen will be accompanied by a small decrease in load at *E* after which the load will increase with considerable elongation to a maximum at *F*, again decrease and the specimen will finally break at *G*. The points on the curve all have a special significance in defining the tensile properties of the iron. Thus the range *ABC* is the elastic range of the material within which the elongation is directly proportional to the applied load. From the slope of the line *ABC* is determined the modulus of elasticity, a quantity which would be useful in calculating, for instance, the deflection of a girder under a given load. The stress at point *C* where the elongation ceases to be directly proportional to the load is called the "proportional limit." The stress at *D* where a marked elongation has taken place without increasing load is the "yield point." The "elastic limit" is the stress at which the initial permanent set of the material is observed and accordingly does not appear on a curve such as shown in Fig. 1, although in value it would be somewhere between *C* and *D*. In order to determine the elastic limit it would be necessary to release the load after each increase in order to ascertain if permanent set had taken place. Because of this extra work involved, the elastic limit is rarely determined in ordinary testing. In fact, there is a large amount of confusion in the use of the term "elastic limit" by both engineers and users of material; it is used in some cases where yield point is meant and and in other cases where proportional limit would be the proper term.

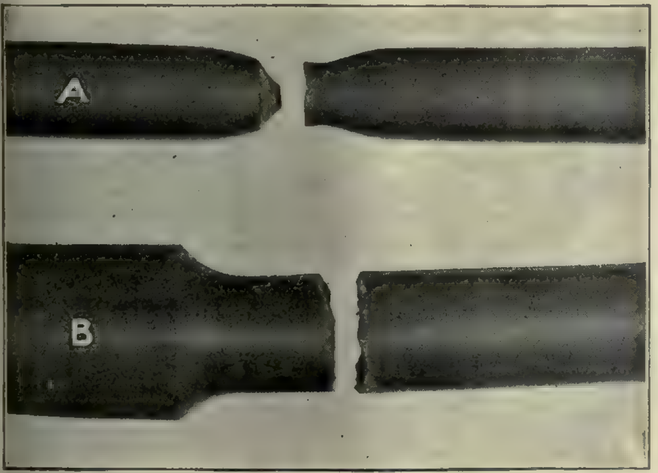


FIG. 2. TYPICAL FRACTURE FOR DUCTILE MATERIAL "A" AND FOR BRITTLE MATERIAL "B"

The stress at the highest point of the curve *F* is the tensile strength of the iron and the elongation at *G* expressed as a percentage of the original length is the "percentage elongation." If the broken specimen is examined it will be found to have drawn out before breaking, assuming a shape similar to the neck of a bottle, as shown in Fig. 2. The ratio of the difference between the original cross-section and the reduced cross-section to the original cross-section is the "reduction in area" of the material. It will be noticed that the last-named properties are essentially a measure of the ability of the material to be drawn out into a wire or of its ductility.

The above description may be taken as typical of what happens when any ductile material is broken; considerable stretch occurs before the metal ultimately breaks. In this class of ductile materials may be mentioned wrought iron, mild steels, many brasses and bronzes, copper, tin, zinc, lead and most of the pure metals. Suppose, however, that we are testing a brittle material or one which will stretch little if any, before it breaks. Cast iron is a good illustration of such a metal and the stress-strain curve obtained by testing cast iron in tension may be illustrated by Fig. 3. Here it is seen that there are no sharp breaks in the curve as was the case for wrought iron. The curve has no straight portion at the start and consequently cast iron can not be said to have a constant modulus of elasticity. Likewise, if the load is released at any time before fracture it will be found that permanent set has taken place, or there is also no "elastic limit." The lack of elastic properties is a fundamental reason why cast iron is seldom used where it would be subject to tension stresses of any magnitude. If the broken test pieces are examined it will be found that the "reduction of area" and "elongation" are practically negligible and only barely measurable, which is further evidence of brittleness.

BRITTLE METALS AND ALLOYS

While all brittle metals and alloys, such as cast iron, severely quenched steel, certain brasses and bronzes, and many other non-important alloys, exhibit the sharp fracture without any ductility, not all of them are without elastic properties in the sense that they have not a constant modulus of elasticity. The hardest quenched steel, for instance, will, if the test is properly carried out, show practically a straight line stress-strain curve from no load to fracture; in such a case there is, strictly speaking, no proportional limit, elastic limit or yield point detected by our present means of measurement, but all of these properties are coincident with the tensile strength.

Conversely not all materials which do not give a constant modulus of elasticity for a portion of the load range, or show permanent sets with even the smallest loads may be considered as brittle materials. Copper and lead, for instance, receive a permanent set from the application of quite small loads although both of these materials are quite ductile. Many of the cast brasses and bronzes also behave in this manner and in order to gain some idea of what "elastic limit" may be considered as a safe value for design purposes it is usual to determine yield point by ascertaining at what load a given elongation such as $\frac{1}{2}$ of one per cent (0.01 in. in 2 in.) has taken place, it having been found by experience that such a value approximates the useful load to which the material may be subjected or a point beyond which further elongation would rapidly increase with only small additions of load.

Between all the extreme cases enumerated above we find numerous examples of materials having intermediate properties. Thus the alloy steels when properly heat-treated have high tensile strength accompanied by considerable ductility, although there is no well defined yield point found on the stress-strain curve as in the case of the truly ductile materials. This is illustrated in Fig. 4.

A knowledge of the compressive properties of metals is quite important for designing structures that carry dead loads such as foundations or columns and also for bearings although in the latter case many other factors must also be considered.

The compressive properties of metals include much the same factors as the tensile properties except that the stresses are such as to tend to compress the material rather than to pull it apart. The elastic properties exist under compression and may be determined from the stress-strain curves. The maximum strength under compression, however, is generally not a definite quantity but will vary for the same material for various shapes of test pieces. For instance, if we submit a cube of a soft material such as lead to gradually increasing compression, it will be noticed that the specimen will keep on flattening out as the load increases and no maximum load will be reached. If, however, the specimen were in the shape of a cylinder of length about ten times the diameter, the load will rise gradually to a maximum point but the bar will finally buckle and give way under the load. Brittle materials such as cast iron have a more definite maximum strength under compression and will break into pieces when this limit is reached. Under compression, cast iron also gives a straight line for a portion of the stress-strain curve in distinction to the continuously curved line obtained in tension. Other metals having properties intermediate between the very soft and the very brittle will ultimately fail also, provided the dimensions of the test specimens are properly chosen, by slipping apart on a plane at 45 deg. to the line of application of the load, the final failure being due to a shearing stress.

The percentage of deformation at the maximum strength (corresponding to the "elongation" in tensile tests) may also be determined in some cases although, as can be readily appreciated, no quantity corresponding to "reduction of area" may be measured.

RESISTANCE TO SHEARING AND TWISTING

When the application of a load tends to force two adjacent parts of a structure to slip past each other, shearing stresses are developed and a knowledge of the properties of metals under such conditions is necessary in the design of many riveted joints, the design of keys to be set in shafting, or in calculating the power required to punch holes into plates, etc. The elastic properties also exist under shear, and accordingly a modulus of elasticity in shear, or more simply a shear modulus, may be determined.

If a bar is twisted at one end about its own axis while fixed at the other end, so-called "torsional" stresses are set up within the bar, although, strictly speaking, the stresses may be resolved into shearing stresses. A lineshaft or the crankshaft of an engine, in fact practically all shaftings, are subject to torsion and must be built to resist such action. The deformations in this case are measured in terms of the angle of twist or rotation of the material and the usual elastic properties may be considered.

FATIGUE FAILURES OF METALS

In all that has been said above regarding the fundamental mechanical properties of metals, it has been implied that rupture of the metal would not take place until the maximum strength of the material had been reached. Unfortunately such is not the case and it has been found that all metals will fail at loads less than the maximum strength (and greater than certain lower limits) provided this load is alternately applied and removed a sufficient number of times. The nearer the applied load is to the tensile strength, the smaller will be the number of alternations required to produce failure; while with lower loads, nearer to the elastic limit, a great number of cycles will be required.

This phenomenon is known as "fatigue," since the metal becomes exhausted and is unable to resist the continued application of the same loads. Its importance in certain forms of structures, particularly where there is vibration or rotation, may be readily appreciated and forms an added excuse for the existance of a "factor of safety" or "factor of ignorance" as it has also been termed. Consider an automobile which is run two hours each day at an average engine speed of 1,000 r.p.m.; at the end of a year about 45,000,000 revolutions of the engine crankshaft will have taken place in addition to the vibrations due to the action of the springs. Certain materials, such as some of the heat-treated

SOME PROPERTIES OF VARIOUS METALS AND ALLOYS*

Material	Tensile Strength, Lb./Sq.In.	Elongation, in 2 In., per Cent	Modulus of Elasticity, Lb./Sq.In.	Compressive Strength, Lb./Sq.In.	Brinell Hardness Numeral	Density Lb. per Cu.Ft.	Melting Point, Deg.F.	Coef. of Linear Expansion Deg. F.	Resistance Ohms Circular Mil-Foot	Temp. Coef. of Resistance per Deg. F.
Cast iron	30,000	None	15,000,000	100,000	100	450	2,000	0.0000068	......	....
Wrought iron	50,000	35	25,000,000	30,000	125	480	2,780	0.0000066	60	0.00322
Low carbon steel, annealed	60,000	35	30,000,000	40,000	...	490				
Low carbon steel, cold rolled	80,000	20	30,000,000	60,000	..	490			95	0.00183
Med. carbon steel, annealed	80,000	28	30,000,000	50,000	135	490	About	About		
Med. carbon steel, heat-treated	125,000	13	30,000,000	100,000	300	490	2,500	0.0000067		
High carbon steel, annealed	86,000	33	30,000,000	....	156	490				
High carbon steel, heat treated	200,000	10	30,000,000	....	375	490				
Alloy steel, heat treated	225,000	10	30,000,000	200,000	410	490				
Copper	35,000	50	17,000,000	....	42	555	1,981	0.0000095	10.37	0.00022
Cast red brass	30,000	22	13,000,000	30,000	40	535	....	0.0000105	39.5	0.00055
Cast gun metal or gov't bronze	38,000	25	13,000,000	....	64	545	....	....	......	......
Manganese bronze, rolled	75,000	25	16,000,000	....	100	525	....	....	......	....
Zinc	12,000	..	11,000,000	25,000	48	445	786	0.0000163	36.5	0.00210
Aluminum	13,000	25	10,000,000	67,000	25	165	1,218	0.0000130	16.98	0.00216
No. 12 aluminum cast alloy	20,000	3	10,000,000	....	55	176	.....	....	....	....
Duralumin, rolled and heat treated	55,000	25	10,000,000	....	...	175	1,200	....	28.5	....
Tin	4,000	35	4,000,000	6,400	14	455	450	0.0000126	67.9	0.00240
Lead	2,000	..	700,000	....	...	710	621	0.0000164	125.0	0.00217
Genuine Babbitt	......	..	....	15,000	25	460	460	....	......	....
Platinum	35,000	50	23,000,000	....	...	1,340	3,191	0.0000050	66.0	0.00204
Gold	30,000	25	....	....	...	1,200	1,945	0.0000081	14.5	0.00206
Silver	45,000	..	9,000,000	....	...	650	1,765	0.0000108	9.9	0.00222
Nickel	40,000	10	29,000,000	....	76	570	2,646	0.0000071	64.0	0.00230
Nichrome	150,000	..	....	....	...	517	2,800	0.0000091	657.0	0.00024
Manganin	......	..	....	....	...	....	....	....	260.0	0.000006
Constantan	120,000	..	....	....	...	554	2,300	0.0000080	293.0	0.00001

* These values are typical only and must not be used for design purposes.

TABLE I—SOME PROPERTIES OF VARIOUS METALS AND ALLOYS

alloy steels, resist fatigue better than other materials and hence are always used where a large number of repetitions of stress are likely to occur. When a metal fails from fatigue, the fracture generally occurs without accompanying elongation or ductility as in the case of a fracture occurring under a static load.

OTHER MECHANICAL PROPERTIES

Another type of load application that causes failure at stresses below the breaking strength is a suddenly applied one or an impact blow. Metals are subject to examination under such conditions but no new fundamental properties are determined in these cases. Mention has already been made of such terms as ductility, brittleness, hardness, etc. These properties are closely interrelated and, although important, are difficult of exact measurement.

Hardness is used in many different senses, each of which requires a different mode of determination. A gage block is required to be hard in the sense that it will resist abrasion or wear and resulting change in dimensions. This type of hardness is practically not determinable and other means of classification are used.

The Brinell hardness method measures the resistance to indentation and is also roughly proportional to the tensile strength of a metal. The scleroscope is used considerably for measuring hardness, but its readings are also influenced by the elasticity of the material, as will be appreciated by trying it on a piece of rubber, the reading obtained being comparable to that on a sample of hardened steel.

Another form of hardness is resistance to scratching. Instruments have been devised for measuring this property but so far they have not been widely used in testing metals. The file test, which is an excellent and sensitive, though crude test in the hands of an experienced mechanic, is probably a measure of a combination of the scratch hardness and the abrasive hardness. There are also magnetic tests for hardness which, however, are still in the development stage and applicable to limited material, but which show great promise for the future. These various methods of classifying hardness will not always place a series of metals or alloys in the same order. For example, manganese steel such as is used for crusher jaws, railway frogs, safes, etc., is extremely resistant to wear or to cutting tools, yet is quite soft as measured by the Brinell method for hardness.

Brittleness is generally associated with hardness, although not always so; it is the tendency to break under suddenly applied loads or to break without appreciable deformation. Toughness is practically the opposite of brittleness, as a tough material is capable of withstanding shock. The two properties may be combined as in case hardened steel which has a hard brittle shell, generally for the purpose of resisting wear, and a soft tough core to furnish the necessary resistance to suddenly applied loads.

Malleability is that property of a material which permits it to be readily rolled, hammered or pressed into various shapes. Malleability generally increases with rising temperature and advantage is taken of this fact in drop forging and in the rolling of metals into various shapes. Some alloys, as for instance some of the brasses, become brittle at elevated temperature and lose their malleability; they must, therefore, be worked at ordinary temperatures.

Ductility is closely allied to malleability; this being the quality which allows a metal to be drawn out into a wire or into cup-shaped articles such as cartridge cases. It can readily be seen that the elongation and reduction of area measured in a tensile test are a measure of ductility.

(To be Continued)

Brazilian Sales Methods of British Equipment Manufacturers

British manufacturers of automotive equipment are specializing on the South American markets for the sale of motor-car and motor-cycle accessories and spare parts for the better known and most popular makes of American cars and trucks, as well as the sale of service machinery to agents of American automotive products by means of illustrated catalogs printed in Portuguese and Spanish.

These catalogs are distributed in the following manner: A letter is prepared and mailed direct from the manufacturer to a list of service stations, motor-car agents, and distributing houses, with an introduction stating that their name has been given to the manufacturer by a well-known business concern located in the Brazilian markets with whom these various concerns are now doing business, or whose standing is known to them. Special emphasis is laid on the bunching of orders with a quantity discount and attractive long-time terms. These orders, when received, are booked through the central distributing agent, which is the firm which has recommended these names, and a discount of 2½ per cent is allowed on sight-draft remittances. Should prospective buyers have buying agents in London a discount of 3¾ per cent is made for cash in London.

This attempt on the part of British manufacturers of service machinery to compete with similar American products, which have been supreme for some years in practically all the world's markets, is an indication that these manufacturers are studying their problems and have found that they must emphasize the importance of service stations and equipment as a means of furthering the sale of their products in export markets. It has been stated that this method of direct letters to the trade has been the means of placing considerable business with British firms who are not even represented in the market by resident salesmen, and it is herewith published for the suggestion it may carry to American manufacturers.

Metal Cutting Tools—XVI

BY A. L. DE LEEUW

(Continued from last week's issue.)

IN ORDER that a proper thread shall be produced it is necessary to have the tool cut along the entire side of the thread for finish. The first full thread of the tap does this finishing, provided that metal is left in the hole. In any case no thread, after the first full thread, can do any cutting except when the lead of the tap is irregular. If, for instance, an 8-pitch thread is cut with the taper part of the tap, and if then the lead should become somewhat more or less than 8-pitch, there will be a slight amount of cutting done even after the full depth of thread has been cut. All such errors in the tap tend to make the groove of the thread *too wide;* in other words there will be a loose fit between screw and nut. As a matter of fact, small irregularities will be found in any commercial tap and we might expect looseness between any screw and its tapped hole, if it were not for the fact that screws also have their imperfections, so that we often find a tight fit, notwithstanding that the tapped hole is too big.

When we said that a tap is merely a screw with some axial grooves milled in, so as to produce cutting edges, we ignored the fact that such a contrivance would not be a true cutting tool, because it would have no clearance. Nevertheless, many taps are made in just that way. A tap made in that way has a strong tendency to bind in the hole and is very apt to break. As a rule, however, taps are not held rigidly in the machine spindle; they have a chance to move sideways so that first one side and then another cuts more heavily clearing the succeeding threads in this manner. As a result it will be found in practice that only one turn of the thread, or at the most two turns, bind in the hole. This binding prevents us from using the cutting speeds which we use for other operations, such as turning, drilling or boring. A tapping speed of 30 ft. per minute is about the best we can expect whereas we use 70 to 100 ft. for other operations. The lack of clearance which can be tolerated to a certain extent for the smaller taps is not permissible at all when the tap is of larger size. In such cases (and, for that matter, even with smaller taps for more refined work) the threads are backed off, thus producing the same effect as we noticed on formed milling cutters.

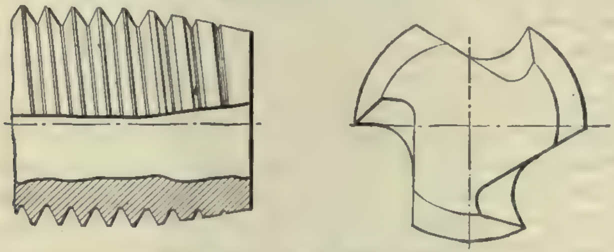


FIG. 269. THE GUN TAP

The V-type taps do not need much cam in order to give an appreciable amount of clearance, due to the large angle of slope of the sides of the thread; the Acme type taps require more cam in order to get sufficient clearance on the side, while a square-thread tap cannot be backed off so as to get any clearance on the sides; at least not if we wish to preserve size and shape of thread; the clearance must be confined to the top.

Of course, a backed-off tap loses its size after sharpening and must be discarded when dull if a fair accuracy of threaded hole is required. This being the case, it is not necessary to give the tap the same kind of relief as a formed cutter. A cutter is made so that the tooth retains its size and shape after grinding, and the loss of the size of the cutter is of no importance. With a tap, on the other hand, size is all-important. No matter in what way we give clearance, the tap is bound to lose its size if we sharpen it, so that we may just as well use the easiest method we know to produce clearance and this is the backing-off method.

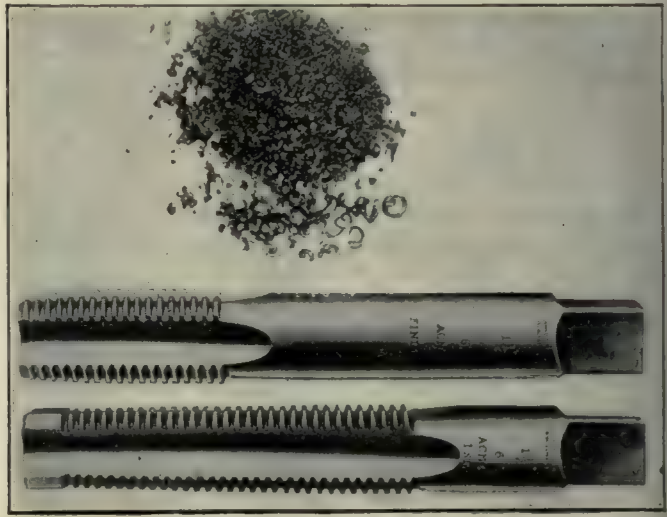


FIG. 270. BATH FINISHING TAP

When we say that we must discard a tap when it loses its size we do not mean that a tap cannot be sharpened at all. As we know, the taper end of the tap does all the cutting while the straight part acts as guide or lead screw. It follows that the straight part will wear but very slowly and that it will be possible to grind the taper part so long as the lead-screw portion of the tap retains its size. When that point is worn beyond the permissible limits of accuracy the tap must be taken out of service.

A tap is not only a poor cutting tool because it has, as a rule, no clearance, but also because it has no rake. The torque required to turn the tap is out of all proportion to the amount of metal to be removed, which is to be expected where there is no rake. A recent development, the Gun tap, made by the Greenfield Tap &

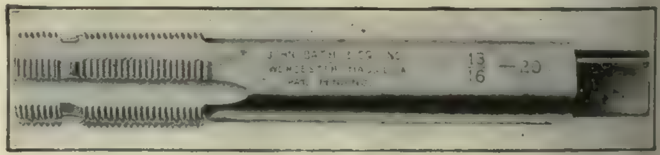


FIG. 271. TAP WITH PILOT

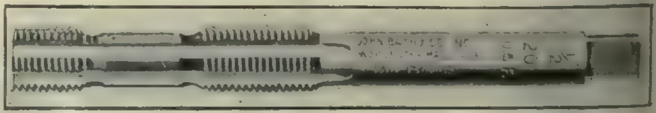


FIG. 272. TAP WITH PILOT AND REAMER

Die Corporation, overcomes this objection and, as a result, removes metal with much reduced power consumption. This means not merely a saving in power which, as a rule, is of minor importance in machine operations, but it means reduced torque and consequent breakage of taps; it also means increased permissible speed. The chips come out as regular boring chips and, as a result, there is much less tearing of the thread. Fig. 269 shows two views of a Gun tap showing clearly how the rake is obtained and the further general features of construction.

Another recent development is a tap brought out by John Bath & Co. This tap, Fig 270, more particularly intended for finishing, has the threads ground on the sides and in such a manner that only one side of a cutting tooth cuts. If the right side of the first cutting tooth does the cutting, then the left side of the second cutting tooth will be active, and so on. This does away with one of the worst difficulties encountered in tapping, namely, the tearing of the thread due to sticking of the chip. With the arrangement of the Bath tap a cut is taken on one side only, the chip curves up and releases itself readily from the material. As a result, there is no tendency to bind and the tapped hole will have the same size as the tap used. This development is really an outcome of the development of a grinding machine by the same company. This machine is capable of grinding the taps in the manner described above.

For further accuracy John Bath & Co. makes a tap as shown in Fig. 271, which is used as finishing tap only and can be used only for through holes. The tap is provided with a pilot or lead screw at the front end, which is ground a few thousandths smaller than the finished size and will guide the tap in its operations accurately and relieve the finishing tap from the necessity of maintaining lead. Ordinarily, when a finishing tap is introduced in the hole a certain amount of end pressure must be exerted to start the cut, and unless the end pressure is exactly sufficient for this purpose there will be a tendency to change the lead. The tap illustrated here avoids the necessity of introducing end pressure.

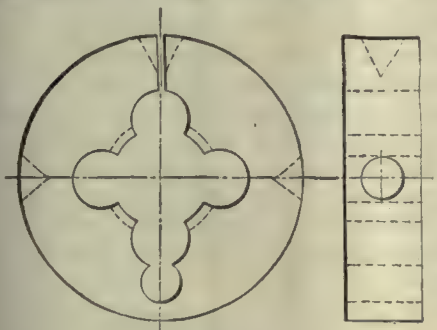


FIG. 273. ORDINARY BUTTON DIE

A further refinement is shown in Fig 272, which shows a tap with pilot and reamer especially for the purpose of removing burrs and bringing the inside diameter to very accurate size. The two developments, gun tap and Bath tap, are really the first striking improvements in taps which have been made for many years. They show a tendency to analyze the action of the tap and meet its requirements.

When large holes must be provided with an accurate thread it is good practice to chase the hole within a few thousandths of finish size and then run a finishing tap through. Such sizing taps do not need a taper portion as leading end, provided that only a small amount of metal is left to be removed. The system of grinding alternate teeth on opposite sides would be particularly helpful in such cases.

There are a great many kinds of commercial taps in existence and it is not the purpose of this article to describe all these varieties as they may be found in any complete catalog. However, we wish to call attention to the pipe tap which differs essentially from the straight tap in this particular: That all the threads of the tap come in action as cutting tools. This divides the cut to be taken over a large number of cutting points, so that the pressure exerted on a single point is small.

At the same time the total surface in action is very large, and for that reason a pipe tap requires a much larger torque to twist it into the hole than the straight tap. One will find quite often in description of drilling machines that its power, or rather, torque, is expressed by a statement as to the size of pipe tap such a drilling machine will pull in cast iron or steel.

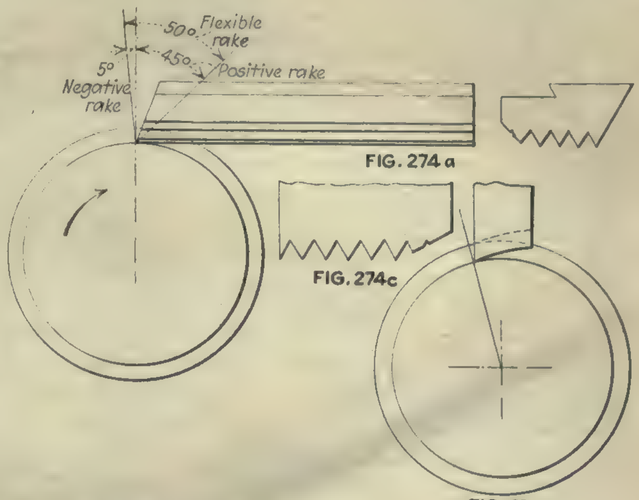


FIG. 274 a

FIG. 274c

FIG. 274 b

FIG. 274. TWO TYPES OF CHASERS

Dies

As a tap is a modified screw, so is a die a modified nut. For very small screws dies are often made without any attempt at clearance or rake. For larger screws, that is, where heavier cuts must be taken, the teeth of the die are relieved. Fig. 273 shows a button die. It is practically nothing but a nut, part of which has been cut away for the double purpose of providing cutting teeth and chip clearance. The front or entering part of the die has been tapered down for the same purpose for which the tap was tapered. If a full thread has to be cut close to a shoulder the taper part of the die must necessarily either partly or entirely disappear. Where threads have to be cut with fair finish and

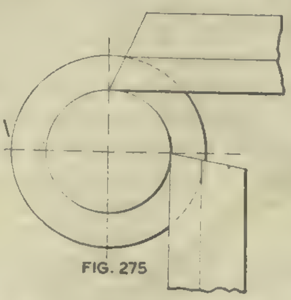


FIG. 275

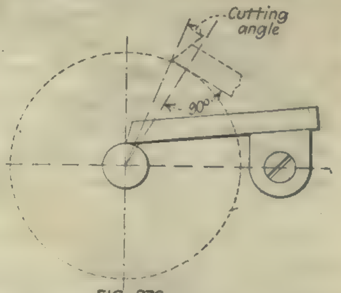


FIG. 276

FIG. 275. DIAGRAM TO SHOW WHY CORRECTION MUST BE MADE WHEN USING CHASER. FIG. 276. EFFECT OF DIFFERENT DIAMETERS

close to a shoulder, it becomes necessary to run two dies over the work, one with a certain amount of taper for the roughing cut, the other without taper for finish. Sometimes little or no taper is allowed and the same die used twice, first for roughing, then, after proper adjustment, for finishing. This is common practice with self-opening dies.

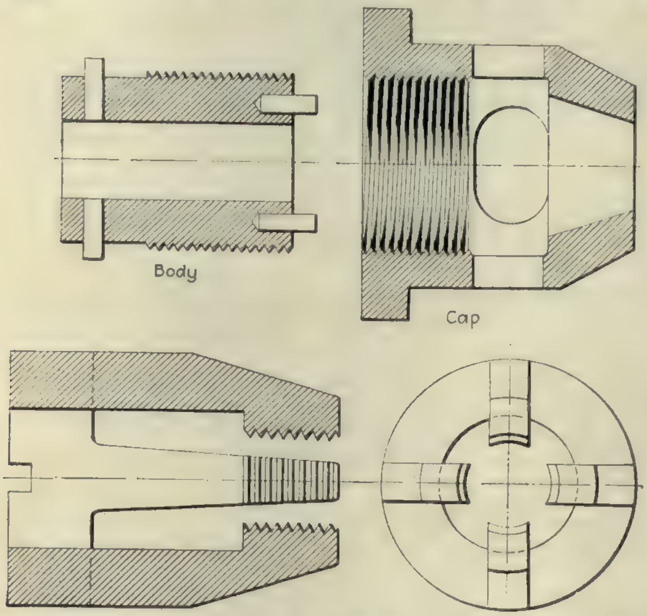


FIG. 277. ACORN DIE OF GREENFIELD TAP AND DIE CORPORATION

To understand the action of a die better, it is well to look first at those dies where chasers are used. A chaser is merely the cutting part of a die which is being held in a fixture or holder. Properties of the chaser determine the action of the die. In order to get a well-finished thread of accurate shape, the chaser must have the necessary rake and clearance angles, the proper lead, and its teeth must be of the proper shape. In Fig. 274a and 274b are shown two different kinds of chasers, both of which are commonly used in built-up dies. The chaser shown in 274b is what is called a hobbed chaser. The sketch shows clearly how the thread is cut in such a way as to provide clearance and rake if the chaser is set in the proper relation to the work. Fig. 274c shows how the tool is tapered away so as to divide up the cut. When the cutting teeth have dulled, the taper is ground further back so as to provide new teeth for the heavy work. There must always be several teeth left to act as guide or lead screw; so that a chaser of this kind can be ground a limited number of times only before it must be discarded, just as was the case with taps.

The chaser shown in Fig. 274a, on the other hand, can be made of indefinite length. Considerations of the amount of room allowable for the die may limit the length of such a chaser, but where the room is unlimited the length of the chaser can be made as great as one desires. This chaser is ground at the front. The taper part of the chaser exists along its entire front, so that no matter how many times it is ground the relation between roughing and finishing part, or one might say between cutting and lead part, remains unchanged. From the standpoint of wear this chaser has many advantages over the one shown in Fig. 274b.

It will be noticed that in both 274a and 274b the normal section of the chaser is not the same as the normal section of the thread to be cut; so that, in order to obtain a theoretically correct thread, the necessary corrections would have to be made in the chaser. As a rule, this is not done, because the threads to be cut with such dies very seldom require a high degree of accuracy. For instance, the chaser shown in Fig. 274a is made by the Landis Machine Co. for the purpose of cutting threads on bolts, pipes, etc. Such work does not require a degree of refinement which these chasers would not give. Where a really first-class thread must be cut it should be the practice to follow the die operations with a chasing operation on the lathe. Fig. 275 shows in an exaggerated form why it is necessary to make a correction when using such a chaser, and Fig. 276 shows, again in exaggerated form, why such a chaser when correct for a certain diameter is no longer correct when adjusted for another diameter. The illustration shows clearly how the adjustment from a small to a large diameter has increased the rake and caused negative clearance.

Button dies of the adjustable type permit a small amount of adjustments for diameter. Self-opening dies permit of a much larger adjustment, and besides, this amount of adjustment can be still further increased by using new chasers, whereas a die of the Landis type permits of a very large amount of adjustment with the same set of chasers. It is well to remember, however, that whenever an adjustment is made, using the same chasers, some error must creep in, and the shopman should keep this in mind whenever he has a job requiring great accuracy.

A button die which will give a greater amount of adjustment and permits of the sharpening of the cutting points without increasing the length of the advance taper is the Acorn die, manufactured by the Greenfield Tap and Die Corporation. This die is illustrated in Fig. 277. The illustration shows clearly how it is possible to grind this die on the side, and the holder illustrated in Fig. 278 is so constructed that it can take care of considerable variation of diameter. Once more we wish to point out that, although all these dies have great practical value, yet none of them will produce a theoretically correct thread except in one position and for one diameter, and only then when the die has been properly corrected for shape of thread.

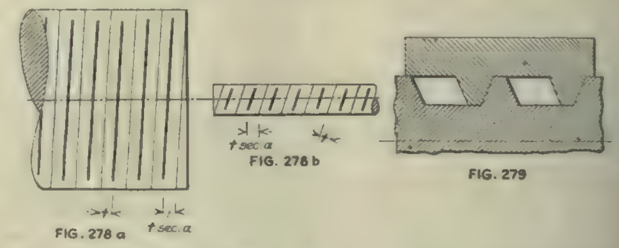


FIG. 278. WHY THREAD MILLING IS INFERIOR TO CHASING. FIG. 279. EXAGGERATED EFFECT OF TOO THIN A THREAD

Thread Milling Cutters

The thread milling cutter does not differ in any essential from other milling cutters. That it cuts screws is due to the arrangement of the machine in which it is used. All that is required of the cutter itself is that it shall have the proper section for the thread to be cut. If a milling cutter were made of such a correct section and if it were set in the machine in the proper position, it would cut a theoretically correct thread, except if it were required to cut a square thread. Square threads cannot be milled, because there would be interference between the cutter and the work. If the cutter could be made small enough, any thread except square thread could be milled. In other words, it would be possible to mill a thread with an angle of one degree or even less. However, this would require a very small cutter, too small for practical purposes. It is now common practice to use threads with small angles on the sides where formerly square threads were used. Whenever the shopman is confronted with the milling of such steep-sided threads, he should carefully look into the matter and see whether there is danger of interference. The presence or absence of such interference depends on the diameter of the cutter, the diameter of the work, the depth of the cut, and the angle of the sides of the thread. Such interference does not occur with Acme or V-type threads.

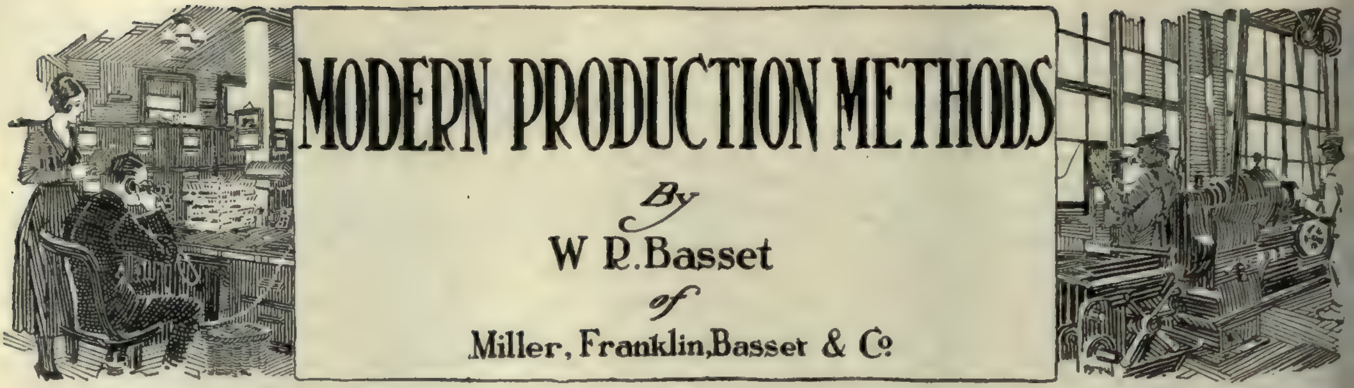
It is a popular belief that the method of milling produces a superior thread. If this is true at all it is so, not on account of any essential merits of the system of milling, but on account of the fact that thread milling machines are precision machines and that the accuracy of pitch or lead does not depend on the tool used but on the accuracy of the machine. Outside of this superior accuracy of lead, the method of milling does not offer any advantages which cannot, in some way or other, be had with other methods, and unless the cutter is properly designed for the thread to be milled, this method is inferior to chasing on an accurate lathe. The reason is indicated in sketches 278a and 278b. Both figures represent a thread cut with the same cutter and, of course, of the same pitch; but the diameters of the two pieces are widely different and consequently the angle of the spiral of the large piece is much less than that of the small piece. As the cutter is set parallel with the spiral the width of the gap must be the same as the thickness of the cutter, say at the pitch line; in other words, the normal width of gap of both threads is the same. If the angle which the spiral makes with the normal plane of the cylinder is α, then the width of the gap measured axially is $t \sec \alpha$, in which t is the thickness of the cutter at the pitch line. Consequently the piece with the smaller diameter will have a wider gap, measured axially, than the larger piece. The pitch or lead must, of course, be the same, as this pitch is produced by the lead screw of the machine and not by any dimension of the cutter. As for a small diameter of screw, if the gap is too wide it follows that the thread must be too thin. If an internal thread were milled the same way, screw and nut would fit together as shown in Fig. 279 in exaggerated form.

Furthermore, as the cutter is set at an angle with the normal section of the work, we have the same condition as we found to exist when cutting square threads with the tool set at an angle, namely, that neither the sides nor the bottom of the thread will be straight lines. This is of special importance when cutting multiple thread screws or screws with very large lead and deep threads. In such cases it becomes necessary either to have a cutter which is corrected for the special job to be done, or else take a finishing cut with a lathe tool.

The name thread hobbing is not entirely correct. The action is not a generating action but is really the same as thread milling action, the difference consisting merely in the fact that a multiplicity of milling cutters is used. As a rule these milling cutters are not separate tools but are all in one, so that a thread milling hob is merely a milling cutter which would make grooves in a flat piece of metal of the same shape as the contour of the thread to be cut. For a V-type thread a section of the hob would represent a number of V's set side by side with a distance from center to center equal to the pitch of the screw. The process of thread hobbing consists of feeding the hob into the work to the required depth, then turning the work against the cutter and advancing it at the same time so that the advance equals the pitch of the screw for one complete revolution of the work. In practice, the work does not first stand still until the hob has penetrated to the proper depth, but as a matter of fact it rotates all the time. Neither is it essential that the work feed forward while it turns; the hob might advance while the work rotates. In short, any mechanical arrangement might be used provided that the result is a screw thread.

The advantages of the hobbing process are obvious. For relatively short screws all threads are milled at once. The teeth of the hob are cut on a cylindrical body and if we should set the hob so that its axis is at right angles to the spiral of the thread to be cut, part of the centerline of the hob would be above, and another part would be below the center of the work, so that some threads would be cut to a larger diameter than they should have; in other words, the threads of the work would be cut on a hyperboloid and not on a cylindrical body. For this reason the hob is set with its axis parallel to the axis of the work. So long as the spiral of the screw to be cut does not make a large angle with the normal section this way of setting the hob leads to no trouble, but where the angle of the spiral is great, interference would take place between hob and work. For this reason the hobbing process lends itself particularly for relatively fine threads.

It must be evident from the foregoing that, with the exception of the single-point tool, all thread cutting tools are in the nature of a compromise. Unless specially made for *one* particular job they produce incorrect threads, in which, however, the inaccuracies are well within the limits of what is permissible in commercial work. When unusual or extremely accurate work must be produced these compromise tools are no longer satisfactory.



MODERN PRODUCTION METHODS

By
W R. Basset
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XXIII. Setting the Standard

Records of Actual Time-Studies of Machine Operations—Fallacy of Taking Over-all Times for Standards—Some Special Complications

WHILE it is essential to understand the fundamentals of time-study work which were described in general terms in the preceding article, nothing will give a clear-cut idea of the procedure in setting standards like a minute description of how an actual standard was set.

In Figs. 105 and 106 are shown time studies Nos. 107 and 380, showing the "mill radius" operation on a part we will call *LU75ABR*.

After a few operations had been observed, it was found that the operation could be analyzed into four performances, which with their stopping points are as follows:

Performance No.	Performance	Stopping Point
1	Mount Part	Feed on
2	Cut	Hand to R. S. Crank
3	Lower table	Hand from R. S. Crank
4	Remove part	Hand to new part

This is an example of a short operation for which the analysis can be prepared in advance. Note the use of the standard stopping points "feed on" and "hand to new part." Sufficient parts are in process to permit the use of "discontinuous times." The observations taken on the first operator are shown in study 107, Fig. 105.

Our first point of attack, as we saw in the preceding article, is to check up on the speeds and feeds; therefore we start the standard setting with performance two in which the cutting time is isolated. The stopping point "hand to R. S. Crank" is practically coincidental with the moment of throwing off the feed, and is chosen because it is more striking in this particular operation. The cut took an average of 70⅖ sec. at a spindle speed of 93 r.p.m. (which was a cutting speed of 91 ft. per minute), and a feed of 1.59 in. per minute measured on the table. Investigation showed the speed and feed to be entirely too slow for this operation. It was found that greatest economy called for a spindle speed of 150 r.p.m., giving 147 ft. per minute with the same cutter, and a feed of 2⅛ in. per minute measured on the table, which would reduce the standard cutting time to 38⅘ sec.—a saving of nearly half. The fact that the operator did not use the proper feed and speed—while it would render the results of a single over-all time observation entirely without value as a standard—did not prevent setting a proper standard from the detailed time study.

Checking the study for unnecessary steps, the second factor in setting standards, it is evident that they all bore directly upon production, and therefore all of them were included in the standard.

Study of the third factor—the speed of the operator—indicates this man does not work at uniform speed throughout the operation. This is usually true, but this time study shows the point unusually well. Take performance one for instance. Twice the operator succeeded in accomplishing this performance in 8 sec., but above that the time ranges all the way up to 16 sec., just twice as long. Had he worked at a uniform rate throughout each operation, the over-all time on the ninth operation would have been twice the over-all time on the tenth, but this did not prove to be the case, for the over-all times are respectively 103⅗ sec. and 90⅖ sec. Observe the fourth performance on these same two operations. It will be noted that the operator performed them in precisely the same time, which was the minimum time for the fourth performance, notwithstanding that the over-all time for operation nine was the maximum in the series.

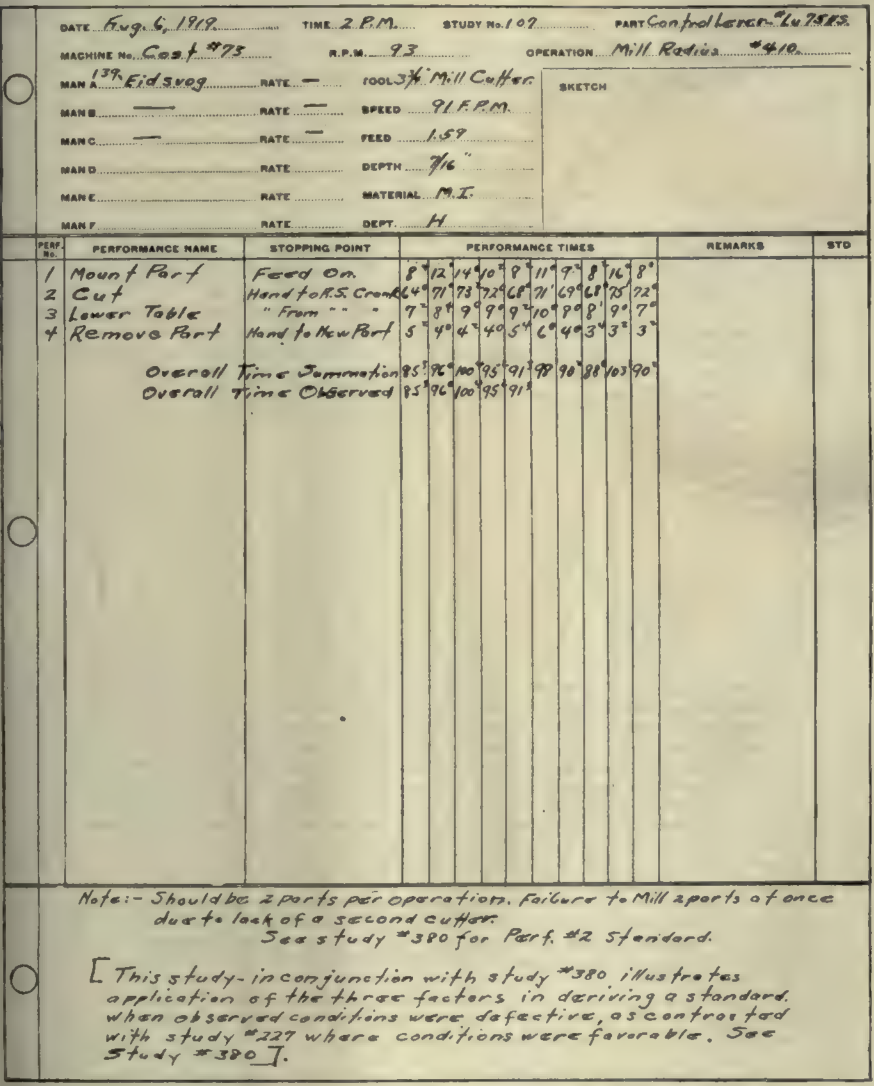
The time for performance one varies from 8 to 16 sec. with an average of 10⅗ sec. As the average is 10⅗ sec., with such a variation there would seem to be no reason why we should consider at all the instances in which 16, 11, 14 and 12 sec. are required. The question is—if the average, which includes the abnormally high figures, is only 10⅗ sec., should we, realizing that the workman is only fairly skilled, allow as much as 10⅗ sec. for a standard time to be expected of a 100 per cent workman? When we consider that the operator twice did the performance in 8 sec., did it once in 8⅖ sec., and once in 8⅘ sec., it appears not unreasonable that a skilled operator with a wage incentive should mount his part consistently in 8⅗ sec. This is therefore set as the standard for performance 1.

Using the same method of thought we set the standards for performance 3 at 8 sec. and for performance 4 at 4 seconds.

The standard time for the complete operation is the sum of the standards of the individual performances. It amounts to 59⅖ sec., whereas the average observed over-all time for the operation was 94 sec., the minimum, 85⅗ sec. and the maximum 103⅗ sec. In other words, the standard is but little over half the average and about 70 per cent of the minimum. Yet with the method we have used we are able to affirm with the utmost confidence that 59⅖ sec. is the proper time which this operation should take.

It happened that we had an opportunity to make another study on the same operation with a different operator, the result of which is shown in study 380, Fig. 106. This operator had already chosen the correct speed and feed, identical with that which we developed by proportion from study 107. Here is a striking example of the fallacy of over-all times.

If we had had no other information about the operation than that given by over-all times, we would have concluded that 94 sec., the average of study 107, would have approximated the proper standard; and this conclusion would have been confirmed by the average secured from study 380—94⅗ sec.—almost exactly the same. Analyzed by performances, the observations reveal an entirely different story. They show that, on the cut, study 380 was almost twice as fast as study 107. The almost exact coincidence of the over-all times was due to the fact that, in all parts of the operation except the cut, the operator of study 380 was almost three times as slow as the operator of study 107. They show furthermore that the operator of study 380 included an extra non-productive performance of raising the table between performances one and two, which we have called in study 380 performance 1A, and which since the 107 operator did not use it, is shown to be unnecessary. We have therefore dropped it in computing the standard. The net effect in this case of taking detailed and analyzed observations discloses that even though the two operators on the performance required identical over-all times, both of these times which checked so well are nearly one hundred per cent too high.



DATE Aug. 6, 1919 TIME 2 P.M. STUDY No. 107 PART Control Lever #Lu 75 F.S.
MACHINE No. Cost #73 R.P.M. 93 OPERATION Mill Radius #410
MAN A 139 Eidsvog RATE — TOOL 3½" Mill Cutter
MAN B — RATE — SPEED 91 F.P.M.
MAN C — RATE — FEED 1.59
MAN D RATE DEPTH 7/16"
MAN E RATE MATERIAL M.I.
MAN F RATE DEPT. H

SKETCH

PERF. No.	PERFORMANCE NAME	STOPPING POINT	PERFORMANCE TIMES										REMARKS	STD
1	Mount Part	Feed On	8	12	14	10	8	11	9	8	16	8		
2	Cut	Hand to R.S. Crank	64	71	73	72	68	71	69	68	75	72		
3	Lower Table	" From " "	7	8	9	9	9	10	8	8	9	7		
4	Remove Part	Hand to New Part	5	4	4	4	5	6	4	3	3	3		
	Overall Time Summation		85	96	100	95	91	98	90	88	103	90		
	Overall Time Observed		85	96	100	95	91							

Note:- Should be 2 parts per operation. Failure to Mill 2 parts at once due to lack of a second cutter.
See study #380 for Perf. #2 Standard.

[This study-in conjunction with study #380 illustrates application of the three factors in deriving a standard when observed conditions were defective, as contrasted with study #227 where conditions were favorable. See Study #380].

FIG. 105. TIME STUDY OF MILLING OPERATION

In this instance, we had a problem in standard setting which combined all three of the factors. At the other extreme we have study No. 227, shown in Fig. 107, where the operator was the foreman for the milling department. The operator's skill was great and his disposition to turn out as many parts as he could was rated 100 per cent. Combine this with the fact that the operation was all hand work, and we would expect the over-all times to form a very reliable guide as to what the standard should be. Observe how very nearly this proved to be true. The times for the first performance were remarkably uniform; the minimum is 6 sec.; the maximum, 8 sec.; and the average 7⅗ sec. In five instances a time of 7 sec. flat was repeated, which is a remarkably consistent record. Compare the "mount part" performance with that shown above in study No. 107 and note how the increased skill of the workman gave greater uniformity. It was not thought advisable to expect of any operator a performance more uniform than that of the observed workman. Accordingly the average time was taken as the standard.

In the second performance, the cutting time, a greater variation occurred, and yet the times shown are fairly consistent; that is to say, the average is almost half way between the maximum and the minimum. Observation showed that this variation was caused by variation in the amount of stock to be removed. The standard on this performance was set by eliminating the two maxima and averaging the rest.

Performance three is remarkably consistent in its turn. The time, 6⅗ sec., was repeated five times, but the variation below this average is a little greater than in performance one. Both the third and tenth operations are substantially below the average. It was therefore thought proper to reduce the standard slightly below the average of performance three. The result is a standard of 6⅕ sec. comparing with an average of 6⅗ sec.

When the total standard is computed, it is found to be 30 sec. compared with 30⅗ sec. average. It develops that we would have been justified in using the over-all average of this operator in fixing the standards, but we could not have done so with the same assurance as we are justified in feeling after taking detailed times.

Without actually reproducing the studies, I want to cite some special complications that have arisen in setting other standards. Needless to say, it would be impossible to describe every difficulty and special case that the time study man will run into. But perhaps typical instances will indicate the method for the more common problems.

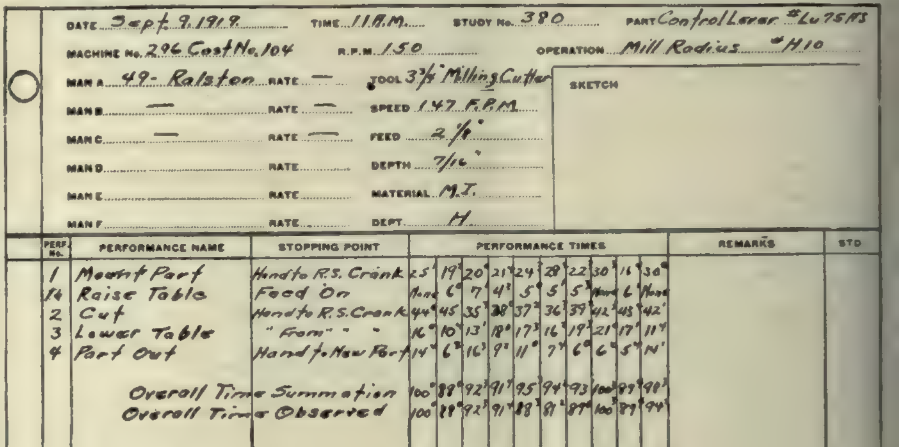
A certain lathe operation consisted in tapering the end of a shaft. The performances as observed were (1) mount new part, (2) set tool, (3) first cut, (4) reset tool; (5) second cut, (5a) reset tool, (5b) third cut, (6) part out and gage, (7) dog off and part aside. Two cuts were all that were needed as shown by the fact that the third cut was omitted by the workman in three out of the ten studies. The foreman and superintendent maintained that a good workman could perform the operation in a single cut. To obtain accuracy of cut we decided to allow two cuts, but to eliminate the third from the standard. The man whom we observed was first-class as to skill, but unsympathetic and anxious to inflate the standards.

Another case was the turning operation on a heavy cast-iron flange which the workman performed in an average of 3,296 sec. In all, there were twenty performances, of which performance (1) was secure new part, (2) insert arbor, (19) remove arbor, (20) move part aside. These four performances took on the average a total of 150 sec. But the total time taken up in cutting while the man was completely idle was on the average 2,300 sec. We supplied him with an extra arbor so that he could perform operations 1 and 2, during the cut on the preceding part and 19 and 20 during the cut on the following part.

After study we set the standard at 2,690 sec., or nearly 20 per cent lower than the old average.

In another study, a wide variation in the non-cutting times was observed. The workman was reasonably skillful, so the variation indicated intentional "soldiering." Experience has shown that no workman can inflate his time consistently. Consistent times, if the method is right, can usually be depended upon to show conscientious effort on the workman's part. In the study under consideration, the times on the "mount part" performance ran, in seconds, 11, 9, 9, 12, 12, 12⅗, 10, 11⅕, 12 and 11. The minimum time, 9 sec., was taken as the standard. The "part out" performance ranged from 5⅗ to 14⅗ sec. The standard set was again the minimum. Later trial of these standards in the shop failed to show that they were hard to achieve.

I cite these instances not only to illustrate the actual setting of a standard, but also to indicate how the development of standards by time study analysis permits an intelligence higher than that of the ordinary workman to arrive at the proper working time—the time which a 100 per cent workman of the kind assigned to the work could be expected to maintain.



DATE Sept. 9. 1919. TIME 11 A.M. STUDY No. 380 PART Control Lever #Lu75 HS
MACHINE No. 296 Cost No. 104 R.P.M. 150 OPERATION Mill Radius #H10
MAN A 49- Ralston RATE — TOOL 3½" Milling Cutter
MAN B — RATE — SPEED 147 F.P.M.
MAN C — RATE — FEED 2/1"
MAN D RATE DEPTH 7/16"
MAN E RATE MATERIAL M.I.
MAN F RATE DEPT. H.
SKETCH

PERF. No.	PERFORMANCE NAME	STOPPING POINT	PERFORMANCE TIMES										REMARKS	STD
1	Mount Part	Hand to R.S. Crank	25	19	20	21	24	28	22	30	16	30		
1a	Raise Table	Feed On	None	6	7	4	5	5	5	None	6	None		
2	Cut	Hand to R.S. Crank	44	45	35	38	37	36	39	42	43	42		
3	Lower Table	" From " "	16	10	13	18	17	16	19	21	17	11		
4	Part Out	Hand to New Part	14	6	16	9	11	7	6	6	5	11		
	Overall Time Summation		100	88	92	91	95	94	93	100	89	98		
	Overall Time Observed		100	88	92	91	88	81	89	100	89	94		

Note:- Compare Study No. 107. The most striking difference is in cutting time standard for which will be taken from the present study with its increased speed and feed. For the other performances no reason occurs to discredit the lower times of Study #107 and therefore they will be used. The discrepancy can in fact be largely accounted for. Performance #4 time was increased by the operators practice of unscrewing his set screw much farther than was necessary this reacted on Perf. #1 to increase it. Similarly, in Perf. #3, the table was lowered a full inch and a half (15 R.S. Turns) more than was required. Part of this was taken up in Perf. #1 throughout which the feed was on, and remainder resulted in Perf. #1a, which is unnecessary.

Note:- When attempt was made to make this rate on the small Kempsmith machine of Study No. 107 it was found that the smaller machine would not take the above speed. Rate is accordingly set in contemplation of the work being assigned to one of the larger machines where it can be done with proper speeds and feeds

Note:- Only lack of a second cutter prevents production of 2 Parts per operation as contemplated by the jig

Setup Rate .09¢

[Note:- See note on Stud #107]

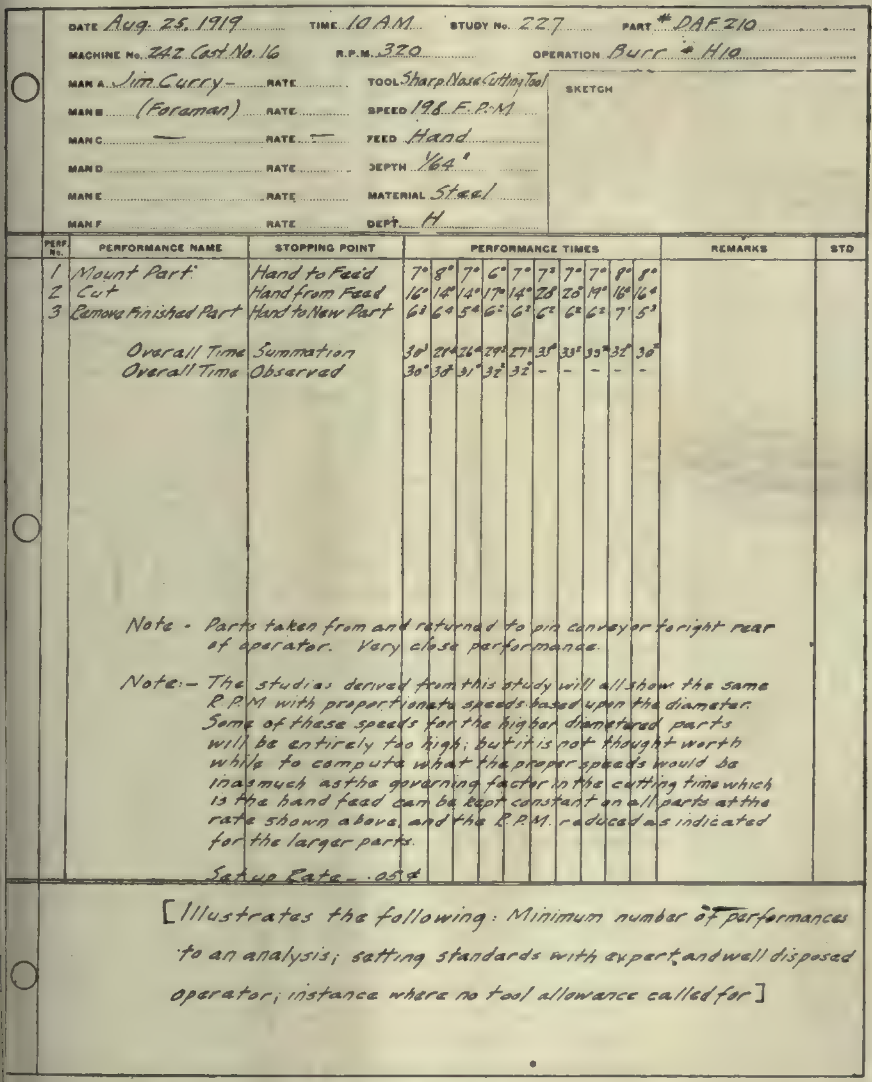
FIG. 106. SAME OPERATION AS FIG. 105 BUT DIFFERENT OPERATOR

The standard is not an average. The nearest approach to a rule that can be given is that the standard may approximate the average obtained from the observations after the extremes have been eliminated. The proportion of observations to be eliminated as extreme would then depend largely upon the estimated skill of the workman. This calls for considerable judgment. It is not a safe rule to follow even then, for we have just seen that sometimes the standard is brought down to the minimum. Sometimes when the workman's method can be improved, the standard time is made less than the minimum. Perhaps it is better to say that, based upon the observations, the standard is *selected*, keeping in mind the definition of a standard, and taking account of the conditions of the study, the skill of the workman, the disposition of the workman, the hardness of the metal and all other relevant data.

Our standards, as so far developed, give the proper amount of time needed for the actual productive processing of a part. I have already mentioned, incidentally, that it is necessary to eliminate from the study and from the standard any items of non-recurring non-productive time. But before we can set a proper rate we must take into account these interruptions. This we do by adding to the standard proper allowances to cover interruptions which may reasonably be expected.

The most common allowances are those for fatigue and tooling. If in addition the operator attends two machines simultaneously, there may be a justifiable loss due to one of the machines being stopped while he is busy with the other.

The fatigue allowance takes account of the fact that a man cannot be expected to repeat an operation indefinitely at a regular and unvaried rate, as can a machine. There must often be a margin allowed to absorb the slackening of effort, which will represent the operator's reaction from the strain of continuous application. We have already seen that where the cutting time is very long the operator may be expected to ecuperate from a considerable strain during the cuting time.



DATE *Aug. 25, 1919* TIME *10 A.M.* STUDY No. *227* PART *# DAF 210*
MACHINE No. *242 Cast No. 16* R.P.M. *320* OPERATION *Burr # H10*
MAN A *Jim Curry—* RATE TOOL *Sharp Nose Cutting Tool*
MAN B *(Foreman)* RATE SPEED *198 F.P.M.*
MAN C *—* RATE *—* FEED *Hand*
MAN D RATE DEPTH *1/64"*
MAN E RATE MATERIAL *Steel*
MAN F RATE DEPT. *H*
SKETCH

PERF. No.	PERFORMANCE NAME	STOPPING POINT	PERFORMANCE TIMES										REMARKS	STD
1	*Mount Part*	*Hand to Feed*	7^{0}	8^{0}	7^{0}	6^{0}	7^{0}	7^{3}	7^{0}	7^{0}	8^{0}	8^{0}		
2	*Cut*	*Hand from Feed*	16^{0}	14^{0}	14^{0}	17^{0}	14^{0}	28	20^{0}	19^{0}	16^{6}	16^{4}		
3	*Remove Finished Part*	*Hand to New Part*	6^{3}	6^{4}	5^{4}	6^{2}	6^{2}	6^{2}	6^{2}	6^{2}	7^{1}	5^{3}		
	Overall Time	*Summation*	30^{0}	28^{4}	26^{4}	29^{2}	27^{2}	35^{6}	33^{2}	32^{2}	32^{0}	30^{2}		
	Overall Time	*Observed*	30^{0}	30^{8}	31^{0}	32^{2}	32^{0}	–	–	–	–	–		

Note - Parts taken from and returned to pin conveyor to right rear of operator. Very close performance.

Note:— The studies derived from this study will all show the same R.P.M. with proportionate speeds based upon the diameter. Some of these speeds for the higher diametered parts will be entirely too high; but it is not thought worth while to compute what the proper speeds would be inasmuch as the governing factor in the cutting time which is the hand feed can be kept constant on all parts at the rate shown above, and the R.P.M. reduced as indicated for the larger parts.

Setup Rate - .05¢

[Illustrates the following: Minimum number of performances to an analysis; setting standards with expert and well disposed operator; instance where no tool allowance called for]

FIG. 107. TIME STUDY OF EXPERT OPERATOR

Fatigue is a somewhat complex problem. It will vary vith the workman's physique, with the size and shape f the parts, with the distance through which they must e moved, with the initial and final positions of the perator in making such movements, with the average ctivity of the operator, and sometimes with still other actors. Since to determine the effect of fatigue is heoretically so complicated, we resort to empirical ules which experience has proved satisfactory.

The general rule is to add 10 per cent of hand time r fatigue. It is usually the hand time which causes atigue, machine time having the effect of absorbing he fatigue loss. But if the cutting is done with hand eed it is classed, for the purpose of developing the fatigue allowance, as hand time. The observer will have to use his best judgment in setting the fatigue allowance if the cutting time is very long.

If, however, the work is very heavy, 10 per cent will not sufficiently compensate for fatigue. In some operations, the operator is required to be constantly active. In such operations 20 per cent, or even more, depending upon the strain and effort, may not be too much to allow for fatigue. I want to impress this fact—that the greatest care and good judgment are called for in setting fatigue allowances, for great injustice and physical harm can come from a standard which workmen rightly stigmatize as "killing." No good can come to the employer from such a standard.

The tool allowance is provided to cover time required for minor adjustments of the machines, for grinding tools, changing cutters and the like. Five per cent of the machine time is a fair average for this purpose. Here again the observer must use his judgment. In some milling operations, 1 per cent tool allowance is enough, especially if exactness of cut is sought rather than speed, and the cutters consequently stand up well and can be changed in a comparatively short time. When the tools are cared for in the toolroom and the operator has only to replace them on his machine, 1 per cent is ample. The duration of cuts will also offset the percentage allowed for tooling. When the cut is long the percentage naturally will be less than for a short cut.

Sometimes no tool allowance whatever is given, for the time which may be required in tool adjustment is so slight that it can be included in the fatigue allowance. Setting the tool allowance does not call for the same measure of judgment as does the fatigue allowance, but even so it should not be assigned without due thought.

Tool and fatigue allowance between them must cover the extra cuts and extra measurements which the operator has to take in reasonable proportion. If lack of skill causes an undue number of extra cuts or extra measurements, it is proper that the operator should suffer in decreased earnings.

On simple operations, the set-up time may be no more than that required to bring the tools from the toolcrib. But for a complicated operation on the automatics, it may be quite extended. It is really a separate standard. It is designed to equalize the earning power of the operator in supplement to the piece rates, taking account of the fact that once a set-up is made, any number of parts may be produced from it. It cannot properly be incorporated in the standard for the part it is intended to produce. Furthermore it may be done by a different man.

Three elements make up the set-up time; first, time for taking down the preceding set-up; second, time for the set-up itself; third, time for the extra cuts and measurements necessary to secure adjustment. The first element is a constant for each class of machines based on the average take-down of jobs on machines of that class. It is obtained by observation. The average must be used because it is impossible to predict for any set-up the job which would precede it, and the only alternative would be to have a take-down rate separate from the set-up rate. The number of set-ups to be made will seldom justify this degree of detail. The second element, the set-up time itself, is standardized from analyzed observation just as are the operations themselves. The adjustment time is most conveniently obtained by subtracting the average of the over-all times on the operation from the observed over-all on the first few parts until adjustment is completed. The complete set-up standard will be the sum of the three elements.

The extent to which detailed set-up times are warranted depends upon the magnitude of the set-up and the frequency with which it recurs.

Wages of Foreign Workers Show Decline

Great rapidity of movement and wide variations locally have characterized the wage changes in Great Britain, France and Germany during and since the war, according to a report issued today by the National Industrial Conference Board. The great number of wage adjustments is the outstanding fact of the material gathered in the board's study. This rapid, almost continuous, change of base was principally due to two factors: (1) The large number of agreements for wage adjustments according to changes in the cost of living, and (2) to the quite general provision that when blanket agreements covering an entire industry existed, local adjustments varying the standard to meet local conditions were permissible. The rapidity and wide variety of changes has characterized the downward as well as the upward movement.

Percentage increases over 1914 wages in the three countries covered varied widely among different groups of workmen. The more highly paid workmen received a relatively small increase, while the lower paid workers received a large increase. Money increases to cover the cost of living were practically the same for all classes of workmen, and the relative increase, therefore, was disproportionate. In Germany especially there has been a tendency for the wages of unskilled workers to approach those of skilled workmen; the former must have a subsistence wage, and employers have been able to pay but a little more than this minimum to skilled workers.

The peak of prices was reached in all three countries at the end of 1920. In Great Britain and France there have followed substantial reductions in wages in most of the industries during the first months of 1921, but in Germany, there was no evidence in wage agreements of reductions in wages, possibly because even with the decrease in prices, the cost of living was still above the wage level.

In Great Britain, according to the report, wages have, in general, followed retail prices so closely that there is little difference in the purchasing power of those wages now as compared with 1914. This is especially true in those industries where the cost-of-living figure is used as a basis for determining wages. Among the more highly paid workmen the increase in wages over those of 1914 amounted up to the end of 1920 to not more than 120 or 130 per cent. Among the lower-paid group of workmen in the same industries the advances were equivalent to 200 per cent or more, and in some instances increases of over 300 per cent over 1914. The average increase in full-time weekly rates of adult workers ranged from 170 to 180 per cent. During this period the length of the nominal work week in Great Britain had been considerably reduced, and owing to the serious decline in employment in the closing months of the year the actual weekly earnings in many industries were considerably lower at the end of 1920 than at the beginning of the year. Reductions in wages, affecting 2,556,000 workers, occurred between January and April, 1921. These reductions fell into the following four classes: (1) Reductions in wages of coal miners in accordance with variations in output of coal; (2) reductions brought about under agreements by which wages vary in accordance with the cost of living figures as determined by the Ministry of Labor. These reductions affect chiefly the railway service, wool manufacturing, textile, dyeing and finishing and the hosiery manufacture; (3) reductions made in accordance with sliding scales based on the selling price of the commodity; (4) agreements resulting from negotiations between employers' associations and trade unions.

The cost of living in France, according to an American official quoted in the report had increased more than 300 per cent by the end of 1920, and wages were lagging behind. The tendency has been to maintain without modification the basic pre-war wage rates and to make necessary increases in the form of bonuses for the high cost of living. The amount of such bonus is fixed, along with wages and other conditions of labor, by collective agreements between employers and employees. In almost all cases extra provision is made for married workers with children.

For Germany no comprehensive figures for the whole country are to be had, but it is estimated that the cost of living has gone up to a greater extent than have wages. A male adult worker in Berlin in November, 1920, is estimated to have received an increase over 1913 in average weekly wages of 700 per cent, while the cost of living in Berlin during the same period had increased 1,100 per cent according to a German authority quoted in the board's report. The average weekly earnings of a man in Berlin in November, 1920, are stated to be about 240 marks, which, according to an average of exchange values of the mark over 1920-1921, is equivalent to about $4.50. A vast system of schedules of wages and salaries has been built up in Germany since the revolution and is now being perfected and adjusted to existing conditions. The tendency more recently has been to fix the wage schedules centrally and to make them applicable to the whole country, adapting them to local requirements and to the constant changing of the cost of living. The number of German wage-earners on a schedule basis is continually increasing.

Automotive Registration in Bangkok

Consul James P. Davis, of Bangkok, Siam, reports that the whole number of automobiles registered in Bangkok in the past twelve years is 1,483, many of which have gone out of service. He states that the present rate of importation into Siam is about 50 per month, most of which are low and medium priced vehicles.

Ideas From Practical Men

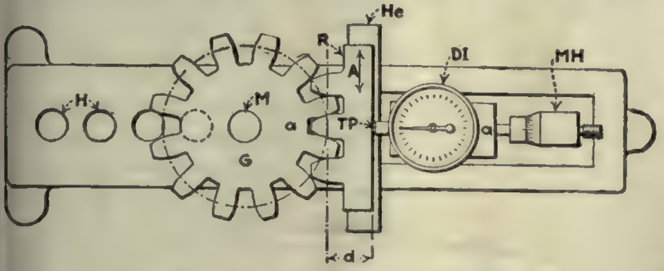
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

A Device for Inspecting Gears

By Frederick Franz

The proper inspection of gears has been difficult and involved because the pitch diameter—the most important practical dimension—is an imaginary line and therefore cannot be measured directly.

An instrument designed by the writer and shown in the illustration herewith may be used for determining whether or not the pitch diameter of a gear is within the specified limits and can be used for inspecting gears in small or large quantities.



DEVICE FOR INSPECTING GEARS

It does not require the use of standard gears or base-circle disks as do some gear-inspecting devices. The member mating with the gear to be tested is a rack which may be made of steel and hardened and ground with simple appliances, as the sides of theoretically perfect rack teeth are straight lines. The principle employed is that of the generating process. The rack R is capable of moving in both directions indicated by the double headed arrow A. It is evident that, if the gear G to be tested (with which the rack is kept in mesh) has perfect teeth, the rack will move in a straight line in either direction and will have its pitch line the correct distance from the center of the mandrel M. The mandrel can be inserteu in any one of a series of tapered holes H one inch apart for gears of various radii and the rack can be adjusted for the fractional part of an inch by means of the micrometer head MH which moves the rack through the medium of a dial indicator DI, mounted on a slide. The dial indicator must read zero when the micrometer reads zero; when the distance from the center line of any hole H to the testing point TP of the dial indicator is a whole number of inches. The adjustment is effected by means of an end measuring bar and, once adjusted, will accurately measure any gear that may be inserted without further adjustment. A different rack R is used for each size tooth, but on all racks the distance d is exactly 1 in. If it is desired to inspect a gear with a pitch circle of ⅛-in. radius and 8-diametral pitch, the mandrel is set in the 2-in. hole, the micrometer head is set to 125 thousandths, and the 8-diametral pitch rack is inserted. The gear is then placed on the mandrel M and if the diameter of the pitch circle is 2⅛ in. and the gear is correct in all other respects of tooth form and spacing, the dial indicator will point to zero. If it is under or oversize the difference will be indicated on the dial indicator. The gear may now be rotated on its mandrel to the limit of the movement of the rack and the variation of the indicator noted and checked with the tolerance permitted by the blueprint. The indicator will read undersize if all the teeth in contact with the rack are too thin or if the pitch radius is undersize. It will read oversize if the teeth are too thick or if one tooth in contact is too thick, if the teeth are not accurately spaced or if the pitch radius is too large, for then the rack is prevented from sinking as deep as it should into the gear. This instrument will enable an inspector to accept or reject gears as being within the tolerance, but will not indicate tooth profile for the correction of the gear cutter.

The head He carrying the rack is mounted so as to rotate 90 deg. on each side of the position shown about the axis aa. This permits measuring all helical gears ranging from a spur to a single threaded worm. The head He is graduated to read within 5 min. of arc by means of a vernier and is set to the correct helix angle before inspecting gears. The gear is measured in steps, the entire rack being withdrawn from the mating teeth and dropped into the next set to be measured. In the helical gear a lateral sliding exists between the rack and the gear teeth when the gear is being turned.

The Fitting of Babbitt Bearings

By J. C. Nicholson

Much time is wasted in scraping babbitt bearings.

Where heavy duty is demanded and the projected area is close to the allowable limit, there is need for scraping in so far as it helps to secure perfect contact, but there is a good deal of such work done largely for other reasons.

If boxes are babbitted directly on the same shaft, or upon one of the same size, that is to run in them, the babbitt shrinks until the diameter of the box is considerably less than that of the shaft. The practice of scraping or reaming such a bearing merely to increase its diameter is often unnecessary and may even be objectionable, for when the babbitt shrinks and makes the hole under the desired size, it also shrinks away from the matrix into which it is poured and should be forced back until it fits properly.

In ordinary boxes of the two-part type, this may be done by hammering the outside of the casting while the shaft is clamped between the two halves of the bearing. Generally, however, it is better when babbitting such boxes to have the cap drawn down tight on the liners that are to remain when the job is finished; then, after the box is poured and the oil holes and grooves provided, place it together again with the same liners and shaft between, and tighten firmly. Then hammer on all sides as far as is possible.

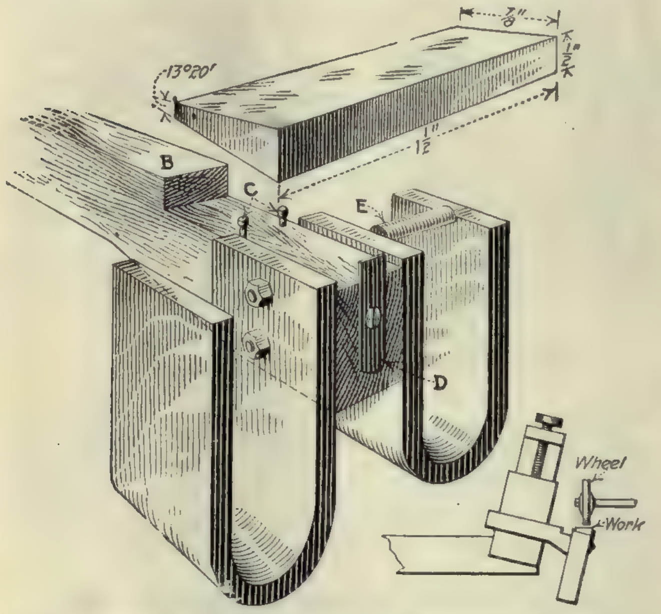
In nearly all cases the babbitt will go back far enough into the matrix to make the shaft just a nice running fit. This hammering must be done with some caution and due judgment, but on ordinary rough work of medium size it is better than reaming or scraping and does not take one-fourth the time.

The principle may also be applied to the babbitting of solid boxes. Usually these are done on a slightly tapered shaft to make removing it easier; though there are other more or less useful expedients. In any case if the box is too small after it is poured, the quickest way to make it right is to taper slightly one end of a piece of stock of the same size as the shaft and then force this well into the bearing with an arbor press, using oil to make it go better. It can be pressed in past the taper until it is quite tight. Then simply hammer all around the outside of the box and it will soon loosen up to a nice running fit.

A Home-Made Magnetic Chuck

By Arthur V. O'Brien

The writer has hesitated for some time before relating his first and only experience in the making of a magnetic chuck, after reading the series of articles which recently appeared in the *American Machinist* on that subject. However, if the successful use of an article is the surest test of its value, it may not be amiss to tell about it.



DETAILS OF THE HOME-MADE MAGNETIC CHUCK

In the course of construction of a built-up lamination die, it was necessary to grind the two faces of twenty-seven wedge-shaped pieces, shown at *A* in the accompanying sketch, to an included angle of 13 deg. 20 min. The pieces were first cut to length, then shaped to approximate dimensions and hardened.

After a few minutes spent in vain longing for a real honest-to-goodness magnetic chuck, and one of those adjustable blocks for use thereon, seen only by the writer in the advertising section of the *American Machinist,* his eye rested on an ancient automobile magneto that had adorned the scrap box for several years, and the great idea was born.

A piece of black walnut about 1 in. thick was bandsawed to the shape shown at *B*, the offset being necessary to bring the poles of the magnets below the wheel for the first grinding. A piece of non-magnetic metal would have been better, but time pressed. Two magnets were removed from the magneto and fastened to this wood shank by brass bolts passing through the holes by which the magnets had been fastened to the magneto frame. The wood shank was then gripped in the tilting vise of a Cincinnati No. 1 tool and cutter grinding machine, with the jaws set horizontally and the ends of the magnets ground true.

Two brads were driven into the wood at *C* with the heads projecting about $\frac{1}{8}$ in. above the faces of the magnets and parallel to the travel of the wheel, and the heads lightly ground to truth with the side of the wheel. A spring *D* made of a hacksaw blade was fastened in place with a wood screw, and a piece of brass rod *E* sprung between the poles of one magnet to act as a stop against the direction of rotation of the wheel. About half of the diameter of the rod projected above the top of the magnets. All this was done, of course, without removing the assembly from the machine.

The vise was then tilted 13 deg. 20 min., the angle being measured by an accurate protractor between the table of the machine and the finished edge of the vise jaw, instead of using the usual graduations on the vise. In use, one tapered block was placed on the magnets with the thin edge against the brads and one end against the stop and the spring swung into place. When one side was ground the piece was reversed and the other side finished. As it was possible to take a fairly heavy cut, the work was finished in good time.

Within two hours of its conception the device was at work.

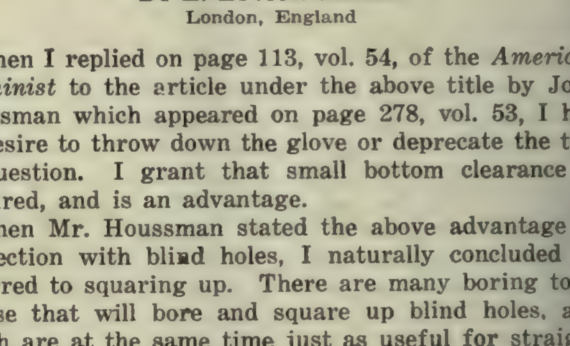
A Boring Tool of Merit

By E. Lytton-Brooks

London, England

When I replied on page 113, vol. 54, of the *American Machinist* to the article under the above title by John Houssman which appeared on page 278, vol. 53, I had no desire to throw down the glove or deprecate the tool in question. I grant that small bottom clearance is required, and is an advantage.

When Mr. Houssman stated the above advantage in connection with blind holes, I naturally concluded he referred to squaring up. There are many boring tools in use that will bore and square up blind holes, and which are at the same time just as useful for straight through holes. His tool looks sturdy and rigid but if the toolbit projected beyond the toolholder, as shown in the sketch, would it not add further to its usefulness by giving it a wider range?



A BORING TOOL OF MERIT

EDITORIALS

Crowbars and Economics

THE second article in this issue is the first of six more or less related talks on the theory of business by Ernest F. Du Brul. The author has chosen a rather picturesque style of presenting his message but he gets it over in a fashion that dispels the terrors from the little-understood science of economics.

When times are hard business men naturally are keen to know when they will improve and their interest in the more theoretical side of business is stronger than in times of plenty when almost anybody can make money. With each successive depression in the wave of business the analyzers learn a little more of the laws that govern these unpleasant fluctuations. We have still very much to learn about the comparatively youthful science of economics which is scarcely five generations old. In fact we know so little about it yet that there is some question as to whether or not what we already know should be dignified by the name of science.

We are learning fast, however, and each contribution to the common fund of knowledge brings us one step closer to the golden age when the hills and hollows will be ironed out of the business curve and there will be no more panics.

Normal Business—and Profits

WITH the largely increased machine building plants erected to meet the war emergency and the large volume of business to which we have become accustomed t is very difficult to know just what a true normal really is. Many who study the situation carefully believe that it is necessary to omit entirely the boom years in order to secure a fair basis for comparison.

One suggestion which has much to commend it is o take an average of the ten years preceeding 1914 as basis. To this should be added a normal rate of rowth for the seven years which have passed since hat time. This it is believed, is a fair basis for judgng the present volume of business.

The question of profits also needs to be considered. mong the suggestions of the unemployment confernce was that profits should be brought to a much lower oint than we have been accustomed to expect during e past few years. It is believed that a normal profit n a pre-war basis will help to restore confidence and imulate the resumption of trade. For though price one may not secure an order, it helps to determine hether or not it will be profitable to replace an old achine with a new one.

Profits must, of course, be carefully considered but der a normal condition rather than with the present gh cost of selling and other expenses. If all possible stomers knew that the price asked involved only a air profit as judged by pre-war standards, it would eatly stimulate buying in many quarters. And a tle stimulation would go a long way toward helping siness get on its feet once more.

Have It Done Now!

THE Unemployment Conference has brought out clearly the fact that unemployment is a nation-wide problem and not to be remedied by legislation, except so far as appropriations for public works are concerned. It also shows, however, that it is a problem in which the individual can do much to relieve the situation.

The individual can find out what action is being taken in his town to follow the suggestions of the Conference. If none is underway, he should not rest content until something has been done. He can at least urge immediate action on the town officials.

But the individual can do more. He can help by serving on committees to find out what work is available in the town and who are looking for employment. He can look around his own house or shop and see what work needs to be done. He has probably looked them over before but decided to postpone the expenditure till later. The great trouble is that almost everyone else has done the same.

Have it done now!

No sane man is advocating making artificial work. Unless the work has a real use it becomes charity and the money might almost as well be given outright. But there is enough real work to be done to keep many employed if we make up our minds to it.

We are evidently faced by two alternatives. Either to spend money for needed work which we have postponed, or to contribute to the maintenance of soup kitchens. Some charitable relief will be necessary in any case—but much can be avoided if each of us does his part to provide as much work as possible.

One of the essential things is to get things moving. So pick out the work to be done and *have it done now!*

Action on Revenue Legislation

IT IS BECOMING more and more evident that the people of this country are growing impatient over the delay in passing some sort of tax and tariff legislation. Some one has said that our worst misfortunes never happen and it seems likely that the saying applies here.

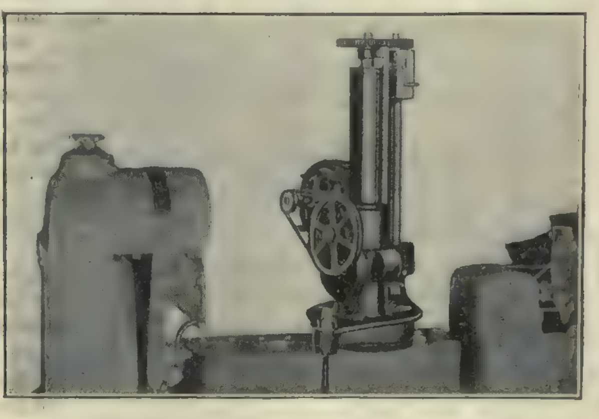
In any event the suspense in which business is struggling is much worse than almost anything our able legislators can do—hence the cry for action.

The most sensible suggestion that has so far emerged from the welter of the conflict is that of one of the ablest economists in the Senate, Mr. Smoot. His idea of wiping the slate clean and starting afresh with a few simple, easily understandable tax provisions is very wise and his three per cent sales tax is growing in favor. It is unlikely that the Smoot amendment will get into the present bill but there is good reason to hope for better things next year. Mr. Penrose is quoted as saying that the present bill is an emergency measure and that immediate consideration will be given to "radical innovations" and "novel and untried suggestions," when it is out of the way.

Shop Equipment News

Storm Motor-Driven Cylinder Reboring Machine

The Storm Manufacturing Co., Sixth Ave. and Fourth St. So., Minneapolis, Minn., is placing on the market the cylinder reboring machine shown in the accompanying illustration. The device is said to be suited especially to the needs of the average sized garage, where electric current is available. It is adapted for use on practically all types of automobile and tractor engines. It can be used for reboring motor cylinders with the motors still in the chassis, as shown. For work in the machine shop where the cylinder blocks are detached from the automobile, a heavy base is provided for mounting the machine.



STORM CYLINDER REBORING MACHINE

The cutter head is supported on a hardened and ground steel bar, which runs in long bearings provided with adjustment to take up wear. The capacity of the machine is for cylinder diameters from 2⅝ to 6 in. An internal feed screw controls the feed of the cutter bar. The machine weighs approximately 300 lb.

A burnishing head can be furnished, if desired. The head, which can be fitted to the spindle in place of the boring head, carries ground steel rollers around its periphery. When using the burnishing head, the cylinders are first bored slightly under the desired size. When the burnishing head is passed through the cylinders, the rollers compress the metal so as to give it hardness and a polished finish.

"Dumore" Combination Drill and Valve Grinder

The Wisconsin Electric Co., Racine, Wis., has recently placed on the market the combination electric tool shown in the accompanying illustration, for use especially in garages and service stations. The device is adapted to various uses, for drilling holes, for grinding motor valves, and for service as a portable grinder and buffer.

When carrying either a drill or a grinding wheel, the rotation of the spindle is, of course, continuous. For the grinding of automotive valves in place on their seats, a separate attachment is used on the drill, and an oscillating motion is given to the attachment spindle for driving the valve. It is stated that the device oscillates the valve more than 1,000 times per minute, so that very deeply pitted valves can be quickly ground. The illustration shows the device equipped with the valve-grinding attachment, which can be very quickly fitted to it. Four hardened tool-steel driving blades and a can of grinding compound are furnished with the device. The tool can be furnished with a steel brush attachment for use in removing carbon from combustion chambers.

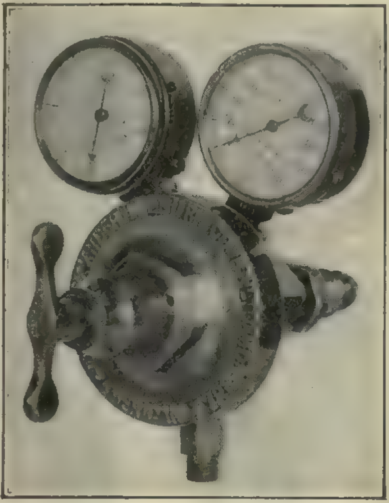
A universal motor is used in the machine, so tha it can be operated by either direct or alternating current. The housing is made of aluminum. The spindl of the machine is offset from the center of the moto casing, so that drilling can be performed in corners The drive is through tool-steel helical gears, hardene and ground, and S.K.F. self-aligning ball bearings ar used for both radial and thrust loads. A Jacob's chuc is furnished with the device, as well as 10 ft. of cord a plug and a switch. The machine is made in tw seats, a separate attachment is used on the drill, an sizes, the Model 1-AB and the Model 1-BD, the latte being illustrated. The capacity in steel of the forme drill is ½ in. and of the latter ¼ in. The lengths over al are, respectively, 10 and 12½ in., and the weights 4¾ an 5 lb. The tool is said to be easily handled by means o the pistol grip, and to be sturdily constructed so as t give long life.

"DUMORE" COMBINATION DRILL AND VALVE GRINDER

Milburn "American"-Type Regulator

The accompanying illustration shows a pressure regulator intended for the control and delivery of acetylene oxygen, hydrogen, and other gases under high pressure such as are used in welding. It was recently placed o the market by the Alexander Milburn Co., 1420 W. Baltimore St., Baltimore, Md. The regulator is said to maintain a constant, predetermined pressure, regardless o fluctuations in the initial pressure line and of variation in the consumption at the torch.

The body of the regulator contains a flexible meta diaphragm suitably mounted in connection with a tension spring. Also, there is in it a fixed nozzle containing a loose operating pin. Over the nozzle is loosel assembled the valve sleeve, which has a row of ga ports drilled around its circumference and carries th valve seat. The seat is closed against the nozzle by th initial pressure of the gas on the valve sleeve and by the pressure of the compensating spring. The operating pin inside the nozzle is actuated at one end by the pressure of the diaphragm and at the other by the pressure of the valve seat. The seat of the regulator closes with the pressure instead of against it, which enables the sealing to be effected by the application of a very slight force. The closing of the seat is independent of the diaphragm. It is said that in operation a perfect balance or equilibrium of pressure is maintained at all times, the device throttling the supply when the desired pressure has been maintained and increasing the supply when the requirements of consumption lower the delivery pressure. All of the main operating parts are easily accessible for examination and cleaning. The makers claim that, on account of the simplicity of the design, the device has great accuracy of regulation, as well as durability. In order to adapt the regulator to different types of gas, it is necessary merely to change the gages and the rear connections on it for fitting to the containers. The illustration shows the regulator equipped with a coupling and gages for use on an acetylene tank, the receiving gage registering up to 500 and the delivery gage to 30 pounds per square inch.



MILBURN "AMERICAN" REGULATOR

Forbes & Myers Motor-Driven Grinder

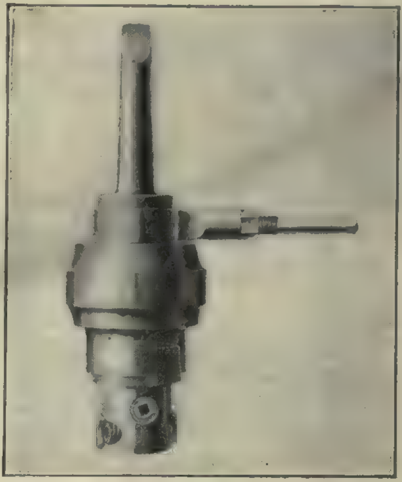
In the accompanying illustration is shown a small electric-driven grinder recently placed on the market by Forbes & Myers, Worcester, Mass. The machine is adapted to general light work, but is especially intended for use on farms where electric current is available. It is stated that by the use of the grinder, farm tools can be sharpened in much less time than on a grindstone. The motor is fully inclosed, so as to protect the windings from injury. Ball bearings are used, the maker stating that they are packed in sufficient grease to last for several years. The machine is built to operate at 3,600 r.p.m. on 110-volt, 60-cycle alternating current. It can be supplied either in the bench type, as shown, or mounted on a pedestal. Two straight-face wheels, one coarse and one fine, are ordinarily furnished, although beveled and round-face wheels can be supplied. The machine is made in two sizes, the No. 42 having a capacity of ¼ hp. and the No. 62 of ½ hp. The former carries wheels 6 x ½ in. and the latter 6 x 1 in. in size.

FORBES & MYERS FARM GRINDER

The diameter of the spindle is ½ in., and its length is 11 in. for the No. 42 machine and 12 in. for the No. 62. The spindle is 3½ in. above the bench in the bench-type machine, and 39 in. above the floor when mounted on a stand. The weights are 30 and 40 lb., respectively, while the weights when mounted on the pedestal are 130 and 140 lb.

Jarvis Friction Tapping Device

The Geometric Tool Co., New Haven, Conn., has recently placed on the market the Jarvis friction tapping device that is shown herewith. The device is intended for use when tapping small holes in tough metal, its purpose being to prevent the breakage of taps and the stripping of threads. As can be seen by the dotted lines, the device is provided with a friction cone, at which point slippage can take place in case the tap should become lodged in the work. It is said that only a small pressure is required to drive the tool, and that the driving force is controlled by the pressure placed on the spindle of the machine. The tap itself can be started and stopped while the spindle is rotated. The device is made in only one size, known as the FD, and it has a tapping range up to ¼ in. It is equipped with a standard chuck for holding the taps.



JARVIS FRICTION TAPPING DEVICE

China's First Automobile Show

The Shanghai Automobile Show, to be held during the week of Nov. 26-Dec. 3, will be the first exhibit of that character ever held in China. The officials of the show have suggested through a cablegram from Trade Commissioner Lynn W. Meekins that it would be well for American manufacturers of automobile accessories to make arrangements with exporters interested in the China trade for an exhibit of their products. In order to reach Shanghai in proper time, it would be advisable to ship samples of accessories and other display material through parcel post or express by way of the Pacific. The existence of a branch of the United States Post Office at Shanghai enables parcel-post shipments to be made under domestic rates and conditions. A majority of the best known American, French, and British automobiles will be displayed by local representatives. A list of importers of and dealers in automobiles and automobile accessories in China may be obtained from the Bureau of Foreign and Domestic Commerce or its district and co-operative office by referring to File No. FE—13011-A.

Machine Tool Exports

United Kingdom Our Only Serious Competitor—American Foreign Business Not Readjusted to Peace Basis—Far Eastern Markets Promising

By W. H. RASTALL
Chief, Industrial Machinery Division Department of Commerce

SUGGESTIONS as to the prospects for foreign trade in machine tools, the strength and trend of foreign competition, and the markets that are now active are provided in the following analysis of the experience of recent years. This industry has been most strongly affected by the war and reconstruction, and in America is feeling acutely the depression that has spread over the entire world during recent months; while in contrast to this position, the latest returns indicate that British manufacturers are enjoying a constantly increasing foreign business.

In considering this subject due allowance must constantly be made for the fluctuations in prices. The abnormal demand during the war raised quotations to high levels so that the results, as expressed in dollars, do not accurately represent the quantities or tonnage actually shipped. Also variations in exchange confuse the situation where foreign currencies are employed.

American and British Exports

The only nation that occupies a position of importance as a competitor in this trade is the United Kingdom, and the superior position of the United States is indicated in the following tables, the first of which shows the volume of the exports from each of these countries and the vast expansion of the business from both during the last few years.

It is scarcely accurate to speak of the above countries as competing in this trade, for as is well known the differences in design are so great as to constitute two distinct classes of equipment. Generally speaking, the British tendency in design is toward "universality," that is to say tools, each of which may perform a variety of services as contrasted with the American tendency toward "specialization," the production or single-purpose machines. To a certain extent Table I also expresses the comparative demand in the world markets for these two types of equipment, and from the nature of the services rendered, neither could expect to exclude the other, as the single-purpose machine is the type suited for manufacturing while the other type has advantages, for example, in the small repair shop. This is illustrated in another way by Table II, and it will be further noted that this table also emphasizes the pre-eminent position of American manufacturers in the machine-tool trade of the entire world, for even before the war the United Kingdom would import machine tools from the United States to a value of from a quarter to a third of her own total exports.

TABLE I. EXPORTS OF MACHINE TOOLS

Year	* Exports from United Kingdom	(b) Exports from United States
1909	$3,734,837	$5,640,034
1910	3,473,072	5,975,503
1911	3,691,121	9,626,965
1912	4,543,813	12,151,819
1913	4,922,208	16,097,315
1914	4,958,108	14,011,359
1915	3,744,552	28,162,968
1916	5,427,930	61,315,032
1917	10,262,750	84,935,410
1918	6,222,433	51,620,297
1919	(c)	58,507,942
1920	(c)	44,312,233

* Converted at $4.86 per pound.
(b) Fiscal year to 1917 — calendar year 1918 and after.
(c) Detailed figures not yet received.

It will be noted that entirely apart from war influences there has been a strong tendency in Great Britain toward the adoption of American style machines, the high percentage that has so long been purchased from the United States, and the steady increase in this volume since 1910 indicating a genuine appreciation of our methods. It seems probable that a reasonable demand for our tools will persist indefinitely even though the experience of recent months shows a serious reduction in these exports for the time being. On the other hand, there seems to be very little to recommend the British type of equipment as the volume of shipments to the United States is not large enough to be given separate mention in the British returns.

TABLE II. BRITISH EXPORTS AND IMPORTS OF MACHINE TOOLS

Year	Exports from U. K. £	British Imports from All Sources £	British Imports from U. S. £	Percentage from U. S.
1909	768,485	81,155	68,293	84
1910	714,604	81,978	66,078	81
1911	759,490	214,219	192,863	93
1912	934,941	282,643	260,100	92
1913	1,012,800	361,440	324,832	90
1914	1,020,187	427,049	376,605	88
1915	770,484	2,128,383	2,099,076	99
1916	1,116,858	2,911,746	2,849,281	98
1917	2,111,677	2,654,825	2,616,286	98
1918	1,280,336	3,858,264	3,771,994	98
1919	....	....	....	..
1920	....	....	....	..

Signs of Improvement

With the foregoing as a brief statement of the position of American equipment in the world machine-tool trade and its history during the last decade, with an estimate of its trend and nature during that time, it is desirable to give closer attention to the present situation, for American exports seem to have fallen to very low levels. This, of course, is but an incident of reconstruction, the depression following the feverish business of recent months, and there are signs that we are already beyond the most severe stages of this collapse. The changes in our exports are shown in detail in Table III, it being remembered from Table I that 1920 represents more or less faithfully the experience of the years since 1916.

British experience is in very sharp contrast with this and it seems that the industry there has readjusted itself pretty well and is practically on a peace basis once more. Data given in the preceding paragraphs indicates the situation there during the earlier years of the decade. The following report of Wilbur J. Page, American Trade Commissioner in London, shows the more recent experience:

"The July returns show a fall in both imports and exports in tonnage and total value, though there is a slight rise in the value per ton. The imported tonnage has been settled at a low level for five running months, and it seems unlikely that Great Britain will import more machine tools than before the war.

"The usual comparative table (Table IV) shows that on all points the present year is turning out very favorably. The decline in imports is too heavy and prolonged to be regarded as a mere fluctuation. The exports are very much above any previous record in deadweight of machinery—about double the level of 1919—and this high level is the result of a fairly steady increase over two and a half years. It is remarkable that the price of exported machine tools did not rise in step with the general inflation of values, and that the price is now being maintained against the general falling tendency; also that this comparative steadiness of value is accompanied by an increasing trade."

TABLE III. AMERICAN EXPORTS OF MACHINE TOOLS

	Lathes		Other Machine Tools	
	1920	1921	1920	1921
Jan....	$631,271	818,068	816,773	1,222,731
Feb....	587,348	442,491	895,675	778,250
Mar...	1,079,793	337,856	1,943,230	528,563
Apr....	560,008	335,614	1,229,819	379,320
May...	829,434	269,835	1,318,478	254,326
June...	846,583	131,140	1,127,297	267,344
July...	542,175	191,983	915,074	281,936
Aug...	414,604	51,569	972,247	209,630
Sept....	506,781	......	1,176,175	......
Oct....	358,088	......	1,170,075	......
Nov...	589,444	......	1,131,461	......
Dec...	629,594	......	1,264,939	......
Total	7,575,123	......	13,961,243	....
1919	10,136,877	......	12,490,600	....
1918	9,853,507	......	11,626,360	....

	Sharpening and Grinding Machinery		Other Metal Working Machinery	
	1920	1921	1920	1921
Jan.....	$394,374	$296,385	$1,611,528	$1,956,879
Feb.....	261,209	148,210	2,024,929	1,412,630
Mar....	475,248	95,645	1,652,604	1,359,489
Apr.....	334,269	84,946	1,489,625	1,255,542
May....	276,057	82,183	1,919,421	669,627
June....	395,903	60,499	1,134,940	1,029,230
July....	396,246	105,293	1,823,097	1,155,283
Aug..	278,864	61,711	1,242,778	608,653
Sept....	333,844	....	1,190,343	....
Oct.....	247,788	....	1,556,908	....
Nov....	237,395	....	1,373,323	....
Dec.....	314,293	....	1,557,881	....
Total.	3,945,490	....	18,830,377	....
1919	5,494,060	....	30,386,405	....
1918	6,161,876	....	23,978,554	....

Returns showing the countries to which this equipment has been shipped have not yet been received, but so far as may be judged from American and earlier experience, the heaviest demands are from Europe. It is not at all certain that it is good policy to concentrate too strongly on these markets because of the abnormal conditions. The demand there for American types of equipment seems to have fallen to very low levels and it may be anticipated that British manufacturers will soon feel the same influences or else there will be a revival here.

TABLE IV. IMPORTS AND EXPORTS OF MACHINE TOOLS FOR UNITED KINGDOM

Periods: Seven Months January to July	Total Weight Tons	Total Value £	Value per Ton £
	Imports of Machine Tools		
1911-14 (pre-war average)	1,930	187,447	97
1915-18 (war average)	11,370	1,681,927	148
1919....................	11,120	2,660,040	239
1920....................	8,221	1,805,432	220
1921....................	2,379	532,199	224
	Exports of Machine Tools		
1911-14 (pre-war average)	8,927	543,583	61
1915-18 (war average)	8,037	771,218	96
1919	7,175	1,024,110	143
1920....................	11,675	1,604,639	137
1921....................	14,629	2,124,309	145
	Exports of Engineers' Tools, Milling Cutters, etc.		
1920....................................		915,779	
1921....................................		611,005	

The Far Eastern Markets and Other Groups

The markets of Asia rank next in importance; and Japan, British India, China, the Dutch East Indies and some of the smaller markets show signs of absorbing an increasing quantity of our equipment. Asia is being industrialized far more rapidly than many of us realize. The next group in order of importance is that including Cuba, Mexico and South America, and although these countries are having serious financial problems, their markets deserve careful attention. The business from even the smallest countries as, for instance, in Central America, is increasing nicely. Australia, New Zealand, and the various countries in Africa give similar promise.

Steel Specifications Submitted for Approval

The American Engineering Standards Committee has now before it for consideration and approval A. S. T. M. standard specifications for cold-drawn bessemer steel automatic screw stock and cold-drawn open hearth steel automatic screw stock.

The materials covered in the two specifications are intended for use in making machine parts in automatic and other rapid-cutting machines in which the highest cutting efficiency is sought, consistent with the nature of the metal specified.

Specifications Date From 1909

The history of the preparation of these specifications dates from 1909, when a committee was organized by the American Society for Testing Materials to prepare standard specifications for cold-drawn steel. In the discussion of specifications for automatic screw stock it became evident that considerable data were required, particularly with reference to material used for machining at very high speed. The committee accordingly undertook a series of tests to determine features which would affect the working qualities and physical characteristics of standard automatic screw stock. The various consumers represented on the committee placed orders with each of the producers for cold-drawn steel for automatic screw machine work for test purposes, and a total of about twenty tons of material was thus furnished and tested. These tests were completed in 1913. The specifications covering bessemer stock were adopted by the society in 1914, and, after revision, the specifications for open-hearth stock were adopted in 1915. There have been no revisions since adoption.

Specifications Ready for Development of Foreign Trade

These specifications have been translated by the Department of Commerce into French and Spanish for distribution in connection with the development of foreign trade.

The specifications are submitted in accordance with the special provision in the procedure of the American Engineering Standards Committee under which important standards in existence prior to 1920 may be approved without going through the regular process followed in new work.

The committee would be very glad to learn from those interested of the extent to which they make use of these specifications and to receive any other information regarding the specifications in meeting the needs of the industry.

These specifications may be found in the 1918 volume of A. S. T. M. Standards. Copies may also be obtained from the American Engineering Standards Committee, 29 West 39th Street, New York City.

Industrial Conditions in Europe

England, France and Germany Better Off Than We Realize—Value of Foreign Branch Factories to American Firms—Better Times Coming

By A. C. HIGGINS
Treasurer, Norton Co.

I VISITED England, France and Germany and in the brief opportunity I had for observation it seemed to me that Europe is not materially and industrially as badly off as I expected to find it. In many ways they have made substantial progress to more normal conditions.

Industrial affairs in England are somewhat complicated by their socialistic experiments, most of which have failed to accomplish what was expected of them. For example, the attempt to solve the problem of unemployment by payments based on idleness rather than on work is an economic failure. Not only in England and France but in Russia people are beginning to realize that the millennium is not to be brought about through governmental agencies, but rather through the orderly operation of economic laws. England, the greatest trading nation in the world, knows what competition is, knows that her future depends upon foreign trade, and is getting ready to meet it in her own shops and with her own ships.

English people are more fully informed on foreign affairs, foreign trade and foreign policies than our people, and the tradesman's common-sense, common to all the English people, will not allow them to sacrifice too far the advantages they have enjoyed for the pipe-dream of some radical labor agitator.

France is fundamentally an agricultural country, a country of well-to-do peasants, and as such is more prosperous than we have been led to believe, and more prosperous, I think, than they would like us to believe. I spent two days going over the battle-line and through the devastated towns from Chateau Thierry through Rheims to Soissons, and, except in some few places which had not been cleaned up, the broad fields which had been furrowed with trenches and blasted by shells were fully and intensely cultivated. Crops have been very good and dire poverty is not in evidence.

Of course the manufacturing industry is at a low ebb but unemployment is not marked, and I was told that the men out of work in industry were back on the farms where they work for food and lodging so that foodstuffs are produced more cheaply and prosperity gets its fundamental start. The French know how to live cheaply and when times are good they save money. In other words, they are thrifty.

In Germany it appeared to me that conditions were better than in any other country I visited. Not only are they not looking for any outside help such as the allied countries may expect from reparations, but they do not seem to be worrying about the reparations, and it appeared to me that they do not seem to believe they would ever be forced to pay or if at all not in any way that would inconvenience them to any great extent.

Germany, of course, is a great manufacturing and industrial country and while France and England are industrially flat German industry is comparatively quite prosperous. With the mark at so low an exchange value they can undersell any other country, and realizing in a sense that they were defeated temporarily in their ambitions, their workmen are willing to take what they can get. There seems to be a general feeling that if things had been a little different they would have won the war, and I could not, in my talks with them, and with others who had spent more time in Germany than I did, help but feel that they expect next time that difference will be in their favor. I do not mean that Germany is now looking for a military revenge. I found no evidence of this. But I found many indications which led me to believe that Industrial Germany, the most important influence in that country today, is expecting to achieve commercial supremacy by the same kind of "will to power" which they exercised in the war. Their factories are uninjured and in a high state of efficiency. They are operating and making money. They have wonderful opportunities in Russia and the Balkan States and are making the most of them.

France does not have this kind of military spirit in commerce and industry but she recognizes it in Germany and fears it—fears that this very definite menace may lead to the military revenge only faintly if at all cherished by industrialists, but which will always be encouraged by the old regime. France would like to throttle Germany commercially while England believes the economic difficulties to this course are insurmountable and the dangers to her own Empire too great.

Of course, one cannot help experiencing a bitter resentment in coming to the realization that Germany is not likely to get a fraction of what she deserves for to render any adequate reparation for her crimes. If she pays in goods or labor when other countries need the work for their own people she benefits more than she suffers. Anything which will keep her factories going full time and her people employed is to her immediate advantage. As the mark goes down wages and prices are adjusted and the volume of trade increases. This complete cycle happened in our own German factory while I was there. The prices of German goods are irresistible, in other countries where they have found their way, and their volume must increase if economic laws operate. Some have predicted that this is leading Germany to bankruptcy, but a bankrupt can run a long time and be a mighty dangerous competitor particularly if he thinks he must eventually make the poor-debtor' appeal to the courts for a fresh start. It is said that good deal of foreign capital, especially American, is becoming interested in German industries since the war. I was not able to verify this but I have no doubt that it is welcome and a friend in court is regarded as valuable factor in future settlements with victors or creditors.

I saw no reason to believe that the allied countries could not pay their debt to the United States. I think so far as we are concerned we ought to do as a government what any good business concern does in such times as these—retrench, collect our debts, watch our credits and go after the business of the world. It seems to me we have had enough sentimentality in our government and enough opportunism in its conduct to serv for a long time and that we ought to get back to sound business principles. I got the impression in England that there was more of a demand for governmental economy and more serious attempt to meet that demand by their government than in this country. It may be a mistaken impression, but I felt in England that the government was a good deal more sensible to the demands of the people and a good deal more directly answerable to them than our Congress.

I was very much impressed in England, especially in the great amount of foreign news we found in the newspapers and met with in conversation on the street, in the hotel and at the dinner table. We do not have the same feeling about foreign affairs that they do. Our old isolation and independence is the basis of our thought, but conditions have changed so that we must figure on other countries and take into account what they are doing. Under the present exchange, labor and political conditions I feel that our company, for example, would find it very difficult to do much foreign business for quite a while but having plants now both in France and Germany I feel very confident that we can meet such trade opportunities as may offer in European countries through those plants, whereas we could hardly expect to meet them from our Worcester plant.

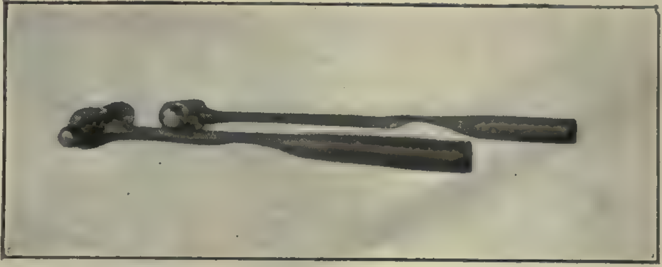
Not only do these European countries figure on the reactions of other countries to their trade policies but politically they are trying their cases before the bar of the world. For example, Lloyd George's letters and messages on Ireland have been written fully as much for America as for England. France cannot settle her policy with Germany without England or against our disapproval, and I think we shall find that when we come to settle the Japanese question that like these other questions it will have to be tried before the people of the world. I felt, however, more thankful than ever before that we were not mixed up politically in European affairs. They are in an awful mess and we have plenty to do on our own Continent without seeking to right things on other Continents.

In the United States I do not believe we have gone so far as the European countries have in reaching a more normal condition. Of course America is a big country and we will do a large business here before we will do it abroad, but some of that business which we should do will be done by the European countries in our own home markets, unless we wake up to the fact that we must get back to more normal conditions and unless we insist that our government cut out the extravagance which is responsible for our burdensome taxes and promptly adjust our tax and tariff laws. I am afraid that Europe will enjoy a real prosperity before we do and that we will be expected to be the easy marks to finance them. It seems to me that the European people learned from the War a lesson of real sacrifice and with the dangers which confront them recognize that they must continue to sacrifice to work back to more normal conditions. I am afraid our people never had this realization and that only an extended period of dull times will bring it. Still I share the usual American feeling that nothing can stop the prosperity of our country and that economic abuses here will not have as dire an effect as they would in countries of less wonderful resources. My feeling is that we have seen the worst of the depression and that gradual improvement will take place.

Are Hollows Worn in Hammer Handles?

By H. F. Penney

How often is it that they have to renew the "Blarney Stone" because of its wearing away under the kisses of the seekers of its potent charms? And it is said that similar salutations have worn away several big toes from a certain statue of St. Peter. Mr. Thwing apparently forgot this tremendous cumulative effect of small forces many times repeated, when he wrote, on page 980, Vol. 54, of *American Machinist*, his skeptical comment on the grooves in hammer handles.

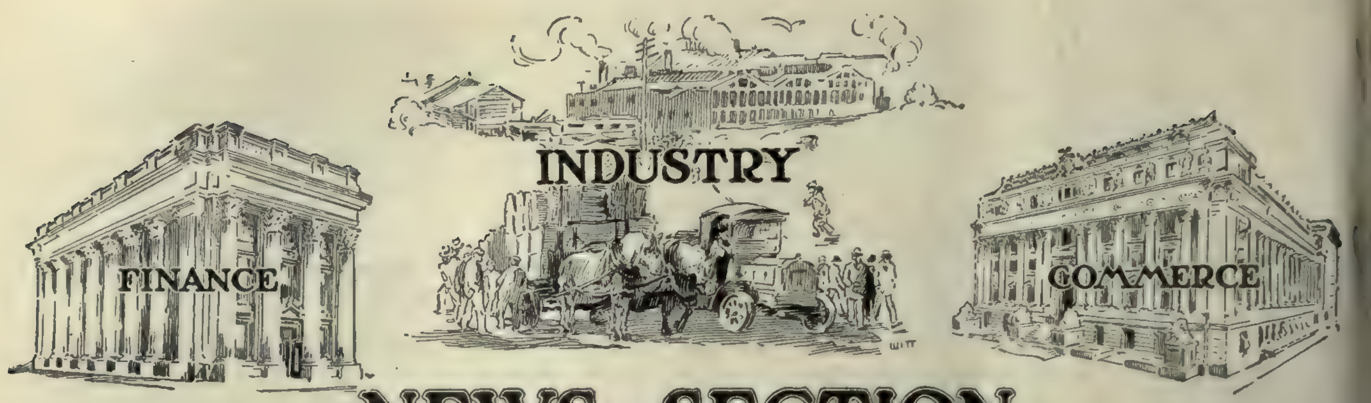


HOLLOWS WORN IN HAMMER HANDLES

Fingers certainly do wear grooves in hammer handles and the fingers are not necessarily grimy nor the work done laborious. This is splendidly illustrated by the hammers used in our handle department; two of them are shown in the accompanying photographs. These small hammers are used by girls for driving the light rivets in the assembling operations on razor handles. During a day the hammers are laid down and picked up hundreds of times and I believe that it is the friction of the hand in doing this as much as that of driving the rivets that causes the excessive wear.

The large groove is worn by the thumb. There is also another very pronounced groove worn by the forefinger but this does not show as plainly in the photograph as it is at a more acute angle across the handle. All the hammers used on this operation show this same effect, the degree depending on the time they have been in use.

I have no doubt that Mr. Thwing will have countless examples of similar action brought to his attention and I believe that if he will look at the spacing bar on any typewriter of not too recent vintage he will find that even the dainty thumb of a stenographer can leave its impression.



NEWS SECTION

Europe Cannot Be Restored Without Our Help

Conviction that the United States cannot refrain from active participation in the settlement of economic and financial difficulties confronting the world, is expressed by a special committee of the Chamber of Commerce of the United States just back from an extended trip through European countries where government officials and business leaders were interviewed and where in a close study on the ground the committee sought the views of the various elements of the populations.

In every country visited the opinion was expressed that neither Western nor Central Europe can be restored to a condition which promises hope and progress for the future without our assistance. Every country desires our friendship and assistance and it is apparent we can participate in the restoration of commercial and industrial productivity on any reasonable and consistent terms, either by modification of the Versailles treaty to meet the policies of the United States, or independently of it.

A chief obstacle at present to a return to normal business conditions throughout the world, the committee asserts, is found in the armed conflicts in progress and in the continued threat of renewed clashes. Business will not resume its forward movement, it is declared, until the menace of recurring warfare is removed. The conclusions of the committee based on an intensive study are published in a special report now available.

On the Chamber's committee are Joseph H. Defrees of Chicago, president of the Chamber; John H. Fahey of Boston, former president of the Chamber and Director of the International Chamber of Commerce; Silas H. Strawn of Chicago, chairman of the board, Montgomery Ward & Co.; Robert P. Lamont of Chicago, president, American Steel Foundries Co.; John J. O'Connor of Washington, manager, finance department, Chamber of Commerce of the United States; and James H. Douglas, Jr., secretary.

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Federal Trade Commission Cites Machine Co.

The Berkeley Machine Works, Inc., engaged in repairing ships at Norfolk, Va., has been cited in unfair competition complaint by the Federal Trade Commission. Thirty days are allowed the company to file its answer, after which the case comes on for trial on its merits. A complaint is issued after a preliminary investigation upon petition being filed with the commission.

The complaint recites that the firm gives to captains, and other ship officers upon whose ships repair work is done, by the company, certain cash commissions to induce the officers to have their vessels repaired by the respondent. These commissions are given without the knowledge of the ship owners. The commissions are alleged to add to the firm's cost of business approximately $25,000 a year, which sum is covered in the bills presented to ship owners for payment, thus becoming a charge upon them which eventually the public must pay. The complaint avers that the practice is unfair and tends to cause competitors to give like commissions to vessels at the port of Norfolk as a means of protecting their trade.

Feiker Advocates Federal Survey of Business Conditions

Federal publication of daily surveys of business conditions, similar to the weather reports, was suggested by F. M. Feiker, special assistant to Secretary of Commerce Hoover, in an address before the Industrial Engineers Conference at Springfield, Mass., on Oct. 5.

Every business man in the country, Mr. Feiker declared, is waiting for some concise authoritative daily guide to the business situation, such as the forecasts of the weather now printed in the top right-hand corner of practically all newspapers. He said the Department of Commerce had already taken a step in this general direction through the publication of a new service known as the "Survey of Current Business." He asked the co-operation of American business men in perfecting this service.

Mr. Feiker also discussed the subject of the elimination of waste in industry. He said that while this country had the highest ingenuity and efficiency in the operation of its individual industries of any nation, the American industrial machine is as yet far from perfect. In summarizing the principal factors contributing to industrial waste, he mentioned: (1) Lost labor during depression; (2) speculation and over-production in booms; (3) labor turn-over; (4) labor conflicts; (5) failure of transportation, fuel and power supplies; (6) loss due to processes and materials; (7) excessive seasonal operation; and (8) lack of standardization. He said all these factors combined resulted in a huge deduction from the goods and services we might all enjoy if we could do a better job of it. In his opinion, the best opportunity for advance in living standards lies in the steady elimination of these wastes.

Mr. Feiker said that the Department of Commerce is planning more systematic co-operation between industries and the U. S. Bureau of Standards, which he described as the greatest scientific laboratory in the world. "That Bureau has hundreds of contacts with industry, but there are still a great many manufacturers who could make very effective use of its wonderful facilities if they were more familiar with the services offered," he declared.

Mr. Feiker also mentioned the establishment of a "Division of Building and Housing" in the Department of Commerce. He said that through the asistance of committees in the industry and an active staff in the department, in Washington, definite recommendations are being drawn up for a standardized building code which will do much to simplify construction and reduce costs and prices.

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I. C. S. Entertained by Bantam Company

About forty representatives of the various branches of the I. C. S. were entertained at the factory of the Bantam Ball Bearing Co., Bantam, Conn., Oct. 12. Dinner was served in the recreation room of the factory, followed by speeches and a program of motion pictures pertaining to the work of the schools. As a special feature the picture, "The Acorn and the Oak," portraying the growth of the Bantam Ball Bearing Co., was staged in the factory theater.

F. R. Lindh Joins Staff of Chicago Belting Co.

Fritz R. Lindh formerly chief engineer of the Graton & Knight Manufacturing Co., has joined the sales organization of the Chicago Belting Co., Chicago, Ill. Mr. Lindh is a West Point man, graduating in the class of 1914. During the war he was located at Sandy Hook and Aberdeen, Md., first as a captain and later as a major. At Aberdeen he was in charge of all army testing of guns, ammunition, powder, tractors, etc.

Leaving the army, Mr. Lindh was about seven months in the advertising business as account executive for Cleland, Inc. He joined the organization of Graton & Knight last year, succeeding Dr. Wilson as head of the engineering department, where he was in charge of all field research and testing at the factory as well as of all field engineering service.

With the Chicago Belting Co., Mr. Lindh will be in charge of the Pittsburgh factory branch besides making personal engineering surveys throughout the country.

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Hearings on Metric System Bill

Hearings on Senator Ladd's metric system bill were expected to begin on Oct. 11. Among the witnesses who will probably appear in favor of the bill are Harvey W. Wiley, former chief of the Bureau of Chemistry; S. L. Hilton, president, American Pharmaceutical Association; Dr. Charles L. Parsons, secretary, American Chemical Society; William J. Scheffelin, drug manufacturer of New York; Theodore H. Miller, works manager of the De Laval Separator Co.; and Howard Richards, Jr., secretary, American Metric Association, of New York.

The executive board of American Engineering Council which met in Washington Sept. 3 decided to take no part in the metric system controversy.

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Barney & Smith Car Co. a Financial Loss

Suspension of further operation and sale of the plant and equipment of the Barney & Smith Car Co., manufacturer of electric street railway equipment and all kinds of railroad passenger and freight cars, are recommended by Valentine Winters, president of the Winters National Bank, according to his report in common pleas court as receiver for the firm.

Liabilities of $2,919,044.72 are listed. Of that amount $2,613,650 is shown to be owing on mortgage bonds and gold notes. Among other creditors are the E. W. Bliss Co., which holds a judgment of $55,866.04 against the firm; and Cadwalader, Wickersham & Taft, to whom $11,506.09 is owing for legal services.

The value of the company's resources is placed at $8,135,271.46; plant and equipment are valued at $3,816,181.35. A value of good will is placed at $3,029,168.69, which includes patents and trade marks.

With a volume of business of $457,033.29 during the receivership period, the firm made a gross profit of $18,448.74, which expenses reduced to a net loss.

The company's bonds are held by the Guaranty Trust Co. of New York.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance,* New York

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It is possible that a mistaken complacency may be induced by the prophecies of prosperity which are to be heard all the way across the continent from Los Angeles, where the American Bankers Association is in session, to New York where the American Manufacturers Export Association has been holding its annual convention. We can be prosperous if we work, but there is grave doubt whether conferences and conventions really inspire much personal effort and there is reason to fear that they may lead us to forget that "The Lord helps him who helps himself."

Of the unemployment conference at Washington it is said that it "has ended where it began." It has discovered that unemployment is a local problem and has recommended that it be dealt with accordingly. Of the Disarmament Congress to be held next month much is expected. Our expectations will probably be disappointed, for no preliminary meeting of minds between the conferees is discoverable.

Of the United States Congress now in session much the same statement is true, for although it is described as almost hysterical over the tax bill, there is no indication that it is anywhere near agreement as to which of the many plans advocated it will adopt. As to the tariff bill, it seems indefinitely shelved and a ratification of the peace treaty with Germany is also debatable in more senses than one.

But despite human mismanagement and lack of co-ordination there is abundant evidence that the machinery of American industry and commerce has readjusted itself to the requirements of a world at peace. It is, however, possible that the *ignis fatuis* if high prices will lead us into the slough of under production and this is the only danger in the present situation.

With the single exception of canned goods no acute scarcity is as yet apparent in any important staple, but in several quarters a shortage is quite possible before the winter is over. New England is commencing to realize that her reviving industries have an insufficient supply of bituminous coal. Copper is advancing because the off-take has exceeded the production for several months past. The same thing is true of lead and tin. The steel industry is picking up because so many mills were idle during the summer that there is no unsold supply of steel anywhere. Coffee is growing firmer day by day as the trade commences to realize that a coffee famine may be the result of the reduction in the coffee acreage ordered by the Brazilian Government a year or more ago. Petroleum is up from 25 to 50 cents a barrel. Dry goods are advancing though reluctantly, as the implications of the short cotton crop become better understood.

The alternative of very high prices for all these things is reduced consumption and while the producers are entitled to a living profit for their toil and risk, it would be well for them and their employees to remember that in the long run their prosperity and that of the country is directly dependent upon the magnitude of both production and consumption.

Wheat, corn and oats are almost the only important staples that have declined during the week. They have been conspicuously weak. Just why is not clear. A world's wheat crop of 153,000,000 bushels in excess of last year, and Canadian competition in the export trade, are among the reasons assigned for the drop in the American markets, but neither is entirely satisfying. The collapse of the farmers' organization for the co-operative marketing of the crop is another of the explanations offered but as there is no doubt that the producers could hold if they wished to, the truth probably is that present prices yield them a small though unadmitted profit. A reduction in the purchasing power of the West is nevertheless to be expected as a result of the decline.

Aside from the decline in grain the most striking feature of the week is the advance in Liberty Bonds which is almost sensational when the amount outstanding is considered. On Thursday last the Fourth 4¼s went up over 75 points. The improvement is directly due to the growing ease of money which is affecting the entire bond market and making it easy to sell the new issues that are being brought out from day to day. An announcement that the public debt has been reduced by $963,000,000 during the year ending Sept. 30 and that the total reduction from the high water mark of August 31 1919, is $2,672,593,000 has also helped to advance "Libertys." The gross debt then was $26,596,701,000. It is now $23,924,108,000 and it is figured that at this rate the entire debt would be retired in 16 years. The figures are, misleading but it is true that if interest rates continue to decline it may be possible to refund and extend the debt on a basis that would benefit the treasury.

The weekly statement of the Federal Reserve Banks shows no change in the reserve ratio and a gain of only $7,000,000 in gold, the smallest in many weeks. Circulation has increased by $25,000,000. The Philadelphia bank has reduced its rediscount rate to 5 per cent and the Minneapolis bank to 6 per cent. No other changes are reported.

In the industrial department the stock market has been soft reflecting the fear that some more important corporations would suspend dividends upon their preferred stock. The railroad shares have been curiously unresponsive to the improved earnings reported. The net revenue of the Class I railroads for August is estimated at $90,000,000, or at the rate of about 5 per cent upon the tentative valuation of the Interstate Commerce Commission. An autumnal shortage of freight cars in the West is now predicted. The traffic is certainly showing a rapid increase. President Harding is still urging the passage of the railroad refunding bill but Congress seems reluctant to enact it. Some day the public will realize that the railway stocks are selling at bargain prices.

Except for the statement of the German Reichsbank which shows an increase of 4,205,300,000 marks in the paper currency outstanding, the financial news from Europe is not sensational. The total of the German paper circulation is now 86,384,300,000 marks. It is somewhat surprising that the price of marks did not decline still further when these figures became known, but rumors that Germany would somehow meet her next reparation payment have had a steadying influence, and as this is written 100 marks can still be sold for about 81 cents. Just why any one should be willing to buy them even at this price is not clear. The fluctuations in other foreign currencies are without significance.

Silver has declined about two pence from the top. By some the reaction is attributed to the political unrest in India which seems to be spreading.

Riots among the unemployed are reported from London but the stock market is unperturbed. Money is growing easier and an excellent investment demand is reported.

Elsewhere in the world the satisfactory and the unsatisfactory appear to be about in balance, as usual, and while we cannot expect the wild activity of war times there is every indication that in Europe as well as in America those who are enterprising and industrious will be able to earn their keep and something more besides.

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Plant and Equipment of Chapman Co. To Be Sold at Auction

The plant and equipment of the Chapman Manufacturing Co. at Winchester, Mass., will be sold at a public auction on Oct. 13 and 14. J. E. Conant & Co., of Lowell, Mass. will have charge of the sale. The factory buildings include a complete machine shop, hardening shop, boiler, house, office building, vaults, storage sheds, scrap bins and steam-heating and electric light plants.

The equipment consists of an extensive collection of standard machine tools and standard mechanical equipment of the highest class. All of this machinery was installed new during the past three years. Some of the items for sale are: Grinding wheels, gages of all kinds, ball bearings, electric grinders, chucks, dies and tapping attachments, dogs, toolholders, steel bits, and other fixtures.

The machine tools include Norton grinding machines, Fay & Scott lathes, turret lathes, Landis grinders, Greenerd presses, Rickert-Shafer tapping machines, Henry & Wright drilling machines, Chicago milling machines, Flather engine lathes and a large variety of small bench and portable machines.

In the heat-treating plant are a number of modern gas furnaces. Other machines are heavy-power shears, Bradley hammers and a few electric motors. In the storage racks are several hundred pounds of steel in strip, angles and tubes.

The Chapman company went into the hands of a receiver a few months ago. The court of Suffolk County, Mass., appointed Willard B. Luther, of Boston, as receiver and he has ordered the sale as stated above.

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Canadian General Praises Mechanical Development

The contribution of the mechanic to engineering development was the subject of an address delivered by General Sir Alexander Bertram at a Rotary Club luncheon in Montreal, Canada, on Sept. 20. It was recalled that General Bertram had started out as a machinist's apprentice himself in company with his father, the latter having come from Scotland in 1852, and in association with Robert McKechnie, had established the first machine tool industry in this country.

The crudity of shop equipment as it existed in the days of his father's apprenticeship in Scotland was brought into contrast in the text of Sir Alexander's address, and in screen pictures used for illustration, with the equipment of the machine shop of today. The old lathe, driven, by a crank, industriously turned by his father as he worked his way through apprenticeship, was brought into view in company with the great machines now in use, electrically and hydraulically operated, in which the touching of a button worked the miracle of power.

Sir Alexander recalled that the first lathe built by his father and Robert McKechnie in 1862 was sufficiently uncommon to be the subject of much curiosity; and mentioned that a radial drilling machine, built by them in 1876 was exhibited at the Centennial Exposition in Philadelphia, his father receiving a bronze medal in connection therewith. He also screened an old telegram, dated 1885, signed T. G. Shaughnessy, in which the firm was asked for quotations on shop equipment.

In connection with his appreciation of the mechanic, embodied in his address, Sir Alexander said: "I started out as a mechanic; I will always be a mechanic, and I am proud of it. Outside of his own business there is not much heard of the mechanic, but he is nevertheless the main factor today, as he always was, in the development of mechanical engineering. No finer type of man exists than the real, first-class mechanic and he should receive a great deal more credit with the outside public than his modesty permits him to claim."

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Electrification of Japanese Railways

The official system for the electrification of the railways of Japan has recently been revised and a new electric bureau established, states an issue of the *Yokohama Chamber of Commerce Journal.* According to the plan now being worked out by the Department of Railways, the first steps will be to electrify the entire Tokaido line, whose traffic has been increasing enormously each year, from Tokyo to Kobe, and a part of the Central line between Iidamachi station in Tokyo and Kofu, in the rear of Mount Fuji, where many tunnels make transportation slow. Electric trains will be used exclusively for passengers, freight trains being propelled by steam as at present.

Penn State College Perfects Employee Training Plan

Pennsylvania State Collge has worked out a plan for employee training which appears nearer to the ideal than anything yet attempted. The methods adopted by this institution have long since passed the expermental stage and are in operation in a large number of plants in Pennsylvania, where it has been demonstrated that an efficiency far beyond that of ordinary class instruction can be obtained.

For ten years past a staff of highly trained men in industrial education has been maintained at the college, and large sums of money have been spent in studying methods of conducting apprentice schools and night classes in the industries. This staff, known as the Engineering Extension Division of the College, has personally organized and operated hundreds of classes in some of the best known plants in Pennsylvania, among them being manufactures of iron and steel, electrical equipment, machines and tools, automobile parts, textiles, and others common to the state. Each such enterprise was accompanied by an intensive study as to the characteristics which entered into its success or failure. The natural result has been that improved methods were continually adopted until it can now be practically assured that a company can inaugurate a general training policy with far more success than is generally believed possible.

Special text book material has been prepared for shop men. The lessons were prepared after an intensive study as to requirements and cover almost every subject which has a daily use in industry. Upward of thirty (30) lesson pamphlets have been prepared and are not only being used widely by the shops but by school boards, Young Men's Christian Association classes and other organizations having an interest in the educational welfare of their community. This lesson material is available at practically cost to any who are interested in industrial education.

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Southern Metal Trades to Conduct Standardization Research

In order to improve the products manufactured by foundries and machine shops in the South that are members of the Southern Metal Trades Association, the organization is planning the appointment in the near future of a research committee that will establish certain manufacturing standards, and members of the association will be required to manufacture their products in accordance with these specifications or will not be allowed to use the trade name that the association plans to adopt. The committee, which is to be appointed by Gus F. Meehan, of Chattanooga, Tenn., president of the association, will include in its membership expert metallurgists and leading men of the foundry and machine shop industries in the Southern field.

Every member of the association wishing to use the special trade name will be required to submit samples of castings and finished products to this committee, and if these products measure up to the requisite specifications, that company will be allowed to use the trade name. The committee also will inaugurate a course for training its members in the manufacture of the very highest grade and quality gray iron castings.

Some idea of the importance of the Southern Metal Trades Association in the Southern field is contained in the recent report of William E. Dunn, Jr., of Atlanta, secretary, showing that the association represents in its membership a $50,000,000 investment in plants, foundries, machine shops, etc., with more than 25,000 employees.

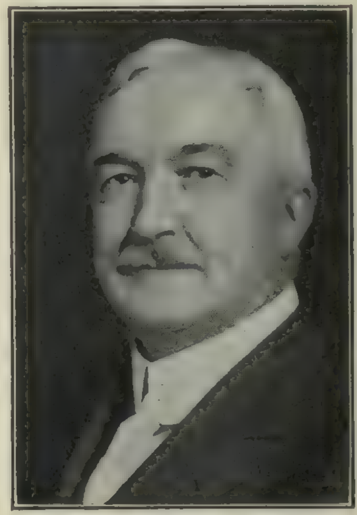
An enormous steel plant that will represent a total investment of between $8,000,000 and $10,000,000 will be established at Chattanooga, Tenn., if Henry Ford is allowed to purchase the Muscle Shoals property and develop the river shipping in this section of the Sotheast. The project was engineered by Chattanooga business men who succeeded in interesting Northern and Eastern capital. Plans and specifications of the proposed plant already have been partly completed and sent to financial interests in New York City.

It is proposed to develop a plant in which steel can be made on the one-heat basis, and by this process more economically produced. The development includes extensive iron ore and coal holdings, and the construction of furnaces. An unlimited supply of high-grade iron ore is available in that section, according to an investigation made some time ago by the United States geological survey.

Dean Cooley, of Michigan University, President of Engineering Council

The election of Mortimer Elwyn Cooley, dean of the College of Engineering and Architecture of the University of Michigan, as president of the American Engineering Council of the Federated American Engineering Societies was announced at a meeting of the Executive Board of the Council, held at the Cosmos Club, in Washington, on Sept. 30. Dean Cooley assumes office at once.

The new head of organized engineering is a past president of the American Society of Mechanical Engineers and has a long record of distinguished service in education, under the Government and in private capacities. He was born in Canandaigua, N. Y., March 28, 1855, and was graduated from the United States Naval Academy in 1878.



MORTIMER E. COOLEY

After several ocean voyages he was detailed to the University of Michigan for three years, under a law which permitted the Secretary of the Navy to detail engineer officers as professors of "Steam Engineering and Iron Shipbuilding," and thus began his long connection with the university which has been his life work and has covered a period of nearly forty years.

Mr. Cooley was vice-president of the American Association for the Advancement of Science (1898); director of the American Society of Civil Engineers (1913-1916); vice-president of the Society for the Promotion of Engineering Education (1908-09); president of the Michigan Engineering Society (1903). He became a member of the American Society of Mechanical Engineers in 1884 and served as vice-president during the year 1902-03, and in 1916-17 as chairman of the executive committee, Detroit section. During 1918-19 Dean Cooley was president of this society.

Much important business was transacted by the executive board of the council at its Washington meeting. The presiding officers were Calvert W. Townley and J. Parke Channing of New York, vice-presidents. Progress was reported in the direction of establishing a Department of Public Works.

The council adopted the report of the Committee on Patents, headed by Edwin J. Prindle of New York, urging the passage of the Lampert bill to remedy conditions in the Patent Office.

The committee opposed the passage of the Stanley Senate Bill which provides for an amendment to the Patent Act, requiring that patents to aliens be granted with a condition that unless such patents be worked in this country within two years after the granting of the patents, the government may grant licenses under them.

It was decided not to hold an engineering assembly next January. The committee in charge of the arrangements was converted into a program and entertainment committee for the annual meeting of the council, to be held in Washington in January.

The board announced the resignation as assistant secretary of A. C. Oliphant.

The board received the report of Col. A. S. Dwight, the federation's representative on the deputation of thirteen which went abroad to confer the John Fritz Medal on Sir Robert Hadfield and Eugene Schneider.

Federal Board Sees Better Steel Business

Favorable prospects for the steel industry are seen by the Federal Reserve Board. In its Oct. 1 analysis of the business situation the following appears:

"After a continuous decline since October, 1920, pig iron production showed an increase during August. The output during that month amounted to 954,193 tons, as compared with 864,555 tons during July. The respective index numbers were 41 and 37. The number of furnaces in blast remained unchanged. Steel ingot production showed a somewhat greater increase, from 803,376 tons to 1,138,071 tons. The respective index numbers were 35 and 49. This increase in output was not, however, accompanied by a similar increase in orders for advanced delivery, as the unfilled orders of the United States Steel Corporation declined from 4,830,324 tons at the close of July, corresponding to an index number of 92, to 4,531,926 tons at the close of August, corresponding to an index number of 86.

Stronger Tone

"There is now a generally stronger tone in the industry. The improvement which made its appearance in August has become somewhat more marked. This is noticeable in the case both of pig iron and of certain finished products. The demand for pig iron has broadened to some extend and more interest is displayed in contracting for future delivery. Total sales in August were the best of the year by a substantial margin and shipments in an even greater proportion. Prices hardened considerably during the latter part of August after having dropped to low levels earlier in the month, and some increases are reported during the present month. Wheras the gain in August pig iron production was due principally to the operations of steel works stacks several merchant furnaces have been blown in since the first of September. The situation with respect to finished steel products however is still uneven and conditions are unsettled. Manufacturers of certain of the lighter products, notably wire and sheets, have booked considerable tonnage and have advanced prices. In other lines, however, particularly shapes and bars, further price reductions have been made, and buyers in these lines still are willing to place orders for future delivery."

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Improved Business Conditions in Germany

(H. W. Adams, representative of Department of Commerce, Berlin, Sept. 10, 1921)

The recent peace legislation in the United States has had no apparent influence on the German stock exchanges or on business conditions in general. However, with the further depreciation of the mark, business conditions have improved, resulting in a rise in the market values of cotton, potash, grain and metal products. Nevertheless, the market is weak and speculation is on the increase.

The Leipzig Fair, which ended Sept. [illegible] proved to be an average success, and the business done at the fair was only above average in a few commodities. Many new inventions were exhibited and special attention was given to the adaptation of former war plants to peace production.

Although shipbuilding is handicapped by the inadequacy of State compensation to shipping companies, unofficial figures show that about 400,000 tons have been added to the merchant marine during the first seven months of 1921. Vessels of less than 1,000 tons are not included in this estimate.

Unemployment Decreasing

The number of unemployed receiving public support decreased from 315,000 in July to 275,000 in August. The struggle between employer and employee over the question of increased wages is becoming more acute in spite of the fact that the employers have partially acceded to the demands of the workers. The government has granted increased wages to its employees.

The administration has declared that an increase in railway and postal rates is unavoidable. The increase in railway rates, it is estimated, will amount to 35 or 40 per cent, while an additional 60 or 70 per cent will be added to the present postage rates. The floating debt of the government on July 31 amounted to 219,000,000,000 marks, of which 190,000,000,000 marks were discounted treasury bills.

"How To Retain and Increase Export Trade"

Convention of American Manufacturers Export Association—M. W. Robinson Elected President for 1922

Taking as its general theme the thought expressed in the title above, the American Manufacturers Export Association held its twelfth annual convention at the Waldorf-Astoria Hotel, New York City, on Oct. 5 and 6. The convention was well attended, though in numbers the delegates were behind other years. The exhibition held in the Astor Gallery in conjunction with the meeting covered a wide variety of export trades and topics. Foreign shipping interests, publishers and advertisers seemed to predominate.

On the morning of the 5th the most important business was the election of officers for the ensuing year. Myron W. Robinson, president of the Crex Carpet Co., New York, was elected president, and the following as vice-presidents: H. S. Demarest, New York; J. S. Lawrence, Boston; E. M. Heinz, Chicago; Frank H. Taylor, Philadelphia; Julius Goslin, Birmingham, Ala.; V. H. Pickney, San Francisco; treasurer, Philip B. Kennedy, New York; directors to serve three years, W. S. Gavan, New York; Walter Drake, Detroit; M. A. Oudin, Schenectady; F. K. Rines, New York; E. W. Drooster, New York.

At the luncheon at noon president William C. Redfield, formerly Secretary of Commerce, presided. The speakers were Ernesto Franco, of Ecuador, and George Weston, general manager of the American Express Co. in South America.

The afternoon session was taken up with the president's address and discussions by Allen Walker, Guaranty Trust Co., on "Problems of Exchange," and by William S. Kies, Federal Foreign Banking Association, on "Foreign Credits and Investments."

In the evening Frank H. Taylor, president of the S. S. White Dental Manufacturing Co., presided. The speakers were W. F. H. Kaeloch, president of the New Netherlands Bank of New York; John S. Lawrence, Lawrence & Co., Boston, and Benjamin M. Anderson, Jr., Chase National Bank of New York. The session was devoted to a discussion of the topic, "Our Relation to the Present European Situation."

The morning session of the sixth was presided over by W. L. Saunders, of the Ingersoll-Rand Co. Speakers were John H. Fahey, of Boston, on "International Chamber of Commerce and American Interests," and Julius Klein on "Bureau of Foreign and Domestic Commerce."

American Valuation Debated

The afternoon session of this day was one of the most important of the convention. The time was devoted to a discussion—or rather a debate—on the "American Valuation Plan," which is the feature of the proposed Fordney Tariff Bill. Thomas J. Doherty, of the National Council of American Importers and Traders, delivered a scathing indictment of the American valuation plan. He traced tariff legislation back to 1789, explaining how duty was imposed then and giving what appeared to be substantial reasons why this proposed plan is not feasible at this time. Mr. Doherty spent twenty-four years in the Government customs service and impressed his audience with the idea that he knew his subject very well.

The defence of the plan was left to Judge John F. Zoller, of the General Electric Company, who, while he apparently knew his subject and gave an excellent presentation of his ideas, was quite outclassed by his opponent who had the added advantage of having the sentiment of the association with him. Judge Zoller said that the American valuation plan would enable us to attend to our own business in our own country and declared that we could not build a tariff wall high enough to keep out foreign competition.

The annual banquet in the evening was featured by an address by the Hon. Herbert Hoover, Secretary of Commerce. Mr. Hoover devoted his address to matters which would be of most vital interest to exporters. He suggested a concert of international banking resources, to which the Federal Reserve Bank in this country, the Bank of England, and the banks of Spain, Italy, France and Amsterdam would be parties, to stabilize exchange and world credits, as a means to rehabilitate the economic situation, especially in Southeastern Europe, and to restore world trade to normal.

Faith in People

Mr. Hoover held out hope of much good to come from the unemployment conference, asserting that the recommendations of the conference had been received with approval. Communities already are at work solving their individual unemployment problems, he declared, and throwing the burden of working out of the depression on to the moral courage of the people, as a whole. "It is from the great qualities of our people, rather than from the government," he added, "that our recovery will come, and with the effort of each and every one of us it will come quickly."

He reviewed some of the evidences of business recovery at hand, alluding to the increase in production of textiles, coal, iron, steel, boots and shoes, building materials and building construction.

He asserted that world stabilization is awaiting the cessation of the issue of flat money and the balancing of national budgets. He criticized the reparations agreement with Germany and stated that "better arrangement of this matter must take priority if we are to see stability in any of the European currencies."

Senator Edge on Taxation

Senator Edge, of New Jersey, advocated the elimination of the surtaxes, excess profits tax and the so-called nuisance taxes for the stimulation of industrial enterprise in this country. In their place he suggested a manufacturers' sales or turnover tax. This apparently met with the approval of most of his hearers. Approaching the tariff question, he asserted that the majority of the Senate is committed to protection, but realized that imports are as necessary to our economic well-being as are exports.

Canadian Automobile Industry

(Consul General J. I. Brittain, Winnipeg, Canada, August 26)

The automobile industry in Canada is divided into three main lines—production of automobiles, manufacture of automobile accessories, and the repair of automobiles. The total value of automobiles produced in 1919 was $80,619,846; accessory plants produced to the value of $8,571,890, and repair plants $11,991,020, making a grand total for the industry of $101,182,756.

Six thousand eight hundred and seventy-six persons found employment in plants manufacturing automobiles, for which they received wages of $9,712,788; the automobile repair plants required 3,629 employees, to whom $3,728,414 was paid. In comparing the number of employees engaged in automobile manufacturing plants and automobile repair shops, it is noted that there were only 11 manufacturing plants, while there were 1,239 shops devoted to repair work, and the latter were to a large extent individual establishments where the owner is himself a mechanic and replaces a wage earner. An important factor in the automobile repair industry is cost of materials used, which in 1919 amounted to $4,375,085, the largest proportion representing automobile parts manufactured by producers of automobiles.

Automotive Developments in Norway

(Vice Consul George Gregg Fuller, Trondhjem, Norway)

The general transportation of pleasure cars and trucks into Norway has almost come to a standstill, due to several causes, chief of which are the present abundant supply and adverse economic conditions. But this is only temporary and manufacturers may count on a fair market upon the readjustment of conditions.

In northern Norway American cars lead in popularity. From 1915 to 1920 the number of automotive vehicles registered increased 450 per cent, of which number 65 per cent were of American make. The next in point of popularity were vehicles of German make. Of the total number registered 16 per cent were German.

Norway was just beginning to use automobiles at the outbreak of the war, but it was not until 1918 that the demand grew strong. The need was met by the importation not only of new cars but of used cars, as manufacturers of the former could not meet the demand. The majority of the vehicles imported were low in price. Believing that the demand would continue, dealers did not cancel their orders for new vehicles.

Cotton Advance Aids Unemployment in South

That material progress has been made in Georgia toward relieving the unemployment situation since cotton began its advance a month ago, that there are now more persons employed in the state than at any time in the past seven months, is the substance of an announcement by Hal M. Stanley, commissioner of commerce and labor, and John Yopp, Federal labor statistician and secretary of the Georgia Manufacturers' Association. The remarkable improvement in business conditions over the state since cotton began its advance is solely responsible for the decrease in unemployment.

Every state in the Southeast has reported material improvement in the unemployment situation during the past four or five weeks.

Employment Less in Metal-Working Trades

Records compiled by the Metal Manufacturers' Association of Philadelphia show employment of metal workers in this district is less than in the 1908 and 1914 depression periods. A letter has been sent to members of the association setting forth the findings.

Surveys at those times show in man-hours in 1908 there was a decline of 44.7 per cent from normal and in 1914 a decline of 33.5 per cent. On Sept. 1 of this year the decline had reached 54.7 per cent. The percentage of unemployed in 1908 was 34.5 per cent, in 1914 27 per cent and Sept. 1, 1921, 48.8 per cent.

There are several indications of minor improvement. Demand for labor, though still slight, has increased noticeably, with some exceptions the gross number of men being released has declined. Average wage reduction at the end of August was 16.5 per cent.

Stove Makers Optimistic

That general business conditions are slowly but steadily improving in the foundries and machine shops of the South, that there will be a fair demand for foundry products during the coming winter and that the industry as a whole is rapidly approaching normal, was the consensus of opinion among the officers and delegates attending the two-day annual convention of the Southern Stove Manufacturers' Association, held at Chattanooga, Tenn., Sept. 19 and 20. Besides the members of the Southern organizations, representatives of several Northern stove plants were present. The sessions were mainly devoted to general business discussion.

New Branch Managers Appointed for Bosch Company

New managers have recently been appointed for the American Bosch Magneto Corporation at its New York and Detroit branches. George Shortmeier, formerly New York manager for the Madison Rubber Co., and later district manager at New York for the Sinclair Oil Co., has been placed in charge of the Bosch branch at New York, replacing O. S. Stanley.

Charles L. Shedd is now manager of the Bosch branch at Detroit, taking the place of Roy Davey, who has been made manager of the manufacturing sales department at Springfield, Mass. Mr. Shedd was at one time promotion manager of the truck division of the Packard Motor Car Co. at Detroit, subsequently served as official distributor at Omaha for that company and still more recently represented as sales manager the Republic Truck Corporation, at New York City.

The company has just completed a new building in the Columbus Circle district, which is now the center of automotive sales and manufacturing interests in New York. The new Bosch building, which stands at 17-19-21-23 West 60th St., has ten stories and mezzanine and is thoroughly modern in every detail. It is of fire proof construction, being built of steel, stone and concrete throughout. The corporation will occupy four complete floors. A large service station and installation garage will be located in the basement and the sales and stockroom will occupy the ground floor. It is the intention of the corporation to rent the upper floors of the building exclusively to automotive concerns, and retain an atmosphere of motordom throughout the structure.

War Doesn't Pay

In an article under the above title in the October issue of the *Nation's Business*, Pierre S. DuPont, chairman of the board of E. I. DuPont de Nemours & Co., has some interesting things to say in defense of the much abused munition worker. Some of his remarks follow.

"The popular conception of a munitions maker is a sinister individual with a deep hatred for peace and a contempt for the pursuits thereof. He is pictured as doing all in his power to fan the flames of distrust between nations and to delight in the conflicts that ensue, since they create enormous and immediate profits for his corporation.

"I called this the popular conception of the munitions maker; in reality it is the popular misconception.

"Consider the E. I. du Pont de Nemours & Co., whose history is coincident in point of time with that of the United States. We have furnished a great part of the explosives used in all the wars in which the United States has engaged. Therefore we feel that our records should show conclusively what war will do for—and to—a maker of munitions.

"No munitions concern can live by war alone. During the 139 years of the existence of the United States as a nation there were four major conflicts before the World War. They lasted about ten years in all, or about 7 per cent of the time. How could any independent corporation keep itself alive for 139 years by turning out a product that was only wanted ten years of the time?

"The manufacturer of war materials who was prepared to meet the emergencies of these years was not supported during the intervening time by preparations for the conflicts. Such manufacturers existed through the ownership of factories occupied in making peacetime products. In that way alone could they stabilize their businesses.

"Most people—business men included—probably think war has no dangers for the maker of munitions. The truth is that no one realizes as clearly as do we makers of war necessities the grave financial dangers of modern conflicts. Even for a company as strong and firmly established as our own, it is a gamble whether it can successfully weather the storm.

"I consider President Harding's move in calling the disarmament conference a long step in the right direction, as it will be held while people still have in mind the physical horrors of warfare, and while the nations still are suffering from economic wounds. Sentiment against war has always been strong; added to this sentiment now is the crushing burden of taxation, and a disarrangement of all the orderly channels of domestic and international commerce. The conference has an excellent chance to achieve the high aim for which it has been called."

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Steel Exports Slowly Recovering

Reports concerning the domestic aspects of the steel industry and trade indicate a further improvement, along lines which began to appear about the end of July. As expected, the August figures for production of pig iron and steel ingots showed an upward turn from the low point touched in July, and further increases in operations to date during September strengthen the conclusion that July actually was the turning point toward better conditions. Steel export activities, however, still lag, for neither volume nor value of shipments during August shared in the increase which has been reported for total exports.

For the seventh consecutive month, August shows a new low record for exports of iron and steel from the United States, with a total of only 73,792 tons. This is the lowest point recorded since January, 1909. The course of the decline in steel exports is illustrated by the following monthly totals:

MONTHLY EXPORTS OF IRON AND STEEL, 1921

	Long Tons.
January	540,916
February	393,266
March	226,152
April	160,087
May	138,106
June	115,194
July	85,082
August	73,792

The total for the eight months, 1,732,595 tons, is at the rate of about 2,500,000 tons for the year; but that figure makes no allowance for the very low level reached in recent months, from which an unexpected sharp and extensive recovery would be necessary to carry the annual total to any such figure. As a matter of fact, the present outlook for exports during the balance of the year holds little or no prospect for a larger tonnage than that of the past four months. Even if the volume exported from May to August, inclusive, is duplicated in the last four months of the year, the annual total will fall short of 2,150,000 tons, or only a little more than 40 per cent of the tonnage exported in 1920.

The rank of the various items in the list during August was as follows:

AUGUST EXPORTS OF IRON AND STEEL PRODUCTS

	Long Tons
Steel sheets	14,170
Wrought pipe	10,537
Structural steel	9,852
Steel plates	9,388
Steel bars	5,180
Rails	4,782
Cast pipe	2,931
Tin plate	2,646
Billets, etc.	2,447
Pig iron	2,419
Galvanized sheets	2,353
Hoop and band	1,386
Wire Nails	1,113
Plain wire	1,077
Bolts, nuts, etc.	1,024
Barbed wire	974
Iron sheets and plates	457
Wire rods	351
Iron bars	257
Nails (not wire or cut)	219
Railroad spikes	196
Ship & tank plate	25
Cut nails	6
Total	73,792

As compared with the rank in July, (see weekly Commercial Reports, September 5, 1921), rails show a very sharp decline of more than 15,000 tons, and sheets a pronounced increase of more than 7,000 tons, and as a result of these changes rails dropped from first to sixth place, while sheets moved from fourth place to the top of the list. Wrought pipe and structural steel continue in the same relative positions, with more moderate declines than noted for rails.

Japan A Big Buyer

Among the leading tonnage items the larger exports of sheets were due to marked increase in shipments to Japan, upward of 20 per cent of the total going to that market. Plates also were taken largely by Canada and Japan, with only small lots to other countries. Shipments of wrought pipe and structural steel, on the other hand, were more widely distributed in sizable amounts.

The rank of the principal markets is considerably different for August trade from that reported for July, the leading countries being as follows:

PRINCIPAL MARKETS FOR AUGUST EXPORTS OF STEEL

	Long Tons
Canada	25,967
Japan	16,534
Mexico	6,755
British India	6,086
Cuba	2,249
Honduras	2,046
United Kingdom	1,779
Argentina	1,554
Australia	1,192
Brazil	1,072
Philippine Islands	1,064
Rumania	1,017

The twelve countries account for more than 90 per cent of the total exports for the month, and with two exceptions they are normally among the chief markets for steel from the United States. It is also interesting to note that Japan again stands second, partly as the result of the larger shipments of sheets already mentioned, and partly as a result of smaller movement to Mexico. China and Dutch East Indies, which were prominent in the July list, have dropped behind, while British India and Argentina have moved forward.

For Canada, Japan and the Philippines the leading items of trade were plates, sheets and structural steel. For Brazil and Honduras rails were the chief factor, and for all the others pipe ranked as the leading product. In general, the details of exports during August suggest a considerable preponderance of small scale merchant buying rather than sales of large lots of material for public works or new enterprises.

French Steel Output

Commenting on the drop in steelwork in France during the last month, *La Revue de France* calls attention to the fact that before the war France produced 10,000,000 metric tons of steel annually, whereas it can use at home scarcely half that quantity. Hence it is a simple necessity for it to export some 5,000,000 tons a year. This fact must be taken into account in determining the price at which it can and must sell its products, necessitating a cut in prices considerably below the present.

Other considerations are to be taken into account, such as the low cut in German prices and "the formidable American production" of automobiles, etc.

Comparing the figures of July, 1921, with those of 1920, of the ten principal automobile works of France, it is noted that there is a general loss of from 24 to 68 per cent of output.

Under these conditions it will be difficult for France to equal its pre-war record of 350,000,000 francs annual export of steel manufactured articles.

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Newcastle Iron Works, South Africa

From the *Natal Mercury*, July 5, 1921

Just alongside the main line near Newcastle, about half a mile from the township and approximately halfway between Durban and Johannesburg, a large block of buildings and towerlike structures are nearing completion. They are the premises of the Newcastle Iron and Steel Works, Ltd., and their erection represents over two years' arduous labor. In about three months' time it is hoped to have the works and plant ready for commencing the manufacture of pig iron on a big commercial scale. The opening of the works will mark an important step in the history of industrial South Africa, and more particularly Natal. Previously, practically all the iron and steel used in this country was imported from overseas, but now, thanks to the enterprise of the promoters of the company, the iron required in the Union will be made in Natal, and there may be a surplus for export. Later on, when the molding plant has been installed at the Newcastle works, iron and steel girders, joists, pipes, and other articles will be manufactured from the pig iron turned out at the works. The output of pig iron will be approximately 150 tons per day, and the plant will be continually in operation.

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Commerce Bureau Can Help You

What is the Bureau of Foreign and Domestic Commerce doing to aid American industry? This question is answered by Dr. Julius Klein, head of the Bureau, in *Forbes Magazine* (N. Y.) "The major change—one of policy that business men in general will appreciate to the full," he says, "is that the bureau has been made the home of commodity experts. The old idea that the director and a few assistants were qualified to keep sufficiently informed of the peculiar needs and problems of each of our commodity lines, has been thrown into the discard. Instead, the policy now is to have in the bureau someone who from experience knows the language, the needs, the problems, and the ambitions of each American commodity group.

"In other words, it is realized that though in the nature of the situation we can scarcely expect all our foreign representatives to be commodity experts in all lines, it is therefore all the more desirable to have at the switchboard in Washington at least one expert for each commodity line. Obviously without such experts at home we could not expect to get the best results from our force in the field.

"And, even if we got the best trade information available, there was, generally speaking, no one in the Bureau who could interpret that information adequately.

"Therefore to meet and to interpret the needs and the opportunities of the hour, the bureau is going to the limit of its appropriations, and is asking for more, to establish commodity divisions. Each of these divisions is headed by a commodity expert of long experience, who is expected to spend at least half of his time keeping in personal touch away from Washington with the trade he represents. The divisions already established cover the following commodity lines: Iron and steel, lumber, heavy machinery, electrical goods, foodstuffs, automobiles, fuels, textiles, shoes, leather, implements and vehicles, rubber goods, paper, and specialties.

"And thirty more are planned for next year."

Book Reviews

AIRCRAFT YEAR BOOK, 1921. 330 pages, 6 x 9 in., 36 illustrations. Published by Small, Maynard & Co., Boston, Mass.

While we all feel that the airplane has been neglected in this, the country where it first had practical demonstration, it is somewhat encouraging to see what has been actually accomplished. There are many pages of data as to notable flights which have taken place, but more than that, the book shows records of everyday flying, of which the average citizen knows nothing. These figures show that over 450 planes are used in commercial passenger carrying at an average charge of 65 cents per mile for intercity flights. Over 115,000 passengers and over 41,000 lb. of baggage were carried in one year, flying a distance of more than 3,000,000 miles. The mail airplanes fly 8,000 miles every day and the coast to coast mails now save from 24 to 42 hr. from New Yory to San Francisco.

About forty-five pages are devoted to outline drawings of planes which show the development from the Wright Brothers glider to the present time. These are particularly interesting. The illustrations in the rest of the book are all excellent halftones and many of them are of more than usual interest. Considerable space is given to the U. S. Air Service and much useful data as to mail carried and its cost is also to be found here. Anyone interested in the future development of aviation should have a copy of this book.

Cylinder Regrinding. By L. A. Hastings; published by the Heald Machine Co., Worcester, Mass. Known as Bulletin No. 515, 6 x 9-in., paper covers.

This is a treatise on the business of regrinding automobile cylinders. It includes much valuable information on regrinding processes, machine operation, methods of getting work and general information on the subject. The book is effusively illustrated with halftones, line cuts, charts and tables.

Chapter headings are: Cylinder Grinding—Its Possibilities and Advantages; Equipment Required; Why Motors Should Be Reground; Kinks that Will Help; Operation of Heald Cylinder Grinding Machines; Advertising; Assembling the Motor; General Information and Summary.

The book can be purchased from the Heald Company for fifty cents.

Business Letter Writing. By Alexander M. Candee. Three hundred forty-seven 6 x 9 in. pages, blue cloth boards. Published by the Biddle Publishing Co., 19 W. 44th St., New York City.

Some of the major subjects taken up are: The Business of Letter-Writing; Means for Conveying the Thought; the Principles of Thinking; Punctuation; Building the Letter; Sales Letters; Complaints and A[illegible]justments; Credit Letters; Collection Letters. The author goes into great detail in putting his message across, not omitting information on the minor points about which so many letter-writers are uncertain.

The book will be found to be an excellent check for those who habitually write good etters. To the novice or to one who has never made any attempt to analyze letter-writing it should prove to be a very valuable guide.

Railroad Shop Practice. By Frank A. Stanley; McGraw-Hill Book Co. Inc., 370 Seventh Avenue, New York. Three hundred and thirty-one 6x9-in. pages, 391 illustrations. Price $4.

This book goes into the details of principal railroad-shop repair work, and is written by a practical man who has had special privileges to note and record the various practices of many large railroad hops in different parts of the United States.

Among the subects covered are: Operations on locomotive cylinders, pistons and piston rings; piston valves, cages and ings; tools for crossheads and guides; conecting-rod operations; driving boxes, shoes nd wedges; eccentric links and tumbling hafts; frame work; driving wheels and xles; wheel shop eqiupment and methods; ipe joints; tools for valves and fittings; ortable tools; special tools; air pumps nd air-hose couplings; blacksmith shop equipment and work; boiler and flue work; welding operations; reclamation work; andling materials.

Business Items

The Motors Accessories Corporation has been organized at Georgetown, Del., to manufacture automobile parts. Capital stock is $200,000.

The Raleigh Motors Corporation has taken possession of its recently acquired plant at Reading, Pa., and will begin the manufacture of the Raleigh car as soon as the equipment is arranged.

The Way-Cleanse Corporation, Syracuse, N. Y., has completed a deal for the plant of the M. L. Oberdorfer Brass Corporation in that city. Machinery and raw materials now at Sandusky, O., will be moved to Syracuse at once. The Way-Cleanse Corporation has an authorized capital of $5,000,000, of which $1,500,000 is in 8 per cent preferred stock and $3,500,000 in common.

The Valley Foundry Co., of Cumberland, R. I., has recently been incorporated with a capital stock of $50,000 to manufacture machinery, etc. The incorporators are Frank Gross, M. M. McKenna and W. I. Sims.

The Verto Products Co., of Pawtucket, R. I., has recently been incorporated and organized under the laws of Rhode Island, to engage in the manufacture of machinery, etc. The capital stock of the concern is $200,000; the incorporators are Darius Gog, W. F. Stanton and William E. White.

The Hutchinson Hardware Co., of Lynn, Mass., has recently been incorporated with a capital stock of $125,000 to deal in hardware, mill supplies, etc. Henry O. Silsbee, is the president; William G. Neale, is treasurer.

According to newspaper reports from Mexico City, Elbert M. Gary, chairman of the board of directors of the United States Steel Corporation, prior to his departure from Mexico City on Sept. 20, entered into negotiations for the purchase of the properties of the Monterey Iron and Steel Foundry Co., the largest in the Republic of Mexico.

The Peerless Wire Fence Co., of Adrian, Mich., has purchased the plant of the Bosworth Bag Co., in Memphis, Tenn., and will remodel it to suit its own production.

The Syracuse plant of the Crucible Steel Co., of America resumed operations in all departments on Oct. 3. E. I. French, general manager, said that enough new orders were being received to warrant this action.

The Clark-Turner Piston Co., of Los Angeles, Cal., has made arrangements with several distributors for handling its line of Delux pistons for all kinds of motors. At the present writing the following firms have been appointed; Kansas City Motor Parts Co., Bently & Diehl Bros., Freeport, Ill., and the Westervelt Machine Corporation, New York City.

The Gilbert & Barker Manufacturing Co., West Springfield, Mass., has adapted a schedule of four days a week. This plan supersedes a proposed shut down of two months.

The Airship Construction and Navigation Corporation has been organized at Dover, Del., and capitalized at $5,000,000. The company will manufacture and sell airships and dirigibles.

The Baker-Skelton Co. has been organized in Syracuse, N. Y., by the merging of the Chapin & Baker Manufacturing Co. with the Skelton Tool Co. The Chapin & Baker Co. was formed several years ago to produce machine tools of special and standard design. The Skelton Tool Co. was engaged in a similar line of work. The offices of the merged concern will be located in Syracuse.

The S-P Manufacturing Co., a Cleveland corporation, has purchased the former American Air Chuck Co. of Chicago, Ill., and has acquired all of the patents, good will, tools, etc., of the latter company. The work of re-establishing the business is already under way and with the aid of J. A. Olson, inventor of the American air chucks, collets, vises, etc., who will be associated with The S-P Manufacturing Co. The regular business of The S-P Manufacturing Co. has consisted of the design and manufacture of special machinery, fixtures, jigs, tools, etc., which line will be continued.

Kearney & Trecker Co., of Milwaukee, Wis., announces that on and after Oct. 1 of this year, its New York branch office will be located in Room 371, Hudson Terminal Building, 50 Church St., New York City, having moved to this location from 1801 Singer Building.

Reorganization of the Locomobile Company, automobile manufacturer, with a plant at Bridgeport, Conn., was reported in New York last week. Coincident with the announcement that Elmer H. Havens of Bridgeport had been elected president, the company said that it had terminated its contract with Hare's Motors, Incorporated, under which it has been operating its properties for the last eighteen months. Continued operation of the Bridgeport plant upon a limited output, together with the approval of a new schedule of prices for its product, were contained in the company's announcement.

Fay & Scott, manufacturers of lathes at Dexter, Maine, have resumed production in their plant on a full-time basis.

The Du Pont Company has announced several changes in its executive forces. Vice-presidents A. Felix Du Pont, J. B. Edge, C. A. Patterson and C. A. Meade have resigned from the executive committee. Vice-presidents H. F. Brown and F. G. Tallman have resigned from the finance committee and are now members of the executive committee.

The Treco Metal Products Corporation has been organized in New York City, to manufacture motors and engines. Capital stock is $25,000.

The Ersted Machinery Manufacturing Co., Portland, Oregon, has purchased the foundry, machine shop and pattern shop buildings and equipment of the Pacific Iron Works in that city. Production of the Ersted machines will be continued on a larger scale with the new facilities thus obtained.

Personals

A. F. Orcutt has resigned as general manager of the Rivett Lathe and Grinder Co., Brighton, Boston, Mass.

A. E. Magnell, for the past four years publicity manager of the New Britain Machine Co., New Britain, Conn., has severed his connections with that company. Mr. Magnell has several plans under consideration for the future, but as yet has made no definite connection.

Obituary

Andrew G. Young, general traffic manager of the American Sheet and Tin Plate Co., died on Sept. 29 in Cleveland, Ohio. Since the end of the war Mr. Young had lived in Pittsburgh. During the war he was in charge of the allocation of steel to the shipyards and had his office in New York. He had been connected with the American Sheet and Tin Plate Co. for more than twenty years. He was 62 years old.

William Kemp, formerly general manager of the J. B. Carr Chain Works, Troy, N. Y. died on Sept. 30 at Elmhurst, L. I., N. Y.

Forthcoming Meetings

The American Gear Manufacturers Association will hold its semi-annual meeting at Rochester, N. Y., October 13, 14 and 15. F. D. Hamlin, 4401 Germantown Ave., Philadelphia, Pa., is secretary.

The National Machine Tool Builders' Association will hold its fall meeting at the Hotel Astor, New York City, October 18, 19 and 20.

There will be a meeting of the Machine Tool Section of the National Supply and Machinery Dealers' Association in the Hotel Astor, New York City, on Wednesday, Oct. 19, at ten o'clock in the morning. Thomas Fernley, 505 Arch St., Philadelphia, Pa., is secretary.

The annual convention of the Industrial Relations Association, of America, will be held in the Waldorf-Astoria Hotel, New York City, on Nov. 1, 2, 3 and 4.

The National Conference of the Industrial Cost Association will be held at Pittsburgh, Pa., on Nov. 2, 3 and 4.

The third annual convention and exhibition of the American Gas Association will be held in the Congress and Auditorium Hotels, Chicago, Ill., on Nov. 7 to 12.

The Weekly Price Guide

This Week's Market

The Pittsburgh mill price of $1.75 for structural steel shapes and plates and $1.65 per 100 lb. for bars continues in effect. Business has been done, however, as low as $1.60@$1.65 for shapes and plates and $1.60 per 100 lb. for bars. Mill shipments, New York, of shapes and plates are quoted at $1.98@$2.13; bars at $1.98@$2.03 per 100 lb. New York warehouses have advanced the price of black and galvanized steel sheets 25c. per 100 lb.

Zinc and electrolytic copper have advanced ⅛c. per lb. in New York and St. Louis. Antimony has gone up ¼c. in New York and ½c. per lb. in Chicago. Both New York and Chicago report a rise of 1c. per lb. on copper sheets, bars, wire and tubing. Advances ranging from ½c. to 1½c., in old metals, are reported in New York and a rise of ¼c. per lb. in Chicago.

Linseed oil is quoted at 73c. as against 76c. in New York and at 81c. as against 87c. in Chicago.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	†$24.50
Northern Basic	†22.52
Southern Ohio No. 2	†23.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	†30.26
BIRMINGHAM	
No. 2 Foundry	†20.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	†22 76
Virginia No. 2	†28 74
Basic	†20 75
Grey Forge	†21.75
CHICAGO	
No. 2 Foundry local	†22.70
No. 2 Foundry, Southern, sil 2.25@2.75	†26.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	†22.96
Basic	†21.96
Bessemer	†21.96

*F. o. b. furnace. † Delivered.

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50	3.28	3.10	3 38
No. 12	2.60	3.33	3.15	3.43
No. 14	2.70	3.38	3.20	3.48
No.16	2.80	3.48	3.30	3.58
Black				
Nos. 17 and 21.	2.85	4.05	3.55	3.95
Nos. 22 and 24.	2.90	4.10	3.60	4.00
Nos. 25 and 26.	2.95	4.15	3.65	4.05
No. 28	3.00	4.25	3.75	4.15
Galvanized				
Nos. 10 and 11.	3.00	4.25	3.75	4.15
Nos. 12 and 14.	3.10	4.35	3 85	4.25
Nos. 17 and 21.	3.40	4.65	4.15	4.55
Nos. 22 and 24.	3.55	4.80	4.30	4.70
No. 26	3.70	4.95	4.55	4.85
No. 28	4.00	5.25	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of Sept. 16, 1921·

Steel			Iron		
Inches	Black	Galv.	Inches	Black	Galv.
BUTT WELD					
1 to 3	68½	56	¾ to 1½	39½	24½
LAP WELD					
2	61½	49	2	34½	20½
2½ to 6	65½	53	2¼ to 4	37½	24½
7 to 8	62½	49	4½ to 6	37½	24½
9 to 12	61½	48	7 to 12	35½	22½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66½	55	1 to 1½	39½	25½
2 to 3	67½	56			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59½	48	2	35½	22½
2½ to 4	63½	52	2½ to 4	38½	26½
4½ to 6	62½	51	4½ to 6	37½	25½
7 to 8	58½	45	7 to 8	30½	18½
9 to 12	52½	39	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded.	60%	46%	60½%	47½%	68½%	56%
3½ to 6 in. steel lap welded.	51%	37%	58½%	44½%	65½%	53%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (heavy)	5.00	6.00	8.25
Spring steel (light)	6.00	6.00	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.03
Hoop steel	3.88	3.29	3.48
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	4.85	2.74	5.23
Cold finished shafting or screw	4 03	3.50	4.00
Cold finished flats, squares	4.53	4.00	4.50
Structural shapes (base)	2.88	2.74	2.88
Soft steel bars (base)	2.78	2.64	2.78
Soft steel bar shapes (base)	2.78	2.64	2.78
Soft steel bands (base)	3.43	....	.....
Tank plates (base)	2.88	2.92½	2.88
Bar iron (2.15@2.25)	2.78	3.52	2.78
Drill rod (from list)	55@60%	55%	50%

Electric welding wire.......... New York $\frac{3}{32}$, 8½c. per lb. ⅛—7.15c.; $\frac{5}{32}$ to ¼—6.75c. Swedish iron sells at 18½c. per lb. in Chicago

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	13.37½
Tin, 5-ton lots, New York	27.25
Lead (up to carlots), St. Louis, 4.60; New York	5.00
Zinc (up to carlots), St. Louis, 4.97½; New York	5.37½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.00	25.00	21.00
Antimony (Chinese), ton spot	5.50	6.00	6.50
Copper sheets, base	20.75	20.50	20 50
Copper wire (carlots)	16.50	15.50	15.50
Copper bars (ton lots)	19.00	22.00	18.00
Copper tubing (100-lb. lots)	20.50	22.00	20.50
Brass sheets (100-lb. lots)	15.25	17.00	15.25
Brass tubing (100-lb. lots)	18.00	18.00	18.00
Brass rods (1,000-lb. lots)	13.25	15.00	13.25
Zinc sheets (casks), (8% dis. carlots)	11.00	11.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ½), (case lots)	19.50	23.50	17.50
Babbitt metal (best grade)	70.00	37.50	32.00
Babbitt metal (commercial)	30 00	13.50	8.00

—Shop Materials and Supplies

MONEL METAL—Base price in cents per lb., f.o.b. Bayonne, N.J.:

hot	35.00	Hot rolled machined rods (base)	53.00
Blocks	35.00	Hot rolled rods (base)	42.00
ngots	38.00	Cold drawn rods (base)	56.00
heet bars	40.00	Hot rolled sheets (base)	55.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	9.00	10.25
Copper, heavy, and wire	9.50	9.00	9.50
Copper, light, and bottoms	8.00	7.00	8.00
Lead, heavy	4.00	3.00	3.75
Lead, tea	3.00	2.00	3.00
Brass, heavy	6.50	5.00	8.00
Brass, light	5.00	3.00	4.75
No. 1 yellow brass turnings	5.25	4.00	5.25
Zinc	3.00	2.00	2.75

N PLATES—American Charcoal Plates—Bright—Cents per lb.

			New York	Cleveland	Chicago
"AA" Charcoal Melyn Grade:					
IC,	20x28,	112 sheets	21.50	......	....
IX,	20x28,	112 sheets	24.00	......	....
IXX,	20x28,	56 sheets	13.75	......	....
IXXX,	20x28,	56 sheets	15.50	......	....
IXXXX,	20x28,	56 sheets	17.00	......	....
" Charcoal Allaways Grade:					
C,	20x28,	112 sheets	18.50	......	....
X,	20x28,	112 sheets	21.50	......	....
XX,	20x28,	56 sheets	12.25	......	....
XXX,	20x28,	56 sheets	14.00	......	....
XXXX,	20x28,	56 sheets	15.75	......	....

Coke Plates, Bright

			(56 sheets)	
Pne, 20x28 in.:				
0-lb,	112 sheets	13.60	......	....
0-lb.,	112 sheets	13.80	......	....
00-lb.,	112 sheets	14.00	6.50	....
,	112 sheets	14.30	6.65	....
X,	112 sheets	16.30	......	....
XX,	56 sheets	9.15	......	....
XXX,	56 sheets	10.15	......	....
XXXX,	56 sheets	11.15	......	.....

Terne Plate

Small lots, 8-lb. Coating:				
00-lb.,	14x20	7.50	6.25	6.25
,	14x20	7.75	6.50	6.50

SHOP SUPPLIES

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	—50%	–60%	—60–5%
1⅛ and 1¼x3 in. up to 12 in.	—40%	60–10–10%	—55%
With cold punched sq. nuts	—30%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	—40%	....	.....
Up to 1-in. diameter, with cold punched hex. nuts (plus std. extra of 10%)	—30%	....	.....
Button head bolts, with hex. nuts	—20%	$3.90 base	.....
Hex. head and hex. nut bolts	—20%	....	.....
Lag screws, coach screws	—50–10%	....	.....
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	50–10–10%	50–5%
Bolt ends, with hot pressed nuts	—50%	....	.....
Tap bolts, hex. heads	—20%	....	.....
Rivets, $\frac{7}{16}$ in. dia. and smaller. *New list*	–50-10%	60-10-10%	–60-10%
Rivets, tinned	–50-10%	60-10-10%	—45%
Semi-finished nuts, all sizes	—70%	75%	50%
Case-hardened nuts	—60%	....	.....
Washers, cast iron, ½ in., per 100 lb.	$5.00	$5.50 off	$4.50
Washers, cast iron, ⅝ in. and larger, per 100 lb	4.25	3.75 off	4.50
Washers, round plate, off list per 100 lb.	3.00	....	.....
Nuts, hot pressed, sq. .... Off list	2.00	3.00	3.00
Nuts, hot pressed, hex. .... Off list	2.00	3.00	3.00
Nuts, cold punched, sq. .... Off list	1.50	3.00	3.00
Nuts, cold punched, hex. .... Off list	1.50	3.00	3.00
Rivets:			
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb	$3.70	3.50	3.68
Cone heads, ditto	3.80	3.60	3.78
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	....
⅞ in. diameter .... *EXTRA*	0.15	....	....
½ in. diameter .... *EXTRA*	0.50	....	....
1 in. long, and shorter ..... *EXTRA*	0.50	....	...
Longer than 5 in. .... *EXTRA*	0.25	....	....
Less than 200 lb. .... *EXTRA*	0.50	....	....
Countersunk heads .... *EXTRA*	0.35	....	....
Copper rivets	50–10%	40–10%	40%
Copper burs	25–10%	15%	15%

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb.	.055@.09	.09	.10
Wiping cloths per M., 13¼x13¼	....	55.00	55.00
Wiping cloths per M., 13¼x20½	....	65.00	65.00
Sal soda, 100 lbs	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb	2.55	3.25	2.75
Linseed oil, per gal., 5 bbl. lots	.73	.88	.81
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 100 lb.		.80	.80

Coke, prompt furnace, Connellsville........per ton $3.25@3.50
Coke, prompt foundry, Connellsville....... per ton 4.25@4.75

NEW *and* ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Conn., Bristol—A. Garrigus—one 30 in. open side planer, one horizontal boring mill with 2½ or 3 in. bar and several 18 in. lathes with 8 ft. bed.

N. Y., Mattituck—T. F. Hutchings, Box 323—one gap lathe, one grinder and one arbor press for use in garage.

N. Y., New York—The Axle Lock Co., 119 East 129th St.—one turret lathe.

N. Y., New York—New York Central R.R., Grand Central Terminal—one 28 in. shaper, one 4 ft. radial drill, one triple head bolt cutter, one 16 in. and one 30 in. lathe.

N. Y., Staatsburgh—G. W. Kidder—One 437 B combination band and circular saw sharpener.

Ky., Maysville—The Maysville Machine Co., P. O. Box 288—one LaPointe broaching machine (used).

Mich., Detroit—E. Gray, Grayhaven, foot of Continental Ave.—equipment for the repair of boats and engines.

Wis., Wausau—The Bd. Educ, c/o S. B. Tobery, Supt.—machines and equipment for vocational department of Central School.

Mo., St. Louis—Uradia Co., 621 Merchants Laclede Bldg., W. E. Perryclear, Purch. Agt.—one blow torch, hack saw and small lathe.

Que., Montreal—The Wonder Tractor Co., Ltd., 234 Grand Blvd., L. Heald, Mgr.—equipment for tractor factory.

Pa., Allentown—The M. & G. Co.—general ice and ice cream machinery.

Pa., Philadelphia—O. Nebel, 3860 Coral St.—knitting machines for proposed factory on 5th and Courtland Sts.

Wis., Peshtigo—J. L. Chudacoff—knitting and special machinery for proposed knitting mill on Thompson St.

Metal Working Shops

NEW ENGLAND STATES

Mass., Boston—H. Frank, 819 Shawmut Ave., will construct a 1 story, 75 x 221 ft. garage and store building on Shawmut Ave. Estimated cost, $50,000.

MIDDLE ATLANTIC STATES

N. J. Trenton—The McFarland Fdry. & Machine Co., Willow St., has awarded the contract for the construction of a 2 story, 50 x 52 ft. addition to its foundry on New York Ave. Estimated cost, $10,000.

N. J., West New York — C. E. and I. Cuneo, 23 Fulton Ave., Jersey City, have awarded the contract for a 100 x 100 ft. garage on Hudson Ave., between 8th and 9th Sts. Estimated cost, $59,000.

SOUTHERN STATES

W. Va., Fairmont — A. B. Knight has awarded the contract for the construction of a 2 story machine shop on East Park Ave., East Side.

MIDDLE WEST STATES

Ill., Sterling—P. W. Kempster is having plans prepared for the construction of a 1 story, 50 x 142 ft. garage. Estimated cost, $40,000. Architect's name withheld.

Ill., Zion—Zion Institutions & Industries, c/o W. H. Glendinnen, Mgr., Administration Bldg., is having plans prepared for the construction of a 1 story, 100 x 140 ft. garage. Estimated cost, $50,000. Architects name withheld.

O., Alliance—The Alliance Machine Co., South Mahoning Ave., plans to construct a one and a half story, 50 x 250 ft. forge plant. Estimated cost, $100,000.

O., Canton — The Amer. Mine Door Co., 9th and Robin St., S. E., has awarded the contract for the construction of a 1 story, 50 x 150 ft. factory. Estimated cost, $75,000.

Wis., Madison—The University of Wisconsin will soon award the contract for the construction of an addition to its service building. A. Peabody, Capitol, State Archt.

Wis., Milwaukee — A. C. Eschweiler, Archt., 141 Wisconsin St., is receiving bids for the construction of a 1 story, 120 x 120 ft. garage on Mason and Van Buren Sts., for the Dort Motor Co., 242 4th St. Estimated cost, $40,000. Noted Sept. 29.

Wis., Milwaukee—Hanson & Phillips, Kinnickinnic Ave. and Logan St., are receiving bids for the construction of a 1 story, 100 x 100 ft. garage on Kinnickinnic Ave. Estimated cost, $40,000. Private plans.

WEST OF THE MISSISSIPPI

Mo., St. Louis—The United Railway Co., c/o A. Perkins, Mgr., 39th St. and Park Ave., is having plans prepared for the construction of a 3 story office and repair shop on Taylor St. and Bway. Estimated cost, $160,000. A. M. Arhelger, care of owner, Archt.

Neb., Omaha—The Billinger Dental Co., c/o B. P. Billings, Mgr., 17th and Douglas Sts. is having plans prepared for the construction of a 3 story, 50 x 108 ft. factory at 1804 Capitol Ave., for the manufacture of dental supplies. Estimated cost, $80,000. C. W. Steinbough, Brandies Theater Bldg., Archts.

CANADA

Ont., Toronto—The Bd. Educ., 155 College St., will soon award the contract for the construction of a 1 and 3 story technical school in Riverdale. Estimated cost, $800,000.

General Manufacturing

NEW ENGLAND STATES

Mass., Somerville—Masury-Young Co., 196 Milk St., Boston, has awarded the contract for the construction of a 3 story, 36 x 75 ft. oil testing and storage building on Rollins St. Estimated cost, $40,000.

MIDDLE ATLANTIC STATES

N. Y., Utica—The State Hospital Comn., Albany, will soon receive bids for the construction of a 70 x 110 ft. cold storage building. Estimated cost, $130,000.

Pa., Allentown—The M. & G. Co. has awarded the contract for the construction of a 3 story, 134 x 156 ft. and a 2 story, 50 x 112 ft. ice cream factory. Estimated cost, $500,000.

Pa. Johnstown—Peris Soap Products Co., South Sheridan St., plans to build a 3 story, 80 x 320 ft. soap factory on South Sheridan St. Estimated cost, $150,000.

Pa., Philadelphia—O. Nebel, 3860 Coral St., has awarded the contract for the construction of a 3 story, 58 x 215 ft. knitting mill on 5th and Cortland Sts. About $100,000.

Pa., Pittsburg—Fried & Reineman Packing Co., 1314 Spring Garden Ave., has awarded the contract for the construction of a 2 story, 40 x 70 ft. packing plant. Estimated cost, $50,000.

Pa., Wilkes Barre—Hess-Goldsmith, 239 4th Ave., New York City, has awarded the contract for the construction of a 1 story silk mill on Ash St. and Darsey Lane. Estimated cost $165,000.

SOUTHERN STATES

N. C., Raleigh—R. S. Busbee, chn. State School for Blind, will receive bids until Oct. 25 for the construction of a group of buildings including laundry, etc., on the campus. Estimated cost, $200,000. J. A. Salter, Commercial Bank Bldg., Archt.

MIDDLE WEST STATES

Mich., Grand Rapids—The Grand Rapids Show Case Co., Ottawa Ave. and Coldbrook St., N.W., has had plans prepared for the construction of a 5 story, 102 x 132 ft. factory for the manufacture of show cases. Estimated cost $75,000. H. L. Mead, Grand Rapids, Archt.

O., Cleveland — The Snearer Furniture Co., 10022 Euclid Ave., has awarded the contract for the construction of a 2 story, 30 x 32 ft. addition to its factory. Estimated cost, $15,000.

O., Piqua—The Valdecker Packing Co., Piqua, is receiving bids for the construction of a 2 story, 29 x 49 ft. addition to its packing plant. Estimated cost, $40,000. Anders & Reimers, Erie Bldg., Cleveland, Archts. and Engrs.

Ohio, Uhrichsville—Uhrichsville Knitting Mills Co. has awarded the contract for the construction of a factory at junction of Pennsylvania R.R. company's property and North Water St. Estimated cost $35,650.

Wis., Merrill—The Merrill Wood Products Co., Merrill plans to build a 2 and 3 story, 60 x 100 ft. woodworking factory on Main St. Estimated cost, $50,000. Architect not selected.

Wis., Peshtigo—J. L. Chudacoff plans to build a 2 story, 60 x 115 ft. knitting mill on Thompson St. Estimated cost, $75,000. Architect not selected.

Wis., Wausau—The Bd. Educ., c/o S. B. Tobrey, Supt., plans to build a 4 story, 60 x 200 ft. central school, including a vocational department, on Main St. Estimated cost, $200,000. Architect not selected.

WEST OF THE MISSISSIPPI

Ia., Ottumwa—J. Morrell & Co., Ottumwa, (pork packers) is having plans prepared for the construction of a 4 story, 102 x 182 ft. plant and a 4 story, 52 x 55 ft. smokehouse. Estimated cost, $500,000. Henschein & McLarsen, 37 West Van Buren St., Chicago, Ill., Archts.

Mo., St. Louis—The Polar Wave Ice & Fuel Co., c/o T. C. Muckermon, Pres., Grand and Olive Sts., is having plans prepared for the construction of a 2 story ice plant on Gravois Ave. and Deoolsey St. About $50,000. H. G. Clymer, Wainwright Bldg., Archt.

Mo., Kansas City—The City Ice Co., 21st and Campbell Sts., will soon award the contract for the construction of a 42 x 80 ft. ice plant on 20th and Washington Sts. Estimated cost, $75,000. G. Carmen, Gumbell Bldg., Archt.

American Machinist

Volume 55 NEW YORK, OCTOBER 20, 1921 Number 16

Automotive Service Methods and Equipment

I. Tools and Methods in Use at New York Packard Service Plant—Testing Fixtures—Special Reamers and Other Tools—"Maximum Estimate" System

BY HOWARD CAMPBELL
Western Editor, *American Machinist*

WHILE the problem of manufacturing automobiles, both cars and trucks, presents a manufacturing problem which is taken care of when the best equipment available is either purchased or built and installed, the repairing or "servicing" of these cars and trucks presents an entirely different problem. Not only are the repairs which have to be made never-ending in variety, many calling for special treatment, but the equipment for taking care of these repairs must be adaptable for use on as many different kinds of units as possible, on as many different kinds of work as possible, and take up as little room as possible. Consequently, a number of ingenious tools and fixtures have been developed for doing the various jobs which are peculiar to service work.

RE-BORING VALVE SEATS

The service station of the Packard Motor Car Co., at Long Island City, N. Y., includes in its equipment a number of interesting and efficient tools, one of which is for the re-boring of valve seats in cylinders. At *A* in Fig. 1 is the roughing tool for valve-seating Twin-Six cylinders. The long pilot is inserted in the valve stem hole and the tool is turned with a tap-wrench. The tool is made with a single blade, ground to cut at both ends. The finishing tool *B* is an eighteen-blade cutter and is turned by hand, as only a fine cut is taken at the finish. At *C* is shown the tool used for re-seating the valves in truck motors. This is also a multi-blade tool, and is so designed that mechanical pressure may be applied, thus making for uniform pressure on all blades, and relieving the operator from the strain of bearing down on the tool with his weight. The method of feeding the tool is as follows:

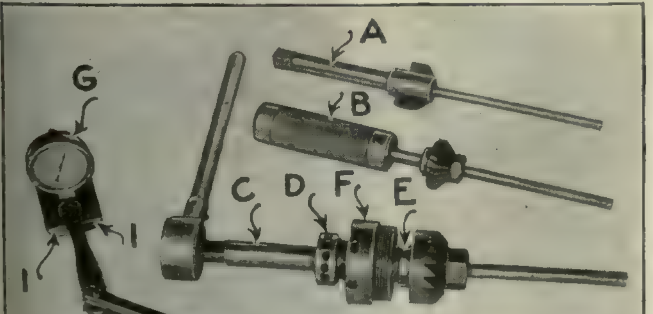


FIG. 1. MISCELLANEOUS SERVICE TOOLS

The shank of the tool passes through the part *D* which is threaded and screws into the part *F*, resting against the shoulder *E*. Part *F* screws into the valve plug hole. Thus it will be seen that in order to set the tool the pilot is first inserted in the valve stem hole with the tool resting in the valve seat. Then part *F* is screwed into the valve plug hole and part *D* is screwed into part *F* until the end rests against the shoulder *E* as shown. The tool is fed down, as required, by screwing part *D* farther down into *F*. The tool is turned with a ratchet wrench which may be used either way.

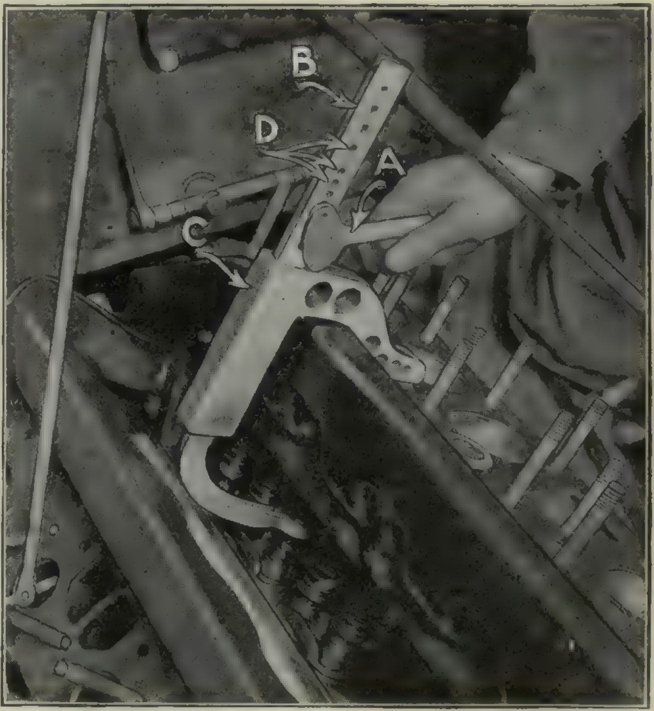


FIG. 2. TOOL FOR ASSEMBLING VALVE SPRINGS TO MOTORS

At *G* in Fig. 1 is shown a dial indicator for gaging cylinder bores. The indicator is fastened to a block which has a bearing at *H*, this bearing being turned to the radius of the cylinder bores. Upon being slid into the cylinder bore, the dial registers 0 if the cylinder is exactly to size, the oversize and undersize spots registering in thousandths of an inch on the dial, which is so turned that it can be easily seen by the operator.

In Fig. 2 is shown a device for lifting valve-springs and holding them while the operator either assembles or removes the collar and pin which holds the spring

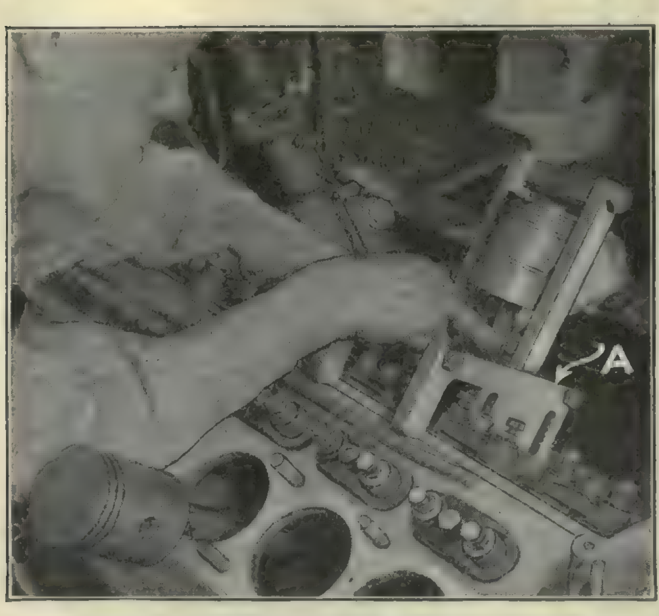


FIG. 3. CONNECTING ROD TEST FIXTURES

in place. The operation of this tool is obvious. When the handle of the cam lever *A* is parallel with the part *B* to which it is attached, the part *C* has room to slide far enough so that the tool may be placed in position as shown. The lower end of *B* is forked so that it will engage the end of the spring on either side of the valve stem. After being placed in position the cam lever *A* is forced down as shown in the illustration, compressing the spring and holding it until released. The tool can be adjusted to fit different sizes of cylinders by pinning the cam lever through any one of the several holes shown at *D*.

GAGING CONNECTING RODS FOR RE-ALIGNMENT

Fig. 3 shows a gage used for determining the amount of straightening necessary to re-align the connecting rod. Part *A*, which is relieved to fit over the parts assembled to the top of the crankcase, rests on the top of the crankcase and the crankshaft is turned so that the piston protrudes as far as possible. A clearance of 3/64 in. is provided at either side of the piston, which is just enough so that if the piston is not in perfect alignment, it can be seen immediately and the usual method of straightening applied.

The last operation in the fitting of a new crankshaft bearing in a connecting rod is that of reaming the bearing to size. This is done with the fixture shown in Fig. 4. The bearings usually have about 0.030 in. of metal to be removed, although this varies with the size of the crankshaft to which the rod is to be assembled. Therefore the crankshaft is gaged with the micrometer, and the reamer, which is adjustable, set to size accordingly. The pin through the small end on the rod holds the rod to the correct center distance and assures that the two holes will be parallel. The fixture is held in a vise on the bench and the reamer is turned with a wrench.

ALIGN REAMING MAIN BEARINGS

Frequently a crankcase has to be fitted with a complete new set of main bearings. These bearings contain about 1/16 in. of metal that has to be reamed out and all of the bearings have to be reamed in line. Not only this, but frequently they have to be reamed out of the original center in order to bring the gear centers in correct relation to each other, due to the wearing of the gears or bearings, or the replacement of a gear with a new one. The tool used for this operation is the Martell reamer, a commercial article of unique design, shown in Fig. 5. The alignment of the reamer bar *A* is obtained by means of several supporting bushings *B*, each consisting of two eccentric bushings held in a conical sleeve, the conical portion of which is provided with a fine pitch thread as shown at *A* in Fig. 6. These conical sleeves are screwed into the soft metal of the bearings to be reamed and the eccentric bushings adjusted until the reamer bar is in the desired position and perfectly aligned through all bearings. Then the reamer head is clamped at the desired location on the reamer bar and the bearings are reamed, one at a time, always keeping at least two of the conical sleeves in place to support the reamer bar. The eccentric bushings are controlled by the flanges *B* (Fig. 6), which is the outer bushing, and *C* which is the inner bushing. A vernier graduation on the faces of the flanges shows in thousandths of an inch the relation of the reamer bar to the bore of the conical sleeve. The screws *D* are lock screws which hold the bushings in place after setting. The reamer is secured to the shaft by the clamping nut shown at *C* in Fig. 5, which screws on to the tapered end of the reamer head. The reamer head is slotted lengthwise of the tapered and threaded portion, so that it compresses as the clamping nut is screwed on. Thus the reamer can be firmly fixed at any place desired on the shaft. The operation of reaming out the bearings, as shown in Fig. 5, is as follows: The operator screws the nose of the three cone bushings into the three bearings as shown, Nos. 2 and 3 on the front side, and the No. 1 on the back side. He then adjusts the eccentric sleeves until the reamer bar will slide easily through all three bushings. The sleeves are then locked in position and the first bearing reamed, being guided by bushing No. 1. By the time the reamer is far enough

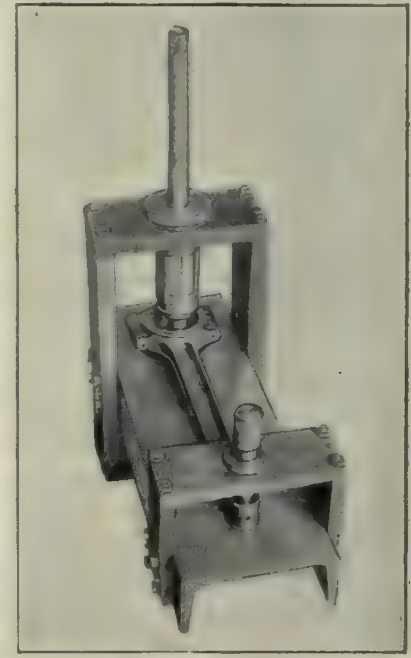


FIG. 4. REAMING FIXTURE FOR CONNECTING RODS

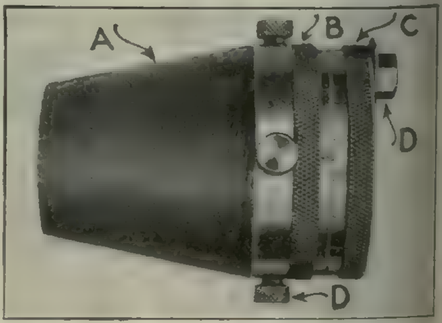


FIG. 6. CONICAL SLEEVE USED ON MARTELL REAMER

through to strike the bushing, it is in far enough to guide itself and the bushing can be removed. The same process is then followed on the other bearings, the reamer shaft always being kept in alignment by cone bushings in all bearings excepting where the reamer is working. By this method a complete set of bearings can be reamed so as to shift the center in any direction desired, thus making it possible to change the relation of gear centers, etc. The reamer is of the inserted blade type, the blades being expanded by means of adjusting nuts at either end which act on tapered cams.

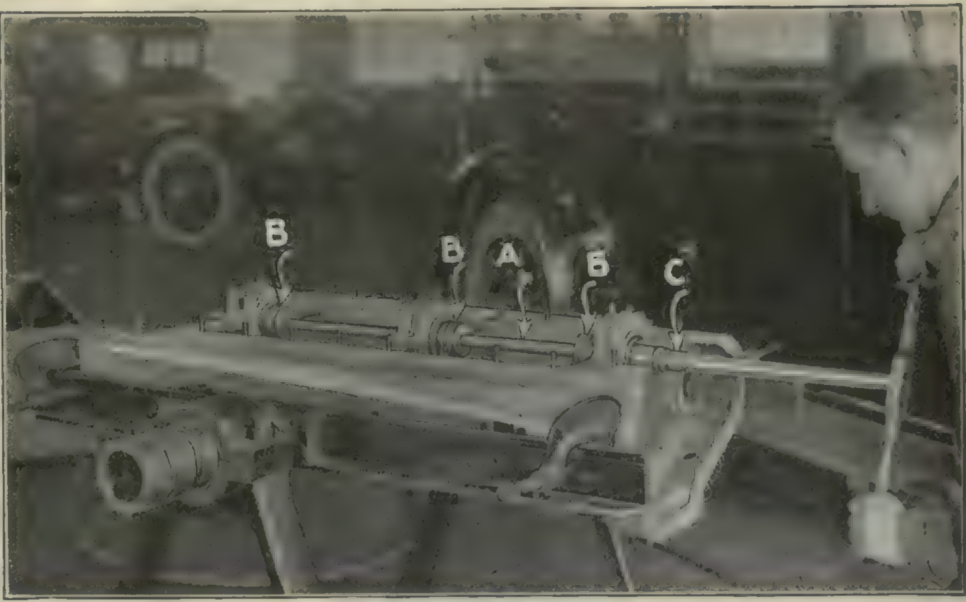


FIG. 5. ALIGN-REAMING MAIN BEARINGS

A tool that is almost indispensable in the service station is the gap lathe, one of which is shown in Fig. 7. In this instance the operator is boring out a brake drum which could not be swung in a medium-sized lathe of the usual type. The gap lathe will handle work that otherwise would require a very large lathe, expensive as to cost, requiring a greater amount of power and occupying room which could often be used to much better advantage in other ways.

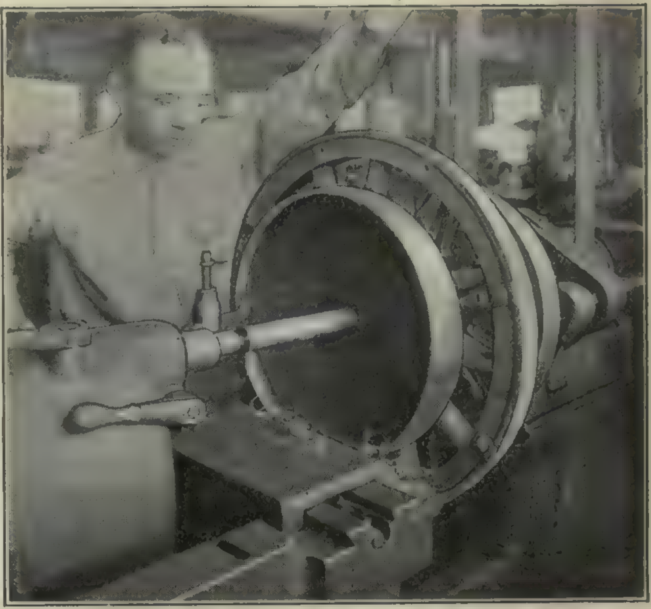


FIG. 7. THE GAP LATHE IN SERVICE WORK

Eliminating Play in Steering Gear

An ingenious method of eliminating play in the steering gear is shown in Fig. 8. Some of the older types of Packard cars were so designed that no provision was made for this contingency, with the result that the service men had to devise a method of correcting the evil. At *A* is shown the steering gear shaft on which a spiral thread is cut at *B*, running through the bronze nut *C*. The action of turning the shaft causes the nut to traverse the length of the spiral, turning the shaft *D*. At *E* is shown a series of collars cut on the shaft with corresponding grooves cut in the bronze steering gear case. These collars and grooves were designed to take the thrust caused by the turning of the shaft in the nut, with the result that the grooves wear, allowing the shaft to "shuck" up and down in the case. This wear is taken up in the following manner: The shaft is turned about $\frac{1}{32}$ in. undersize at *F*, and a collar *G* is made, being $1\frac{5}{8}$ in. O. D. and bored just large enough to slip over the shaft. Then it is threaded, 16 threads to the inch, and grooves are milled in it lengthwise as shown. It is then slipped on to the shaft and brazed in the position shown, leaving just enough room for the thrust bearing *H*, which consists of two brass thrust washers and a steel ball retainer.

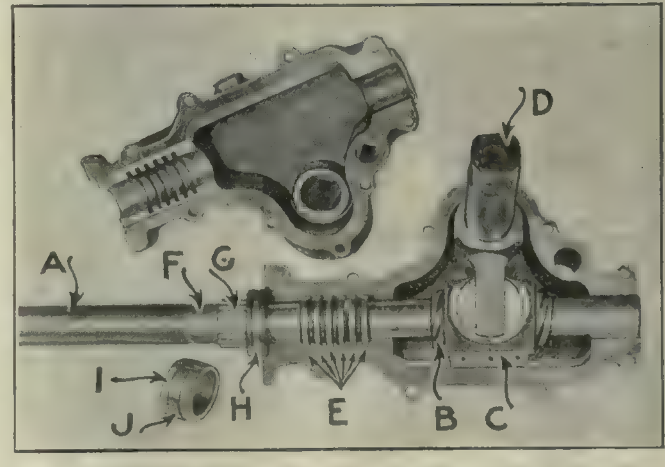


FIG. 8. STEERING GEAR WITH "HOME-MADE" ADJUSTING NUT TO ELIMINATE PLAY

A collar or nut *I* is now made, threaded inside to fit the part *G*, and having slots milled lengthwise on the outside so that it may be turned with the aid of a screwdriver. Several holes are drilled in it, all being in a circle equi-distant from the end and about half an inch apart. A spring *J* is made, having a pin in one end which fits into one of these holes. The thrust bearing is now put on to the shaft and the nut *I* is screwed on to the part *G* until it is quite tight against the thrust bearing, the spring *J* being slipped on to the nut so that the pin projects through one of the holes and into one of the slots in the collar *G*. Thus the wear is all taken up in one direction and as fast as the mechanism wears appreciably the spring-pin is pried out of the hole, the nut is given part of a turn with a screwdriver or other tool, and the spring pin is slipped into a hole again, engaging a slot in the collar and preventing the nut from working either way. As can be seen, the slots are quite close together, but more than one hole is drilled in the nut to insure having at least one pin-hole over a slot.

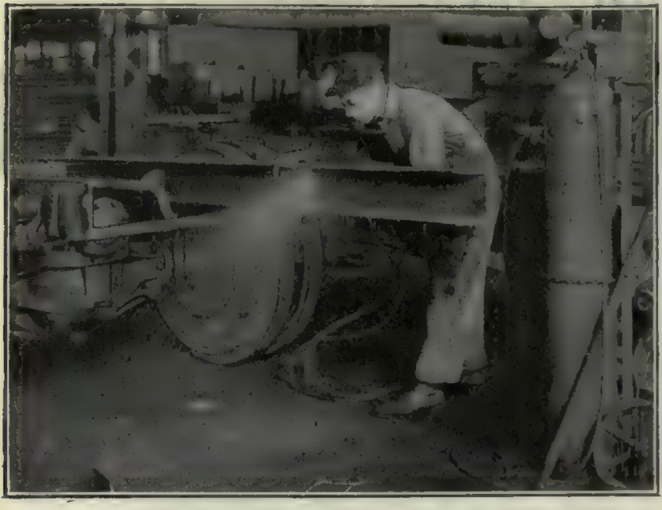


FIG. 9. CUTTING OFF A STEEL FRAME WITH THE ACETYLENE TORCH

CUTTING OFF A FRAME

The use of the acetylene torch to cut off a steel truck frame is shown in Fig. 9. In this instance the purchaser of the truck intended to fit it with a special dump-body, which required a shorter frame than the one furnished, so the frame was cut off to the desired length and the usual end section riveted on. The layout man marks off the place where the frame is to be cut, then the torch operator clamps a steel block to the frame with one edge of the block parallel to and resting on the line. This is to guide the "nose" of his torch, as the line cannot be seen when the torch is burning. A complete frame, which is of 7-in. angle steel, can be cut off in less than ten minutes. After the piece has been severed from the frame, the operator trims the edge of the section with the torch, making the edge fairly smooth and ready for the end piece to be riveted on.

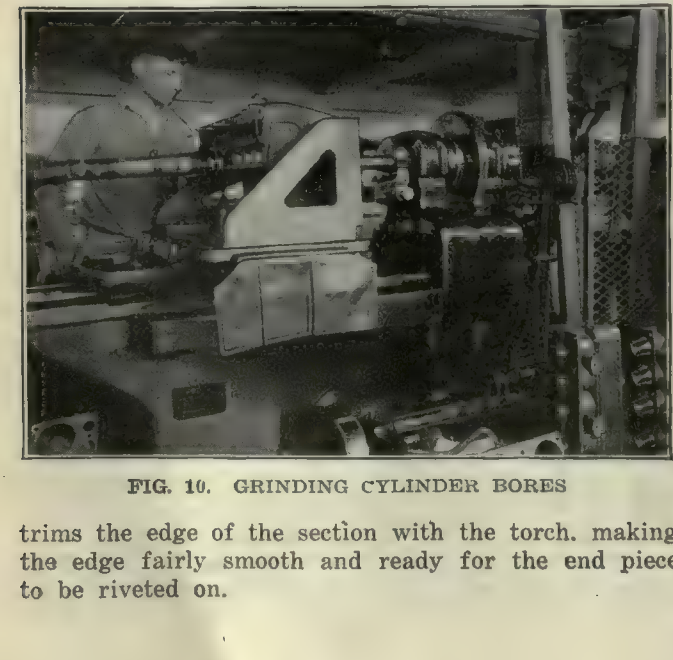


FIG. 10. GRINDING CYLINDER BORES

Cylinders that are badly worn or "scored" are ground oversize and fitted with pistons ground for this purpose. The oversize dimensions are 0.020 and 0.040 in. larger than the standard size of the cylinder. Pistons supplied from the factory for service work are ground to these sizes. The fixture used for holding the cylinder while it is being ground, is a large angle plate as shown at *A* in Fig. 10. The front of the fixture has openings so that the spindle of the grinder can be inserted into the cylinder bore, and the block is located on pins by the same holes by which it was located when the bores were originally bored and ground. The cylinder is clamped to the fixture in the position shown, resting on jacks, one of which shows at *B*. At *C* is shown a set of six locating blocks or stops which save time in locating the cylinder for the various bores. Each block is about an inch wide, and has a line across the center of it, parallel with the spindle of the machine. On the table of the machine at *D* is a stationary perpendicular block bearing a similar line. When the table is shifted so that the line on any one of the blocks *C* coincides with the line on block *D*, one bore is exactly central with the spindle. Thus no time is lost in lining up the different bores with the spindle.

"MAXIMUM ESTIMATE" SYSTEM

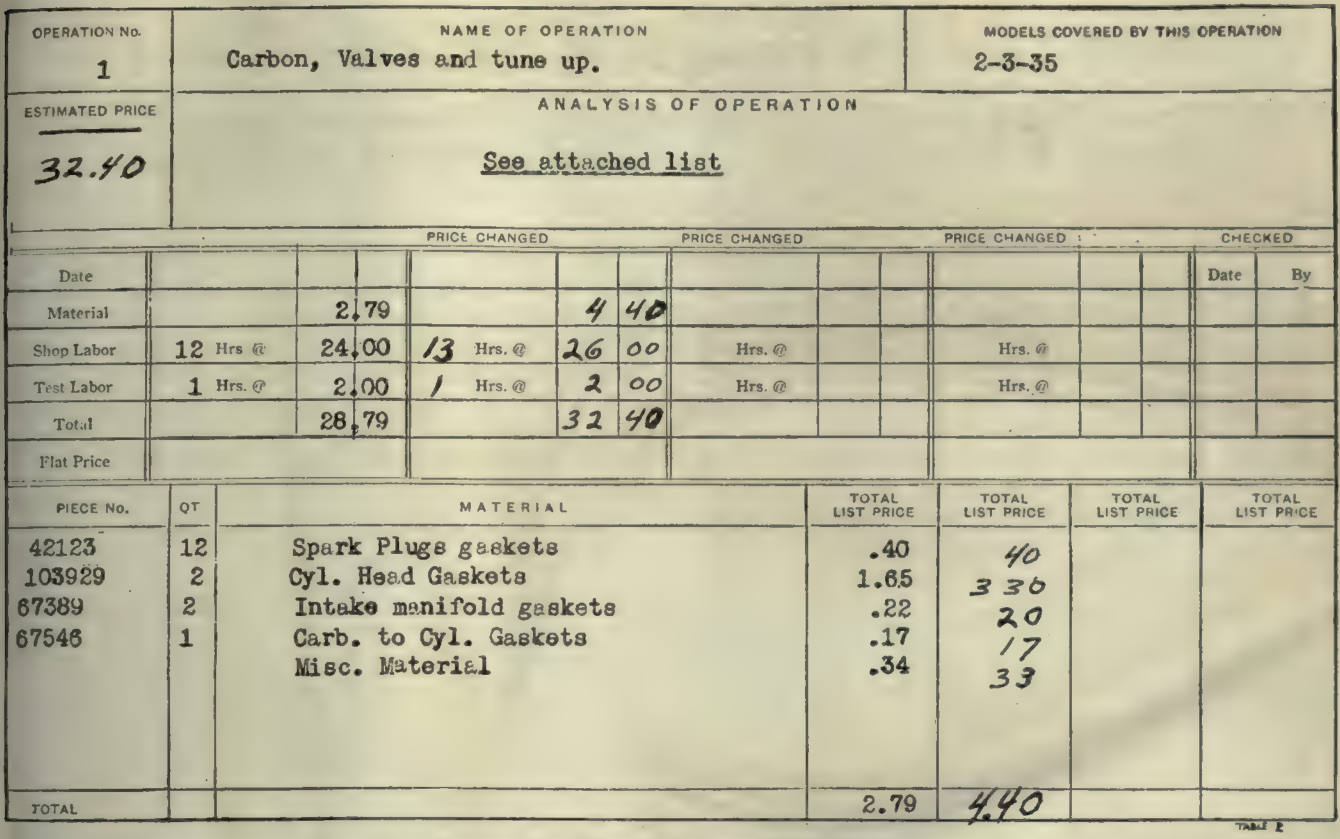
A unique feature of Packard service is that of giving the customer a maximum estimate in advance on the cost of the work that is to be done. Every car owner has had the experience of taking his car to the repair shop assuming that certain repairs which are obvious to him are all that are needed to put the car in first-class shape. Frequently, the workman or inspector discovers that the job requires a great deal more time and material than was apparent, with the result that the customer is both surprised and dissatisfied with the amount of his bill.

TABLE I. SHOWING LIST OF OPERATIONS AND PRICES

Operation	Models 2–38	3–38	4–5–48	1–25	2–25	3–25
1 Carbon valves, tune up	29.98	29.98	29.98	41.00	32.40	32.40
2 Rebored cyls.	260.29	263.65	265.12	326.27	316.34	316.34
3 Supply and attach new cyl. (2)	493.59	493.59	496.77	562.11	563.61	563.61
4 Supply and attach new cyl. (1)	261.13	261.68	280.77	308.74	316.27	316.27
5 Rebored cyls. (off car) exchange and fitted.	......	......	131.98	162.50	162.50	162.50
6 Rebored cyls. (off car) exchange, no fitting	78.00	78.00	78.00	96.00	96.00	96.00
7 Replace chain	......	......	......	31.41	26.41	26.41
8 Tighten chain only	......	......	......	14.66	1.00	1.00
9 Tighten chain and retime	......	......	......	15.66	9.22	9.22
10 Scrape carbon and tune up	14.05	14.05	14.05	23.50	25.22	25.22

Under the Packard system, the amount of labor and material necessary for each individual operation has been carefully recorded and the cost figured, so that an estimate of the cost of his service can be furnished to the car-owner before the work is started. If he specifies that certain labor be performed, such as taking up the bearings, or adjusting the brakes, he is told immediately what the maximum cost is for this job. If he wants the motor overhauled or asks that the car be "put in good condition," an inspection is made at once, the various requirements noted and a maximum estimated cost is rendered. This estimate may not be the actual cost, because if less time or material is required than the estimate called for, the customer is given the benefit of the saving, while if it exceeds the estimate, the company stands the loss.

Every definite operation in car repairing is numbered and recorded together with the estimated cost of the operation as applied to each model of car or truck.



OPERATION No.	NAME OF OPERATION	MODELS COVERED BY THIS OPERATION
1	Carbon, Valves and tune up.	2-3-35
ESTIMATED PRICE 32.40	ANALYSIS OF OPERATION See attached list	

				PRICE CHANGED			PRICE CHANGED			PRICE CHANGED			CHECKED	
Date													Date	By
Material		2	79		4	40								
Shop Labor	12 Hrs @	24	00	13 Hrs. @	26	00	Hrs. @			Hrs. @				
Test Labor	1 Hrs. @	2	00	1 Hrs. @	2	00	Hrs. @			Hrs. @				
Total		28	79		32	40								
Flat Price														

PIECE No.	QT	MATERIAL	TOTAL LIST PRICE	TOTAL LIST PRICE	TOTAL LIST PRICE	TOTAL LIST PRICE
42123	12	Spark Plugs gaskets	.40	40		
103929	2	Cyl. Head Gaskets	1.65	3 30		
67389	2	Intake manifold gaskets	.22	20		
67546	1	Carb. to Cyl. Gaskets	.17	17		
		Misc. Material	.34	33		
TOTAL			2.79	4.40		

TABLE 2

TABLE II. OPERATION ANALYSIS CARD

One of these operation sheets is shown in Table I. Table II is an operation analysis card, on the front side of which (*A*) is recorded the name of the operation, the name of the parts required together with the number of pieces and Part No. of each, the number of hours of labor required, and the cost of both labor and materials, all of which comprise the estimated price of the job.

On the back side of the card (*B*) are listed all the various jobs that are included in this operation, so that the operation will always include the same amount of work and no part of the operation will be omitted. The customer may also know at once just what will be done to his car, as well as the maximum cost.

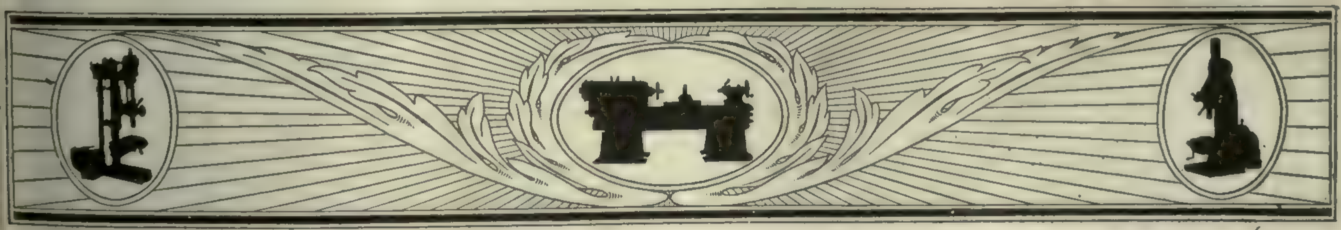
Auto Show at The Hague

Announcement is made that the same committee which organized and managed the successful automobile show at The Hague in April of the present year is to organize and manage a second show, which will be held from the 1st to the 15th of May, 1922, according to a report from Consul General Anderson, at Rotterdam. The show next spring will be held in the Kurhaus, at Scheveningen, the seaside resort near The Hague, and it will be arranged to have the leading hotels and cafés of the resort opened at the time. In connection with the show there will be an exhibition of airplanes and automobile boats with demonstrations. The temporary office of the secretary of the exposition has been established at No. 185 Spui, The Hague.

Electrical Developments in China

Four electrical undertakings, the *Far Eastern Review* reports, have recently been registered with the Chinese Ministry of Agriculture and Commerce, namely, the Shou-shing Telephone Co., Shou-shing, Chekiang; the Jui-An Electric Light Plant; Sui-an, Chekiang; the Chowshan Electric Co., Chowshan, Chekiang; and the Sun Fong Electric Co., Kiangsu. Other electric companies that have been organized are the Yau Tai Electric Light Co., at Tai Hsin, Kiangsu, and the Sing Yang Electric Light Co., of Sing Yang, Honan.

The same publication also states that Chen Yi-hee, president and organizer of the Sunning Railway, expects to organize a company with $2,000,000 capital to develop a water-power project near the town of Sunning. As was the case in the construction of the Sunning Railway, it is proposed to secure the money for this water-power enterprise from former residents of the Sunning district who are now living in the United States. As soon as the necessary capital has been fully subscribed, it is planned that contracts for the equipment will be placed immediately.



Notes on the Design of Shaving Tools

Blanked Pieces of Sheet Metal Have Rough Edges—Second Operation Necessary to Insure Accuracy of Size and Contour—Three General Classes of Shaving Tools

By HUGO F. PUSEP

THERE is no branch of the interchangeable system of manufacture, the development of which opens a wider field of possibilities to the tool engineer than that of punch press tools. The subject, however, is so vast that in order to approach it in a comprehensive manner one must limit himself to the discussion of one particular branch at a time.

Shaving dies present great possibilities in the way of reducing the cost of manufacture in certain specific lines, and are being taken advantage of more and more; but the field is yet comparatively new. Having in mind the immense advantages to be derived from a further application of the principle, I have in this article gone into the subject of shaving dies in a systematic manner, showing some of the principles upon which shaving die design is based. I have endeavored to make my sketches simple in order to bring out the main idea clearly at first glance. The table of shaving allowances worked out upon a "percentage thickness of stock" basis, is, to the best of my knowledge, the first attempt to present such material in a convenient form.

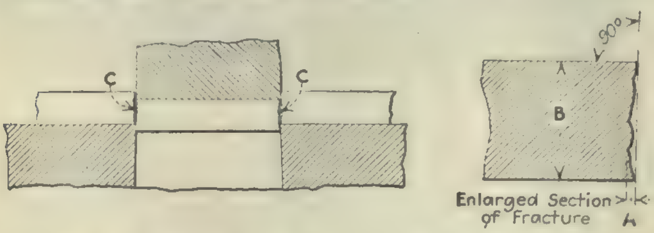


FIG. 1. ACTION OF BLANKING PUNCH AND DIE

Purpose of the Shaving Die

The term "punch and die," in the ordinary sense of the expression, conveys to one the idea of a rather approximate sized hole or blank in sheet metal in which the accuracy of contour is left more or less to chance. That this is not the case is well known in certain specialized industries, such as the manufacture of typewriters, adding-machines, watches, etc., in which success depends upon the production to extremely close limits of a multitude of small, intricate parts of sheet metal.

This accuracy is made possible by that class of dies known as shaving dies. A shaving operation bears the same relation to the shaved blank as does the grinding operation to a rough-turned shaft. Both are intended to produce accuracy and finish in their respective fields.

The shaving die is a carefully designed and constructed set of tools made for the purpose of taking a finishing cut on the contour of a blank; either on the outer edges or in a pierced hole. This finishing cut takes the shape of a thin shaving in comparison to the thickness of the blank; hence the term "shaving dies." It might be argued that, as the results from shaving dies are obtained by careful and accurate construction of the tools, the same results could have been gotten from the original blanking dies by exercising the same care in making them. For answer let us consider the action of a blanking die.

The diagram in Fig. 1 serves to illustrate what takes place when a punch is being forced through a piece of sheet-metal stock against the edges of a blanking die. The pressure exerted by the punch is greater than the shearing strength of the stock; therefore a fracture occurs, corresponding in outline to the punch. The slug, or punching, continues to be pushed downward by the descending punch and is finally detached from the stock.

Edges of Parts From Blanking Die Are Torn and Uneven

If we now carefully examine the edges of this punching as shown in the enlarged section of the fracture we discover that they are comparatively rough and uneven. By drawing a line at 90 deg. from either surface of the blank it will be seen that the edges represent a series of depressions, some deeper than others, resembling in appearance a badly torn surface.

When two or more blanks of different thicknesses are examined and compared, we discover this interesting fact, that the thicker the stock being punched the rougher and deeper the imperfections around the contour of the blank. In other words, the depth *A* bears a definite relation to the thickness *B* of the blank.

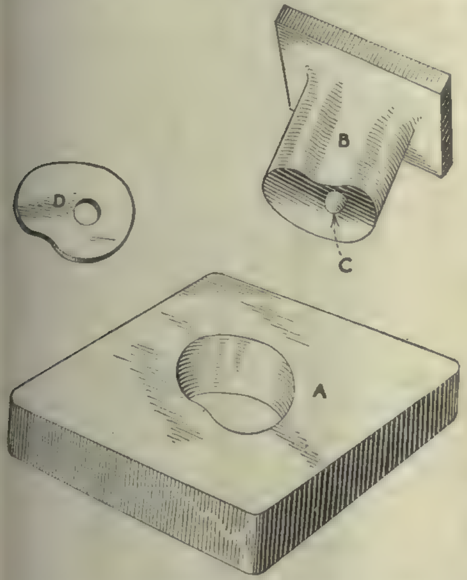
We are thus enabled to see what takes place when the stock is giving away under the pressure of the punch. A fracture of metal occurs along the lines *C C* made uneven by the variation in the structure of the metal. As these uneven edges pass each other, they cause more tearing and displacement. The punch, in following the blank through the stock, will force in, or cut off, the higher projections, causing the hole in the stock to take the same size and outline as the punch. The blank being pushed through the die will take the outline and dimensions of the die for the same reason. That is the reason in a technical sense why the punch will govern the size of the hole and the die that of the blank.

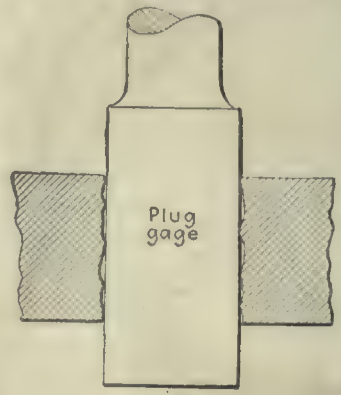
Sizes Obtained by Blanking Methods Not Dependable

This, however, is true only in a general way, as will be seen on examining Fig. 2, where the plug gage is held in a punched hole by a number of uneven projections; only a small percentage of the surface of this hole being in contact with the periphery of the gage. Such a hole may be a good push fit for the gage at a first trial or so, but were the trial to be repeated a number of times the feel of the gage will become looser as the higher ridges around the circumference of the hole become smoothed by its passage. Were this hole to serve as a fulcrum point for some intricate mechanical movement the accuracy of the machine would, indeed, be short lived.

The modern designer specifies shaving operations wherever a smooth, accurate hole or contour is desired in a sheet-metal part. Any shape of hole or contour can be successfully finished by shaving. As regards limits in the thickness of stock for shaving, it is general practice not to shave stock thinner than 0.020 in.; the break in stock up to this thickness usually being smooth enough for all practical purposes. On the other hand it is quite practical to shave stock $\frac{3}{8}$ in. thick. In many shops where shaving dies are now extensively used it had been the usual custom, if the blank was thicker than $\frac{3}{16}$ in., to ream all accurate holes and mill the particular parts of the outline to size. This practice is fast going out of favor—the shaving die taking the place of the reamer and milling cutter—resulting in the saving of thousands of dollars to the manufacturers.

Shaving dies may be roughly divided into two classes: Dies for shaving the blank all around; and dies for shaving only a part of the contour. Dies of the former class can be further subdivided into groups according to construction and the kind of service for which they are made. Thus we have the "push through" type; the "spring pad," and the "compound" shaving die.





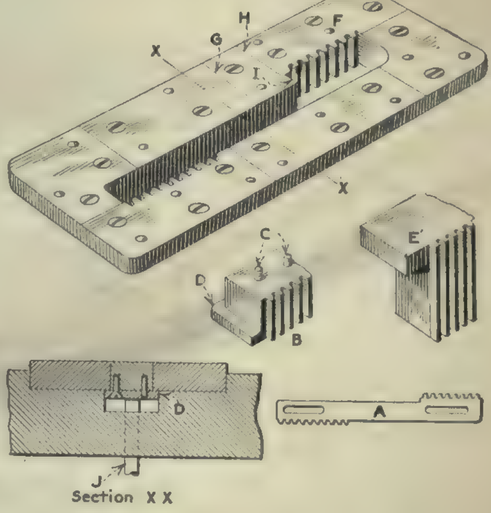


FIG. 2. (ABOVE) SHOWING INSUFFICIENCY OF BEARING SURFACE. FIG. 3. (LEFT) A COMMON FORM OF PUSH THROUGH DIE. FIG. 4. (RIGHT) THE SPRING-PAD TYPE OF SHAVING DIE

It is very often the case that a blank having a central hole that is not subject to wear, must have the periphery very smooth and accurate. A gear blank with a hub riveted into the central hole must have the teeth accurately formed. In this particular instance the hole in the center serves only for the reception of the hub and need not be shaved. This is where the push through type of shaving die can be used to advantage. The principal points in construction of such a die are shown in Fig. 3, and consist of the die *A*, the punch *B* and the pilot *C*. In this die the cam blank *D* is to be shaved all around.

The blank is located over the opening of the die by suitable locators and when the punch descends, the pilot *C* in entering the hole in the blank will line it up and push it into the die opening, shaving off the oversize allowance around the blank and leaving the contour of the cam smoothly finished and accurate to size. The next blank will push the one already in the die further down, and so on till the finished blanks begin to drop through the die at each stroke of the press.

There is only one objection to this type of shaving die, and it is that a slight amount of draft must be allowed in the die opening for the successful push through of the blanks. This feature will result in the blanks coming slightly oversize after a number of regrindings, and is the only point against this useful class of dies for very accurate work.

As will appear from the sketch, the construction of this die resembles closely that of a blanking die. These dies are very rapid in action, it being necessary only to insert the blanks, the push through feature taking care of the rest. As a general rule, however, this type of die is suitable only for such blanks as have a central hole and a comparatively symmetrical outline.

For long blanks that are to be shaved all around, the spring pad type of shaving die is often used. It is to be preferred to the push through type, as with it a greater degree of accuracy is attainable. The reason for this is that, as the blank is pushed up out of the die immediately after shaving, the sides of the die opening can be left perfectly square with the top and consequently no amount of regrinding will affect the size of the shaved blank.

In Fig. 4 is shown in perspective the top view of a spring pad shaving die for the rack shown at *A*. This view shows the die without the spring pad. As the rack blank is rather long, and also to facilitate cutting the teeth in the die, the latter is made up of several sections screwed and doweled to a cast-iron die-shoe. A pocket is milled out in the die-shoe for the sections to fit into as clearly shown in the section 20. There is also a deeper pocket provided at the center as a working space for the spring pad.

One end of the pressure pad is shown at *B* with two pins *C* to enter the slot at one end of the blank. A duplicate of this section being at the other end of the pressure pad, they thus serve to locate the blank by means of the slots. Other methods of locating a blank will be discussed later in this article.

There must necessarily be a flange around the lower part of the pressure pad as shown in partial view at *D* to serve as a limiting stop to the upward travel of the pad. As it would be rather inconvenient to machine it, more especially if the shape of the blank is intricate as in this case, it is good practice to make the stop flange a separate piece, holding it in place by suitable screws and dowels as may be seen in the sectional view. This construction also permits the diemaker to shear the nearly completed pressure pad into the finished die from the top, thus saving much valuable time and effort in fitting.

In designing the punch, which of necessity must have a good solid flange for rigidity, this flange can be left off entirely in places that are difficult to machine, as in the case of the rack teeth section of the punch shown at *E*.

Arrangement of the sections in the die is another important feature to be carefully analyzed by the designer. It will be noticed from the perspective view of the die that the sections comprising the rack teeth are so arranged that they can be easily reached by the cutter. As an example let us consider the section *F:* If this section had been extended to *G*, instead of stopping at *H*, it would have been almost impossible to use the small diameter standard gear cutter for the machining of the rack teeth because of interference of the projecting corner *I* with the milling machine arbor, necessitating the making of a special cutter for this operation. All straight sections should be made long, as shown on the sketch, because in this way they are easily made and, if distorted in hardening, can be quickly corrected on the surface grinding machine.

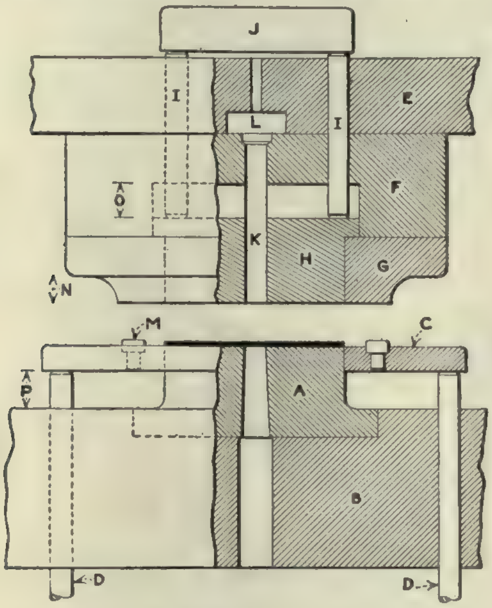


FIG. 5. THE COMPOUND SHAVING DIE

The operation of the spring pad shaving die is quite simple. The punch, being an exact counterpart of the pressure pad and die opening, forces the blank, which is located by the pressure pad, into the shaving die against the spring pressure which is transmitted from below the die through the pins *J* upon which the pressure pad rests. In so doing the surplus stock is shaved off, leaving the blank accurately to size and smooth in finish. The pressure pad pushes the blank out of the die as the punch ascends.

Probably the most efficient of all shaving dies is the compound die. It is possible with this type of die to pierce or shave holes simultaneously with shaving the contour of the blank. The order of placing the punch and die is reversed in the compound die, the punch being held to the lower member, or die-shoe, while the die is fastened securely to the punch holder.

The sketch, Fig. 5, shows a partial section of a typical compound shaving and piercing die. The hardened tool steel shaving punch *A*, which is screwed and doweled to the cast-iron die-shoe *B*, is a snug sliding fit in the machine steel stripper plate *C*. The latter is supported from below on drill rod pressure pins *D*. The upper member consists of a cast-iron punch holder *E*, machine steel sub-die plate *F*, hardened tool steel die *G* and shedder *H;* which latter is a sliding fit in the die opening. The shedder pins *I* are actuated by an ejecter plate *J*, which gets its movement from the knockout rod of the punch press ram from above.

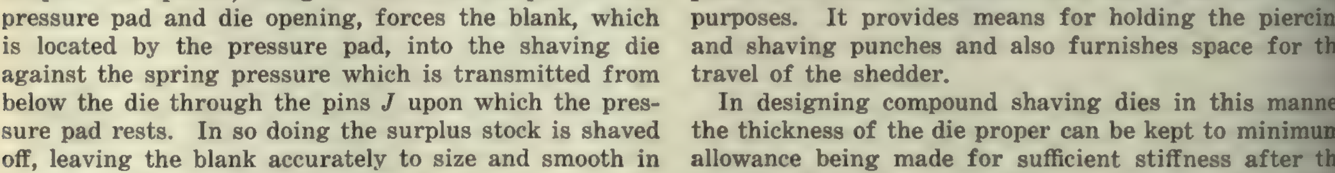
The piercing punch *K* is driven into the subplate *F*, being backed by the hardened steel thrust button *L* in the punch holder, and kept from pulling out by the countersunk head. This construction of a piercing punch, however, is modified for larger sizes and also where the punches are extremely slender. The space available in most cases determines the kind of construction to use. In many large shops where the compound shaving and piercing die is an established institution, a certain standard construction of piercing punch is adhered to and the new designer is instructed in these standards.

In operation, the blank to be shaved is placed on the shaving die *A*; being located correctly by suitable means from the stripper *C*. As the upper member descends, the die *G* comes into cantact with leveling studs *M*, the latter being driven into the stripper plate and ground level with the stock. At this moment the shaving and piercing of the blank begins, the stripper *C* going down with the movement of the die. The slug from the piercing punch is pushed down through the opening in the shaving punch and ultimately drops through the clearance hole in the die-shoe and bolster plate.

After the completion of the shaving operation the blank is carried up with the die *G* until the ejector plate *J* comes in contact with the upper knockout rod, causing the shedder *H*, operated by shedder pins *I*, to eject the finish blank from the die. The sub-die plate *F* is made of machine steel and it serves several purposes. It provides means for holding the piercing and shaving punches and also furnishes space for the travel of the shedder.

In designing compound shaving dies in this manner the thickness of the die proper can be kept to minimum, allowance being made for sufficient stiffness after the shoulder *N* has been ground away in successive grindings of the die. Spaces *O* and *P* should be made equal to *N* plus the thickness of stock to be shaved. Shouldered screws, not shown in the sketch, must be provided for limiting the movement of the stripper.

(To be continued.)



Navigation and Business

Qualifications of Business Managers Should Be as Carefully Scrutinized as Those of Navigators—Functions of Trade Associations

By ERNEST F. DuBRUL
General Manager, National Machine Tool Builders' Association

FROM the earliest dawn of human activity there has been some sort of commerce. Men bartered their products even in the savage and nomadic states of existence. As cities were built some sort of industry flourished. Unfortunately, the history of commerce is almost a sealed book. Historians have probably been of the frame of mind that viewed commerce as something sordid and degrading, so we find history as being more political than anything else.

Babylon, Persia, Chaldea, Egypt, Palestine, Greece, and Rome all had cities of size, and the very existence of cities necessitated commerce to supply their daily wants.

Some of the most important political changes in Rome are known to have been due to pressure of business or economic conditions on certain elements of the population. But as to the every day methods of doing business in Rome we know very little.

We do know, however, that navigation has played an important part in all commerce. Phoenicia, Carthage, Greece and Rome all sent out their ships to bring in products of distant lands, and of course these ships carried the products of the owner countries. At first navigation was simply wild adventure. No maps, no charts, no surveys were available to the first explorers. These developed with the centuries. When the Vikings sailed out to find adventure, without chart or map, a lot of them never came back.

In all ages navigation was backed by business, and as time went on business found it necessary to provide its navigators with charts and maps. At first these were very crude, but in time they were corrected and amplified until now the highly organized coast surveys are even charting the bottom of the ocean. Every rock that is found by a navigator is now spotted on the maps, for the benefit of others, and so navigation is made safer and safer from year to year. Weather observation is a development of very recent times, and storm warnings are given out, so that navigators can lay their plans with greater safety.

No matter how good his maps and charts, a captain has to know how to take his observations, to lay his course from day to day. And he has to know how to run his ship according to many changeable and changing conditions.

Because of the value of human life and the value of property entrusted to a ship captain's care, no one is allowed to take out a ship without passing an examination as to his qualifications, nor without showing by a long apprenticeship that he is actually qualified by experience as well, to be entrusted with the management of a ship. If he passes the examination he gets his license and only then can he take out a ship. Likewise, all the ship's officers and engineers have to have licenses.

Now business finds all this to be good for a mere branch of business—navigation. It recognizes the science as well as the art of navigation. Why should business be so slow in recognizing the science and art of business itself? Why should business men allow all kinds of people to put out a lot of water-logged business concerns to clutter up the channels of business itself? Why should not business men freely report experience and information that will assist in the making of business charts and maps that will plainly show the dangerous rocks on which are wrecked 87 per cent of the businesses launched from day to day?

But business men seemed to prefer the wild adventuring. They didn't want to show exactly the courses they sailed or the dangers they met, because each seemed to think that he had a little island off in the business ocean that he could exploit all by himself, and he didn't want anybody else to know anything about it. He didn't realize for a long time that a lot of other fellows knew as much as he did about ways of getting to that island and when he himself got to it he often found others on the ground—perhaps more than the business of the island really justified.

Some businesses have begun to realize that charts and maps of business will help them, as well as everybody else, and they are now, through various agencies, governmental, individual and associate, contributing business information of general value. They are plotting their past voyages and taking business weather conditions into account in planning their future trips. Some of them are studying the fundamental sciences underlying their businesses and are giving attention to the main science that will better their course—economics.

Some of them recognize the danger to business navigation caused by business craft being operated by incompetent navigators, and through trade associations they better their own methods and help educate their fellow navigators.

Business is learning the generous laws of the sea. It is not so long ago that piracy on the high seas was prevalent, but it dawned on society that piracy was bad for humanity and bad for business, and so piracy was eliminated. In the same way business piracy is being eliminated through various legislative enactments—such as the Sherman Law, the Clayton Act—that keep open the doors of equality of opportunity.

Business is learning the humane and generous lesson of rescue and salvage of business craft in distress. Creditors' committees nowadays find it much better, as well as humane, to keep a business going if possible, rather than to push it onto the rocks of bankruptcy.

If, now, business will demand that, like ship's officers, business officers should be chosen only from among those who know the rules of the road, and the science of business navigation, and from those who have attained their qualifications by study and experience, business will take a long step forward.

The blue-sky laws passed to protect the investor from fraudulent promotions, do not protect the investor from ignorance and incompetence in business management. Not all states have even a blue-sky law. None has a "Corporation Manager's License Law."

A start has been made by licensing public accountants, but this only touches the fringe of business. A license would not be needed for managers of small business, any more than for an oarsman who only rows himself out in his own skiff. But when a business venture is incorporated, and thereby uses the rights and privileges conferred by the state, it is not too much for the state to ask that the corporation provide itself with duly qualified and certified managers who will know how to keep the corporation on a safe business course, and will know how to keep it safe for all those who are embarked in it as well as for all others who may be navigating the seven seas of business.

A Cylinder Milling Fixture

A Double Cylinder Fixture Which Allows Adjustment in Every Direction—Gages for Securing Equal Compression Space

SPECIAL CORRESPONDENCE

THE double milling fixture for handling cylinder blocks of the Peerless eight-cylinder motor has a number of interesting features. The general appearance of the fixture is shown in **Fig. 1.** The cylinder is placed in the fixture resting on the two inclined surfaces *C* and *D*. The clamps *A* and *B* slip into holes left by the water-jacket cores. The ratchet wrench *G* operates the screw shown at *E*, Fig. 2, which holds the end clamping jaw against the cylinder.

Depth gages *F* are placed in both the end cylinder bores. The swinging gage *H* is then moved to both of the depth gages, determining the depth of the cylinder in order to get the distance from the combustion chamber to the bottom flange.

POSITIONING THE CYLINDER

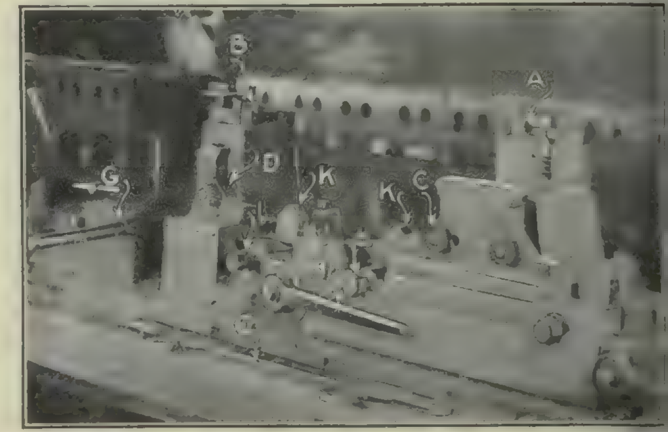
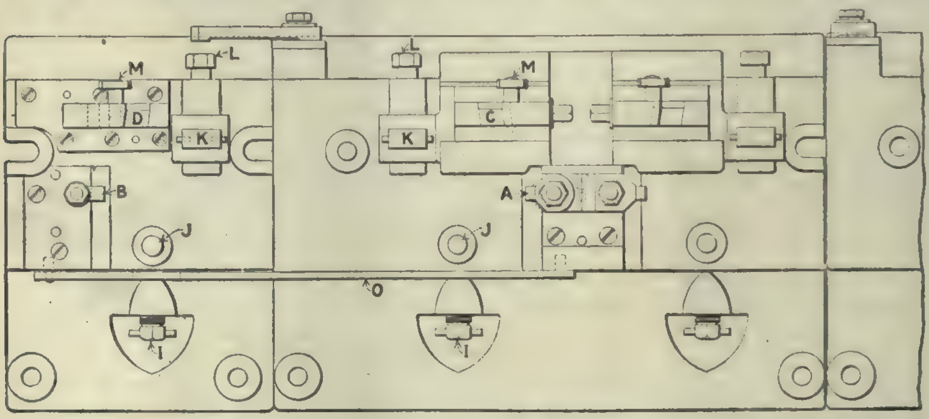


FIG. 1. PEERLESS CYLINDER MILLING FIXTURE

The cylinder is positioned by means of the two clamps *K* and the two screws *L*, which force the cylinder away from the swinging gage *H*. The screws *M* are operated by means of a key-wrench as shown at *N*, and move the cylinder toward the operator if necessary, in order to bring the points *F* into proper relation with the swinging gage *H*, and so determine the proper depth o the combustion chamber in relation to the bottom flange

On the opposite side of the cylinder the target profil gage *O* is used. This gage carries a profile of th two end cylinders and the beading flange. One en of the cylinder block is adjuste by means of two plungers *J* which in turn are actuated b the two screws *I* to lower o raise the cylinder with relatio to the profile gage *O*. The screw *E* is clamped tight with th ratchet wrench when the clamp *A* and *B* are fastened. Th swinging gage *H* is then lowere and the depth gages *F* are re moved as well as the target pro file gage. The cylinder is the ready for milling.



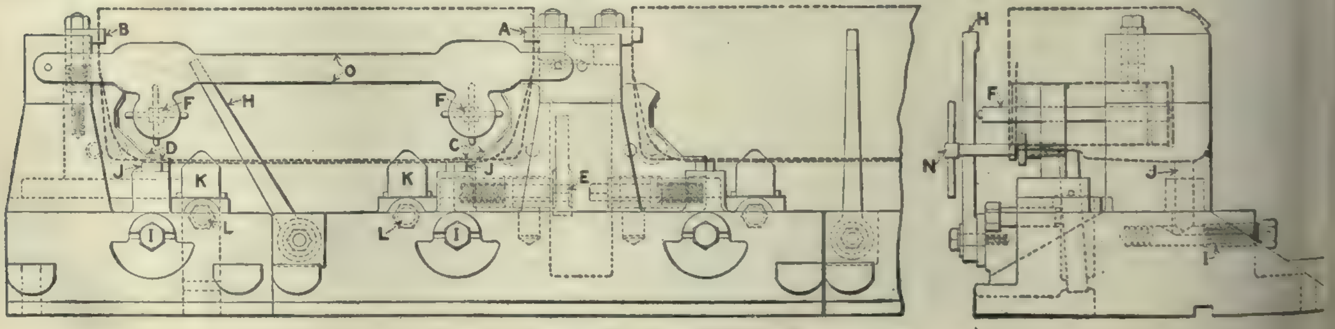
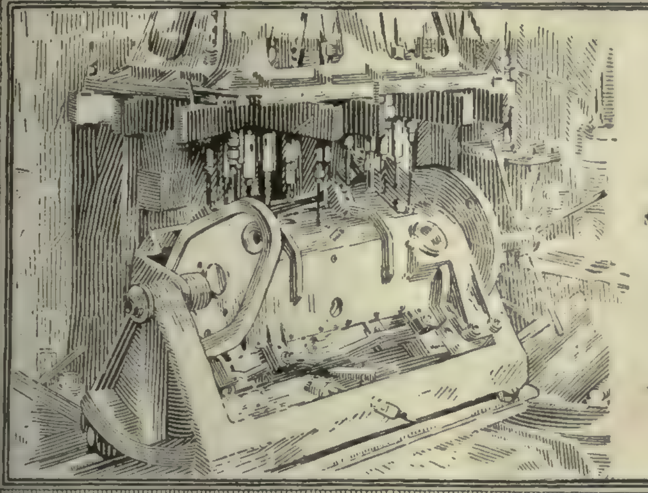


FIG. 2. GENERAL DETAILS OF FIXTURE



Tool Engineering

By

Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Albert A. Dowd Engineering Co., New York City

Chucking Long Work—The Use of Locating Rings—Special Face-Plate Fixtures—Ring Pot Fixtures—Fixtures for Rectangular Work—Holding Thin Castings

IN A PREVIOUS illustration several methods were shown for holding long, cylindrical work, but these were comparatively small pieces. The casting shown at *A* in Fig. 231 is of good size and quite long so that it needs additional support at the outer end. It would be possible to design a set of chuck jaws to hold it without any additional means of support, using one of the principles shown in the previous illustration. A simpler method and one which is less expensive is given, however, as it is more suited to the particular piece we have illustrated. The method of centering the work is by means of jaws *B* which not only provide an end location but at the same time center it accurately. In order to give support to the outer portion of the casting a ring pot *C* is fastened to the face of the chuck. This pot is cut out in three places at *D* in order to allow the chuck jaws to operate. Considerable allowance should be made around the jaws in order to prevent trouble which might be caused by chips and dirt. By coring the holes in the casting no machining is necessary except the facing of the bottom of the pot and the drilling and tapping for the set-screws at *E*. These screws are used to support the work and are set up by hand. When each piece is placed in the jaws care must be taken not to exert too much pressure as otherwise the casting might be distorted. It would be possible to use spring jacks in place of set-screws and there would be some advantages in this method as there is less likelihood of distortion. This is a cheap arrangement, involving very little trouble and giving satisfactory results.

Chucking With a Locating Ring

The example shown in Fig. 232 is a little out of the ordinary as it involves the use of a chucking ring *B* which is placed on the casting *A* and which helps to support and center the long hub. Several chucking rings should be provided as they are put on the casting before it is placed in the chuck. A setscrew *C* holds it firmly in place so that the end does not "wobble." The outside of the ring is made in spherical form so that it fits the hole in the chuck at *D*. The jaws used in this case are arranged so that they grip the work at the point *E* and the end location is obtained through the hardened stud *F*. A method of this kind can be used to advantage when the work is long and it is not desirable to have it extend too far out from the face of the chuck. The portion *G* of the casting is slightly tapered so that the ring fits it snugly and it is often unnecessary to tighten the setscrew. Theoretically the jaw at *E* should be almost a knife edge but in actual practice it can be made about as shown without experiencing any difficulty.

The pot casting shown at *A* in Fig. 233 is to be machined at *B* and *C* in such a way that the outer wall is concentric with the inside. It is therefore necessary to devise a means of holding which will locate the work from the inside cored surface. The chuck is equipped with entirely special jaws, one of which *D* bears at *E* and *F* on the inside of the casting. A reference to the end view will show that jaw *D* is quite wide and that it is relieved in the center so that it bears at two points *K* on the inside surface of the casting. The other jaw *L* has a swivel member *M* which equalizes any variations which there may be in the inner cored surface, thus permitting the chuck to grip the work firmly and with a uniform pressure. The rod *N* is set into the body of the chuck so that it will act as an end stop for the casting. When jaws of this kind are to be made it is quite necessary to make them very substantial on account of the amount of overhang from the chuck. Unless they can be made very stable it is not advisable to use them but rather to devise some other method of holding, in order to obtain the desired results.

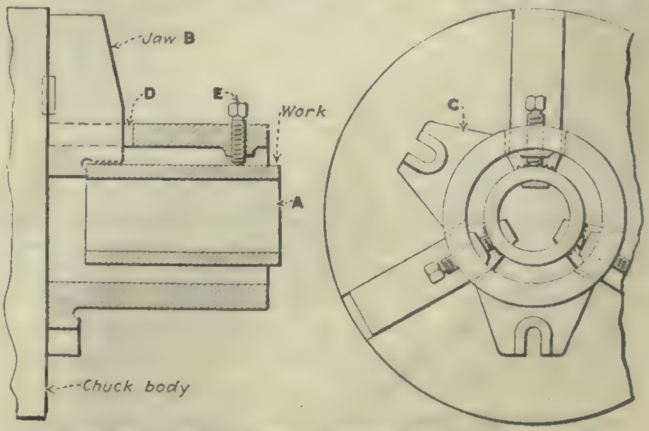


FIG. 231. CHUCKING A PIECE OF LONG WORK

In Fig. 234 is shown a piece of work *A* which cannot readily be held in chuck jaws. It appeared advisable therefore to make up a special faceplate for the purpose. The faceplate *B* is fastened to an adapter *C* which screws on to the end of the spindle. In the center of the faceplate is a spring bushing *D* which has a tapered end *E*. This end acts as a locater in the casting and centers it on the faceplate. The flange *F* rests on three hardened points *D* equally spaced in the body of the fixture. These points are so arranged that they can easily be replaced when worn or broken. In setting up the work a plug can be placed in the turret of the machine and carried forward so as to hold the work in place while the clamps are being tightened. These clamps are three in number as shown at *G* and they are slotted so that they can easily be removed from the work. They are set up by means of nuts at *H*. Attention is called to the method in which the outside of the faceplate is carried up in the form of a ring in order to form a continuous surface so that the operator will not be endangered by projecting clamps. If desired, it would be possible to carry the bolt which operates the clamps through to the back of the fixture and tighten them from the side instead of from in front. The convenience of the operator must always be considered when deciding on a point of this kind but in the particular case mentioned it would probably be fully as convenient to operate the clamps from the back as from the front and the cost would be little different from the method shown.

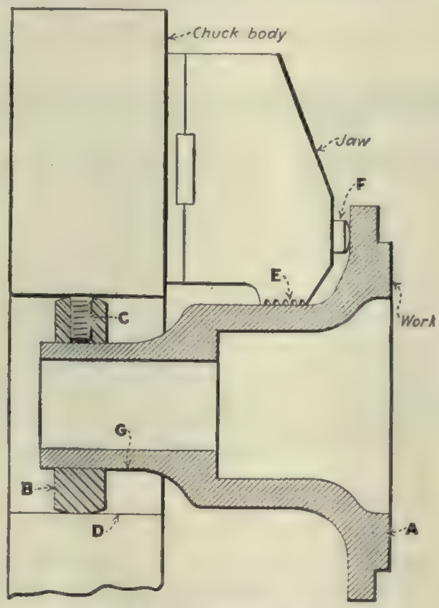


FIG. 232. CHUCKING WITH A LOCATING RING

Chucking a Long Sleeve

When work is very long and extends a great distance out from the spindle, it is sometimes necessary to provide an additional support other than that which can be obtained from the chuck or faceplate itself. It is always objectionable to make any fixture with too great an overhang from the spindle as this is likely to cause vibration and imperfect work.

Fig. 235 shows an example of this kind in the work *A* which is a long cast-iron sleeve held and centered at one end by the chuck jaws *B*. A casting *C* is bolted to the face of the chuck as shown and the outer end of this casting is fitted to a cylindrical sleeve *D* and bolted thereto. At the outer end of this sleeve are three setscrews *E* which are used to center the work and hold it in position. A special steadyrest *F* is mounted on the ways of the turret lathe in such a way that it supports the sleeve *D* which is a running fit in the large bearing at *G*.

An arrangement of this kind permits a piece of long work to be held firmly even though it extends a long distance out from the end of the spindle. It is therefore possible to hold it securely and without any chance of vibration while the cutting tools are in action. The casting *C* is cored out so that the three jaws *B* can be readily moved without interference. Cored openings are also provided in the walls as shown at *K*, in order to permit chips and dirt to fall out. In making up a steadyrest of this kind provision should always be made for oiling the bearing, either by means of a large glass oil cup or some other approved method.

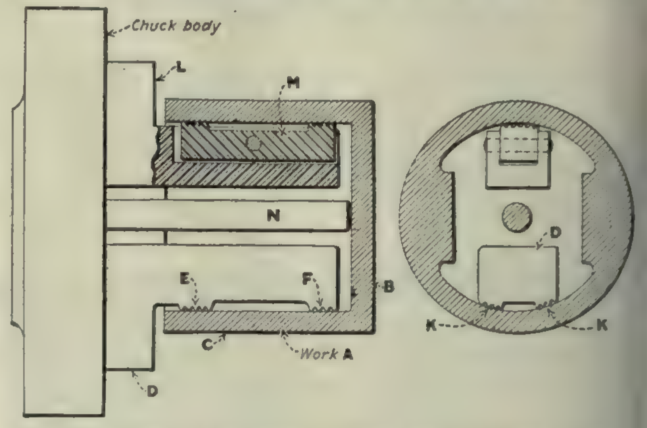


FIG. 233. TWO-JAW CHUCK WITH EQUALIZING JAW

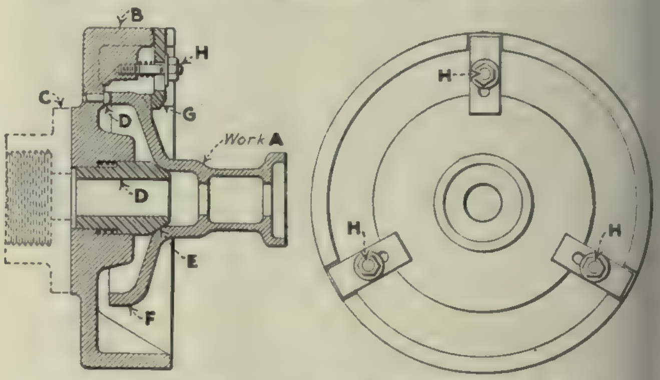


FIG. 234. SPECIAL FACEPLATE FIXTURE WITH LOCATING PLUNGER

The problem of holding thin work requires care and thought in its solution. The matter of distortion is of great importance and unless a proper method of holding is determined upon, the work will be untrue when finished. In addition to the possibility of distortion there is always a likelihood of extreme vibration on account of the thin and unsupported walls of the casting. Therefore the cutting tools that are used must be correctly designed in order to counteract this tendency as far as possible. More will be said about this matter under the head of "cutting tools." Fig. 236 shows several methods of holding a thin ring pot *A*. This casting is of a type commonly used in making piston rings. Both the inside and outside of the casting are finished and it is then cut up into narrow rings of a predetermined width.

If the work here considered is held in jaws like those shown at *B*, the casting will undoubtedly be distorted from its original shape as shown at *C*, because it would not be possible to hold the work firmly without exerting considerable pressure on the jaws. It is possible to avoid this difficulty by making up a set of special jaws like those shown at *D*. The outside of this jaw can be set up lightly on the ring part with just sufficient force to prevent it from turning freely by hand, and after this is done the hook bolt *E* can be tightened so as to make a firm metal-to-metal contact. There is an added advantage to this method of holding, in that it tends to "kill" the vibration in the metal and thus prevent "chatter." A device of this kind can be used for many kinds of thin work whether it is regular or irregular.

The method shown at *F* is most commonly used for the manufacture of piston rings. A special form of pot casting is made up like that shown at *G*. One end is provided with an angular ring of sufficient thickness to withstand the crushing action of the chuck jaws *H*. The angularity of the ring keeps it from pulling out of the jaw and at the same time tends to hold it back strongly against the seat of the jaw. Naturally there is considerable waste when this type of casting is used, but this is offset by the convenience of operation and the good results obtained.

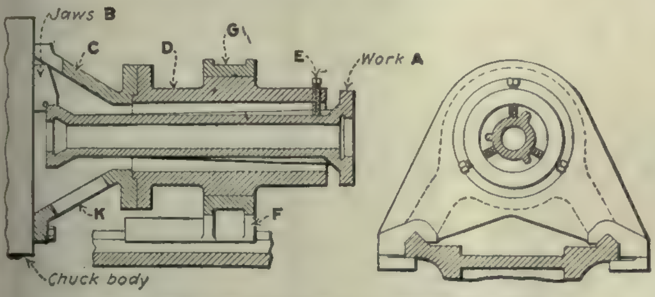


FIG. 235. CHUCKING A LONG SLEEVE

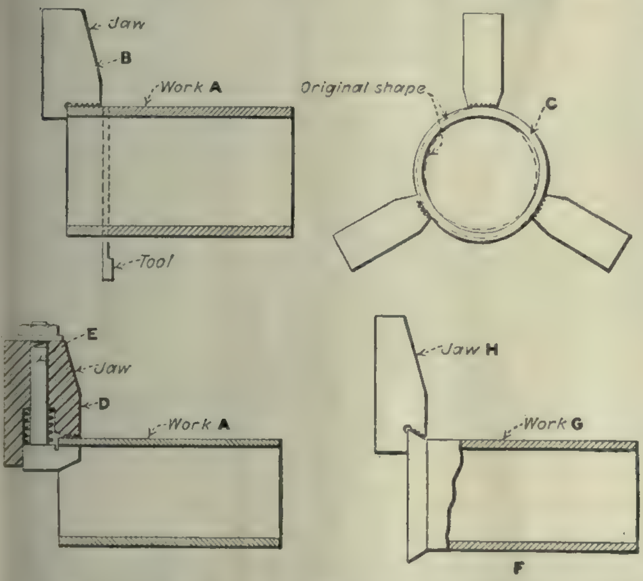


FIG. 236. SEVERAL METHODS OF HOLDING A THIN RING POT

Two-Jaw Chuck Used for Rectangular Work

The work *A* shown in Fig. 237 is a casting of such shape that it may be held in a fixture or by means of chuck jaws. The work which is to be done is shown by the marks *f*. There is very little danger in using this method of holding if the casting is small; but if of large size it would probably be necessary to provide extra supports under the corners *B* and *C*. These might be made in the form of spring jacks and attached to the face of the chuck if desired. The jaws *D* in the case shown are cut out in V-form so that they receive the corners of the casting and at the same time center it so that the hub *E* is in proper alignment with the center of the spindle. The method of chucking shown here holds the work very firmly but it is open to the objection mentioned when the work is large.

Holding Fixture for an Aluminum Casting

In Fig. 238 is shown an aluminum casting *A* of somewhat similar form to that previously described, but the method of holding is decidedly different as the piece is considerably larger in size. Furthermore it must be made accurately to size and the surface *B* and the relieved proportion *C* must be machined very carefully. The fixture body *D* is bored out and threaded at *E* to fit the end of the spindle but it can also be made in such a way that it can be attached to an adapter if this seems advisable. The work is located on three fixed points, *F*, *G* and *H* in the body of the fixture. A fourth point *K* is adjustable and can be made in the form of a spring plunger which is locked by the hollow setscrew and plug at *L*. There are three round knife edges at *M*, *N* and *O* against which the work is located by means of three swinging knife-edged clamps, *P*, *Q* and *R*, thus locating the work and at the same time preventing it from pulling out of the fixture. Two supporting jacks at *S* and *T* take the thrust of the cut when facing the boss *U*. These spring jacks are respectively located by the setscrews and plugs at *V* and *W*. This design of fixture will be found useful for work on which clamps cannot be applied in the usual manner. The design is clean and simple and there is no tendency to distort the work unless too much pressure is applied to the clamps *P*, *Q* and *R*. The action of these swinging members has been previously described in the articles on "Drill Jig Design."

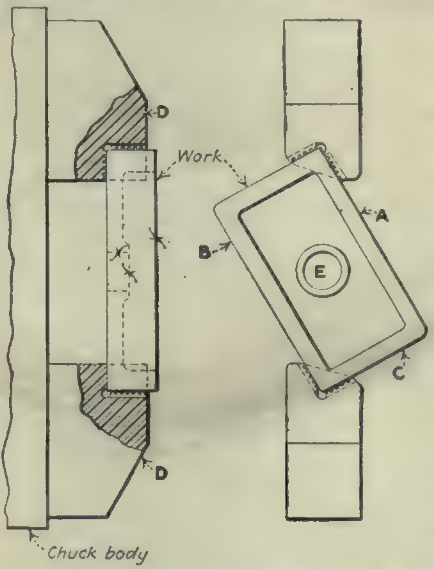


FIG. 237. TWO-JAW CHUCK HOLDING RECTANGULAR WORK

Holding Fixture for Fragile Aluminum Casting

In Fig. 239 is shown at *A* an extremely difficult piece of work to hold and machine without considerable distortion. The fixture shown in the illustration gave excellent results in use although it appears somewhat complicated in design. The casting *A* is of thin aluminum and the portion *B* is approximately $\frac{3}{8}$ in. thick and entirely unsupported. The portion *C* is only $\frac{1}{8}$ in. thick and is machined all over the face shown. The entire face of the flange *D* is machined and the tongues *E* are also cut to an accurate diameter in the same operation. It will be understood from the foregoing that it is necessary to hold this work in such a way that it will not be distorted either by the clamping or during the process of machining. The work is set up and located in the "V" *F* on the body of the fixture and it rests on three fixed points *G*, and a spring plunger *H*. The portion *E* is supported by three spring plungers *K*. A single knife edged point *L* acts as a stop against one side of the work. It is clamped in this position by means of the swinging knife edge *M* and it is thrown over in the V-block *F* by another knife edge clamp *N*. The flange *B* rests between the jaws of the floating hook bolts at *O*, *P* and *Q*. The floating clamps are so arranged that they can be tightened so that they hold the work firmly and yet do not distort it. After they have been tightened the setscrews at *S*, *T* and *U* hold each hook bolt in position.

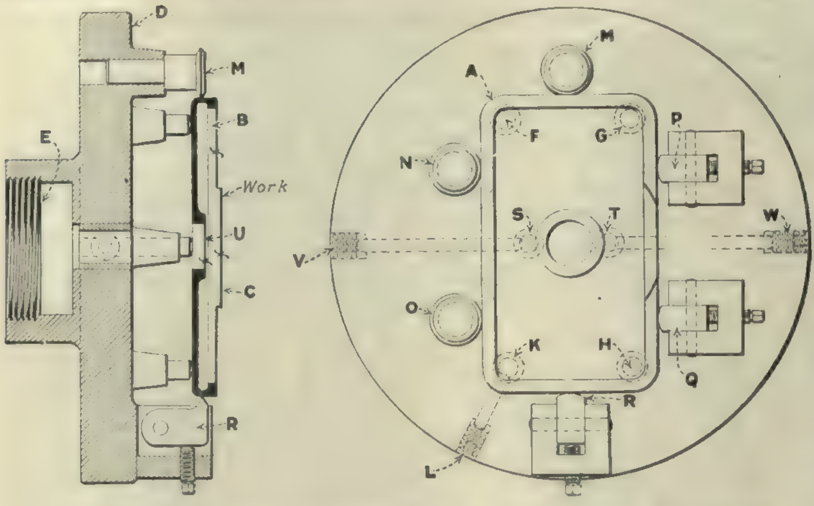


FIG. 238. HOLDING FIXTURE FOR AN ALUMINUM CASTING

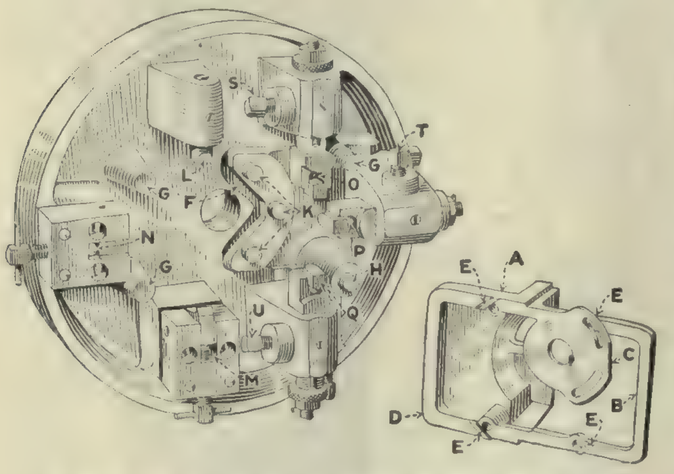


FIG. 239. HOLDING FIXTURE FOR A FRAGILE ALUMINUM CASTING

Reminiscences of an Old-School Machinist

By R. Thomas Huntington

During the eight months that I worked for the Baldwin Co., I had no occasion to ask the foreman for work. Every morning as the whistle blew, the foreman would go to each man (whose work was just behind him on the floor; the finished work in one pile, unfinished in another pile) and if there was not enough of the latter to last through for ten or more hours, would make a note of same whereupon the truckers would bring in more work; one piece for each finished piece taken.

Each machine had its particular work to do, and it was very seldom that any change was made. The foreman visited each workman at least once a day—he had between one hundred and two hundred workmen—and looked over his work. If any defects were found that the man could remedy, the foreman placed the defective piece with the unfinished work. If a defective casting or forging was found, a big chalk mark would be placed at the defective place and such pieces were also placed with the unfinished work. If any of the work was spoiled, a different mark would be made on it and the piece placed between the finished and unfinished work. If there were too many spoiled or defective pieces, the man was quite likely to lose his job.

There was a like number or quantity of each part in the rough in the stockroom or in the works being finished and orders would be issued to the foundry or forge shops for replacement whenever any of the rough pieces were sent out to be machined. I do not believe the boilers, tenders, or cabs were kept in the stockroom, but as the completed engines were run off of the erecting floor, other boilers were ready to take their places. Certain men were assigned to do certain operations and as fast as they had completed their task on one boiler or engine, they passed on to another that was waiting for them. This is the first instance of team work in the machine shop that I ever came in contact with. In case of rush orders there might be from six to twelve locomotives on the floor at once, with a relay of workmen to each.

Good Advice

There was one man at the Baldwin shops who gave me some very good advice. I went to him one day as boys are apt to do, telling about a shopmate. This man said: "Now, Thomas, if you can tell me something nice about him I will listen, but if you cannot, I do not wish to hear what you have to say. You should not repeat anything about any one unless it is a good deed or action."

This man also tried to interest me in mechanical drawing. Although working at the bench as a fitter, where he assembled the boxes in the connecting rods, he was a very fine draftsman, and I have since regretted that I did not take the lessons.

Motor Transport in Rumania

There are several companies operating motor transportation and freight lines in Rumania, but owing to the cost of repairs, the wear and tear of tires due to the state of the roads and probably careless handling in some cases, there is little profit in this business under the system hitherto adopted, states the commercial secretary of the English Legation at Bucharest in his recent report on economic conditions in Rumania. Quite recently an interest has been expressed in 2- and $2\frac{1}{2}$-ton trucks for road transport, worked in conjunction with a 2-ton trailer. Thus the load would be 4 tons for each machine and trailer. This distribution of the load over four axles will probably prove more practicable than the use of heavier trucks. Many of the main roads in old Rumania are practicaly unmade, so that the weather constitutes a serious factor with which this business has to contend. At the same time high-priced goods can be transported economically from and to the large centers of population by this means, and there still remains a good field for those firms that are able to buy trucks and import them to Rumania for the purpose of entering the motor transport business.

Interesting Inspection Methods

Fixtures and Gages for Inspecting Crankshafts—Camshafts Measured by Micrometer and Tested for Hardness by Scleroscope—Inspecting and Weighing Connecting Rods

By FRED H. COLVIN
Editor, *American Machinist*

THE last operation on the Essex crankshaft before the final testing and inspection is that of polishing the bearings, utilizing the clamp method as shown in Fig. 1. A fine grade of abrasive cloth is held between the two clamps and the surfaces of the bearings brought to the desired degree of polish.

The crankshaft is then placed in substantial V-blocks mounted on one of the testing benches, as in Fig. 2.

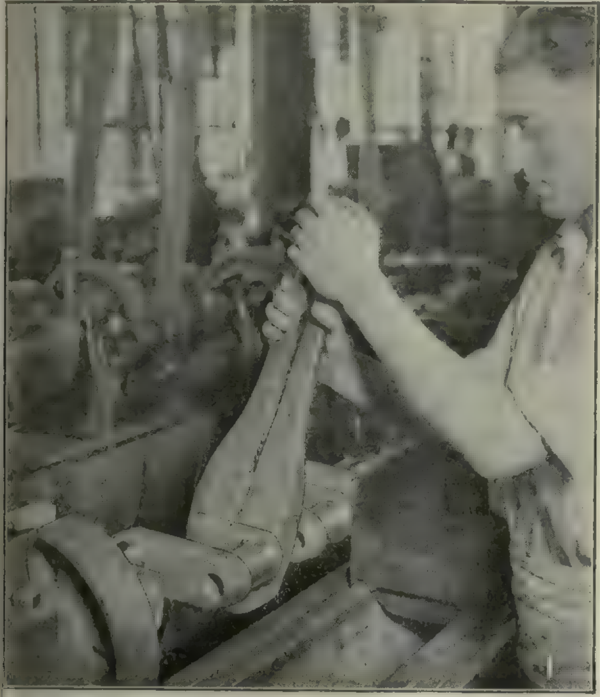


FIG. 1. POLISHING THE MAIN BEARINGS

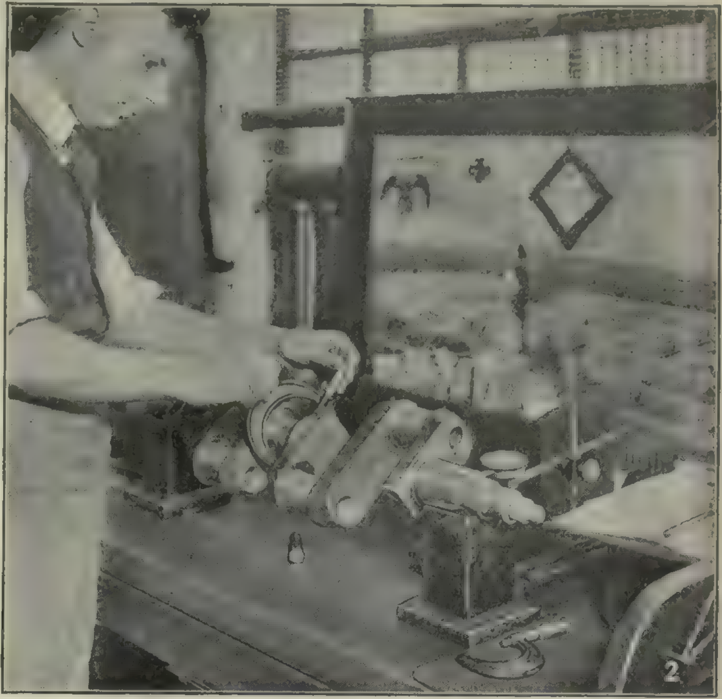


FIG. 2. TESTING THE MAIN BEARINGS

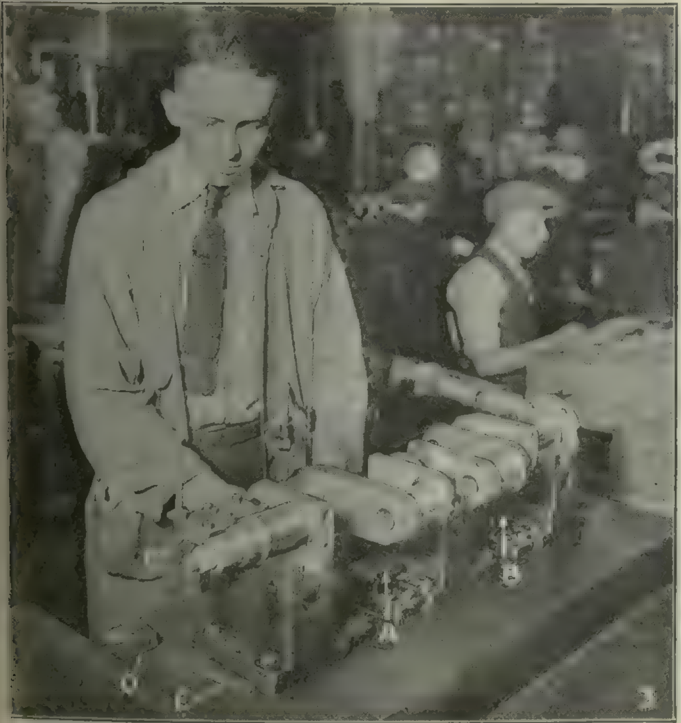


FIG. 3. INSPECTING THE CRANKPINS

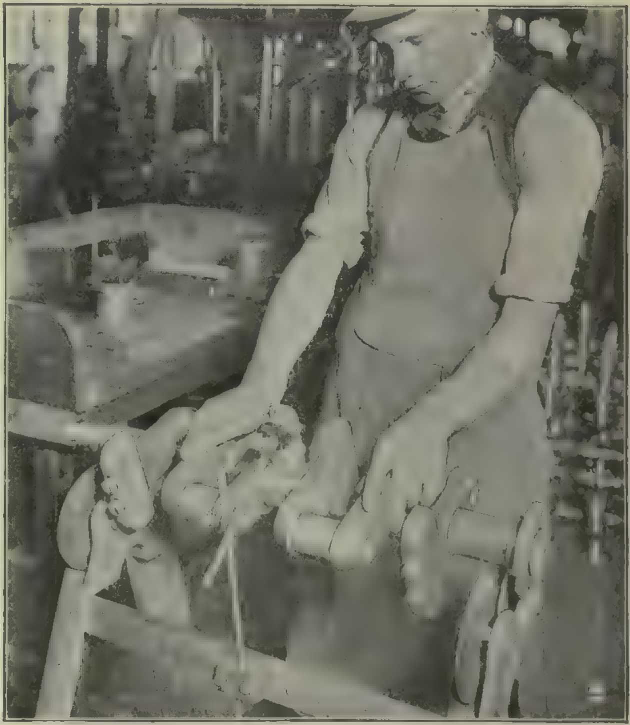


FIG. 5. TESTING FOR STATIONARY BALANCE

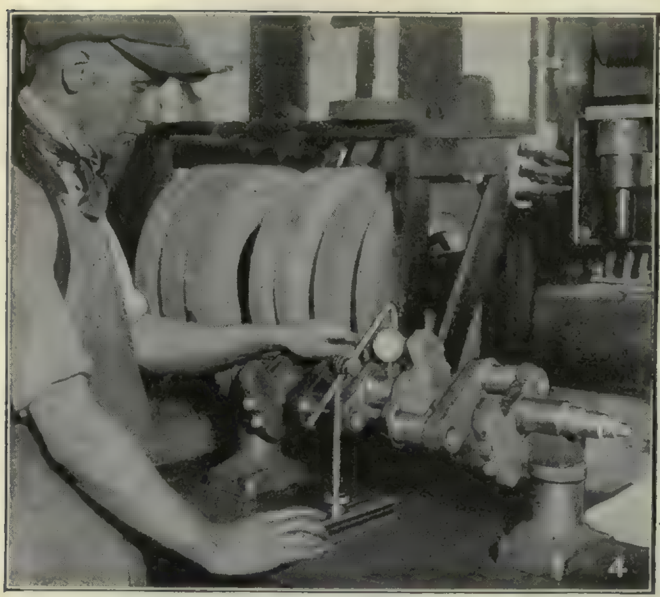


FIG. 4. INSPECTING MAIN BEARINGS

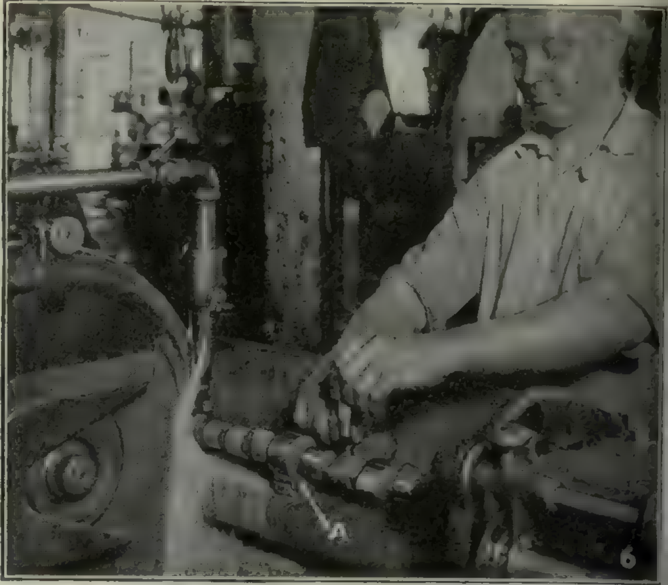


FIG. 6. MEASURING THE CAMS

Here it is supported by the end bearings which rest on suitable pads in the V's to prevent marring or damaging them in the slightest degree. The bearings are tested for diameter, with the micrometers shown.

In testing the crankpin bearings, the crankshaft is mounted in the fixture shown in Fig. 3 which contains three sets of large rollers to support the main bearings while the crankpins are being tested. The crankpins are all tested in this way. This method allows the crankshaft to be turned in various positions so that all the crankpin bearings can be inspected. The stand which supports the dial gage can be moved to inspect all four pins, the blocks *A* and *B* being two of those provided for this purpose. The block *C* carries what may be called an indexing pin for locating the crankshaft in the desired position. Two other gages are shown at *D* and *E*.

In Fig. 4 the counterweights have been added to the crankshaft which is again mounted on the block and the center bearings tested with the dial gage to be sure that the shaft is not sprung but that the three main bearings are in line.

In the final test the crankshaft, with the counterweights attached, is mounted on the roller balancing ways shown in Fig. 5 and tested for static balance the center bearing being again tested with the crankshaft free to revolve on the disks shown.

Coming to the camshaft, Fig. 6 shows that the micrometer is depended upon to be sure of the correct size. It also shows how the camshaft is supported during grinding by its large diameter bearings which ride in a suitable support as at *A*, to guard against springing by the wheel pressure.

Before the camshaft goes to the assembling department all the wearing surfaces are carefully tested for hardness by the scleroscope as indicated in Fig. 7. It

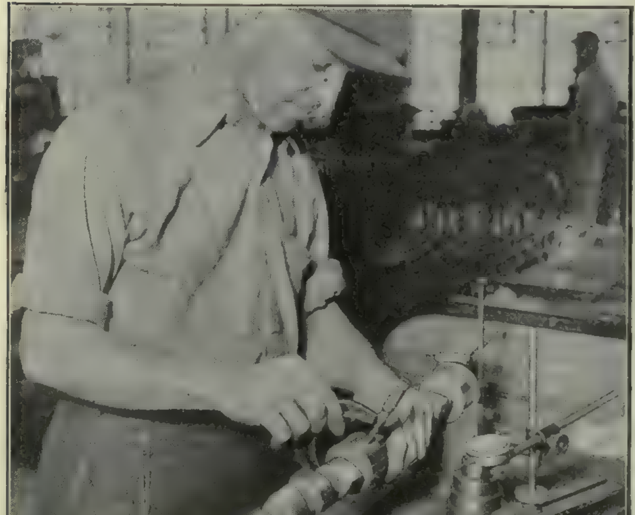


FIG. 8. MEASURING THE CENTER BEARINGS

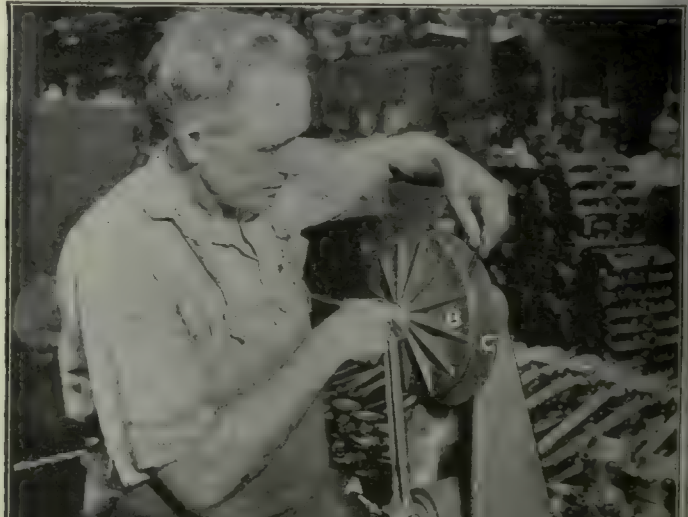


FIG. 9. TESTING SQUARENESS OF CONNECTING RODS

is then finally tested in the stand shown in Fig. 8, the end bearing being suitably supported and the diameter and concentricity both tested by the use of micrometers and the dial gages shown.

INSURING ACCURATE CONNECTING RODS

An interesting and ingenious method of testing the squareness of both ends of the connecting rod is shown in Fig. 9. Here the large end of the rod slips over the stud *A*, which is a good twist fit. The disk *B* has a central stud which fits the hole in the small end of the rod and a connecting rod is then swung on *A* so that the disk *B* moves across the face of the corresponding disk *C* which is set square with the stud *A*. The large diameter of these disks multiplies the error very rapidly, the feeler which is shown in Fig. 9 being used to measure the amount by which the holes are out of square. Similar methods are used in a few other shops, but these are the largest disks yet noted and they make a very severe test for the accuracy of the end holes with each other.

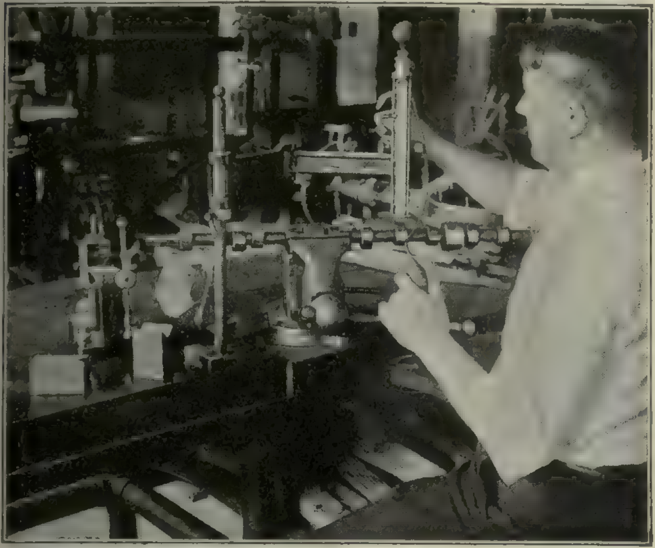


FIG. 7. TESTING THE HARDNESS OF CAMSHAFTS

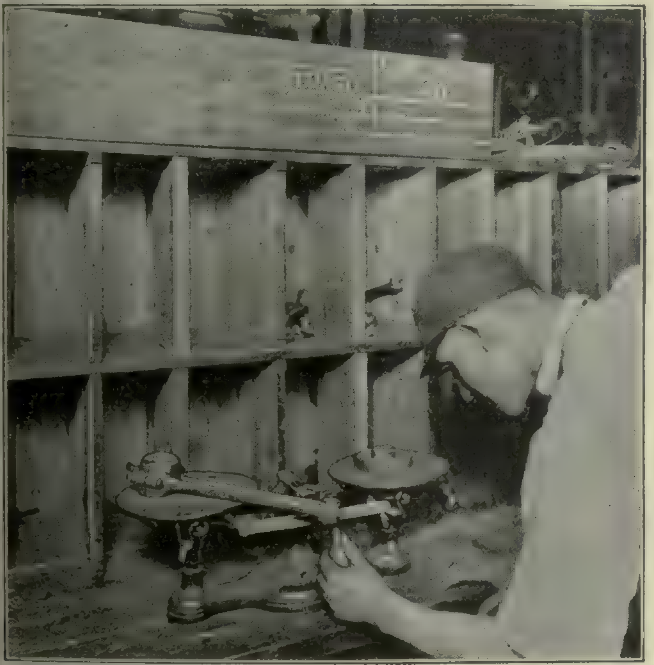


FIG. 10. WEIGHING THE CONNECTING RODS

The rods are finally weighed as shown in Fig. 10, the weight being held within close limits and the rods placed in separate bins, according to the weight, so that rods as nearly alike as possible will be assembled in the same motor.

Rathenau Statements Indicate That Reports on German Competition are Exaggerated

During the period which has elapsed since the establishing of the reparations question between the Allied Nations and Germany, there has appeared in print and also obtained circulation through various other sources, much in the way of reports as to Germany's competition with the rest of the nations and her ability to ship her manufactured products to the ports of the World at prices beyond any hope of competition.

Students of the situation in this country, including the chiefs of the various bureaus connected with our Department of Commerce, have from time to time expressed skepticism as to the truth of these statements as applied particularly to manufactured goods, when material, quality and workmanship were taken into consideration.

If we are to judge by the printed word of Germany's chief spokesman on such matters, Walter Rathenau, Minister of Reconstruction, we have been more scared than hurt, for in his latest book called "The New Society," published in German, and only recently translated into English, he makes the following remarkable statement, found in Chapter VI, and which is worthy of the earnest attention of those who have been anticipating disastrous competition from Germany.

After approaching the subject from its various social and industrial angles, he says:

"The absolute productivity of work, the relative efficacy and the quality of the product, have all deteriorated. With smaller turnover we have witnessed a falling off in the excellence of the goods, in research-work, and in finish. Industrial plants have been worked to death and have not yet recovered. Auxiliary industries, accessories and raw materials have fallen back. High-quality workmanship has suffered from defective schooling, youthful indiscipline and the loss of manual dexterity. The new social order has lost a generation of leaders in technique, scholarship and economics. Universities with all institutions of research and education, have suffered from this blank. Technical leadership is gone, and the deterioration in quality has reacted detrimentally on output. We can now turn out nothing except what is cheap and easy, and what can be produced without traditional skill of hand, without serious calculation and research. For all innovations, all work of superior quality, Germany is dependent on the foreigner. The atmosphere of technique has vanished, and the stamp of cheap hireling labor is on the whole output of the country."

On page 59 of the same chapter, in speaking of things of common use, Mr. Rathenau says:

"Our half, or wholly imitative products are turned out as cheaply as possible in substitute materials and are made as well, or as ill, as the relics of our craftsmanship permit, or as our existing machinery for that purpose is capable of. Cheapness and ease of manufacture are the principles aimed at."

Structural Properties of Metals and Alloys

By R. W. WOODWARD
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(Continued from last week's issue.)

WHEN a metal is heated it will with few exceptions increase its linear dimensions and the amount of this expansion per degree for a unit length is known as the coefficient of linear expansion. This coefficient is not quite the same at high temperatures as for low temperatures but for ordinary purposes it may be considered a constant.

In all structures where large changes in temperature are encountered, allowance must be made for the expansion of the metal. This is particularly the case if two different metals are in proximity, as the various metals and alloys in general have different coefficients of expansion. For example, in gas engines having aluminum alloy pistons a greater clearance must be provided than in a similar engine equipped with ordinary cast-iron pistons. Similarly, the comparison of gages with precision blocks requires that careful control be kept of the temperature so that the corrections due to expansion may be accurately known.

The expansion of an alloy cannot in general be predicted from the expansion of the component metals. A steel termed "invar," containing about 36 per cent nickel, has the lowest coefficient of any known metal or alloy and hence is much used for standards of measurement or for scientific instruments where constancy of dimensions is required. Other alloys of nickel and iron have the same expansion as glass and can be used for the sealing-in wires of incandescent lamps where a gas tight joint is required. Platinum may also be used for the same purpose but is, of course, more expensive.

The patternmaker, in constructing patterns, makes a shrinkage allowance of from $\frac{1}{32}$ to $\frac{5}{16}$ in. per foot according to the metal which is to be cast. This allowance is approximately equal to the expansion of the metal from the solidification temperature down to atmospheric temperatures. Type metal alloys expand instead of contracting during cooling and this aids materially in making a clean cut and sharp casting of the type face.

Pure metals (i.e., single elements) melt upon heating or freeze upon cooling at a definite temperature. Alloys, except for certain mixtures of their constituents, do not have such a single melting point but will melt or solidify over a range of many degrees. Advantage is taken of the latter fact in ordinary plumber's solder used for wiping joints. The solder becomes pasty during the solidifications period and allows the plumber to manipulate and shape the solder into the desired form about the joint.

The melting point or range of an alloy is generally less than that of its component metals and low melting alloys can be made upon this principle. An alloy of 50 per cent bismuth, 25 per cent lead 12.5 per cent tin, and 12.5 per cent cadmium will readily melt in hot water although the lowest melting point of any of the constituents, that of tin, is 450 deg. F.

Ordinarily in machine construction little use is made of the fact that metals conduct heat. In some instances such as refrigeration machinery, heating apparatus, or engine design, a knowledge of the conductivity of heat is required. The order of metals as regards thermal conductivity is practically the same as that for electrical conductivity, and for most metals there is a constant ratio between the two. Silver is the best conductor, copper and gold respectively about 75 and 55 per cent that of silver. In other words, if similar shaped bars of silver, copper and gold are heated to the same temperature at one end, at the expiration of a given time 75 per cent as much heat will have flowed to the other end of the copper bar as has in the silver bar, while in the gold bar the transfer will be only 55 per cent. The other metals are quite inferior in their conducting properties to the three named above. It is also a fundamental fact that any alloy will have a lower conductivity than any of its constituent metals. This will be treated more fully under electrical conductivity.

Many metals and alloys undergo transformations at various temperatures which markedly alter their properties, the material being in a different crystalline state. A familiar illustration is carbon (carbon however is not a metal), which also exists as diamond and graphite. All of these are the same fundamental element, carbon, but their properties are quite different; in this case, however, a change of pressure is also necessary to produce the various modifications.

The heat-treatment of steel and other alloys is fundamentally due to this phenomenon but can only be briefly mentioned at this time. When the steel or other alloy is heated to a point above the transformation temperature and then suddenly cooled as by quenching in water, the crystalline state present at the higher temperatures is retained at the lower temperature. For steel this brings about greater hardness and increased tensile strength but for some alloys less desirable properties would be brought about by a similar treatment. The microscope is extremely valueable in determining the crystalline structure of metals and alloys, interpreting the properties that may be expected from the observed structure and in advising the proper treatment to be given.

There are many other thermal properties that could be discussed such as boiling point, specific heat, latent heat, vapor tension, etc., but their knowledge is no essential to the designer or constructor of machinery except in special cases.

ELECTRICAL PROPERTIES

The electrical properties of metals and alloys ar important for all apparatus in which electricity i employed. When a metal is required to transmit electric current, its ability to do so becomes of first importance. Pure metals are the best conductors of electricity, silver, copper and gold being the most efficien as mentioned above under heat conductivity. Aluminum is next in order and although it is a poor conducto relative to copper, it is used in preference to copper fo long transmission lines when the relative cost of th two materials is in favor of aluminum.

A more useful manner in which to express the abilit of a metal to conduct electricity is in terms of it resistance or the tendency to oppose the flow of th electricity. The specific resistance or resistivity is th resistance of a unit volume of the material and from its value the actual resistance of a conductor of any size may be computed. The resistance of most metals increases with a rise in temperature and within certain limits this rise is a constant ratio for each degree of rise. This ratio is the temperature coefficient of resistance.

Alloys always have a greater specific resistance than their constituent metals, although the temperature coefficient is generally less for the alloys than for the pure metals. Thus for electrical heating apparatus, which depends upon the resistance of the metal to develop the heat, alloys are generally used because of their high resistance, although such materials must also be able to withstand the oxidizing effect of the atmosphere when heated to the desired temperature.

Certain alloys such as manganin (a copper, manganese and nickel alloy) and constantan (a copper-nickel alloy), have a temperature coefficient of resistance which is practically zero and such materials are therefore used for constructing standards of resistance or for resistances which must remain of a constant value over a range of temperature.

Use is also made of the temperature coefficient as a means of measuring temperature; by measuring the resistance of a coil of wire at two different temperatures the temperature interval may be computed. For such purposes a metal with a high temperature coefficient would be desirable, and accordingly a pure metal such as platinum or nickel is used.

When two dissimilar metals are jointed together at each free end and the junctions are kept at different temperatures an electric current will flow through the metals. This is the principle of which use is made in the thermo-electric method of measuring temperatures, and which is used almost universally in the heat-treatment of steel. For the same difference in temperature all metals will not generate the same electromotive force or voltage and those metals and alloys are used for measuring temperatures which generate the largest electromotive forces and also have the requisite stability and cheapness. Platinum and platinum alloys are used for exact scientific work, where cost is not a controlling factor, because of the constancy of the metals and the ability to withstand high temperature. The so-called base metal thermo-couples (generally nickel alloys) are used in industrial work mainly because of their low cost; but they also give much larger thermo-electric forces than the platinum couple, and are in general quite constant in their properties if not abused.

Magnetic Properties

The magnetic properties are usually associated with iron, steel or other alloys containing a large percentage of iron. While these metals are by far the most strongly magnetic, two others, namely, nickel and cobalt, also exhibit magnetic properties. There are also alloys of copper, manganese and aluminum known as Heusler alloys, which are unusual in possessing similer characteristics although none of their constituent metals are magnetic.

Magnetism in a magnetic material is generally set up by an electric current which produces the "magnetizing force"; the resulting magnetic condition is measured in terms of the "magnetic induction." The ratio of the magnetic induction to the magnetizing force is the permeability. Materials which are readily magnetized have a high permeability, although permeability is not a constant for a given material but is different for various values of magnetizing force. The permeability increases with low values of the magnetizing force to a maximum value and then gradually decreases. Accordingly the magnetic induction does not increase indefinitely with increasing magnetizing force but reaches a constant maximum value or "saturation."

When the magnetizing force is removed, the magnetic induction or magnetism is not completely lost, a certain amount, known as the "residual magnetism," being retained. Permanent magnets are made of material such as a hardened tungsten steel having a high residual magnetism. For making electromagnets for which a strong field is required, as for instance in a lifting magnet, a material having a high permeability, such as wrought iron, would be used.

All of the magnetic properties of iron and steel are not only greatly influenced by the composition but also by the previous mechanical working and the heat-treatment of the material. In fact the magnetic properties of steel are measured in many cases in order to determine what the previous history of the meterial has been and to form an idea of its mechanical properties. Such tests can be applied to finished products without injuring them and in the future such tests may play an important part in the testing of metals.

Optical Properties

The mechanician is little interested in the optical properties of metals. For cases where a high polish is desired he generally knows what metals will answer his purpose. The ability to take such a polish, however, may be determined by physical measurements in terms of the reflectivity of the metal.

Probably many persons have observed that when an open hearth or Bessemer steel furnace is being tapped, the slag stream appears much hotter than the stream of molten steel. Such, however, is not always the case, since the difference in optical properties of the two streams could easily cause such an appearance. This property, the emissivity of the metal (or of the slag), is a quality which depends upon the color of the light through which the body is observed as well as the character of the metal surface. Emissivity can hardly be defined in simple terms, but a knowledge of it is important when making temperature measurements of hot bodies with an optical pyrometer, else erroneous results will be obtained.

After we have constructed a metal structure, we are of course interested in how permanent it will be, or what means must be used to secure its permanence. Corrosion is one of the worst enemies of metals and is always tending to destroy them. Some metals are quite readily corroded by the ordinary atmosphere, as evidenced by the rusting of iron and steel, while other metals require the strongest acids to attack them. Gold and the platinum metals are excellent examples of the latter class. Between the extremes there are many metals which are resistant to some corroding agents, but are subject to others.

The resistance to corrosion of an alloy cannot be predicted from the properties of the component metals but an indication can sometimes be obtained in such manner. Nickel resists atmospheric corrosion quite as well as do most of its alloys, some of which are extremely noncorrodable. Brass, composed principally of copper and zinc, is resistant in certain mixtures of the constituents and less so in others.

Impurities have a marked effect on the corrodibility of metals and alloys, sometimes increasing the effect and in other cases decreasing it. For example, small percentages of copper in sheet iron or steel appear to decrease the tendency to corrode in most atmospheres; while on the other hand, a small amount of tin in aluminum alloys is quite detrimental, the resulting alloy disintegrating in a short time, especially in warm moist atmospheres.

When two dissimilar metals are in contact and moisture, particularly salt solution, is present, there is a greater tendency for the metals to corrode than would be the case if there were no contact. That metal which is electro-positive to the other will be most rapidly attacked, the action being similar to that of an electric cell. A few years ago a yacht was constructed having a Monel metal (principally a nickel-copper alloy) hull, the Monel plates being riveted together by iron rivets and bolts. The yacht never left her dock, the iron rivets having all been eaten away by corrosion but the Monel was untouched. Had the rivets also been of Monel the yacht would probably still be afloat.

Since the atmosphere has such a deleterious effect upon many metals, it becomes necessary to protect the metal from the air and this is most readily accomplished by simply painting with ordinary paint, enamel or with oil. Metal coatings are also supplied, the most usual form being the familiar galvanized or tinned iron. It is well to point out here that unless the tin coating completely covers the iron base it is preferable that there be no coating at all. Iron is electro-positive to tin and if any pin-holes are present it can be seen from what was said above that the corrosion of the iron will be accelerated rather than retarded. Zinc, on the other hand, is electro-positive to iron and the effect of any incomplete covering of the iron base would be to corrode the zinc rather than the iron.

The weight of a structure often times plays an important part in the selection of proper material. The density of metals may be found in the tables which give directly the weight per unit volume of the material or the specific gravity, that is the ratio of the density of the metal to that of water. Where extreme lightness is desired, aluminum and its alloys are found quite useful, as they also possess remarkable strength. Lately, alloys of magnesium, which are still lighter than aluminum, have been introduced.

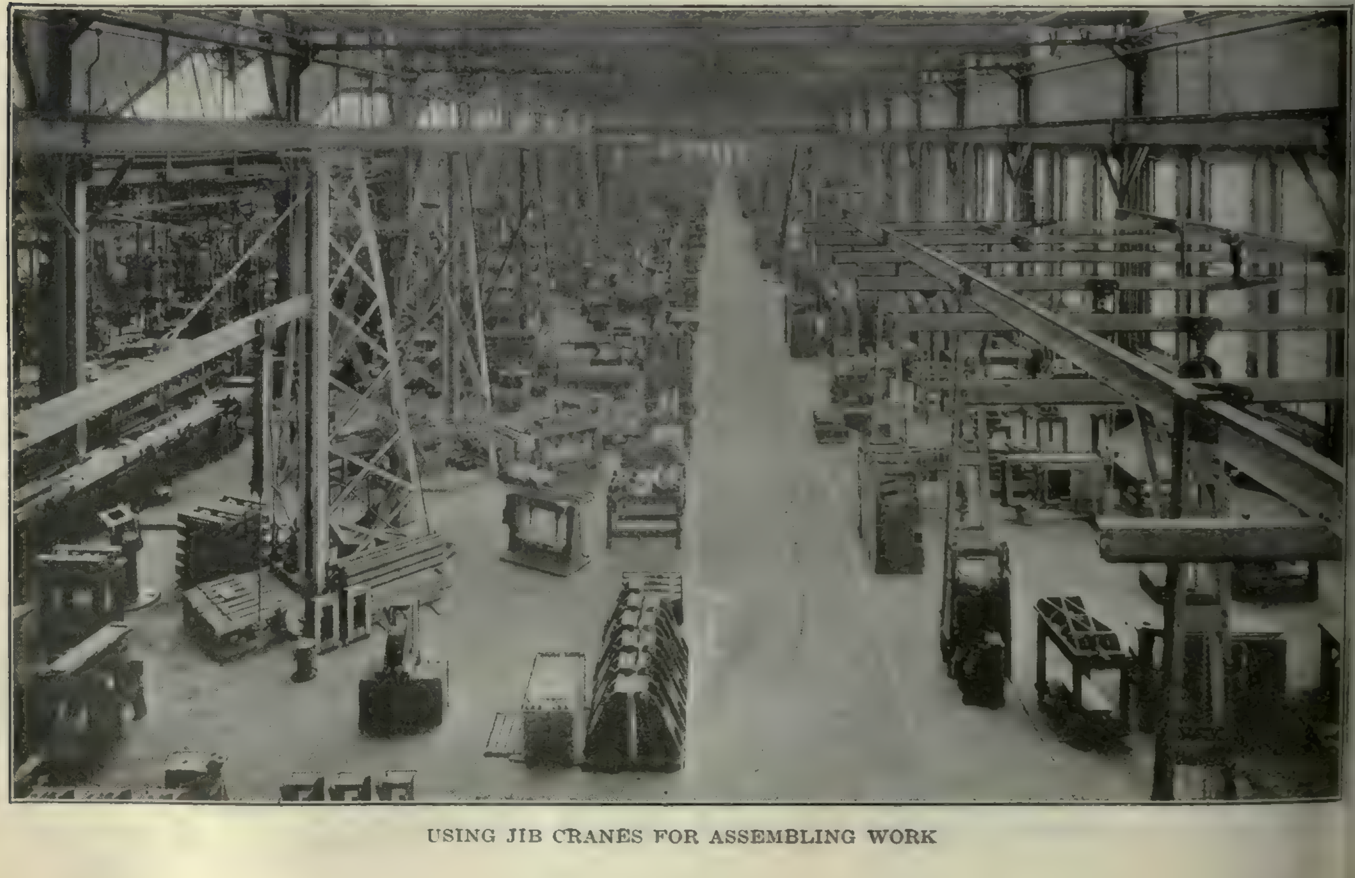
Jib Cranes in Assembling Work

Special Correspondence

The illustration shows the assembling bay in the plant of the Cincinnati Milling Machine Co., this bay having much more headroom than the manufacturing space in order to allow for the runway for the large crane. The length of the bay is 725 ft., the span 58 ft., and there is a clearance of 16 ft. from the floor to the crane hook. Two cranes are provided, one a Niles of 5-ton capacity and the other made by Pawling & Harnischfeger of 7½ tons. The smaller crane has a speed of 250 ft. per minute on the runway and 500 ft. per minute for the trolley. The hoisting rate is from 40 to 60 ft. per minute. On the larger crane the speed of the bridge is 220 ft. per minute, of the trolley 350 ft. and of the hoist, from 30 to 60 ft.

At the right is a small craneway over the fitting and scraping floor. This is provided with a series of monorail cranes or trolleys equipped with 1 to 1½-ton chain blocks. In some cases direct air hoists are used.

On the other side are the jib cranes built with triangular bases and anchored at both top and bottom. These cranes are 1-ton capacity and the one in the fore-ground has a 1-ton direct lift air hoist. The arm is 15 ft. at a fixed height of 12 ft. from the floor.



USING JIB CRANES FOR ASSEMBLING WORK

Positive Lubrication of Machinery

The Adaptation of Automobile Grease Lubrication Methods to Machine Tools —Smaller Clearance in Bearings for Lubricant

SPECIAL CORRESPONDENCE

THE lubrication of machine tools is an ever present problem for every shop manager. There seems to be no question as to the failure of lubrication being at the bottom of most machine repairs, the cause of most of the idle time, when production ceases but overhead goes on piling up its quota of cost.

Something over a year ago this problem came up at the new plant of the Central Gear Works, Detroit, Mich. Machines gave trouble from lack of lubrication, while in some cases motors burned out because of too much oil, usually drippings from machine bearings above.

Special men were appointed as oilers to relieve the machine operators of all responsibility and trouble in the matter, but still some of the trouble hung on with amazing persistence. It so happened that one of the men responsible for machine maintenance, B. R. Secord by name, had been one of the first to use forced grease lubrication on his own automobile with great success. Having a few of the cup connections left over, he put them on a machine which had been giving trouble, and gave it a shot of grease twice a day. The trouble disappeared so completely that Samuel L. Ayr, the assistant general manager, ordered all machines which could be successfully lubricated in this way, equipped with the proper connections.

There are some machines and a few conditions where this system does not seem to apply. But these are few indeed, and on lathe spindles, bevel gear planers, drilling machines, grinding machines and the like the system is working out to the entire satisfaction of the management.

The main feature of the plan, which is known as the "Alemite" system and manufactured by the Bassick Manufacturing Co., Chicago, Ill., is to use a screw pressure grease gun with bayonet joint connections for the parts to be lubricated. When the new grease is forced into the bearing it naturally and automatically forces out the old grease and any dirt which may have worked its way in.

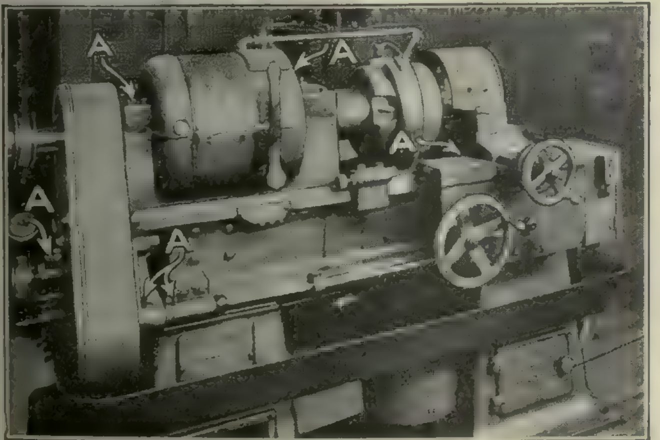


FIG. 1. REED-PRENTICE LATHE

One difficulty with the use of oil from a can is that the oiler naturally stops pouring or squirting when the oil overflows from the cup or pipe. If it is stopped up so that no oil gets to the bearings he has no means of knowing it, and goes on to the next machine believing he had done his full duty. With the pressure system, he turns the handle of the Alemite gun until the old grease is forced out of the bearings. Then he knows that the passage is clear and that new grease is in place in the bearings.

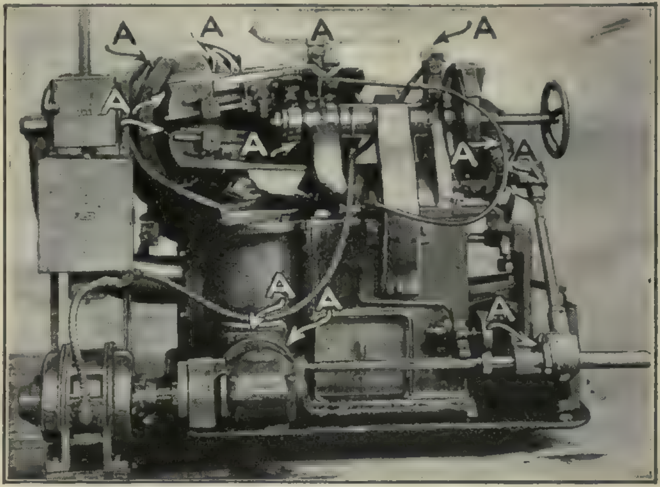


FIG. 2. GLEASON BEVEL GEAR SHAPER

The comparative merits of oil and grease have been discussed many times. But all will agree that it is better to know positively that some kind of lubricant is between the bearing surfaces and the result which the Central Gear Works has secured with the use of grease on machine-tool bearings certainly makes it worth while investigating as a method for more general use, especially on exposed bearings.

One interesting feature is that it has been found possible to run spindles with less clearance for lubricant than could be done when oil was used. This is not in accord with old time ideas and is all the more interesting on this account. Figs. 1 and 2 show two machines equipped for Alemite. The connections are shown by *A*'s.

It will be seen that the grease lubricant is supplied to sliding as well as to revolving surfaces in both the lathe and the gear cutter shown. No difficulty has been experienced from any tendency to lift the moving part off the ways as the grease can flow out of the ends. The pressure of the cutting tool or the weight of the part evidently thins the grease film to a fixed thickness which does not exceed oil. At least no trouble has been experienced from this source.

This is mentioned because experiments in lubricating planer ways by using oil under pressure, have indicated that it was an easy matter to float the table and so interfere with the accuracy of the work. Similar contingencies must be borne in mind in all new applications, but there has been no evidence of trouble from that source in any of the cases mentioned.

Metal Cutting Tools.

By A.L.DeLeeuw

XVII—Hollow Mills—Box Tools, Chisel Point and Ordinary Tools—Trephining Tools—Right and Wrong Methods of Using Roller Back-Rests

A HOLLOW mill is essentially a tube provided with cutting teeth at its front end. It is particularly adapted for turning up bosses and other projecting parts. Either the tool or the work may rotate. In appearance a hollow mill resembles a counterbore without pilots or shank. It has, however, certain characteristics by which we can recognize it and which are absolutely necessary to its proper functioning.

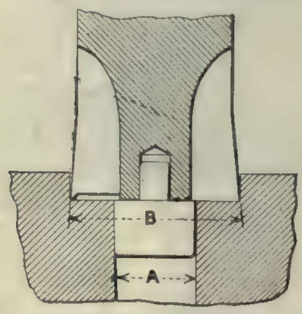


FIG. 280

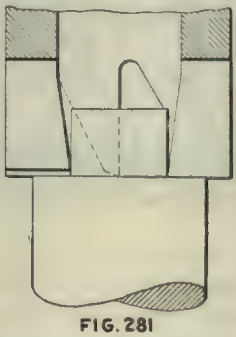


FIG. 281

FIG. 280. COUNTERBORED HOLE WITH COUNTERBORE AND PILOT. FIG. 281. HOLLOW MILL FINISHING BOSS

In Fig. 280 a counterbored hole is shown. The hole *A* was made first so that whether we use a counterbore with or without pilot there is no danger of the tool interfering with the metal toward the center because this metal has already been removed; but there was a possibility of the tool interfering with the metal on the outside of the hole *B*. In other words, the tool had to have clearance on the outside but not on the inside.

Fig. 281, on the other hand, shows the action of a hollow mill and clearly shows that the hollow mill requires clearance toward the inside but not on the outside. As soon as a hollow mill is resharpened its inside diameter becomes greater, so that unless something is done to overcome this handicap a hollow mill would be good for one grinding only. As a rule, this trouble is overcome by placing a collar around the projecting teeth of the mill. This collar may be provided either with a binding screw which permits of its being clamped tightly (see Fig. 282), or else it may have a number of setscrews, each one bearing on one tooth of the mill, or, as shown also in Fig. 282, a threaded collar on a taper body.

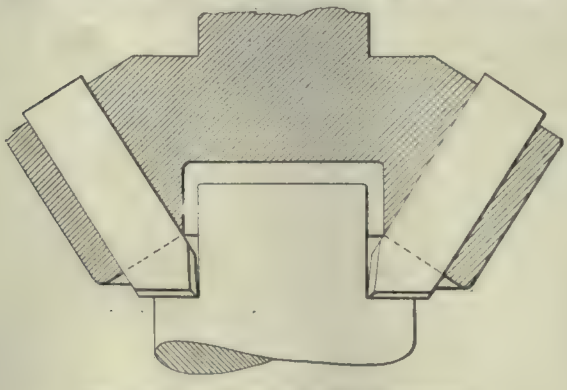


FIG. 283. BUILT-UP HOLLOW MILL

Another way of overcoming this difficulty and one which is often used where the tool is needed for quantity production is the following: Two tools are used, one for roughing and one for finishing. Of course the finishing tool has a smaller inside dimension than the one used for roughing. Naturally, the wear on the finishing tool is considerably less than on the roughing tool, so that one grinding of the former will correspond to several grindings of the latter. As a rule, enough tolerance is allowed on the piece to be hollow milled to permit of one or two grindings of the finishing tool, after which it is used for roughing. It should be kept in mind that a single grinding of a hollow mill does not increase the diameter very much. If, for instance, the clearance at the inside of the teeth is 3 deg., and we should grind off five-thousandths from the front of the teeth, we would increase the inside diameter one-half thousandth.

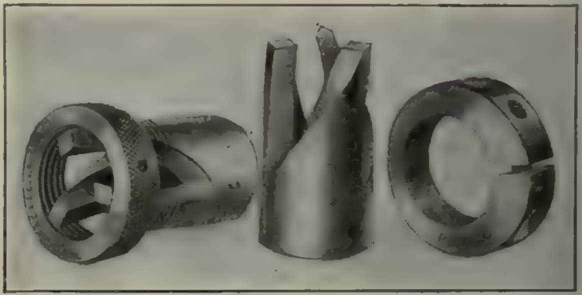


FIG. 282. HOLLOW MILL WITH ADJUSTING COLLAR

At the best, a hollow mill made out of a single piece of steel is a rather expensive tool and is, as a rule, not used in the larger sizes. Where larger diameters have to be turned built-up mills are used. Fig. 283 shows one of the many ways in which hollow mills are built up. In this case square pieces of steel are inserted in holes in either a grey iron or steel casting, or possibly a forging. Sometimes round steel is used for the tools and a setscrew bearing on a flat is supposed to hold them in the proper position. However, this method is not adequate for heavy cuts, as there would be a great tendency for the cutting edge to turn away from the work and either cause too large a diameter or else cause the tool to cut with negative rake and excessive clearance, with resulting rapid dulling of the tools. In some cases plates are used, screwed on to the outside of a body and projecting far enough to allow the entire length of the boss or lug to be turned up without striking the body. The manner of constructing the hollow mill should be entirely dependent on the special conditions of the case. A facing head in which the tool has an in and out motion or in which the tool gets its axial feed motion by the movement of the spindle may, in a way, be considered as a hollow mill. To many people a hollow mill is merely a turning tool which rotates while the work is standing still. In that sense, then, a facing head used for turning may also be considered as a hollow mill.

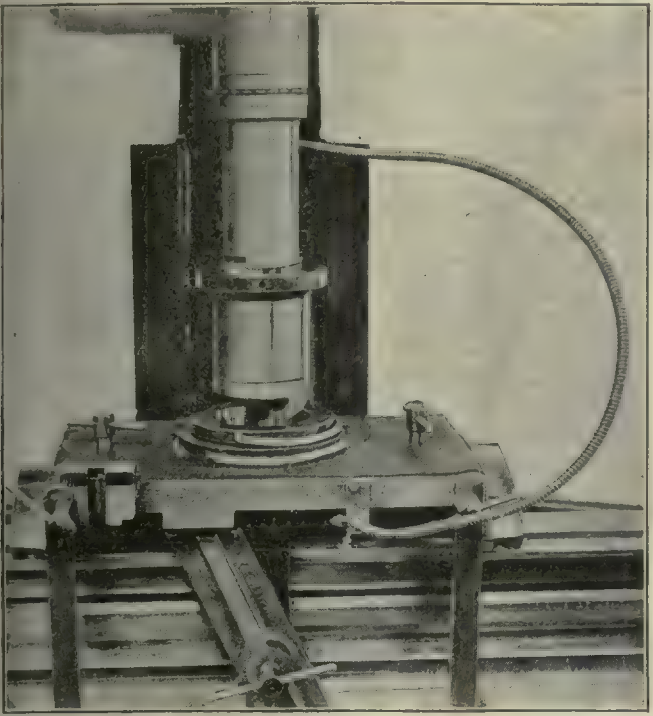


FIG. 284. HOLLOW MILL ROUGHING 75-MM. GUN RECOIL MECHANISM TRUNNIONS

Hollow mills are very apt to cause chatter. In the first place, we are dealing here with broad nosed tools; as a rule, (almost always, in fact), with square nosed tools. Furthermore, the cut is divided between a number of these tools so that the feed per individual tool is very much reduced. Still further, a hollow mill is necessarily a poorly supported tool. It overhangs from a spindle, or possibly from a fixture, but in any case it does overhang. All these facts combined make the action of a hollow mill very unfavorable for smooth cutting and accurate size. Where the piece to be turned up is of considerable length, it will be found to be very difficult to keep it round or to size, and wherever possible a single point lathe tool should be preferred to the hollow mill if an accurate job is required. Nevertheless, there are a great many jobs where the use of the single point tool would be impossible or impractical, and there the hollow mill plays a very important role.

Fig. 284 shows an interesting hollow mill arranged to be guided in a large jig eye and used for rough-turning of trunnions of the recoil mechanism of the 75-mm. gun. It is particularly interesting for the way in which this tool was arranged to take very wide cuts in tough material and for the manner of inserting the blades.

A trephining or trepanning tool is used for boring holes without converting all of the metal of the hole into chips. The operation of trephining is particularly useful where holes of large diameter and short length have to be bored. Cutting out a piece of boiler plate by means of a tool in the spindle of a drill press is really a trephining operation. We often see the trephining operation in the toolroom where a fiber washer is required, but we hardly recognize the operation by this name. When trunnion rings or jackets for heavy guns are made it is often the practice to use solid forgings and trephine the inside part which leaves a very useful chunk of material for some other purpose. When trephining, the tool will have to clear both toward the inside and the outside and this is the chief difference between a trephining tool and a hollow mill. Stating the difference between counterbore, trephining tool and hollow mill once more, we have:

A counterbore must have clearance on the outside diameter.

A hollow mill must have its clearance on the inside diameter.

The trephining tool must have its clearance on both the inside and outside diameter.

Fig. 285 shows a trephining tool for relatively short work of large diameter, such, for instance, as the cutting out of the core of a trunnion ring. The toolhead is a heavy steel casting fastened in some way to the spindle of the trephining machine, which, by the way, is merely an extraordinarily heavily built drill press. The head has three arms, though of course any other number of arms might be used. The tools are broad blades, curved to correspond to the cylinder to be cut out and thicker in front than in the rear. This difference in thickness provides the necessary clearance Oblong holes are cored in the arm of the trephining head and the blades are set to the proper diameter by means of packing. In order to set all the blades to the same diameter and the same depth, one blade is put in first and then a shallow cut is taken with this one blade so as to make a groove in the work in which the other blades can be set. The entire arrangement and manner of adjusting are extremely crude. However,

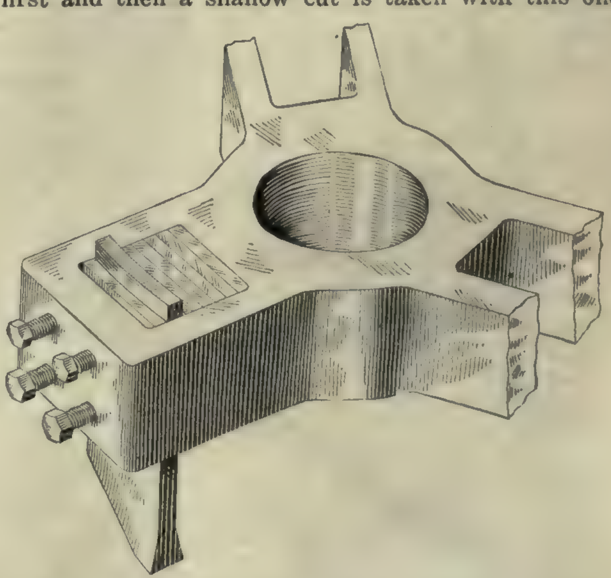


FIG. 285. TREPHINING TOOL FOR SHALLOW WORK

tools of this description are not used for quantity production and the amount of time required to set such a tool is small compared to the total time required for the cut. The greatest difficulty to overcome with this arrangement of head is the grinding of the blades, which should have the same width at the cutting edge.

Fig. 286 shows a trephining tool as used for long work, such as the coring out of heavy castings or the making of cylinders out of solid stock. The tool is made out of a tube, preferably of some high-grade material, so as to keep the walls as thin as possible, and a number of tools are inserted in the front end of the tube very much in the manner in which saw teeth are inserted in large circular saws. The width of these blades must be considererably greater than the thickness of the tube, so as to make it possible for the chips to escape along the outside of the tube while oil under pressure is admitted to the inside.

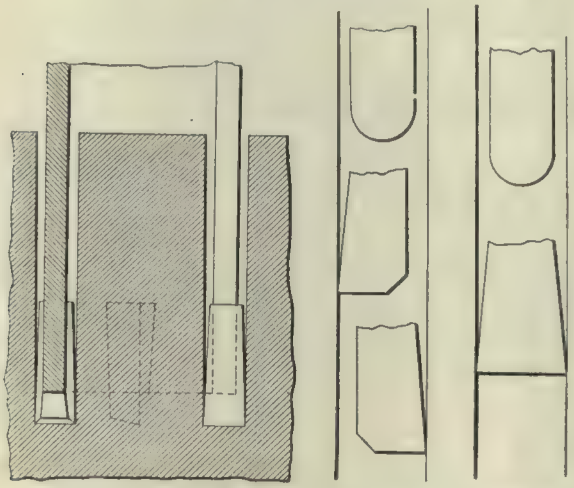


FIG.286 FIG.287 FIG.288

FIG. 286. TUBULAR TREPHINING TOOL FOR DEEP WORK.
FIG. 287. ONE WAY OF ARRANGING TEETH.
FIG. 288. ANOTHER WAY

The teeth of this type of trephining tool are sometimes made as represented by Fig. 287. Here the first tooth is of the round nosed tool type; the next tooth cleans up one side of the groove made by the first tool, and the third tool cleans up the other side. Sometimes they are arranged as shown in Fig. 288 where roughing and finishing teeth alternate.

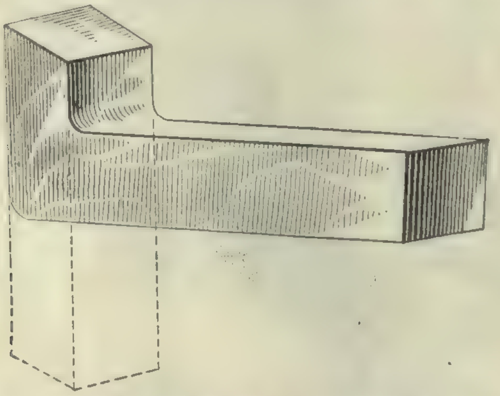


FIG. 289. SKETCH SHOWING DIFFERENCE BETWEEN CHISEL POINT AND ORDINARY TOOLS

It is essential to limit the rake of the tools so as to prevent the making of long chips. The small amount of rake and abundant clearance at the bottom or front end of the cutting edge causes short, compactly curled chips which, as a rule, can escape. Even with the greatest care it will be found necessary to withdraw the tool from time to time so as to prevent choking up.

It might be asked why the second arrangement of tool would not always be better than the trephining head first described. The advantages of the three-armed head are the following:

The cut is always open, so that there is no possibility of choking by chips.

It is possible to make tools for various diameters at relatively slight expense.

It is possible to vary a diameter slightly without requiring new tool blades.

Heavier cuts can be taken with this arrangement of tool because a cut can be started and can progress to a certain depth with a small amount of overhang of the blades, after which the blades can be readjusted for a deeper cut. By repeating this operation several times very heavy cuts can be taken until the blades are pushed out to a considerable depth. If the tubular trephining tool is used, the depth of cut is always dependent on the maximum amount of overhang of the tube. In other words, this depth is always a minimum.

Notwithstanding all of the above advantages the tubular tool is to be recommended for production work, especially if the work is of considerable length.

Box Tools

A box tool is not so much a special kind of metal cutting tool as a special arrangement of a tool. It is used for lathe work of relatively small diameter and where a tail center cannot be employed; in other words, for screw machine work. The tool used is ordinarily the so-called chisel point tool. Though this type of tool is known by its special name, yet it cannot be said to differ in any essential from the ordinary lathe tool. Fig. 289 shows a forged lathe tool of the ordinary type and the dotted lines show how it would be transformed into a chisel point tool if the shank were attached in a different manner—that is, under, instead of back of, the cutting part. This shows that there is no real difference in the action of an ordinary lathe tool and chisel point tool.

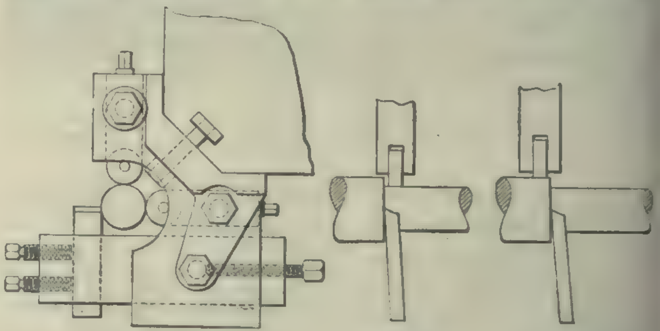


FIG.290a FIG.290b FIG.290c

FIG. 290. A TYPICAL BOX TOOL

When a heavy roughing cut is taken on an ordinary lathe the feed is, generally speaking, considerable as compared to the depth of cut. It is, for instance, quite common to use ⅛-in. feed with a depth of cut of ¼ in. In screw machine work, however, we will find many cases of a deep cut with a relatively small amount of feed—for instance, where the hexagon stock for a bolt is reduced to the bolt size, and in many other cases. When such a cut is taken the feed probably does not exceed 0.020 in. In general, in turret lathe and screw machine work the feed is small as compared to depth of cut for roughing work, and for that reason the chisel point tool is particularly useful. As practically all of the cutting is done on the side and not in front, it gives the looker-on the impression that a different kind of cutting action is taking place, but this is not so. The construction of a chisel point tool, merely a bar of steel ground at the end, lends itself particularly well for box tools.

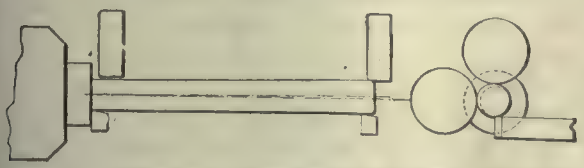


FIG. 291. EFFECT OF SETTING ROLLERS TOO FAR FROM WORK

The function of the box tool is to guide the work as well as to carry the cutting tool. In a sense it has the same function as a hollow mill, except that the size of the work is determined here not by the relative position of three or more cutting points, but by the relative position of a cutting point and a back rest. In the case of a box tool the back rest can be arranged either as a "V" or with rollers. The advantage of the "V" is that it has no lost motion. On the other hand it has the disadvantage of introducing a great deal of friction and a tendency to score or mar the work, and for that reason the rollers are used more and more for a back rest. Fig. 290 shows a box tool as used on Gridley automatic turret lathes. As will be seen, each one of the rollers, as well as the tool, is independently adjustable.

In order to have ideal conditions each of the rollers, as well as the tool, must be at a distance from the centerline of the spindle equal to the radius of the work. It is rather difficult to meet this requirement. The "V" would seem to have the advantage because one needs to pay attention to one side of the "V" only. However, if it is located in such a way that one leg bears harder against the work than the other, there is no way of correcting the error, while the independently adjustable rollers offer an opportunity to correct any error which may have crept in.

The rollers, or for that matter the "V," of a box tool may be set either in advance of the tool or may follow, as indicated in Fig. 290b and 290c. The first arrangement has the advantage that the work is held before a cut is taken. The second has the advantage of the assurance that the piece against which the rollers bear is round and of even size. As a rule we cannot depend on the evenness of size nor on the roundness of the stock, nor can we be absolutely sure that the stock is held concentrically in the spindle; so that when a roughing cut is taken we should have the roller follow the tool. When, however, a box tool is used for a second cut, better results are obtained if the rollers lead, provided that there are no shoulders which make this method impossible.

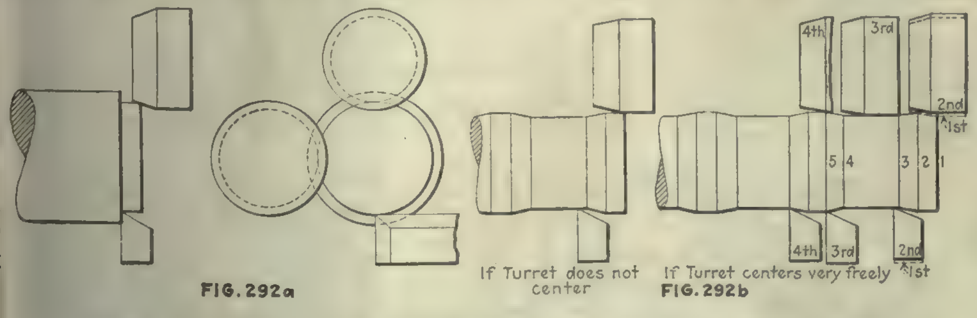


FIG. 292a

FIG. 292b

FIG. 292. EFFECT OF SETTING ROLLERS TOO CLOSE TO WORK

Considerable difficulty is experienced when trying to produce an accurate piece of work with a box tool. The errors are, as a rule, relatively small, yet sufficient to cause considerable trouble unless great care is taken to avoid those conditions which are most apt to cause them. Among these conditions are eccentric chucking, lack of accuracy of spindle, lack of alignment between spindle and turret slide, looseness of turret and turret slide, and lack of accuracy in the setting of tool and rollers to correct diameter. The scope of this article does not permit of making a complete analysis of the effects of all these conditions, and only a few combinations will be indicated here. In the following illustrations the errors are grossly exaggerated because it is not possible to show them as they actually occur. However, the principle remains the same.

In Fig. 291 the rollers are set to a diameter somewhat larger than the diameter to which the tool is set. By this is meant that the distance from the roller to the axis of the work is too great. What will happen is indicated in Fig. 291. As the tool leads the rollers the pressure of the tool against the work will make the work spring until it rests against the rollers. As a result the instantaneous center of rotation of work at the beginning of the cut is some distance away from the axis of the spindle, the work is pushed against the rollers, provided it is slender enough to allow such an amount of spring, and the diameter of the front end of the work will be too large. As the cut progresses toward the spindle the pressure of the cut is no longer sufficient to spring the work enough to bring it up against the roller and the diameter of the finished work gradually decreases until at the spindle the diameter corresponds with the diameter to which the tool is set. The total result is that we obtain a piece of work which is of a larger diameter at one end than at the other. However, it will not be a straight taper. If, for instance, the work were very slender, a large portion of the total length might have been turned up with the same diameter as the front end. Finally, the taper will start, but this taper itself would not follow a straight line, but rather some curve more or less resembling a parabola. If, on the other hand, the piece had been of sufficient stiffness so that it cannot be pushed against the roller, even at the front end, the piece would have been taper over its entire length.

In the foregoing it was assumed that spindle, turret and slides were without any lost motion, and this assumption will also be held in the following where it is supposed that the rollers are set to a smaller diameter than the tool. Figs. 292a and 292b show this condition. Attention is once more called to the fact that the illustration grossly exaggerates the error.

Fig. 292a shows an end and a top view of the condition at the beginning of the cut. The tool being in the lead has cut a short distance of the correct diameter, provided the pressure was not sufficient to cause any material springing of the work, or, if the work were slender, the diameter at the end would have been somewhat oversize. The illustration shows the roller about to enter onto the work. The roller has either a tapered or a rounded leading edge. For the sake of simplicity this leading edge is shown tapered.

Fig. 292b shows what will happen at various stages when the cut is taken. The length 1—2 has been cut before the roller touches the work. As the taper part of the roller climbs onto the work the stock is pushed against the tool and compels it to cut to a smaller diameter than that to which it is set. The center of rotation, therefore, is no longer situated in the axis of the spindle. But after the cut is finished this center will spring back again to its original position. As a result of this action we obtain a piece, 2—3, which tapers down. For some length of time the diameter will remain unchanged. This length depends on the length of the cylindrical part of the roller. As long as any part of this roller slides over the portion 1–2 of the work we will turn a small diameter. When the back edge of the roller slides over the taper part 2–3 it permits the work to come back again to its original center of rotation, so that the tool passes over the part 4–5, and we will get the full diameter at the point 5, retaining this full diameter until the taper part of the roller once more pushes the work back as it passes over the taper part 4–5. This action will be repeated as long as the work is slender enough to allow of sufficient spring. If a cut must be taken close to the spindle, or on a heavy piece, so that such an amount of spring is no longer possible, a condition will be reached where either the machine stalls or something breaks down. As a rule the operator would discover this condition before anything serious happens. He would not be so likely to discover why a piece of work is of uneven size or rough, and he is liable to attribute the faulty work to almost anything before he realizes that tool and roller are not set to exactly the same diameter.

One gets the same result when the turret or slide allows a certain amount of movement rather freely, and particularly so if at the same time the work is springy. Under those conditions the tool starts in to cut the piece too large, both because the piece will spring away and because the turret will move away from the piece. Consequently the roller is compelled to move onto the piece under the same conditions as were described before, namely, that the piece is too large for the setting of rollers and tool. Whereas in the former case we started in with the correct diameter and the waves of variations would oscillat between correct and minus, in the case we are considering now we start in with a diameter which is too larg and the size of diameter will fluctuate from plus t minus.

In order to minimize the bad effects of the weavin of the turret or spring of the piece it is well to tak a starting cut with a box tool in which the rollers lea and take the greater part of the cut with another bo tool in which the rollers follow.

(To be continued in next week's issue.)

International Fair at Riga, Latvia

Trade Commissioner H. Lawrence Yroves, Riga

The Riga International Fair, held from July 31 t Aug. 28, while not developing any important volum of immediate sales or orders, has been a success as a advertising opportunity for those working for futur international business.

Agricultural machinery made up the most importan exhibits—most of it of German origin, with plows harrows, and cultivators especially in evidence. German-made mowing machines—virtual duplicates of well-known American brand—were shown, as well a German thrashing machines and a large assortment o hand tools. The other most important groups wer woodworking machinery and household utensils, als largely of German make.

German goods constituted 75 per cent of the display by the 600 or more exhibitors. The Czecho-Slova Metal Industry combine had a display of machinery The only passenger automobile at the fair was th small French Citron exhibited by its Riga agency. number of German motor trucks were on display. On American farm tractor was shown by its Latvian cooperative agency. English products were represente with one steam and one gasoline tractor and displays o textiles. The Scandinavian countries, Italy, Franc Switzerland, Austria, and Poland had displays of on or more products.

An interesting exhibit by the Bolshevists during th last ten days of the fair included a good deal of hand work such as embroidery, coarse laces, and product of home industry. Rugs, some machine-made and som hand made, were evidently from pre-war times. Ther was a good display of furs and baled flax, with som leather of poor quality. Charts, diagrams, and map indicated Bolshevist programs for child welfare an industrial production and development, including plan for electrification of Russia.

The Riga management proposes to hold a simila fair some time next spring, concerning which detaile information may be obtained by addressing Izstad (Exhibition), 24 Gr. Schloss Str., Riga, Latvia.

Machine Tools and Educational Institutions

Caldwell Act Gave Over Two Thousand Surplus Machine Tools to Schools—More To Be Available Soon—Applications Now Being Received

MACHINE TOOL users as well as machine tool builders, will be interested to know of the result of the Caldwell Act for the disposition of surplus government machine tools to educational institutions. The *American Machinist* welcomed the opportunity to do a real service to the machine tool industry, as well as to the educational institutions of the country, and it was its privilege to aid materially in 1919 in securing the passage of this bill.

While the original proposal was to lend the machines to colleges and schools, the plan finally adopted sold them at 15 per cent of their cost. As a result of this 2,408 machine tools are now in educational institutions in various parts of the country. Machines which cost the U. S. Government $2,145,022.25 were sold to schools for $321,753.34. They went to every state in the union, one even going to Porto Rico. A list of the schools taking advantage of this opportunity follows, and it is interesting to study the distribution. California leads with 314 machines installed for the education of her youth and is to be congratulated on the foresight displayed.

Here is the list:

Alabama: Alabama Polytechnic Institute, 5; Birmingham Board of Education, 14.

Arizona: Bisbee High School, 6; Phoenix High School, 28.

Arkansas: University of Arkansas, 10.

California: Alameda High School, 3; Berkeley High School, 2; University of California, 14; Chino High School, 2; Coachella Valley High School, 1; Colton High School, 2; Corona High School, 1; Coronado High School, 5; Fullerton High School, 8; Healdsburg High School, 10; Los Angeles City Schools, 27; Alhambra High School, 7; Oakland Public Schools, 106; Oakland Polytechnic College of Engineering, 4; Orange High School, 4; California Institute of Technology, 21; Pasadena High School, 5; Red Bluff High School, 3; Riverside Polytechnic High School, 1; Roseville High School, 2; San Bernardino High School, 2; San Diego High School, 2; San Jose High School, 3; California Polytechnic School, 2; San Mateo High School, 4; San Rafael High School, 2; Santa Ana Polytechnic High School, 6; University of Santa Clara, 1; Tamalpais High School, 19; Leland Stanford Junior University, 9; Stockton High School, 9; Whittier State School, 4; Fresno High School, 1; Chaffey High School, 16; Dinuba High School, 2.

Colorado: University of Colorado, 15; Pueblo High School, 2.

Connecticut: Connecticut Agricultural College, 21; Waterbury Vocational High School, 6; Norwalk, Public Schools, 4.

Delaware: Wilmington High School, 4.

District of Columbia: Bliss Electrical School, 8; Catholic University, 16.

Florida: Jacksonville High School, 4; Florida Agricultural and Mechanical College, 3.

Georgia: Americus Public Schools, 1.

Idaho: Twin Falls High School, 1.

Illinois: Lewis Institute, 15; Thornton High School, 13; Moose Heart School, 4; Ottawa High School, 6; Bradley Polytechnic Institute, 4; Peoria Manual Training School, 1; Rockford Board of Education, 8; Sterling Township High School, 6; Streator High School, 11; University of Illinois, 4.

Indiana: East Chicago High School, 1; Indianapolis Public Schools, 34; Purdue University, 22; University of Notre Dame, 2; South Bend Public Schools, 11; Rose Polytechnic Institute, 2.

Iowa: Cedar Rapids Vocational High School, 2; Davenport High School, 3; Sioux City Public Schools, 9; Iowa State Automobile and Tractor School, 8.

Kansas: Cherokee County High School, 11; Kansas State Agricultural College, 40.

Louisiana: Delgado Trades School, 8; Tulane University, 1; Louisiana Industrial Institute, 1; Southwestern Louisiana Industrial Institute, 14.

Maine: West Brooke School, 3; Bangor Public Schools, 1.

Massachusetts: Massachusetts Agricultural College, 1; Boston Trade School, 4; Boston Y. M. C. A., 17; Harvard University, 23; Massachusetts Institute of Technology, 108; Chicopee High School, 45; New Bedford Vocational School, 4; Norwood High School, 5; Springfield Technical High School, 11; Tufts College, 14; Westfield Boys Trade School, 9; Williams College, 2; Worcester Polytechnic Institute, 24; Quincy, Public Schools, 4.

Michigan: Adrian High School, 1; University of Michigan, 34; Detroit Institute of Technology, 6; Michigan State Auto School, 9; Detroit Northeastern High School, 1; Flint School of Automobile Trades, 1; Grand Rapids Board of Education, 41; Ironwood Public Schools, 1; Jackson High School, 14; Michigan Agricultural College, 33; Lansing Public Schools, 21; Menominee High School, 5; Saginaw Public Schools, 32; Arthur Hill Trade School, 5; Wakefield Public Schools, 5; Cass Technical High School, 13; Manistee School District, 4.

Minnesota: University of Southern Minnesota, 8; Independent School District No. 12, 1; William Hood Dunwoody Industrial Institute, 15; University of Minnesota, 21; St. Paul Public Schools, 2; St. Paul Y. M. C. A., 5.

Mississippi: Mississippi Agricultural and Mechanical College, 1.

Missouri: St. Louis Y. M. C. A., 11; Sweeney Automobile and Tractor School, 10.

Montana: Billings Polytechnic Institute, 4; University of Montana, 14; Flathead County High School, 2.

Nebraska: University of Nebraska, 7.

Nevada: University of Nevada, 2.

New Hampshire: Dartmouth College, 2.

New Jersey: Franklin Vocational School, 2; Rutgers College, 8.

New Mexico: Albuquerque High School, 6; State University of New Mexico, 1; Carlsbad High School, 1; Roswell High School, 3; Santa Fe High School, 1; New Mexico College of Agriculture and Mechanical Arts, 19.

New York: Alfred University, 11; Auburn Academic High School, 3; Pratt Institute, 25; Polytechnic Institute of Brooklyn, 10; Brooklyn Y. M. C. A. (Bedford Branch), 23; University of Buffalo, 2; Buffalo Y. M. C. A., 3; Elmira Vocational School, 2; State Institute of Applied Agriculture, 2; Hudson Industrial School, 2; Cornell University, 27; Kingston High School, 7; Hebrew Technical Institute, 1; Holmes Vocational School, 4; New York Y. M. C. A. (West Side Branch), 22; Niagara Falls Department of Education, 1; Olean Board of Education, 8; State Normal School, 3; Rochester High School, 20; Silver Bay School for Boys, 7; Solvay Schools, 1; Syracuse Y. M. C. A., 2; Rensselaer Polytechnic Institute, 9; Utica Free Academy, 8; Waverly High School, 1.

North Carolina: State College of Agriculture and Engineering, 11.

North Dakota: Hanson Tractor and Automobile School, 2; University of North Dakota, 12.

Ohio: University of Akron, 8; Cambridge Public Schools, 3; Canton Public Schools, 11; Canton Y. M. C. A., 18; Chillicothe Public Schools, 2; University of Cincinnati, 10; Case School of Applied Science, 23; Cleveland East Technical High School, 7; Cleveland University School, 4; Cleveland West Technical High School, 8; Cleveland Y. M. C. A., 48; Ohio State University, 5; Columbus Trades High School, 8; Columbus Y. M. C. A., 22; Dayton Y. M. C. A., 20;

Elyria Technical High School, 2; Sidney Public Schools, 3; Toledo Public Schools, 25; Toledo University, 4; Warren City Schools, 1; Antioch College, 6; Youngstown Y. M. C. A., 6; Shaw High School, 6.

Oklahoma: University of Oklahoma, 2; Oklahoma A. and M. College, 4.

Oregon: Portland Y. M. C. A., 12; Benson Polytechnic School, 17.

Pennsylvania: Polish National Alliance College, 6; Easton High School, 1; Erie School District, 32; Haverford College, 1; Philadelphia Board of Education, 6; Drexel Institute, 4; Spring Garden Institute, 16; Pittsburgh Public Schools, 14; Swarthmore College, 11; Washington High School, 8; Washington and Jefferson College, 7; Williamsport Public Schools, 9; York Public Schools, 20; Chambersburg School District, 6; Philadelphia Y. M. C. A., 8; Steelton Public Schools, 3.

Rhode Island: Rhode Island State College, 6; Westerley Public Schools, 2; Providence Trade School, 5.

South Carolina: Charleston Public Schools, 10; Clemson Agricultural College, 1.

South Dakota: South Dakota State Tractor and Auto School, 2; South Dakota A. and M. College, 5; University of South Dakota, 17.

Tennessee: Lincoln Memorial University, 9; University of Tennessee, 13; Vanderbilt University, 14.

Texas: Sul Ross Normal College, 3; A. and M. College, 6; Houston Public Schools, 2; Rice Institute, 1; Port Arthur School District, 1.

Utah: Granite School District, 1; Nebo School District, 1.

Vermont: University of Vermont, 3.

Virginia: A. and M. College, 12; Hampton Normal, 8; St. Paul Normal, 3; Maury High School, 5; Virginia Normal School, 17; John Marshall High School, 2.

Washington: Port Angeles Public Schools, 2; State College, 24; University of Washington, 4; Seattle Y. M. C. A., 8; Walla Walla High School, 4.

West Virginia: Benwood High School, 10; West Virginia University, 23; Wheeling Public Schools, 5.

Wisconsin: Beloit Vocational School, 9; Chippewa Falls Vocational School, 5; Eauclaire Vocational School, 2; Green Bay Vocational School, 3; Kenosha Vocational School, 8; University of Wisconsin, 49; Manitowoc Vocational School, 3; Menasha High School, 4; Stout Institute, 5; Milwaukee Continuation School, 41; Marquette University, 12; Neenah Industrial School, 3; Oshkosh Vocational School, 7; Racine Vocational Schools, 4; Marinette Vocational School, 11.

Porto Rico: Castro Technical School, 1.

Competition from British and Italian Automobile Manufacturers

WILLIAM I. IRVINE

Trade Commissioner, Automotive Division, Commerce Dept.

Reports that European manufacturers are seriously undermining Americans in overseas automotive markets are not borne out by the official export statistics. But the figures received do indicate that competition from two countries—England and Italy—is developing, and that to meet it successfully American manufacturers must support their export organizations at this time so that they may hold the positions won during the past year.

The most interesting phase of these statistics is that for the first three months of 1921 Italy shows in the total number of automotive vehicles shipped an excess over the same period in 1920; but, as automotive products in Italy are classified by weight, it is impossible to separate passenger from commercial vehicles in considering the excess. Italy's exports have grown steadily since 1919. In that year, during the first three months, 493 vehicles were exported, about half of which went to France and the remainder to Belgium, Portugal, and scattered countries. During the first three months of 1920 a total of 2,033 was exported, the greatest number going to Great Britain, Switzerland, Spain, and Algeria.

GROWTH OF THE SPANISH MARKET

It is interesting to note that the exports to Spain developed from 17 in 1919 to 222 in 1920. The progress has continued in the first three months of 1921, when 314 were shipped. The total figures for the first three months of 1921 are 3,174, of which 652 went to Great Britain, 385 to Spain, and 210 to British India and Ceylon. The Indian development should be of interest to American manufacturers who believed that their principal competition in this market would come from Great Britain. This total of 210 was shipped during the first three months of this year, as against 119 for the corresponding period of last year. A comparatively small number of Italian vehicles have gone to South America, the total being 131 for Argentina and 55 to Brazil.

It is almost unquestionable that the low rate of the Italian lira is the important contributing factor to growing exports of Italian manufacturers. It is natural to assume that when Italian vehicles come into competition with products of American manufacturers the factor of price plays largely in the closing of sale. It would be to the interest of American manufacturers at this time to prepare sales arguments which would better fortify their representatives overseas to meet this kind of competition.

Exports of British manufacturers do not show a heavy falling off for the first seven months of 1921 as compared with the similar period for 1920, but it must not be assumed that this is because of a strong preference in overseas markets for British products. Last year Britain was not in a position to do very much exporting, because the demand for the home market was so great that manufacturers felt it obligatory to satisfy most of this demand before permitting exports. The number of cars shipped during the first seven months of 1920 was 2,916, as compared with 2,081 for the same period of 1921. The decline in the number of trucks exported is even less. The figure in 1920 was 2,045 as compared with 1,838 for the seven months period of this year. The relative standing of America with Britain as an automotive export market may be judged from the fact that during the first seven months of 1920 America shipped 88,640 cars and 18,333 trucks while in 1921, during the same period, 19,466 cars and 5,092 trucks were shipped.

The Schoop Process of Metal Spraying

Protective Coating of Metal Sprayed by Compressed Air—Impalpable Particles Discharged at High Velocities Penetrate Pores—Variety of Metals Can be Used

BY SPECIAL CORRESPONDENCE

WHILE the Schoop process of spraying metals for protective coating has been in use in European countries for several years, it is only lately that it has become a factor in the industries of the United States.

Two methods are used in the application of the spray in which the metals used may be lead, tin, zinc, aluminum, copper and nickel, Monel metal, bronze or other alloys, and the precious metals.

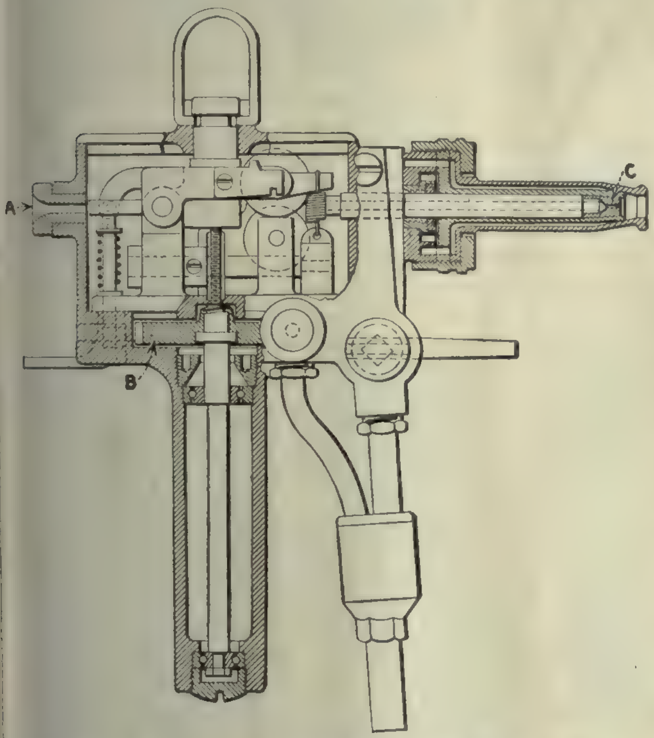


FIG. 1. SECTIONAL DRAWING OF THE PISTOL

A gun or pistol weighing but 3½ lb. used in the first method is illustrated in Fig. 1. The metal to be sprayed is introduced at *A* in the form of wire and is fed continuously and uniformly at the rate of about 12 ft. per minute, through mechanism operated by the air-driven turbine *B*, to the muzzle *C*. Here the wire encounters a reducing flame of oxy-acetylene or oxy-hydrogen and is melted at a rate equal to the amount of feed. Under these conditions the end of the wire is melted a drop at a time and each drop, at the instant of formation is met by a blast of air at 50-lb. pressure, converted into spray and shot out in a diverging cone having a core of reducing gas and a surrounding sheath of air. The spray of metal being discharged at high velocity penetrates the pores of the object to be coated while still plastic.

ACTION SIMILAR TO THE AIR BRUSH

The pistol is essentially a metal-coating air brush, the spray from which covers a surface of about 2 in. in diameter at a distance of 5 in. from the muzzle.

The wire used is from No. 13 to No. 21 B. & S. gage. A single coating is about 0.001 in. thick though a coating of any thickness can be built up by continued application. It is claimed that a coating 0.003 in. in thickness, well-impacted on the surface, is as effective as a much thicker one.

For greater speed of operation where large areas are to be covered another method is used, employing the coating metal in the form of dust. The apparatus used in this method is known as the "Gravitas" gun and is shown in Fig. 2. A cylindrical container, holding about 20 lb. of powdered metal is fitted at the top with a removable cover to which is attached a pressure gage. At the bottom is a distributor through which the dust is forced by air at a pressure of 12 to 15 lb. From the distributor the dust passes through a rubber tube to the spraying tube or gun, from the muzzle of which it emerges between two concentric flame zones. The dust is heated to a plastic state and shot out onto the surface to be coated.

EXAMPLES OF WORK

In Figs. 3 to 5 are shown some of the applications of coating by the use of the pistol. Fig. 3 illustrates the coating of pipe for an oil pipe-line to be laid in the alkali fields of the Pacific coast, where an uncoated pipe line would be destroyed in a year. Fig. 4 shows the process being employed to protect the jaws of a street car frame. In Fig. 5 a pipe coil is being coated.

The use of the "Gravitas" apparatus is shown in Fig. 6 where the surface of a large drying plate is receiving a protective coating.

All metal surfaces to be coated should first be made clean, preferably by the sand blast process. When spraying indoors, particularly with lead or zinc, some

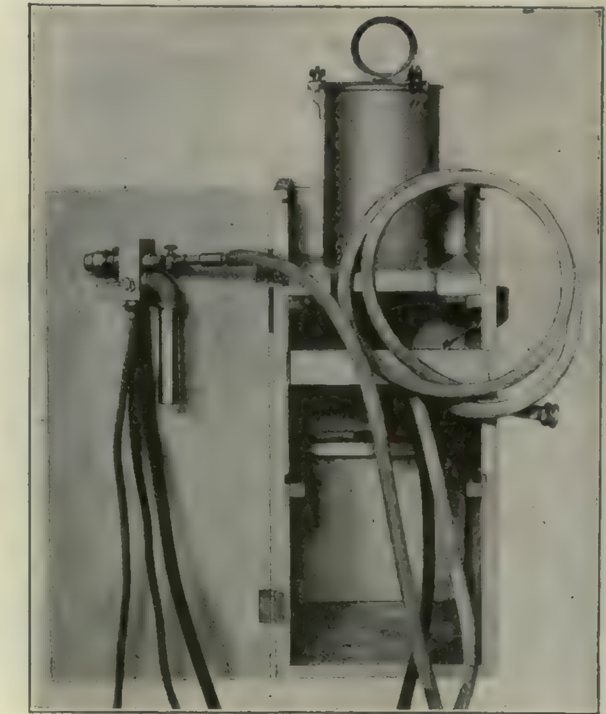


FIG. 2. THE "GRAVITAS" GUN

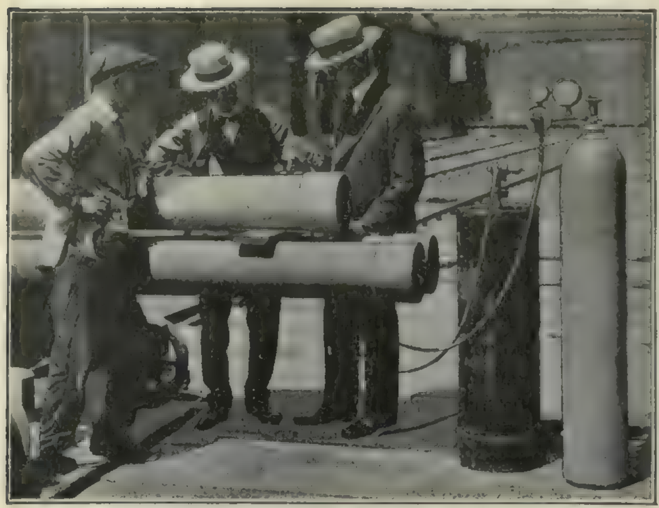


FIG. 3. COATING PIPE FOR A PIPE LINE

arrangement should be made to carry off the noxious fumes.

Protective coating is but one of the many uses of the metal spray. Copper can be deposited on carbon brushes, also on portions of work to be carbonized and casehardened in some parts while other parts are to be left soft; glass condensers can be coated with tin; wooden patterns can be preserved and strengthened for long service by spraying with any desired metal; radiators, stoves, etc., can be ornamented by spraying with various metals or alloys; seamless tubes can be formed of any thickness or length on cores or mandrels, and so on.

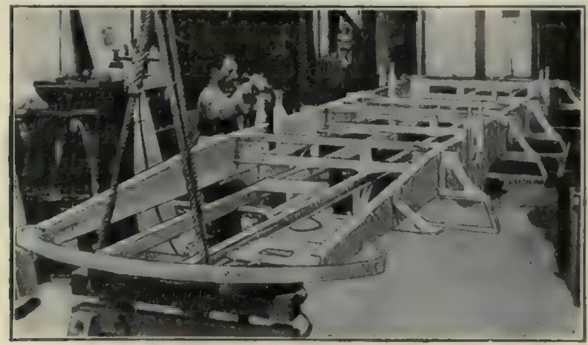


FIG. 4. PROTECTING PART OF A STREET CAR FRAME

The process may also be used as a "putting on" tool for the building up of worn commutators and other parts of machinery. Recently the piston rod of a very large hydraulic accumulator, worn so that the packing would not keep it from leaking, was successfully built up with Monel metal.

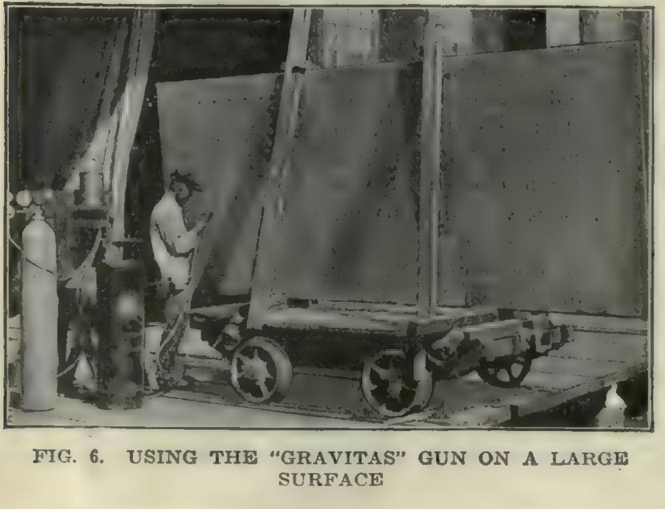


FIG. 6. USING THE "GRAVITAS" GUN ON A LARGE SURFACE

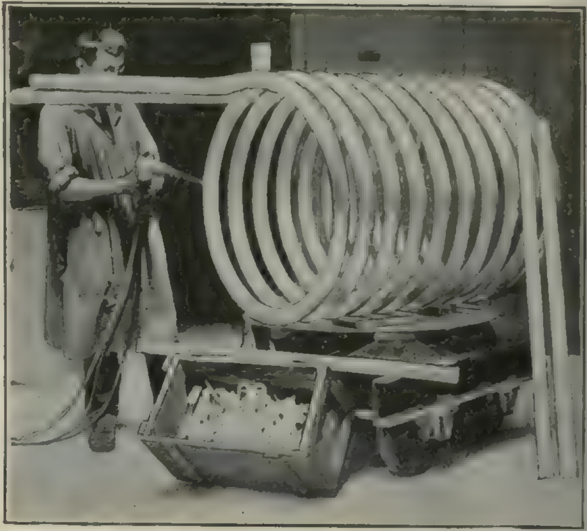


FIG. 5. SPRAYING A PIPE COIL

It is claimed that metals can be sprayed on fabrics or paper as the heat of the spray at 6 in. from the muzzle of the gun is not sufficient to ignite them.

The owner of the American rights for the Schoop process is the Metals Coating Co. of America, 495-497 North Third St., Philadelphia, Pa., to whom your correspondent is indebted for the illustrations and data used in the preparation of this article.

A Dangerous Experiment

It seems at this time that we are trifling with a particularly dangerous experiment in attempting to build a high tariff wall for the protection of our manufacturers. Europe is much more anxious to buy our goods than we are to buy hers. By placing a high tariff on her manufactured products, we are incurring the ill-will of her capital and her labor. In fact, the United States has today become more unpopular commercially than ever. In addition to that, we are still further decreasing Europe's buying power by making it almost impossible for her to sell goods to us. The most important item confronting us is to supply Europe with funds with which to purchase our commodities.

Our Future Linked With Europe's

It would seem that it devolves most strongly upon us to have our Government issue another large credit in favor of the foreign governments, going so far even as to remove the requirement that the proceeds of this credit shall be expended for the purchase of American goods. (It is a harmful fallacy to suppose that we can set aside the time-worn law of supply and demand.)

Let us not lose sight of the fact, whether we be Republicans, Democrats, or what not, that our future is linked indisputably with Europe, and that she helps us or hinders us according to the degree of prosperity or depression she is undergoing. We must remove to a great degree the backwash of Europe's financial difficulties by lending her a helping hand with her credit and our advice before we can hope to quickly regain our own prosperity.—Julian W. Potter, in *Forbes Magazine* (N. Y.)

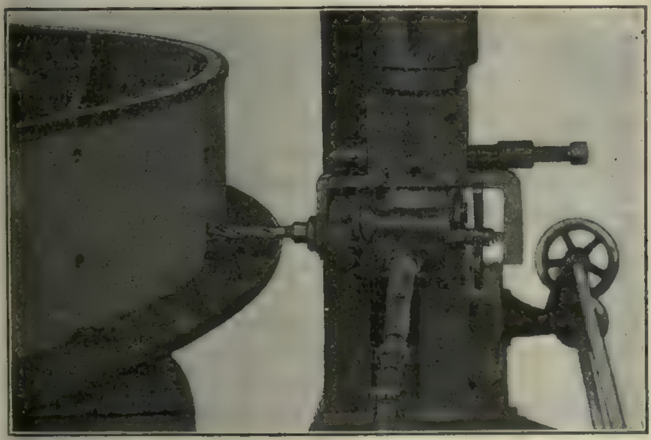
Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Boring Horizontal Holes on a Vertical Boring Mill with a Pneumatic Drill

By F. A. McLean

It sometimes happens in shops doing a wide variety of repair work, that a piece will come in for drilling that is too large to be handled on any post or radial drilling machine in the plant. Such jobs are always a problem, the successful solution of which usually depends on the ingenuity and skill of the foreman in rigging up or adapting such tools and odds and ends as may happen to be available. A case in point which clearly illustrates the value of pneumatic tools for such work is shown in the halftone reproduction of the photograph herewith.



BORING HORIZONTAL HOLES ON A VERTICAL MILL

The brake ring on a large mine hoist was broken so badly that a new one was required. The casting for this ring, or spider, was between 9 and 10 ft. in diameter and had to be bored and turned all over. This operation was done on a 14-ft. boring mill and the next step was to drill ninety-six 1⅜-in. holes through the rim (which was about 1½ in. thick) to permit the bolting on of wooden friction pads or shoes.

Owing to the large size and awkward shape of the ring casting it was impossible to drill it on an ordinary drill press, so that it became necessary to seek some other way of doing the work. The old method of doing the job would have been to use ratchet drills, figuring on about twenty minutes per hole and adding the time lost in shifting the drill, setting up the "old man," etc., and would probably have required the services of two men for about thirty-two hours.

Drilling the casting on the floor with a pneumatic drill would have required the services of two men for eight hours, and in addition some time would have been lost in shifting the casting from the mill to the floor and vice versa. After the friction pads were bolted in place they had to be turned to form a good seat for the brake band and it was finally decided that the best way of doing the job was to drill it on the boring mill; thus saving the time which would otherwise be lost in moving the piece to and from the mill and resetting it.

A small pneumatic drill was clamped to one of the toolheads of the boring mill by a simple yoke. The cross and vertical movements of the toolhead were used for feeding and adjusting the drill up and down, while the table was revolved from time to time as required, thus acting as a sort of indexing device insuring the proper location and alignment of the holes.

The actual drilling time, using the equipment illustrated, was eight hours for one man. The holes were all drilled true and very little time was consumed in shifting the drill. One and one-half hours was saved in moving the casting to and from the mill and half an hour for resetting the piece to turn the brake pads after they were bolted on, thus saving approximately twelve hours over the estimated time required for two men to drill this piece on the floor with a pneumatic drill.

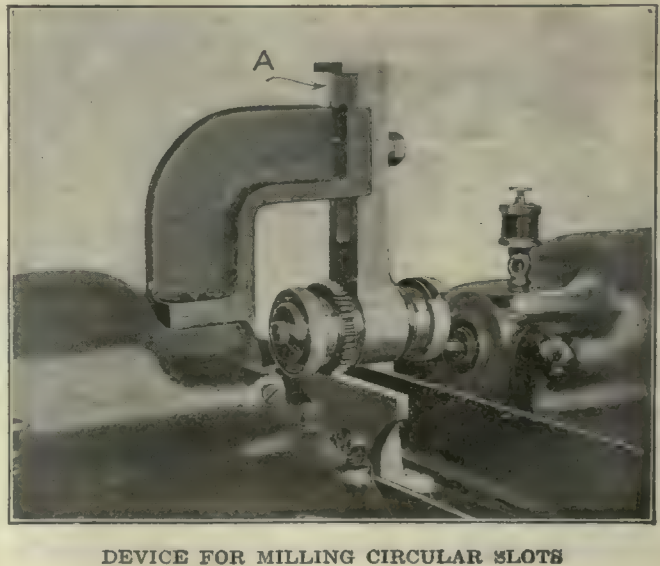
It is obvious that the equipment shown could be adapted to boring large horizontal holes by using a portable boring bar suitably geared to the pneumatic drill chuck instead of an ordinary twist drill. Such an arrangement would be of value in repair shops not equipped with a horizontal boring mill or where it is desirable to have both vertical and horizontal holes bored in large pieces at one setting.

Rotary Slot Milling Fixture

By J. M. Henry

A clever arrangement for rotary slot milling is shown in the accompanying illustration. The machine used is the regular Pratt & Whitney 47-in. spline milling machine, and the fixture was designed and is used by the United Shoe Machinery Co., of Canada.

The arrangement consists of a rack, adjustable for



DEVICE FOR MILLING CIRCULAR SLOTS

height, bolted to the regular table and meshing with a gear that drives the work spindle. A bracket is screwed and dowelled to a milled-off portion of the right-hand spindle head of the machine, and in this bracket is a vertically adjustable slide that carries the work spindle. The latter is double ended, so that both of the machine spindles may be utilized to mill slots in two pieces at once.

As the work spindle is raised or lowered to secure the proper slot radius, the rack is adjusted up or down to compensate. The work is held in place by slip washers clamped by a through bolt with nuts at each end. The fixture has a capacity from 0 to 3½ in. radius, and the setting is obtained to any degree of accuracy by inserting size blocks at *A* between a ledge on the slide and a surface ground on the bracket. Either a whole circle or any part thereof can be milled by adjusting the length of stroke on the reciprocating table. The regular range of feeds on the cutter and the speed of the table stroke, both cam controlled, are available without change.

Method of Casting Long Babbitt Lined Nuts Without Shortening the Lead or Reducing their Diameter

By Martin H. Ball

Difficulty is generally experienced in casting babbitt metal linings in long nuts, due to the shrinkage of the metal in cooling and the consequent change of lead in the thread, causing the nut to bind on the screw; a trouble that is further aggravated by shrinkage in diameter.

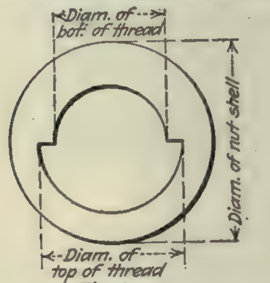


Fig. 1

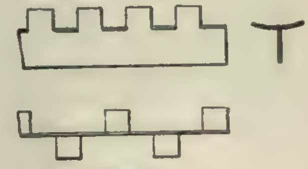


Fig. 2

FIG. 1. WASHER FOR SEPARATING SECTIONS TRANSVERSELY

FIG. 2. SEPARATOR TO BE PLACED LENGTHWISE OF SCREW

The lead difficulty can be overcome by using one or more washers, shown in Fig. 1, as may be required to make sufficient divisions in the babbitt lining. These washers are made of ordinary detail drafting paper for small diameters of nuts, and of heavier grades of paper for the larger sizes They are placed on the screw in the same manner as a nut at intervals of about 1½ in. or less. By making them fit closely on the screw and into the opening provided for babbitt in the nut shell, they will stand straight and keep their places while the babbitt is being poured.

To prevent the shrinkage in diameter the babbitt metal must be separated, parallel to the axis of the screw, into blocks not to exceed 1½ in. in width on the larger sizes of nuts, and into at least four sections on small sizes. This can be done by using the same paper recommended for the washers; cutting and forming it as shown in Fig. 2 to fit the screw and the opening provided for babbitt.

A simple method of handling the smaller sizes of split nuts is shown in Fig. 3. The paper spacers *A* and *B* are clamped in place between the half nut parts as shown; the nut is placed in a horizontal and level position and the babbitt metal poured up to the center line *CC* and allowed to cool sufficiently to take a permanent set. The upper sections are then poured, thus forming a parting line or what is commonly called a cold-shut on line *CC*.

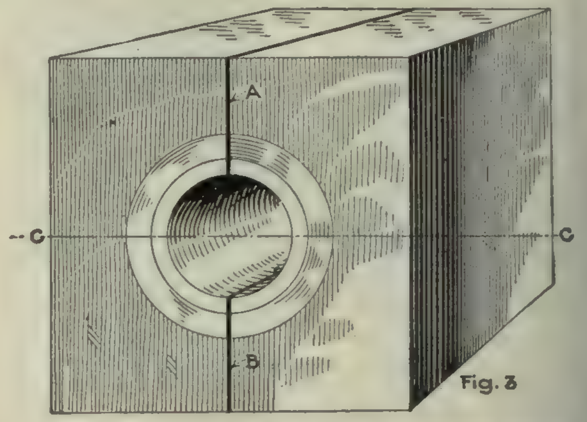


FIG. 3. METHOD OF CASTING SMALLER NUTS

The interval of time between the pourings need not be long to accomplish this result, and both pourings may be done at the same heat. This method of separation can be used on larger sized work where it is necessary to divide the nut bearing into several sections by using one separating piece and rotating the nut on the axis of the screw until the required point of the adjacent separation piece is in a horizontal position.

The first pouring is then made and as soon as the metal sets the procedure can be repeated until the complete lining is cast. Care should be exercised to always have the line which the babbitt metal takes when the pouring is stopped, both radial and horizontal.

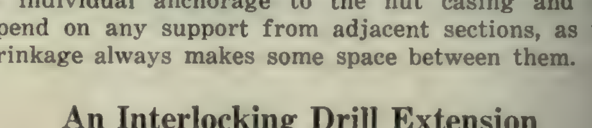
The sections of babbitt metal should in no case be over 1½ x 1½ in. and each section must be provided with its individual anchorage to the nut casing and not depend on any support from adjacent sections, as the shrinkage always makes some space between them.

An Interlocking Drill Extension

By C. Davies

A drill extension that can quickly be made, does away with the troublesome soldering method usually employed, and can be depended upon to drive the drill, may be constructed as shown in the sketch.

A hole is bored in the end of the drill-shank that is a push fit for the rod to be used, and the end of the latter is flatted off to half its diameter for a short distance. A slot is now filed across the drill just below the end of the axial hole and the rod driven in, the flatted off portion passing beyond the bottom of the hole and engaging the slot in the drill, thus insuring a positive drive.



EXTENSION FOR SMALL TWIST DRILLS

EDITORIALS

The Unemployment Conference Progresses

RUNNING true to form under the masterly direction of Herbert Hoover, the Washington Unemployment Conference has accomplished two of the three things it set out to do. It has figures on actual unemployment which are fairly accurate, something we have never approached before. The importance of accurate statistics can hardly be exaggerated as almost all relief measures must wait until the extent of the trouble is known. The original Department of Labor figures were hopelessly inaccurate and the announcement of an unemployment total of 5,700,000 did far more harm than good. We understand that steps are being taken to make possible the securing of reliable statistics of this nature at all times.

As to the second step, that of recommending the procedure to be followed in remedying this winter's emergency, certain drastic steps have been decided upon by the conference and given to the public. More important, however, is the recognition of the fact that the "buck" passed to the Federal Government by the various committees must be passed back again with definite instructions and offers of aid in handling each local problem. As a result of this move a steadily growing number of cities (forty-two as this is written) have embarked on positive relief plans and are making encouraging progress in decreasing the number of unemployed.

The third purpose of the conference, the formation of a policy toward unemployment in the future, is still in committee, but the bits of information that have leaked out indicate that sane suggestions will be offered in due time.

The conference, of course, has no power to go beyond the suggestion and recommendation stage; an awakened public conscience must take action. It has, however, ascertained the facts and indicated the remedies as far as it has gone. The vision and faith of President Harding and Mr. Hoover have been justified.

Engineers and International Peace

AN unusual gathering has just been held in New York. It was a welcome-home banquet to the delegation of engineers from the four founder societies, the Engineers' Club and the Federated American Engineering Societies which went to England and France to bestow the John Fritz Medal on Eugene Schneider and Sir Robert Hadfield for distinguished achievement in the field of engineering.

It was evident from the accounts of their experiences given by members of the delegation, that the spirit of cordial co-operation between the American engineering societies which made the trip possible, made a profound impression on the European engineers. It is not too much to hope that as a result of the visit some sort of international organization of engineers may result.

What may develop from such an association was beautifully expressed by the chairman of the delegation, Ambrose Swasey. Mr. Swasey looks forward to "engineering association and co-operation that will create bonds which will so unite the three countries that there will be little for the diplomats to do or undo to keep the peace of the world."

After all, will not such international association of engineers, of business men, of citizens, go far to make future wars impossible? Community of interest is a great discourager of disputes and may well be considered by the statesmen and others who sit down together in Washington next month to discuss disarmament.

Is This the Time to Spend Millions for Dirigibles?

NOW that the first shock of the tragedy of the ZR-2, whereby a number of naval officers and men of both Great Britain and the United States lost their lives, is over, we can view the whole deplorable matter with a better sense of perspective. It points out the dangers of using inflammable gas in connection with a motor-driven airship and the hazards which attend the pioneering of any new mode of travel. It also emphasizes the tremendous amount of money tied up in a single experiment.

Leaving aside the question of proper or improper design, for this is a new field of engineering, the necessity of using non-inflammable gas for passenger-carrying airships is shown to be imperative. This we realize imposes a heavy handicap on the dirigible, as helium gas is not only expensive but is scarce as well. We do not allow explosives or inflammables on passenger-carrying steamships where the danger is much less than in the air. If the navy demands dirigibles, the present gas but adds to the hazards of war. But no airship should be permitted to carry passengers unless it uses helium or some other non-inflammable gas.

While the question of cost is subordinate in the face of the loss of life, it must nevertheless be carefully considered. The cost of the ZR-2, no matter who pays it, would purchase many airplanes and allow for much development in that line. The cost of the single hangar at Lakehurst, N. J., variously stated at from $2,000,000 to $6,000,000 would build many landing fields. The four or five hundred men required to guide a giant dirigible into its hangar would man the landing fields which could be equipped with the cost of the hangar at Lakehurst.

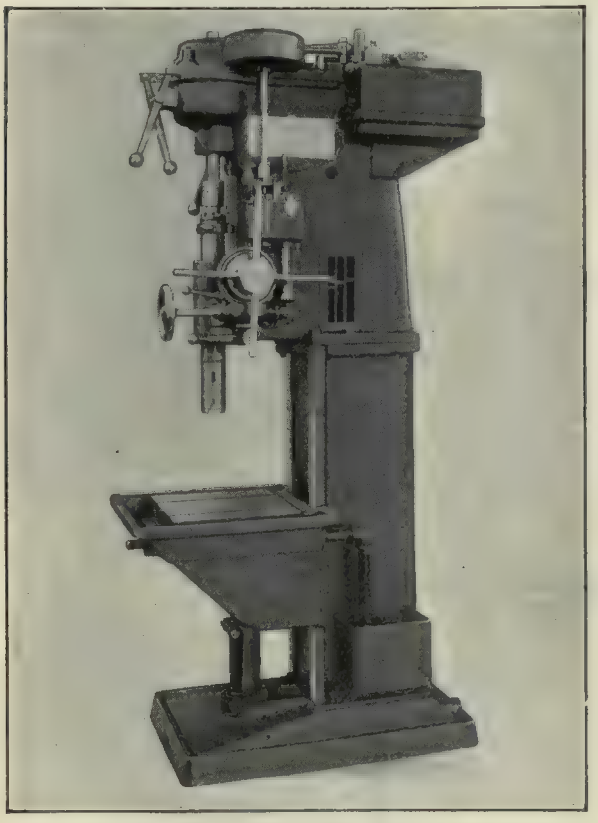
The dirigible may have its place in the transportation of the future. But its progress to date has been very slow and very costly both in lives and money. The great drawback of involving such huge sums in a single experiment, which is unwieldly at best and dependent on the wind and weather to a far greater extent than the airplane, makes this an inopportune time to spend further millions in that direction.

Develop the airplane by all means, along sane lines which will aid in its adoption for commercial purposes. But the further expenditures of millions for such hazardous experiments as the ZR-2 should not be permitted at this time.

Shop Equipment News

Baker Light Heavy-Duty Boring and Drilling Machine No. 121

In the accompanying illustration is shown the No. 121 drilling machine recently placed on the market by Baker Bros., Toledo, Ohio. The machine is known as the light, heavy-duty type, and is intended for driving drills from ⅜ to 1½ in. in diameter, as well as for such work as boring and facing.



BAKER NO. 121 HEAVY-DUTY DRILLING MACHINE

The machine can be furnished as either a single-purpose or a quick-change drilling machine, the former lacking the gearing of the latter. If it be desired to make a quick-change machine out of the single-purpose one, it is only necessary to add the additional parts, the head being completely bored and drilled for them.

Tight and loose pulleys are mounted at the back of the machine and supported by brackets cast integral with the head, the shaft running on roller bearings. By this means wide-face pulleys can be used, without sacrificing the possibility of placing the machines in gangs with close center distances. The machines can be furnished in gangs with a dimension of 18½ in. between the spindles.

All control levers are placed so that they can be conveniently reached by the operator when standing in front of the machine, and their positions are said to be such as to enable the speedy operation of the machine. All gears in the speed train are hardened. By using transposing gears for both the speed and feed trains, in connection with the sliding quick-change gears, practically any number of combinations of speeds and feeds can be obtained to suit special jobs. The machine can thus be effective with small as well as large sizes of drills or tools. It is stated that a 4-in. pipe tap has been successfully driven on it.

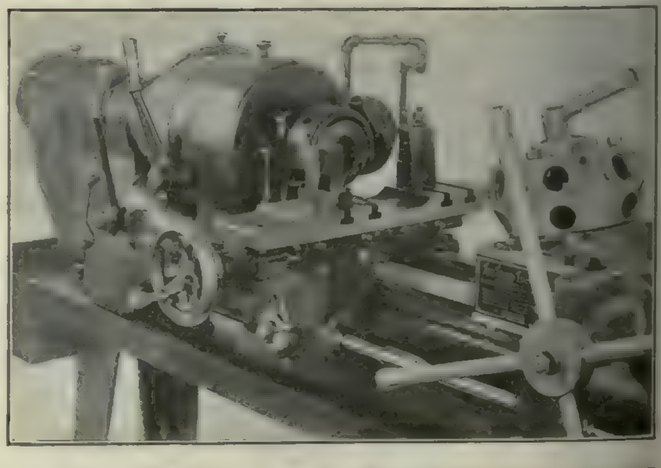
The machine is provided with an over-counterweighted spindle, and a device which absorbs the inertia of the return of this spindle at the top of the stroke. This device is said to increase production, because no effort on the operator's part is required to disengage and withdraw the tool and spindle from the work. The machine is stopped and started by means of the tight and loose pulleys, a spring device holding the belt in place. In the off position a brake is applied automatically, so as to stop the spindle.

It is stated that practically any speed can be obtained by the use of slip gears. The standard speeds are from 144 to 468 r.p.m. for the single-purpose machine, and from 38 to 632 r.p.m. for the quick-change machine. The feed on the single-purpose machine can be varied from 0.006 to 0.1 in. per revolution by the use of slip gears, although 0.008 and 0.025 in. are the standard feeds. On the quick-change machine, ten changes of feed are ordinarily provided, the minimum being 0.008 in. and the maximum 0.094 in.

The plain table is of the box knee type, raised by means of a telescoping screw. A compound table having screw adjustments can be furnished. Various attachments and modifications can be provided, such as a tapping reverse, multiple-spindle head, motor drive, oil pump and gang assembly. The floor space is 22 x 36 in., and the weight 2,100 lb.

Power Crossfeed for Tilted Turret Lathes and Screw Machines

A power crossfeed to the cut-off slide has recently been developed for the Nos. 2, 3, 4, 5 and 6 Tilted Turret lathes and screw machines, manufactured by the Wood Turret Machine Co., of Brazil, Ind. The design of the cross-slide allows of casting the apron or gear box integral with the saddle proper, which insures rigidity as well as permanent alignment of these parts.



TILTED TURRET LATHE WITH POWER CROSSFEED FOR CUT-OFF SLIDE

The arrangement of the slide is shown in the accompanying illustration, the machine itself being similar to the one illustrated on page 320, Vol. 49, of the *American Machinist.*

The power is transmitted to the feed screw by means of two bevel gears on the lower feed shaft meshing with a third gear on a vertical shaft, thence through helical gears to the feed screw. The single-lever control allows of feed engagement in either direction. When the lever is in a vertical position the feeds are disengaged, while throwing it to the left causes the slide to travel in, and to right to travel outward. Six feed changes, ranging from 0.003 to 0.023 in. per revolution of the spindle are provided, any feed being instantly available without stopping the machine.

Provision is made to safeguard the feed mechanism against overload or accident, by a brass shear pin on the lower feed shaft. The bronze feed nut is of the solid flanged type and is held in place by two capscrews. Since it is bolted to the back side of the saddle, it can easily be removed without disassembling the other parts.

A large dial, graduated to 0.001 in., is fitted on the handwheel. The feed screw is provided with two bronze bearings in the outboard end of the slide. The back lash of the feed screw is taken up by means of a knurled adjusting nut, which is locked by a handwheel. Positive screw stops are mounted at the front and rear to control the depth of the cut when using forming tools.

Bridgeport Cylinder Refinishing Machine

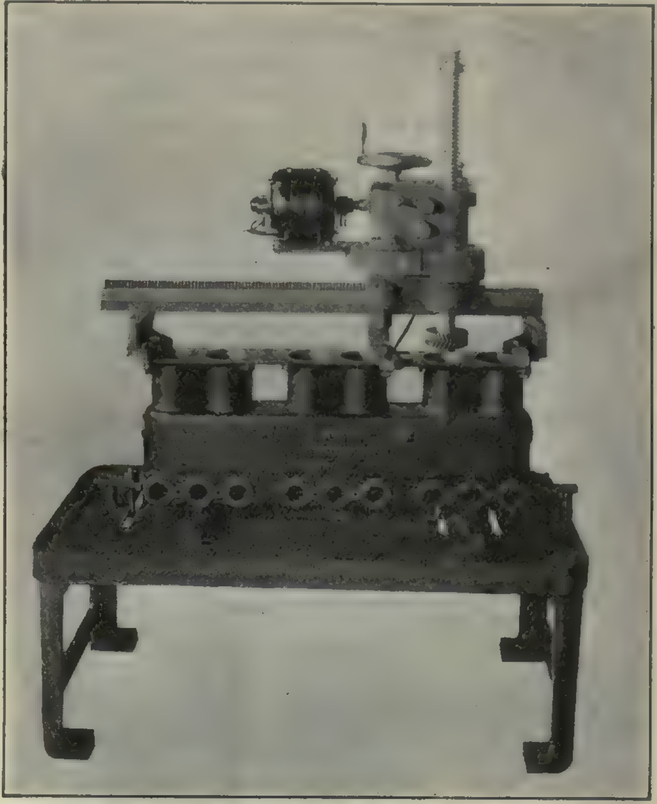
A machine for the reboring and refinishing of the bores of automotive cylinders has recently been placed on the market by the Bridgeport Cutter Works, Inc., 50 Remer St., Bridgeport, Conn. It is electrically driven and is portable; it is also said to be adapted to all makes of automobile cylinders, and to be very speedy in its operation.

The machine consists essentially of a sliding head supported on a guiding way that is carried on the top of the cylinder block by means of suitable brackets. Provision is made for adjusting the way in line with the center of the cylinder, by means of an indicator. The head carries a cutter bar held in large bearings. This bar is centered over each cylinder in turn by the aid of an indicator, and an additional clamp is provided for supporting the head close to the point where the cutter is working.

The bar is driven at slow speed through reducing gearing, by means of an electric motor, the latter being of such a size that it can be driven from any lighting circuit. A geared power feed of about 1/32 in. per revolution is provided. It is possible to disconnect the feed, so as to raise and lower the bar by hand. The machine is provided with an indicator and a holder for it, as well as various sizes of bolts, stops, clamps and studs with which to mount it. Cylinder blocks having removable heads can be left in the chassis of the automobile while the refinishing is being done. However, in the case of closed-head cylinders, it is necessary to remove them from the chassis. The stand shown in the accompanying illustration is furnished for mounting the cylinders while the cutting operation is being performed.

The type of cutter or reamer employed resembles that described on page 624, Vol. 54, of *American Machinist.* It is known as the "Herri-Stag" and consists of two herringbone cutters, the teeth of which are staggered. The bottom cutter, which does the roughing, has its teeth cut with a right-hand helix, so that it will bite into the glazed surface likely to occur in the bore. The finishing cutter is slightly larger in diameter, and has a left-hand helix, so that its teeth act chiefly as scraping tools. It is stated that the finishing cutter serves as a guide for the roughing cutter and helps to maintain the hole true.

The cutters can be furnished for practically any make of automobile cylinder, being provided with the standard oversizes of 0.010, 0.015 and 0.020 in. The sizes vary from about 2¾ to 4 in. Since the cutters can be ground down to serve for smaller sizes, it is stated that their upkeep cost is small. The maker claims that the holes produced are true to size and straightness, and that in finish they compare very favorably with ground holes.



BRIDGEPORT CYLINDER-REFINISHING MACHINE

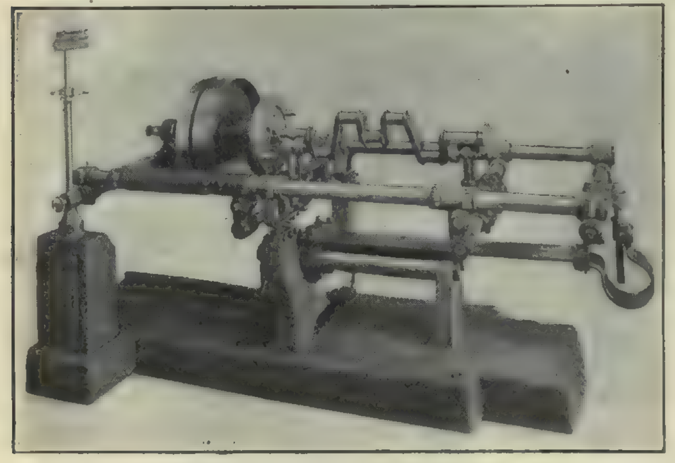
"Precision" Balancing Machine

The illustration shows a balancing machine recently placed on the market by the Precision Balancing Machine Co., 3020 E. Franklin Ave., Minneapolis, Minn. The machine is said to apply the principles of dynamic and static balancing invented by B. L. Newkirk, so that it is possible to obtain complete dynamic and static balance by two single corrections, individually measured and located near the ends of the body. The determinations are, it is stated, made by a procedure producing the required result irrespective of the skill of the operator; and when duplicate parts are to be balanced in production, great rapidity can be attained, as static balancing is rendered unnecessary and the operator has only a few simplified steps to perform.

A spring-mounted and pivoted frame carries a special type of headstock and adjustable rollers to support the work. By the form and location of the springs, a free vertical vibration of the overhanging right-hand end of the frame may take place about the pivot springs as a fulcrum point. All revolving parts, including the rollers which support the work, are mounted on ball bearings. A speed of rotation above the "critical speed" of the frame is first used, and the driving power is then disengaged, permitting a gradual diminution of speed down to and through the critical speed of the frame At this point there occurs a maximum vibration, which is proportional to the correction required in the overhanging end of the work, irrespective of any unbalance having a single resultant in the plane of the pivots. From the observation on the dial indicator, mounted part way up on the column at the left, the amount of the required correction is determined.

A disk at the left of the revolving parts carries a standardized 10-oz. weight, adjustable radially by means of a vernier reading to 0.01 inch. These parts are exactly balanced when the weight is at zero. The disk is adjustable to any angle with reference to a protractor dial, which engages the other revolving parts by a jaw clutch. This permits adjustments to be made without first bringing the work to rest.

With the correction thus arbitrarily applied, the system is again speeded up and allowed to pass through the critical speed as before. The second amplitude bears a relation to the first amplitude dependent on the angle between the point of application and the point required After determining and setting off this angle, a third run will check the result. For determining the corrections proportionate to amplitudes, taking ratios and ascertaining angles, a special calculating rule requiring but two settings is installed at the top of the instrument column at the left.



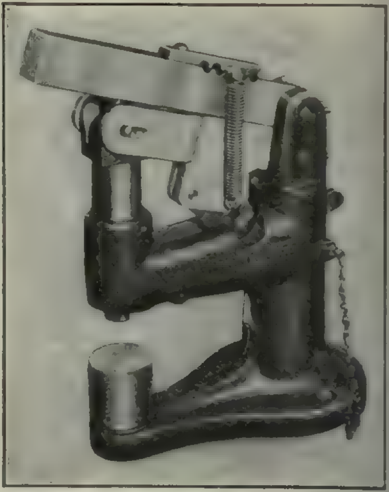
"PRECISION" BALANCING MACHINE

After completing the first determination, the work is reversed in position and the correction determined for the plan initially over the pivots, thus completing the operation. As a critical speed of about 100 to 110 r.p.m. is said to give the best results, the machine can be manipulated by hand or by an electric motor suitably mounted. The speeds employed permit visual observation of the amplitudes, and prevent distortion of the work from centrifugal forces.

The machine is adapted to a wide variety of work, including balancing automotive crankshafts, flywheels, and parts readily mounted on arbors. It will receive bodies up to 24 in. in swing and 32 in. between bearings. The sensitiveness of measurement is said to be sufficient for bodies of small weight.

Giles "Trip-Hammer" Staking Machine

The H. C. Giles Corporation, 303 Cox Bldg., Rochester, N. Y., has recently placed on the market the machine shown in the accompanying illustration for staking cupped or drilled rivets, studs, screws and other small screw-machine products. The machine is intended for mounting on a work bench or on a separate pedestal. It is actuated by the foot of the operator, a rod extending through the base to the treadle. An inclosed spring extending through the bench below the base of the machine serves to lift the treadle and spindle, while the springs on the side of the hammer provide an adjustment of the force of the blow. The spindle houses the hammer and the pad carrying the staking set. By a suitable mechanism, the bar at the top of the machine serving as a hammer is tripped when the staking set has been brought to position.

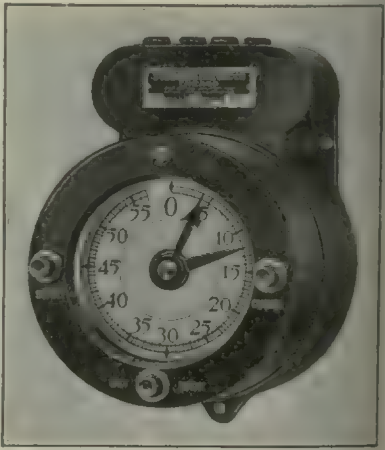


GILES STAKING MACHINE

It is said that work can be neatly and quickly riveted with the machine, and that uniformity of work results. Adjustments are provided for both the point of tripping and the height of lift of the hammer. The spring back of the pad in the spindle is ordinarily compressed about 3/16 in. when the spindle is at its lowest point and the staking set is in contact with the work.

Stromberg Process-Timing and Signaling Instrument

An electrically operated timing and signaling instrument, intended for timing the length of a process, has been developed and placed on the market by the Stromberg Electric Co., Chicago, Ill. The instrument is for use in all manufacturing processes where the element of time is a factor, such as in the heat-treatment of steel, enameling, plating and etching. In this instrument the clockwork is eliminated, the mechanism consisting of an electric motor and gearing, which can be operated from an alternating - current circuit. The instrument will indicate the total length of a process, the length of time a process has been in operation, and how much longer the process is to continue; and then automatically operate the signal when the process is completed. The



STROMBERG PROCESS-TIMING INSTRUMENT

signal, which may be either a bell, a light, or both, will continue to operate until stopped by the person in charge.

One hand, shown on the right in the illustration and enameled red, is set to show the period of time of the process. The other or indicating hand starts from the point at which the instrument has been set and travels to zero. Thus the time that must elapse before the process is completed, is indicated. The button marked "change" is for setting the instrument for any length of process desired, causing the "setting hand" to move to the correct position.

When the indicating hand reaches zero and the signal is given that the process is completed, the operator pushes the button marked "set back," which causes the indicating hand to return quickly to the starting point. The indicating hand remains stationary at the starting point until the operator is ready to start a fresh process, at which time he presses the button marked "start," which releases the indicating hand and causes it to travel toward zero.

The white dial is 3½ in. in diameter and protected by a glass cover. The dials vary in markings and total time covered, depending upon whether they are to be used for long or short processes. The instrument can be furnished with any one of four standard dials. For an instrument which will operate a maximum time of 5 min. and 48 sec., the dial is graduated in seconds; for a maximum of 11 min. and 24 sec., graduations indicate three seconds; for 57 min., 30 sec.; and for 1 hr. and 54 min., the graduations are in minutes.

The electrical contact automatically made by the instrument at the end of the predetermined time may also be used for controlling current to operate mechanisms such as steam or air valves.

It is said that the instruments are very rugged and are built for hard service. The terminal box is conveniently arranged for the connecting of the wiring to signals and to the current supply. The instrument is 7 in. high, 5½ in. wide and 5½ in. deep, and weighs about 9 lb. It can be furnished to operate from 110- or 220-volt alternating current of any standard frequency.

Borgeson Universal Joint

A universal joint combining the features of ruggedness and adjustability has been placed on the market by the Borgeson Manufacturing Co., Torrington, Conn. The sockets of the joint are of cold-rolled steel milled from the solid bar, while the working parts are of carbonized and hardened mild steel.

BORGESON UNIVERSAL JOINT

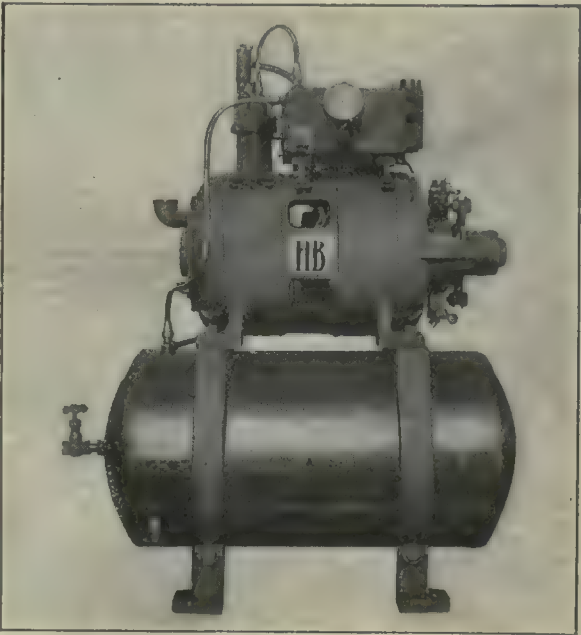
The "ball" is a cube with the corners rounded, and is made in two parts, held together by a bolt, nut and cotter pin. The pins upon which the ball swivels are driven into the wings of the sockets, and are staked in place. The bearing surfaces of the pins are tapered, and each pin has a small head or shoulder to preclude the possibility of its working loose.

To compensate for wear, the bolt is withdrawn and the flat mating surfaces of the two parts of the ball are ground slightly on a disk grinder, an operation quickly performed. Because of the tapered bearing surfaces of the pins, the joint will be tight when reassembled.

Hobart Automatic Air Compressor

The accompanying illustration shows an automatic air compressor unit recently placed on the market by the Hobart Bros. Co., Troy, Ohio. The device is especially intended for use in garages and service stations where it is necessary to keep a constant air pressure in the air lines. The maker claims that the device automatically does this, and that it requires no attention after once installed.

The device is compactly made, the compressor unit being mounted on top of the supply tank. The pump is of the rotary type and driven directly from the motor, which is mounted on the same shaft. The current is taken from the ordinary lighting or power circuit. No gears are employed and the shaft runs on ball bearings, so that the unit is quiet in operation.



HOBART AUTOMATIC AIR COMPRESSOR

The chief feature to which the maker calls attention is the magnetic pressure release, which enables the motor to start without load. By this means instantaneous starting is assured, and the motor does not consume an unnecessarily large starting current. An air and oil filter, a safety valve, gage and tank are standard equipment, so that the unit is complete and ready for operation.

Pig Iron in Japan

The price of pig iron in Japan is below the cost of production, according to the *Far Eastern Review*, and stocks are estimated at 400,000 tons, of which 300,000 tons are held in Osaka, Kobe, Tokyo, and Yokohama, and 100,000 tons in Chosen and Manchuria. To stabilize prices a bank loan has been raised and a plan has been under consideration by manufacturers to provide for a uniform selling price through the operation of a syndicate.

NEWS SECTION

Briscoe Motors Sold to Earl Interests

Following a meeting of the board of directors held at Jackson, Mich., on Oct. 2, new plans for the Briscoe Motor corporation were announced whereby $5,000,000 additional capital will be put into the business immediately and the name of the factory organization will be changed to Earl Motors, Inc.

In making the announcement Clarance A. Earl, former first vice-president of the Willys-Overland Co., who took over control of Briscoe as president last March, stated that the board has voted unanimously for the introduction of the new capital, necessitated through the fact that the distribution end of the business has been expanded by the addition of 20 new distributors and 240 dealers in the past six months.

The plans also, according to Mr. Earl, involve the marketing nationally of a new "Earl" car, closed models of which will be ready for delivery Oct. 15 and open models Nov. 1. For the time being Briscoe cars are still being turned out, while certain divisions of the factory are busy on producing the parts for the new car soon to make its debut.

The board as now constituted with Mr. Earl as president consists of John John Fletcher, vice-president of the Fort Dearborn National Bank, Chicago, who is treasurer; H. F. Wardwell, president of the Burnside Tilden & Company, Chicago; Horace DeLisser, chairman of the Ajax Rubber Co., New York City; Wallace G. Kay, secretary and treasurer Kay & Co., Detroit; J. Fletcher Farrell, vice-president of the Sinclair Refining Co., New York; J. Weissenbach, of Weissenbach, Hartman, Crain & Cormack, Chicago, as directors and L. E. Latta as secretary.

Publicity Exhibit

The Third Annual International Sample Fair in Milan, to be held from April 12 to 17, 1922, will include a special section devoted to an exhibition of publicity methods. As planned at present, this exhibit will contain posters, catalogs, folders, pamphlets, and magazine advertisements, representative of as many countries as possible, and placed on exhibition without charge. The Italian Chamber of Commerce in New York City, 99 Hudson St., is assembling the exhibit to present publicity methods of the United States and is desirous of obtaining as much material as possible.

Prof. Cavalier at Columbia

Prof. Jacques Cavalier, rector at Toulouse, France, and a widely known authority on metallurgical chemistry, has come to America as the result of arrangements for an annual exchange of professors of engineering and applied science between French and American universities. This plan, which corresponds to the exchange of professorships in academic studies will be put into operation this fall.

Prof. Cavalier, who is now at Columbia University, New York City, and whose visit is another link in the world movement for engineering solidarity started by the organized engineers of American, England and France, will divide his time during the academic year among the co-operating institutions, Columbia, Harvard, Yale, Cornell, Johns Hopkins, Massachusetts Institute of Technology and the University of Pennsylvania. The American universities have selected as their representative in France for the first year Dr. A. E. Kennelly, professor of electrical engineering at Harvard and M. I. T.

Objects of S. A. E. Research Department

President Beecroft of the Society of Automotive Engineers, has expressed the view that within less than ten years the research department which the society has established recently will be of as great magnitude and value to the industry and the country as the renowned S. A. E. Standards Department which is just entering its second decade.

Dr. H. C. Dickinson, manager of the S. A. E. Research Department, in an address before the Detroit Section of the society at its opening session of this season, outlined the purposes, aims and possibilities of the department. He said that, in general, the testing of any individual device or any particular material is not included in the definition of research. On the other hand, the study of methods of test as well as the deduction of general information from a systematic series of tests is properly so classed, although to be of value as research the results must be put in such form that they can be of general application.

In general, the object of the S. A. E. Research Department is to secure through concerted effort more, and more reliable, fundamental technical information for the use of the members of the society and to make this information more easily available.

Dr. J. W. Richards, Noted Metallurgist, Dead

Dr. J. W. Richards, professor of Metallurgy at Lehigh University and world-wide authority on aluminum, died suddenly at his home in Bethlehem, Pa., on Oct. 12, of heart trouble. Dr. Richards was fifty-seven years old and was born in Oldbury, England.

Dr. Richards was one of the foremost engineers of the country and had an international reputation in various branches of metallurgical technology. His services were widely sought as legal expert in chemical and metallurgy cases. He was a member of many engineering clubs and the author of many books.

He was a charter member of the American Electro-Chemical Society, its first president in 1902, and 1903 and its secretary since 1907. He was a member of the Franklin Institute of Philadelphia, president of the chemical section, 1897-1899, and professor of electro-chemistry of the institute, 1907-1910.

He was a member of the American Institute of Mining and Metallurgical Engineers, former vice-president of the institute and chairman of the iron and steel committee since 1914; member of the Iron and Steel Institute of Great Britain and of the American Iron and Steel Institute. He was also a member of the Board of Engineering Foundation and a member of the National Research Council. He was representative of the American Institute of Mining and Metallurgical Engineers on the joint conference committee of the Federated American Engineering Societies.

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Philadelphia Foundrymen Hear F. J. Ryan

The Philadelphia Foundrymen's Association held its 310th meeting in that city on the evening of Oct. 12. The subject of the lecture was "Recent Developments in Heating Coke Ovens with Oil or Electricity and the Heating of Iron, Brass and Steel in Electric and Oil Heating Furnaces." The speaker was F. J. Ryan, of F. J. Ryan & Co., Philadelphia. Mr. Ryan illustrated his remarks with a series of lantern slides and showed a recent installation of an electric coke oven in a Philadelphia foundry.

Following Mr. Ryan's talk a general discussion was held on the foundry industry—past, present and future. Thomas Devlin, president of the association, presided.

Delegates of American Engineering Societies Get French Honors

Nearly two hundred engineers attended the dinner to the delegation from the American Engineering Societies to Great Britain and France, at the Hotel Pennsylvania, on Monday evening, Oct. 10. Representatives of the British and French governments and of foreign engineering societies gave to the event an international aspect unique in gatherings of engineers. Medals struck by the French government were presented to the general chairman of the deputation, to the chairman of each individual delegation and to the presidents of the four founder societies. The meeting was regarded by engineers as formerly ushering in a definite movement for world unity in the engineering profession.

J. Vipond Davies, president of the United Engineering Society acted as toastmaster. The speakers were Ambrose Swasey, Charles F. Rand, F. B. Jewett, A. S. Dwight, John R. Freeman, all members of the deputation, and M. Gaston Liebert, French Consul General; Captain G. H. Armstrong, British Consul General; G. G. Clapperton, representing the British Institution of Electrical Engineers, and Prof. Jacques Cavalier, spokesman for the French universities. Among the engineers from other cities was Governor James Hartness, of Vermont.

Captain Armstrong, the first speaker, thanked the assembled engineers on behalf of His Majesty's government for the honor bestowed upon Sir Robert Hadfield, who with Eugene Schneider of Paris received the John Fritz Gold Medal at the hands of the deputation. The visit of the delegation had greatly furthered the movement for international co-operation among engineers, said Captain Armstrong, who made a strong plea for still closer relations between British and American engineering interests.

Mr. Davies in a glowing eulogy presented Ambrose Swasey, past president of the A. S. M. E. and sponsor of the Engineering Foundation, as the "dean of American engineers." Mr. Swasey, who was general chairman of the deputation, said that the French and British peoples are making giant strides in reconstruction and will speedily be back on a normal basis. "England will stand for hundreds of years as she has stood for hundreds of years in the past," added Mr. Swasey. "It is the same with France. We must help them, for their success is our success, and we are enshrined in their hearts."

France Will Pay

M. Liebert, the next speaker, asserted that French honor and industry would discharge the nation's debt to the last dollar. He spoke of the enormous resources of France, and declared that twenty years hence France would be on firm ground financially as one of the world's richest nations. At the close of a speech remarkable for its patriotic fervor, its optimism in its expression of international friendship, M. Liebert, on behalf of the French government, presented medals to the following:

George S. Webster, Philadelphia, president of the American Society of Civil Engineers; Edwin Ludlow, New York, president of the American Institute of Mining and Metallurgical Engineers; Edwin S. Carman, Cleveland, president of the American Society of Mechanical Engineers; W. McClellan, Philadelphia, president of the American Institute of Electrical Engineers; Charles T. Main, Boston, chairman of the A. S. C. E. delegation; A. S. Dwight, New York, chairman of the A. I. M. E. delegation; Ira N. Hollis, Worcester, Mass., chairman of the A. S. M. E. delegation; F. B. Jewett, New York, chairman of the A. I. E. E. delegation; Ambrose Swasey, Cleveland, general chairman of the deputation.

Herbert Hoover sent a message congratulating the deputation upon the success of its mission abroad and urging a closer union of engineering endeavor on both sides of the Atlantic. Cable messages were read from Sir Robert Hadfield, Eugene Schneider, the Institution of Civil Engineers, the Institution of Mining and Metallurgy and Mining Engineers, Captain Riall E. Sankey, president of the Institution of Mechanical Engineers; Magnus Mowett, secretary of the Institution of Mechanical Engineers; the British Iron and Steel Institute, Engineers Club of London, Faraday Society, Viscount James Bryce, Arthur Neal, member of Parliament from Sheffield; Jesse Merrick Smith, and A. E. Kennelly, exchange professor to France.

Honors conferred upon the visiting American engineers was cited as fresh evidence of the permanence of the ties of friendship and interest created during the war. Mr. Swasey was elected to honorary membership in Institution of Mechanical Engineers, the Institution of Mining and Metallurgy and the Institution of Mining Engineers. He also received the Cross of the Legion of Honor and was made an honorary member of the Societe des Ingenieurs Civils de France.

Mr. Rand was elected to honorary membership in the Iron and Steel Institute, Institution of Mining and Metallurgy and the Institution of Mining Engineers. Arthur S. Dwight and William Kelly were elected to honorary membership in the Institution of Mining Engineers.

The members of the deputation, in whose honor the dinner was given, were as follows: Ambrose Swasey, general chairman and member of delegation from A. S. M. E.; Charles T. Main, chairman of delegation from A. S. C. E.; John R. Freeman, member of delegation from A. S. C. E.; Robert A. Cummings, member of delegation from A. S. C. E.; Lieut-Colonel Arthur S. Wwight, vice-chairman and member of delegation from A. I. M. E.; Charles F. Rand, secretary and member of delegation from A. I. M. E.; William Kelly, member of delegation from A. I. M. E.; Ira N. Hollis, chairman of delegation from A. S. M. E.; Jesse Merrick Smith, member of delegation from A. S. M. E.; Lieut.-Colonel Frank B. Jewett, chairman of delegation from A. I. E. E.; Arthur E. Kennelly, member of delegation from A. I. E. E.; Major-General George O. Squier, member of delegation from A. I. E. E.

American Gear Manufacturers' Association at Rochester

The semi-annual meeting of the American Gear Manufacturers' Association was held in Rochester, N. Y., at the Powers Hotel on October 13, 14 and 15, and was well attended. As usual with this association, there was not an idle moment, the main features of the meeting being the reports of committees on the many factors of gear making subject to standardization.

The convention was welcomed to Rochester by Andrew C. Gleason, and the Gleasons, individually and collectively, did much to make the meeting a pleasing and lasting memory to those who were fortunate enough to attend. Some idea of the scope of the reports may be had from the following list of committees and their chairmen: "Public Policy," H. E. Eberhardt, "Legal," J. E. Gleason; "Publicity," J. C. McQuiston; "Uniform Cost Accounting," J. H. Dunn; "Industrial Relations," J. B. Foote; "Tariff," S. L. Nicholson; "General Standardization," B. F. Waterman. Under this latter heading came sub-committees on "Spur Gears," Frank E. Eberhardt; "Bevel and Spiral Bevel Gears," F. E. McMullen; "Gears and Pinions, Electric Railway and Mine," W. H. Phillips; "Nomenclature," Frank E. Eberhardt; "Worms, Worm Gears and Spirals," J. C. O'Brien; "Inspection," F. G. Eppley; "Sprockets," C. R. Weiss; "Metallurgical," C. B. Hamilton Jr.; "Composition Gearing," John Christensen; "Keyways," H. J. Eberhardt; "Herringbone Gears," A. F. Cooke; "Differentials," S. O. White; "Transmissions," A. W. Copland; "Tooth Form," H. J. Eberhardt; "Library Committee," E. W. Baxter.

In addition to the reports of committees there were addresses on "Gear Tooth Wear," by S. O. White, chief engineer of the Warner Gear Co.; "First Hand Impressions of Europe," by E. S. Sawtelle, assistant general manager of the Tool Steel Gear and Pinion Co.; "Duralumin as a Material for Worm and Other Gearing," by R. W. Daniels, Baush Machine Tool Co., and an excellent paper on "Tooth Forms," by E. W. Miller, chief engineer of the Fellows Gear Shaper Co.

As a respite from the almost continuous night and day sessions, the convention visited the Gleason Works on Friday, the 14th, in time to partake of an excellent lunch in their splendid cafeteria. After lunch a brief session was held at which bevel gear tooth forms were discussed by many members. The subject was, however, postponed to a later date so that sufficient time could be devoted to the proper consideration of the standard proposed. Following this was an inspection of the Gleason plant, with particular attention to several recently completed machines.

The machines shown were a three-spindle bevel gear rougher, a three-spindle bevel gear generator, which finishes both sides of a tooth space at once, and an 8-in. spiral bevel gear generator, a 4-in. spiral bevel gear generator, a two-tool 38-in. bevel gear planer, in which the toolblocks can be reversed so as to cut either forward or backward, a 9-in. bevel gear generator, and a new burnishing machine for burnishing the teeth of bevel pinions. Then there was a chamfering machine for trimming the outer ends of spiral bevels, special cutter grinders for spiral bevel cutter heads, and a continuous electrically heated furnace for the hardening of gears. This is built for a temperature of 1,550 deg. F. and the rate of feed of the work through the furnace can be timed to suit.

The informal banquet was well attended and was followed by dancing. Both the speakers were well received and left a message for after consideration. Ernest A. Paviour, formerly president of the Rochester Advertising Club, after some clever sallies which included "Phillie Gear" Markland, spoke strongly of the value of the trade or business papers for advertising mechanical products as against the use of general magazines for this purpose.

Hon. Arthur E. Sutherland, ex-judge of the Supreme Court, spoke on "Capital and Labor." After pointing out the shortcomings of some of the labor leaders he said that employers must recognize skill and ability on the part of the workers more than they have done in the past. He said, "The moment a worker gains ability or skill to make an article better than it ever has been made before he gains capital; a capital that cannot be bought or sold and that the sheriff cannot attach. When we discuss capital and labor we sometimes forget that it is ability which has made the world progress. Ability is a capital contribution and must be accorded its proper place, whether it is contributed as an industrial worker or in a managerial role. This ability must be recognized and he who gives it must be allowed a return or dividend on the investment. The worker who, day after day for a term of years, gives ability, skill and precision to his work has a right to expect something more than just a pay envelope on pay day. He has an equity in the business he has helped to build up, and the employer who believes in and practices the square deal, will recognize this equity."

After a strenuous morning, the last session running until almost 2 p.m. on Saturday, the Gleasons provided automobiles and took the whole party to the White Horse Tavern, about 23 miles out of Rochester, to a clam bake which will long be remembered. Games for both the men and the ladies whetted the appetites for dinner, and no clams, lobsters or chickens were ever enjoyed by a more enthusiastic gathering. Any member or guest who can forget the Rochester meeting is a fit subject for a course in memory training,—or worse.

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The President's Conference on Unemployment

General Recommendations for Measures for Permanent Recovery of Employment

Recovery of our industry and employment must necessarily be a process of gradual healing of the great economic wounds of the World War. This healing is making distinct progress.

Without attempting the impossible task of assessing the relative weight of different forces, the conference presents the following summary of the more important matters that require constructive and immediate settlement if recovery in business and permanent employment are to be more expeditiously accomplished:

(1) Readjustment of railway rates to a fairer basis of the relative value of commodities, with special consideration of the rates upon primary commodities, at the same time safeguarding the financial stability of the railways.

(2) Speedy completion of the tax bill with its contemplated reduction of taxes, in order that business now held back pending definite determination may proceed.

(3) Definite settlement of tariff legislation in order that business may determine its future conduct and policies.

(4) Settlement of the financial relationships between the Government and the railways, having in mind the immediate necessity for increased maintenance and betterments, making effective increased railway employment and stimulation of general employment in order that the railways may be prepared for enlarged business as it comes.

(5) Limitation of world armament and consequent increase of tranquillity and further decrease of the tax burden, not only of the United States but of other countries.

(6) Steps looking to the minimizing of fluctuations in exchange, because recovery from the great slump in exports (due to the economic situation in Europe) can not make substantial progress so long as extravagant daily fluctuations continue in foreign exchange, for no merchant can determine the delivery cost of an international shipment.

(7) Definite programs of action that will lead to elimination of waste and more regular employment in seasonal and intermittent industries, notably in the coal industry, in order that the drain upon capital may be lessened and the annual income of workers may be increased.

(8) In the field of all the different industries and occupations the rapidity of recovery will depend greatly upon the speed of proportionate adjustment of the inequalities in deflation. A table is attached hereto, drawn from various sources, showing the percentage of present levels above the levels of the same commodities and services of the pre-war period. It will be observed that agriculture has reached an unduly low plane, while transportation, coal, and some branches of the construction industries are of the highest. It will also be observed that there is an entire disproportion between the price of the primary commodities and the ultimate retail price. These disproportionate increases in the progressive stages of distribution are due to increased costs of transportation, enlarged profits, interest, taxes, labor, and other charges.

If the buying power of the different elements of the community is to be restored, then these levels must reach nearer a relative plane. For example, the farmer can not resume his full consuming power and thus give increased employment to the other industries until either his prices increase or until more of the other products and services come into fair balance with his commodities, and therefore within reach of his income.

APPROXIMATE INDEX NUMBERS, BASED UPON 100, FOR 1913

	August, 1921.
Cost of living:	
Department of Labor (May survey)	180
National Industrial Conference Board	165
Average price to producer, farm crops	109
Average price to producer, live stock	113
Average wholesale price, foods	152
Average retail price, foods	155
Wheat and flour:	
Wheat average to producer	128
Flour, wholesale, U. S. average	173
Bread, retail, U. S. average	173
Freight rate flour, Minneapolis to New York domestic	187
Live stock and meats:	
Pork—	
Hogs to producer	116
Wholesale ham at Chicago	166
Retail ham	197
Wholesale bacon, rough side	102
Retail sliced bacon	162
Wholesale short side	108
Wholesale pork chops	184
Retail pork chops	181
Retail lard	115
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Cattle, average to producer	91
Wholesale carcass beef at Chicago	124
Retail, sirloin steak	157
Retail, round	160
Retail, rib roast	147
Retail, chuck roast	130
Retail, plate beef	112
Wages in meat packing (Department of Labor investigation)	186
Freight rates, dressed beef, Chicago to New York	214
Hides and leathers:	
Hides, green salted, packers, heavy native steers (Chicago)	76
Hides, calfskin, No. 1, country, 8 to 15 lb. (Chicago)	86
Leather, sole, hemlock, middle No. 1 (Boston)	120
Leather, chrome, calf, dull or bright, "B" grades (Boston)	195
Wholesale boot and shoes, men's vici calf, blucher-Campella (Brockton)	225
Freight rate shoes, Lynn, Mass., to Chicago	210
Wage scales in shoe industry (Massachusetts), about	200
Cotton:	
To producer	105
Yarns, carded, white, Northern mule, sun, 22 cones (Boston)	107
Wholesale sheeting, brown 4/4 ware, shoals L. L. (N. Y.)	118
Wholesale printcloth 27 in., 64 x 60, 7.60 yd. to pound (Boston)	137
Wool:	
To producer	92
Wholesale worsted yarns 2/32, crossbed stock white in skein (Philadelphia)	148
Wholesale women's dress goods, storm serge, all wool, double warp, 50 in. (N. Y.)	157
Wholesale suitings, wool-dyed blue, 55-56, 16 oz., Middlesex (Boston)	183
Freight rate clothing, New York to Chicago	210
Wage scale in mills, about	200
Building and construction:	
Prices—	
Lumber, average southern pine and Douglas fir (at the mill)	128
Brick, average common, New York and Chicago	199
Cement, Portland, net, without bags to trade, f.o.b. plank (Buffington, Ind.)	175
Freight rates—	
Brick, common, Brazil, Ind., to Cleveland, Ohio	204
Cement, Universal, Pa., to New York	179
Building labor:	
Union scale, simple average, 15 occupations	190
Union scale, weighted average, 8 occupations, frame houses (3)	197
Union scale, weighted average, 8 occupations, brick houses (3)	193
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Construction costs: Cement buildings (Aberthaw Const. Co.)	161
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Price, bituminous, Pittsburgh	186
Price, anthracite, New York Tidewater	198
Union wage scales, about	173
Non-union scale, about	136
Freight rates	187-299
Metal trades, union wage scale: Simple average, 19 occupations	218
Metals:	
Prices—	
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Lead, pig, desilverized, for early delivery, N. Y.	100
Zinc, pig (spelter), Western, early delivery, N. Y.	80
Day labor, scale U. S. Steel Corporation	150
Printing and publishing:	
Book and job, union wage scale	194
Newspaper, union wage scale	167
Railroad, average receipts per ton-mile	177
Bureau Railway Economies estimate of railway wages, based on average annual compensation, third quarter	226
General estimate all union wage scales by Prof. Wolman	1[illegible]

Note.—The wage indexes refer mostly to wage scales, not the earnings which necessarily also depend upon regularity of employment.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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In these letters I have more than once alluded to the economic importance of the coming Disarmament Congress, and the increased confidence likely to follow an agreement that would reduce the burden of the world's taxation and expenditure for military preparedness. But the high hopes thus inspired have been dashed by the action of the Senate last Monday in passing the bill which repudiates the Hay-Pauncefoote treaty and exempts coastwise American shipping from the payment of Panama Canal tolls.

For this the Democrats are as much to blame as the Republicans, for the bill could not have been passed if some Democrats had not voted for it, and while the opposition of the President and Senator Lodge may make the Senate action a legal nullity, it is generally felt that the willingness of our most mportant legislative body to disregard our treaty obligations renders it very unlikely that the foreign powers will be disposed to take our disarmament proposals seriously.

To this feeling the reactionary tendency of the financial markets last week would seem to be directly due. The decline in Liberty Bonds was the first and an entirely logical expression of a essened confidence in the future. An undiminished expenditure for war means more bonds and more bonds mean ower prices for those already issued. The total of Liberty Bonds and Victory Notes outstanding Oct. 1 was $18,938,-99,050.

The advance from the record low prices of 1920 to the high prices of Sat-rday, Oct. 8, was equal to an appreciation of $1,712,400,000 in the value of hese securities. The decline in the four most active issues that has occurred ince Oct. 8, the last market day pre-eding the action of the Senate, aver-ges 56 points, which is equal to nearly 100,000,000 on the amount outstanding.

These figures will give a partial idea f what the game of politics as at pres-nt played is costing this nation, but hey represent only a fraction of the oss due to the partial paralysis of en-rprise that is being caused by Con-ressional ineptitude and delay. Presi-ent Harding is doing his best but nless public sentiment can be aroused nd crystallized in his support there ill be a strangulation instead of a re-val of business.

Therefore I take advantage of a com-aratively newsless week to urge all he men of affairs who read these lines write to their Senators and Repre-ntatives at once urging prompt and tional action upon the financial ques-ons before Congress, especially those hich have to do with taxes and the riff. Almost anything would be better an the present uncertainty, which to y personal knowledge is holding up w enterprises that would put over fty million dollars in constructive cir-lation.

After the news from Washington and he sensational fluctuations in the price of Liberty Bonds, probably the most important item in the week's record is the foreign trade statement for the month of September.

Net imports of gold during September, 1921, were $62,000,000. Even allowing for the decline in prices these figures show somewhat greater decrease in exports than had been expected but the balance of trade in our favor is surprisingly large when it is considered that we are practically exacting payment of it in gold.

A surprising development of the week is that for the first time since the present tide of gold turned toward this country the amount of the metal held by the Federal Reserve Banks shows a decrease. The drop totals only $4,000,000 and possibly results from use of gold in paying off obligations due to the member banks. If this assumption is correct the decrease is only a species of statistical camouflage without barometric significance. It does not change my view that a period of steadily easing credit and stimulated industrial activity lies ahead of us, and though the softness of stocks, grain and cotton seems a challenge to my opinion, the unwillingness of the public to buy in the speculative markets is only a natural result of the feeling that Congress may put more sand in the driving mechanism of the business locomotive—than it pours on the rails.

Not in weeks have the barometric indications in the news been so uniformly favorable. The unfilled tonnage of the United States Steel Corporation on Sept. 30 showed an increase for the first time since July, 1920. September automobile shipments showed less than last year's seasonal decline. Building last month was more active than in any previous September on record, and lumber orders for the last week of the month exceeded the first week by 65,-000,000 feet. Coal production steadily increases. The Bureau of Labor Statistics reports a slight gain in the number of workers employed during the month. And the Treasury statement of Oct. 1 shows a gain in the money circulation per capita from $52.41 to $52.45, which, while too small to be important, is significant because it is the first break in the decline which has been going on for nearly a year.

Copper at 13 cents is 1⅜ cents above the August quotation and sales are far ahead of production. Advances in crude and refined oil prices have followed rapidly on the general and apparently sudden perception that demand on its return to normal will meet a curtailed supply. This rapid upturn is comparable to the sharp advance which occurred in cotton last month and it is having the same stimulating effects on trade in the regions affected. A similar recovery is to be expected eventually in coffee and sugar, though they declined last week, for a period of excessively low quotations for the great staples is invariably followed by a curtailment in production and an advance in price. Already Cuban reports indicate a marked decrease in the sugar crop for 1922.

Demand for lower railway rates from many important quarters, including the agricultural "bloc" in the Senate and the unemployment conference, will strike a common target at the meeting of railway executives now being held in Chicago. A statement by President Rea, of the Pennsylvania, that lower rates are necessary to readjustment connotes an important change from the attitude heretofore held by many executives that the increase last year was so small as to play no part in curtailing traffic. A voluntary rate reduction would place the powerful weapon of public support in the railroads' hands for use in their war against present wage scales and working rules.

Not the least important item of the week is a confirmation of reports that women's skirts are to be longer, which government statisticians estimate will mean the consumption of $50,000,000 worth of cloth above last season's total.

From abroad comes news of another billion mark expansion in German note circulation and a continued scramble in central Europe to exchange paper money for physical property, which can only presage an uninterrupted decline in the purchasing power and ultimate demonetization of the irredeemible paper in circulation. Reflecting this the mark has declined to a new low, and in New York last Thursday 100 marks could be bought for 69 cents.

The threat which this plague spot holds for the rest of the world is not yet adequately understood here. American relief workers in Russia report that the suffering from famine is far worse than they have seen in any other European country. I know my readers will be surprised to learn that there are three wars at present being fought across the atlantic, the Greco-Turkish, the Spanish-Moroccan, the Albanian-Jugo-Slavian, and that fighting is going on in Silesia and Burgenland, between Austria and Hungary. Western Europe, however, makes progress, and sterling exchange advanced to $386¾ last week. In India Gandhi's "passive non-co-operation" has become active enough to burn European goods and the movement, with its potentialities of more serious trouble, is gathering strength.

Only infrequent shadows of these troubles falls across the United States, and certainly none of them have darkened the Polo Grounds in New York where 270,000 people have paid nearly a million dollars to see eight baseball games. That this should go on while a conference in Washington was discussing means to relieve unemployment is a spectacle worthy of the attention of any able satirist. Discussion of the incongruity is not within the scope of these articles, but it is obvious that nothing can be seriously wrong with a country where thousands of important business men can shed their troubles so lightly.

Industrial Engineers in Convention at Springfield

"Industrial Stability" the Keynote—Delegates Visit Local Factories—Professor Roe Elected President

The Society of Industrial Engineers held its national fall convention in the Municipal Auditorium in Springfield, Mass., Oct. 5, 6 and 7, with about 600 delegates in attendance. The meetings dealt with the topic of "Industrial Stability." In addition to the main gatherings there were sectional meetings for groups having to do with the respective departments of education, manufacturing and selling, financing and accounting and industrial relations. Inspection trips were made by the groups to the principal manufacturing plants of Springfield and vicinity.

President L. W. Wallace, of Washington, D. C., opened the convention Wednesday afternoon with an address in which he assigned as the chief causes of industrial unsettlement the fluctuation in the purchasing power of the dollar, over-expansion of currency and credit, excessive taxation, short-sighted labor policies and various forms of waste in production. He was followed by F. M. Feiker, assistant to Secretary of Commerce Hoover, who spoke of the need of a government service that would provide a barometer of business analogous to the Weather Bureau, and also of the need of better research facilities enabling a business man to possess the facts in relation to his line of business at any given time. A start had been made along this line, he said, by the Commerce Department. He spoke of the need of further localization of statistics as a factor in stabilization.

At the Wednesday evening meeting the principal address was by E. St. Elmo Lewis, of New York, on "Setting Sales Standards." He considered the subject as related to quotas for the individual and incentives to the salesman. He said the present situation has come to a point where every one must take his losses and assist in bringing about the economic balance. "At this time," he said, "we find the manufacturer getting his raw materials at a much lower cost than formerly, but labor costs have dropped but little. Accordingly, the laboring man faces two alternatives. Either he must produce more in return for the wages he receives, or he must perform the same amount of work for lower pay. But labor is not the only one that must submit to a readjustment. Railroad rates must be reduced and taxation equalized."

At the Thursday evening meeting president Ira N. Hollis, of Worcester Polytechnic Institute, presided and made a short address in which he expressed the belief that future stability depended on the relations of factory owners, managements and employees being harmonized. Arthur T. Davenport, of Sweet, Orr & Co., New York, spoke on "The Importance to the Factory of Constant Output." Harry Arthur Hopf, organization counsel for the Federal Reserve Bank of New York, spoke on "Standardization of Salaries of Administrative Employes," accompanying his remarks with stereoptican slides. He stressed the point that a standardized wage system not only made for fairness to employees and afforded a better incentive to work, but it enabled the employer to know better what his business is costing.

A luncheon meeting was held Friday noon at the Hotel Kimball under the direction of the committee on elimination of unnecessary fatigue in industry. Frank B. Gilbreth, of Montclair, N. J.; urged the use of white paint for office and factory interiors, to the end of eliminating color fatigue and giving added keenness of vision.

Friday afternoon's meeting dealt with "The Elimination of Waste in Industry by Standardization." Robert B. Wolf, of New York, dealt with material standardization; and Frank B. Gilbreth, of Montclair, N. J., with "Standardization of the Task.." General discussions ensued on each topic.

The convention was concluded Friday night with a banquet at the Hotel Kimball, with L. W. Wallace as toastmaster. Reuben A. Lundquist, chief of the electrical division of the Federal Department of Commerce, spoke on "The Influence of Foreign Trade on Industrial Stability," showing the close interrelationship of American and Europe in the matter of necessary readjustments. Floyd Parsons, of Philadelphia, spoke on "The Education of the Public for Industrial Stability." He referred to the unequal advance of civilization as regards science, industry, business and politics and said we must learn to apply the same scientific spirit in respect to production and distribution that was manifest in the scientific and technical fields. He pointed out glaring defects in our social order that make for instability.

Every morning was devoted to excursions to nearby industrial establishments, during which many instructive points relative to factory management, cost accounting, and so on, were elicited. The plants visited were: National Equipment Co., candy machinery, Springfield; American Bosch Magneto Co., Springfield; Gilbert & Barker Manufacturing Co., gasoline pumps and tanks, Springfield; William Carter Co., underwear, Springfield; Greenfield Tap & Die Corporation, Greenfield; McCallum Hosiery Co.; Northampton; Fisk Rubber Co., Automobile tires, Chicopee Falls; Rolls-Royce of America, Inc., Automobiles, Springfield; Chemical Paper Manufacturing Co., Holyoke; Hendee Manufacturing Co., motorcycles and bicycles, Springfield; Strathmore Paper Co., Mittineague, and Moore Drop Forging Co., Springfield.

Speakers who bore a prominent part in the sectional conferences were W. G. Sheehan, Detroit; A. L. Rose, Cumberland, Md.; Joseph W. Roe, New York; Robert Douglas, Boston; Ralph Barstow, Greenfield, Mass.; Matthew Porosky, Boston; Horace G. Crockett, New York; Dudley R. Kennedy, New York; George E. Buxton, Pottsdam, Pa.; B. M. Maynard, New York; Gordon Wilson, New York, and Clinton H. Scovell, Boston.

Officers of the society for 1922 were chosen as follows: President, Joseph W. Roe, head of the industrial engineering department of New York University; treasurer, F. C. Schwedtman, vice-president National City Bank, New York; secretary, W. G. Sheehan, Detroit: business manager, George C. Dent, Chicago.

Business Items

The Wilmarth & Morman Co., of Grand Rapids, Mich., manufacturers of grinding machinery, have issued revised catalogs as of Oct. 1, announcing reductions in price varying with different machines but amounting in some cases to 16 per cent.

The Austin Machinery Corporation, of Chicago, has organized a subsidiary firm at Woodstock, Ontario, Canada. The concern has been incorporated under the laws of Canada and will act as sole manufacturer and distributor of a complete line of Austin earth-moving and concrete-mixing equipment.

Notice has been received of the formation of a partnership to be known as Sir Charles Bright & Partners, with offices at 146 Bishopgate, E. C. 2, London, England. Sir Charles Bright, senior member, is a well-known British consulting engineer; A. T. Stubbs was formerly engineer in chief of the royal post offices; Lt.-Col. H. W. Woodall has been a consulting engineer with several large gas and motor companies; A. Hugh Seabrook has been identified with engineering service for 20 years, specializing in electric and railroad enterprises.

Mayor James E. Higgins, of Chicopee, Mass., who has owned and operated the Higgins & Co. brass foundry at Holyoke, Mass., for the last 23 years, has retired and sold his interest in the business to his partner Frank Williams, who will run the business as in the past.

The Toronto, Ontario, Canada, office of the Independent Pneumatic Tool Co., Chicago, Ill., has been removed from 32 Front St. West, to No. 163 Dufferin Street, Toronto. This new location will give the company larger space and increased facilities for carrying a complete stock of Thor pneumatic tools, electric tools, spare parts and accessories. The Toronto office will remain in charge of William McCrae.

The East Iron and Machine Co., at Lima, Ohio, employing a large number of men, has sufficient orders on hand for machinery to keep the plant on full time until Jan. 1, according to sales manager A. J. Filliez.

Part-time classes for apprentice machinists have been initiated by the United Foundry and Machine Co., Youngstown, Ohio, the first industrial concern to take advantage of this privilege for its apprentices under the new Smith-Hughes school law. R. W. Hiestand, experienced trade and industrial teacher, of Dayton, is in charge of the classes, which are held three days a week.

The Hartford Tap and Gauge Co., of Hartford, the Hanson-Whitney Machine Co., Inc., the Taylor & Fenn Co and the Whitney Manufacturing Co have arranged to be represented i New York by L. C. Bigelow & Co., Inc

The Cumberland Foundry and Supply Co., Cumberland, Md., has leased the foundry of the Union Mining Co., Mt Savage, Md. The making of aluminum patterns will be a feature of the new unit.

Personals

Edward Kopper, Jr., formerly assistant superintendent of the American Hoist and Derrick Co., St. Paul, Minn. has severed his connection with that concern to become associated as a partner in the H. C. McNair Co. also of St. Paul, agents for manufacturers' of steel and railway supplies.

Raymond P. Frye has resigned his position as chief draftsman of Page, Beck & White, Inc., Chicago and is now with the Western Electric Co. as special machine designer.

E. O. Zacharias has accepted a position as assistant chief engineer with The Shanklin Manufacturing Co., Springfield, Ill. He was formerly master mechanic for the Teavous Spring Lubricator Co., Cleveland, Ohio.

H. A. Brinkerhoff and R. W. Stovel, for many years associated with Westinghouse, Church, Kerr & Co., and since 1920 with its successor, Dwight P. Robinson & Co., Inc., announce the formation of a partnership as engineers and contractors, with offices in New York City.

J. M. Willis, formerly vice-president and general manager of the Baltimore Dry Docks and Shipbuilding Co., Baltimore, Md., has been appointed general manager of the Baltimore Dry Docks Plant of the Bethlehem Shipbuilding Corporation. He will also have charge of all ship repair sales in the Baltimore district. The Baltimore Dry Docks Plant of the Bethlehem Shipbuilding Corporation was formerly the Baltimore Dry Docks and Shipbuilding Co., having recently been acquired by the Bethlehem interests.

George H. Hartman, mechanical engineer of the Locomotive Appliance Co., Toledo, Ohio, has accepted temporarily the position of mechanical engineer for the Autovent Co. and the Service Machine Co., both of Cleveland, Ohio.

Arthur E. Hutchinson, who is associated with the Grinnell Co. has been transferred from Warren, Ohio, to New York City.

E. J. Loring is now chief engineer, Aircraft Armament Division, Ordinance Dept., U. S. A. and is located in Washington, D. C.

F. F. Boyd, formerly vice-president and manager of the Providence Engineering Corporation, New York City, is now connected with the Ames Iron Works, of that city.

Prof. Comfort A. Adams has resigned as chairman of the Division of Engineering of the National Research Council and is devoting his time to his work at Harvard Engineering School, Cambridge, Mass. Alfred D. Flinn has assumed temporary chairmanship of the division.

Robert L. Browne, of the Metal and Thermit Corporation, has been transferred from New York City to Boston.

William A. Miller has severed his connection as mechanical draftsman and tool designer for the U. S. Hame Co., Buffalo, N. Y., and is now serving in a similar capacity for the J. P. Devine Co. of that city.

Fred C. Schreiber, formerly with Stocker-Rumely-Wachs & Co., Chicago, Ill., is now with the Sterling Grinding Wheel Co.

James E. Fritz is leaving the Stocker-Rumely-Wachs Co., Chicago, Ill., after seventeen years' connection. He has not announced his plans as yet.

C. B. Cole has opened an office at 546 West Washington St., Chicago, Ill. as consulting mechanical engineer. He is specializing in tools, gages, systems and interchangeable manufacturing.

J. W. Wall, formerly with the Gardner Governor Co., Chicago, Ill., is now general manager of the U. S. Lock Nut Corporation.

Gus V. Ziv, formerly manager of the Chicago branch of A. Milne & Co., announces his entry into business for himself as president and treasurer of the Ziv Steel and Wire Co., 4423 West Kenzie St. The new company will handle tool and solid drill and hollow drill steel. Norman J. Hyslip is general sales manager.

Richard H. Collins, formerly vice-president and director of the General Motors Corporation and president and general manager of the Cadillac Motor Car Co., has assumed active management of the Peerless Truck and Motor Corporation of Cleveland, Ohio. It is reported that Mr. Collins acted individually in putting over this $4,500,000 deal. A general reorganization of the Peerless company will take place.

Peter D. Thropp, treasurer of the John E. Thropp Sons' Co., Trenton, N. J., recently underwent a serious operation at the Atlantic City (N. J.) Hospital. He was on his way to that city to join his family when he was taken ill on a train.

W. B. Montgomery, previously staff service director of C. E. Knoeppel & Co., Inc., industrial engineers of New York City, is now located in Rochester, N. Y., with A. F. Stock, formerly of the same company, under the firm name of Montgomery & Stock, industrial engineers.

H. W. Townsend, formerly district manager of the Aldrich Pump Co., Pittsburgh, Pa., office, has returned to the main plant in Allentown, Pa. as works manager.

Russell G. Paddock has resigned his position as tool designer and engineer with the Indiana Lamp Co. of Connersville, Ind., and has accepted an instructorship in the School of Mechanical Engineering at Purdue University.

August Ulman, Jr. is now instuctor in mechanical engineering department at the University of Pennsylvania. He was formerly connected with the General Chemical Co., Marcus Hook, Pa.

J. W. McMorris has accepted a position with the Mercer Motors Company of Trenton, N. J., as factory manager.

Norman Allderdice, superintendent of the open hearth department of the National Tube Co. plant at Lorain, Ohio, and son of Taylor Allderdice, vice-president of the National Tube Co., has been made sales manager in the Cleveland and Pittsburgh districts, with offices in Pittsburgh. He succeeds the late Robert A. Boyle, vice-president of the company and manager for that district. H. J. Hair, office manager at Pittsburgh, has been appointed district sales manager in Pittsburgh.

H. W. Bishop, Jr., formerly in the general sales department of the La Belle Iron works, Steubenville, Ohio, has been made sales manager of the Superior Pipe Co., Columbia, Pa.

Obituary

Henry B. Barnett, superintendent of the open hearth department, Brier Steel Company is dead at his home in Youngstown, Ohio. For the past five years he had been identified with that company, coming there from Chicago where he had been superintendent of the Illinois Steel Co. for eight years. He was 59 years old.

Albro M. Tilton, founder and president of the Drop Forging Co., of New York, died suddenly on Oct. 5, at his home in Brooklyn, N. Y. He was 55 years old.

William B. Butterworth, director of the H. W. Butterworth & Sons Co., Philadelphia, Pa., died on Oct. 5. He was a prominent manufacturer of textile machinery.

Trade Catalogs

Polyphase Induction Motors. Allis-Chalmers Manufacturing Co., Milwaukee, Wis. Bulletin No. 1118 describing a new line of continuous rated polyphase induction motors, covering in particular the type "AR" squirrel cage line. The type "B" potential starter is also introduced.

Deep Hole Drilling Machines. Pratt & Whitney Co., Hartford, Conn. Circular No. 273 illustrating and describing a recently perfected line of deep hole drilling machines.

Catalogs Wanted

The Klamath Iron and Steel Works, Inc., Klamath Falls, Oregon, would be pleased to receive catalogs of machinery and equipment to replace those destroyed when fire razed its plant on Sept. 9.

C. H. Connell, Box 5, Aurora, Mo., would like to receive catalogs on all kinds of machinery and equipment for car and railroad shops, garages, foundry, mill and general factory buildings.

A concern in Southern California is desirous of receiving catalogs on machinery for manufacturing pistons (not over 6 in.) and piston rings. Address all communications to S. Hoffman, 415 West Fifth St., Santa Ana, Cal.

A prominent Argentine engineering magazine which provides a free service for any of its subscribers who may desire information on where to purchase construction materials, machinery, etc., would be glad to receive catalogs from American manufacturers of building materials, construction machinery, and railway equipment. These will be placed at the disposal of the subscribers, who number nearly 7,000. The name of the periodical may be obtained from the Bureau of Foreign and Domestic Commerce or its district or co-operative offices by referring to file No. 47120.

Forthcoming Meetings

The annual convention of the Industrial Relations Association, of America, will be held in the Waldorf-Astoria Hotel, New York City, on Nov. 1, 2, 3 and 4.

The National Conference of the Industrial Cost Association will be held at Pittsburgh, Pa., on Nov. 2, 3 and 4.

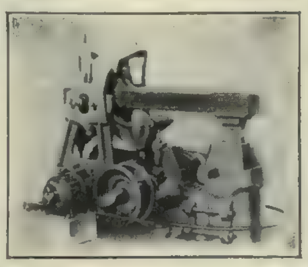
The third annual convention and exhibition of the American Gas Association will be held in the Congress and Auditorium Hotels, Chicago, Ill., on Nov. 7 to 12.

The twenty-fifth annual convention of the National Founders' Association will be held in the Hotel Astor, New York City, on Nov. 16 and 17.

Condensed-Clipping Index of Equipment

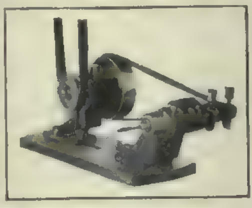
Patented Aug. 20, 1918

Hammers, Power, Helve, Motor Drive for
C. C. Bradley & Son, Inc., Syracuse, N. Y.
"American Machinist," June 9, 1921



The hammers built by the concern can now be furnished with electric motor drives. The drives are not direct, but through belts. The cushioned helve hammer shown has the motor on a separate foundation at the side of the machine, which arrangement can be applied to the other types, so as to have the motor on a mounting separate from the machine. The application of motors and belts is clearly shown. Motors for alternating or direct current and with various voltages, phases and cycles can be furnished.

Attachment, Grinding, Internal
Hjorth Lathe and Tool Co., 27 School St., Boston, Mass.
"American Machinist," June 9, 1921



It is said that the attachment can be used on practically any of the plain or universal grinding machines now on the market. It has a ceiling countershaft adjustment and a table center adjustment of 2½ in. for accommodating different center heights, and also its own countershaft belt adjustment between the quill bracket and countershaft. The spindles are of two types, one for deep and large holes and one with taper arbors for small holes. Each spindle has two adjustable bearings, lubricated by oil chambers, and a separate adjustable end thrust bearing. The countershaft spindle is driven by a clutch to a live spindle, thereby relieving the strain from the live spindle.

Fountain, Drinking, Ice-Cooled, Economizer
Manufacturing Equipment and Engineering Co., Boston, Mass.
"American Machinist," June 9, 1921

The principal feature of the device is the fact that two coils and two cooling compartments are used. One of these cooling compartments with a coil immersed in it is cooled by ice, while the other is cooled by the water which is ordinarily wasted during drinking and which has been thoroughly cooled. The combined length of copper coils carrying the drinking water is 105 ft. This waste water circulates about the lower or primary coil. Either inclined or vertical-stream types of blubber can be furnished. The device has a cork-insulated cover, an air chamber surrounding the tank, and large connecting pipes.

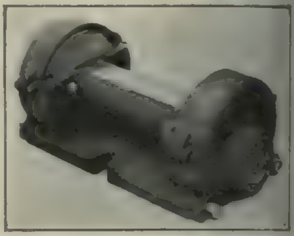
Handle, File, "Shur-Grip."
Parker Supply Co., 785 East 135th St., New York, N. Y.
"American Machinist," June 9, 1921

The principal feature of this handle is a case-hardened steel thread in the file opening, into which the tang of the file is screwed. This thread is said to cut into the tang as does a die and to hold the file absolutely rigid, not only eliminating the usual troubles of keeping the holder on the file, but making it possible to use the holder on different files. A steel casing around the thread prevents it from turning or expanding. This casing and thread are held in by a steel ferrule which covers the end of the holder. The grip is of hardwood. The handle is made in three sizes, for use with files from 6 to 18 in. long.

Boring Machine, (Re-), Cylinder, Keeler
Central City Machine Co., Syracuse, N. Y.
"American Machinist," June 9, 1921

The machine is for use in garages and repair shops for reboring automobile cylinders and is built on an angle plate intended to be secured to the top of the cylinder block. It is motor driven, and when in use there is no necessity for removing the engine from the automobile. Three cutter heads are furnished to bore from 2¾ to 4½ in. Each head has five high-speed steel cutters centrally adjustable by means of a five-lobed cam, so that any account of over-size can be obtained for any size of cylinder. The bottom of the cutter head is slightly conical, so that the head can be centered in the cylinder bore before the machine is clamped in place. An adjustable stop is provided, to stop the motor when the cutter head has reached a predetermined depth.

Truing Machine, Grinding Wheel, No. 23
Precision Truing Machine and Tool Co., Cincinnati, O.
"American Machinist," June 9, 1921



The machine is similar to the Precision No. 21 machine, but is made for larger grinders such as the Blanchard and Norton surface grinders with wheels up to 6-in. face. The machine carries wheels 4 in. in diameter with 1-in. face. The wheels when not in use, are thoroughly protected by hinged wheel guards, as shown. Two different grades of wheels can be carried at the same time, making it possible to use one machine on a number of surface grinding machines when different classes of finish are required; or one wheel can be used for roughing and the other for finishing the same grinding wheel. The machine is equipped with ball bearings.

Table, Cut-Off, Swing Saw
Oliver Machinery Co., Grand Rapids, Mich.
"American Machinist," June 9, 1921

The table is designed for use with an overhead swing cut-off saw and is 16 ft. long, 19½ in. wide and 30 in. high. The top is made of kiln-dried maple with angle-iron girths and the legs are cast iron. The table is composed of two parts or sections. On the rear of the right-hand section is mounted the scale rail, which is graduated in eighths of an inch up to 96 in. On the left hand section is mounted the No. 419 automatic swing cut-off saw gage, which comprises a square rod graduated in eighths of an inch up to 96 in. Four automatic malleable-iron stops, one center and two end door-holders are mounted in place. The bed of the table carries a set of rollers. A dust chute is fastened between the two sections of the table.

Chuck, Drill, Automatic
Eastern Tube and Tool Co., Inc., 594 Johnson Ave., Brooklyn, N. Y.
"American Machinist," June 9, 1921

This drill chuck is for use with straight-shank drills. The shank of the drill is held between three cam-shaped rollers, by the simultaneous rotation of which the size of the space for the drill shank can be varied. It is possible for the operator to change the drill while the spindle of the machine in which the chuck is fastened is rotating. The cam rollers automatically rotate so as to grip the work. The chuck is said to be self-centering and to be very rapid in its action. The presence of oil in the chuck does not prevent the securing of a strong grip. Morse taper shanks either Nos. 1, 2 or 3, are ordinarily furnished. The chuck is made in two sizes. The No. 6 size having a range from ⅛ to 25/64 in., and the No. 8 from $\frac{3}{16}$ to 33/64 in.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Mass., Lowell—The Lamson Co., 196 Walker St., manufacturer of carrier tubes, A. W. De Camp, Genl. Supt.—$30,000 worth of machine tools for proposed plant at Eastwood, N. Y.

N. J., Newark—Lindeny Metal Novelty Wks., 15 Boyden Pl.—three Zeh & Hahremann No. 3 and 4 power presses.

N. J., Trenton—Crescent Insulated Wire & Cable Co., Olden and Taylor Sts.—machinery and tools.

N. Y., Buffalo—The Fisher Knitting Co., 1043 Jefferson St., M. J. Fisher, Purch Agt.—machine shop equipment including lathes, milling machine, drill press, etc.

N. Y., Buffalo—Hyde Electric Service, 1474 Main St.—small bench lathe.

N. Y., New York—The Bd. Educ. will take bids on 2,600 items of machinery.

N. Y., New York—J. S. Mertins, 359 Pearl St.—one shaper with 16 in. stroke.

Pa., Easton—The Nash Sales and Service Co., 728 Wolff St., L. A. Snyder, Master Mechanic—machine to clamp on head for regrinding cylinder bores.

Pa., Hazleton—The Automatic Products Co., Hazleton—

One turret lathe, wire feed, 2 in. capacity with power feed to cross slide and power feed to turret.

One 4 in. or 6 in. spindle drill press for drilling up to 9/16 in. diameter in soft steel with individual feed and speed to each spindle.

One 6 in. circular cold saw for cutting off bar stock.

One small 2 spindle high-speed drill press, either ball-bearing or plain or single spindle drill press, high speed with cluster-box attachment so 2 or 3 size drills can be used at once.

Ala., Birmingham—G. R. Mueller Co., Brown Marx Bldg., C. R. Mueller, Purch. Agt.—

One belt or motor driven shear for cutting 1½ in. round steel bars. Alligator shear not wanted as machine is to be used for cutting above and smaller size bars in quantities to specific lengths.

One belt or motor driven punch, capacity 1 in. hole in 1 in. plate or heavier, having not less than 36 in. throat. (Used if in good condition.)

Fla., Orlando — The Southern Cement Block Machine & Supply Co., Hughey and Silvia Sts., H. G. Lindsay, Secy. and Treas.—drills, milling machines, hack saw blades, planers, emery wheels, planers tools, nuts, bolts, etc.

Ga., Rome—The Bowie Stove Co.—complete machinery for stove foundry.

Ga., Thomasville—W. J. Barnett Boiler Wks., W. J. Barnett, Purch. Agt. — one radial drill, Morris or Fosdick, with 3 ft. or 30 in. arm, want most up-to-date machine made, (will consider used).

Ky., Louisville — The Progressive Auto Service Co., 207 West Bway., L. H Prescott, Genl. Mgr.—will be in the market about Jan. 1 for complete equipment for garage to house about 150 machines, also equipment and machinery for large automobile repair shop.

La., New Orleans — The Orleans Steel Products Co., Inc., 1021-25 Bienville St., P. O. Box 274.—one Jones & Lamson or equal, 2 or 2½ in. x 26 in. turret lathe, latest model (used).

La., New Orleans—F. A. Smith & Co., 538 Camp St., manufacturer of mechanical instruments, No. 1 or 1½ milling-machine with complete equipment, dividing head, etc., and a No. 3 inclinable punch press, (new or used).

N. C., Wilmington—Carters Production Wks., 210 South Water St., O. Carter, Mgr.—complete machinery for small cabinet shop and equipment for light machine shop including knife grinder, etc.

N. C., Winston-Salem—Ferguson Armature Wks., 125 West 8th St.—one lathe, 12 or 14 in. swing, about 8 ft. bed direct motor driven (used if in good condition).

S. C., Charleston—J. H. Roberts, 211 Spring St.—complete tools and machinery for the manufacture of geometric squares.

Tenn., Memphis—Millin Drug. Co., 89 North 2nd. St., M. M. Martin, Mgr.—complete machinery and equipment for the manufacture of metal out-door advertising signs.

Va., Norfolk—The Tidewater Glass Mfg. Corp., J. L. Welton, Pres., will receive bids until Nov. 1 for 18 in. drill press, 8 ft x 18 in. modern type lathe, 500 ft. 50 lb. pressure air compressor, air fan with 36 in. outlet or about 30,000 ft.

W. Va., Logan—Guyan Machine Shops, B. Shell, Mgr.—combined slitting shear and punch for ½ in. plate, steel frame, 220 volt, 3 ph., 60 cycle, motor driven.

Ill., Chicago—C. Fabri, 600 North Dearborn St.—tinners steel brake.

Ill., Chicago—G. Hohn, 2513 South Robey St.—bending and pipe threading machines.

Ill., Dixon—Reynolds Wire Co.—20 ft. x 10 in. engine lathe, milling machine, and bolt threader.

Ill., Waukegan—Wayvell, Chappell & Co. punch press with 6 in. stroke and 24 in. between pillars.

O., Cleveland—The Co-operative Machine Co., 113 St. Clair Ave.—punch press, 3,500 to 4,000 lbs., 6 in. stroke, plain or geared.

O., Columbus—C. T. Dunkle Motors Co., 4th and Gay Sts.—complete equipment for proposed service station.

Wis., Baraboo—H. H. Mueller, Baraboo—lathes, several ton presses, etc.

Wis., Hingham—P. Eernisse & Co. (garage)—repair shop machinery.

Wis., Madison — T. Roster & Co., 440 Clemons Ave.—drill press.

Wis., Milwaukee—The Amer. Toy Shop, 435 Grove St., A. Banse, Purch. Agt.—small size iron shaper.

Wis., Milwaukee — F. J. Hanson, 463 Lenox St.—two drill presses for auto repair work.

Wis., Milwaukee—S. T. Kotowski, 691 Mitchell St.—lathe suitable for auto repair work.

Wis., Milwaukee—The Milwaukee Sheet Metal Wks., 226 Reed St., A. Meyer, Purch. Agt.—One 30 in. or 36 in. square shear, gutter beaters and sheet metal tools.

Wis., Milwaukee—The Milwaukee Electrical Wks., Inc., 315 Mineral St., W. Krist, Purch. Agt.—one lathe and probably a drill press.

Wis., Milwaukee—Pauly-Marx Co., 2530 North Ave.—lathe, drill press and emery wheel for garage.

Wis., Milwaukee—J. H. Tice, 2319 Lisbon Ave.—lathe and drill press for garage.

Wis., Oshkosh—Green & Negendank, Nebraska St.—lathe and other equipment for automobile repair work.

Minn., Minneapolis—S. A. Otness, 4009 12th Ave., S.—new or second hand pipe bending machine.

Tex., Harrisburg—The Harrisburg Machine Wks., Inc., F. D. French, Secy. and Treas.—one 3 ft. radial drill, one 250 or 300 lb. trip hammer, and one bolt cutting machine up to 1½ in.

Que., Montreal—L. Britton, 980 St. Denis St.—complete equipment for auto repair shop at 971-73 St. Christopho St.

Australia, Sidney — The Victorian Railways Co.—Duplex locomotive rod boring machine.

N. Y., Buffalo—L. A. Maier, 339 Landon St.—perforating machine for perforating art needle work patterns, Julius Sternfeld make preferred.

Pa., Philadelphia—Brownhill & Kramer, c/o H. A. Brownhill, 406 Memphis St.—new knitting machines.

Pa., Philadelphia — Queens-Brooks Co., c/o J. S. Queens, American and Diamond Sts.—general knitting machinery.

Ga., Macon—Central Sash & Door Co., T. M. Willingham, Secy. and Treas.—machines for the manufacture of sash and doors.

N. C., Hamlet—The Chamber of Commerce, J. F. Moffet, Mgr. — complete machinery and equipment for cotton mill.

Va., Mt. Crawford—J. S. Dovel—cut-off saw suitable for dado work, on which arbor slides up to work on level plant, (used).

Ill., Chicago—The Chicago Metallic Mfg. Co., 542 West 35th St., manufacturer of electric appliances—power scrap-tin baling machine.

Mich., Detroit—Beaubien Ice & Coal Co., 4205 West Jefferson Ave.—equipment for making ice.

Mich., Detroit—J. Tekieli, 9201 Home St.—one portable saw mill complete, (used).

O., Columbus—The Central Tablet Mfg. Co., Harvard Ave., D. A. Heffner, Genl. Mgr.—six ruling machines, 6 cutters and other equipment for proposed addition to plant.

Wis., Beaver Dam—R. F. Clark, special machinery for proposed canning factory at Fox Lake.

Wis., Clayton — J. Rothenbuhler — belt driven machinery for making cheese.

Wis., Eau Claire—Eau Claire Wood Products Co., Wilson and Gilbert Sts., S. R. Davis—wood-working machinery to manufacture wooden specialties and wood work.

Wis., Fox Lake—R. F. Clark, Beaver Dam, and G. Otto, Randolph—power driven machinery for corn and pea cannery here.

Wis., Janesville—Brittingham & Hixon Lumber Co., 314 West Mliwaukee St.—wood-working machinery.

Wis., Manitowoc—The Brewer Mfg. Co., Meadow Lane, manufacturers of pianos, cabinets, etc.—woodworking machinery for proposed factory.

The Weekly Price Guide

This Week's Market

Structural steel shapes are quoted at the Pittsburgh mill at $1.60@$1.75; plates at $1.55@$1.65 and soft steel bars at $1.50@$1.65 per 100 lb. Mill shipments, New York, of shapes and plates are quoted at $1.98@$2.13; bars at $1.98@$2.03 per 100 lb. Chicago warehouses report a reduction of ½c. in cold rolled strip steel and 2c. per lb. in light spring steel. New York quotes cold finished shafting at $3.88 as against $4.03 and cold drawn flats, squares, etc., at $4.38 as compared with $4.53 per 100 lb. formerly.

Electrolytic copper and tin have both advanced ½c. per lb. in New York. Brass sheets and rods have advanced 1c. per lb. in New York and Chicago warehouses. Aluminum ingots are quoted at 20c. as against 21c. per lb. in Chicago. Cleveland reports a rise of 1c. in copper sheets, wire, bars and tubing and advances ranging from ½c. to 1½c. per lb. in old metals.

Linseed oil is down 8c. per gal. in Cleveland, to 80c.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$24.50
Northern Basic	22.52
Southern Ohio No. 2	23.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	30.26
BIRMINGHAM	
No. 2 Foundry	20.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	22.75
Virginia No. 2	28.74
Basic	20.75
Grey Forge	21.75
CHICAGO	
No. 2 Foundry local	22.70
No. 2 Foundry, Southern, sil 2.25@2.75	26.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	22.96
Basic	21.96
Bessemer	21.96

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50	3.28	3.10	3.38
No. 12	2.60	3.33	3.15	3.43
No. 14	2.70	3.38	3.20	3.48
No.16	2.80	3.48	3.30	3.58
Black				
Nos. 17 and 21.	2.85	4.05	3.55	3.95
Nos. 22 and 24.	2.90	4.10	3.60	4.00
Nos. 25 and 26.	2.95	4.15	3.65	4.05
No. 28	3.00	4.25	3.75	4.15
Galvanized				
Nos. 10 and 11.	3.00	4.25	3.75	4.15
Nos. 12 and 14.	3.10	4.35	3.85	4.25
Nos. 17 and 21.	3.40	4.65	4.15	4.55
Nos. 22 and 24.	3.55	4.80	4.30	4.70
No. 26	3.70	4.95	4.55	4.85
No. 28	4.00	5.25	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of Sept. 16, 1921:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	68½	56	¾ to 1½	39½	24½
LAP WELD					
2	61½	49	2	34½	20½
2½ to 6	65½	53	2¼ to 4	37½	24½
7 to 8	62½	49	4½ to 6	37½	24½
9 to 12	61½	48	7 to 12	35½	22½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66½	55	1 to 1½	39½	25½
2 to 3	67½	56			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59½	48	2	35½	22½
2½ to 4	63½	52	2½ to 4	38½	26½
4½ to 6	62½	51	4½ to 6	37½	25½
7 to 8	58½	45	7 to 8	30½	18½
9 to 12	52½	39	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	60%	46%	60½%	47½%	68½%	56%
3½ to 6 in. steel lap welded.	51%	37%	58½%	44½%	65½%	53%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (heavy)	5.00	6.00	*3.78
Spring steel (light)	6.00	6.00	†8.50
Coppered Bessemer rods(base)	8.00	8.00	*6.03
Hoop steel	3.88	3.29	3.48
Cold rolled strip steel	7.50	8.25	6.75
Floor plates	4.85	2.74	5.23
Cold finished shafting or screw	3.88	3.50	4.00
Cold finished flats, squares	4.38	4.00	4.50
Structural shapes (base)	2.88	2.74	2.88
Soft steel bars (base)	2.78	2.64	2.78
Soft steel bar shapes (base)	2.78	2.64	2.78
Soft steel bands (base)	3.43	....	.....
Tank plates (base)	2.88	2.92½	2.88
Bar iron (2.15@2.25)	2.78	3.52	2.78
Drill rod (from list)	55@60%	55%	50%

Electric welding wire.......... New York $\frac{3}{32}$, 8½c. per lb.; ⅛, 7.15c.; $\frac{5}{32}$ to ¼, 6.75c. Swedish iron sells at 9c. per lb. in Chicago. *Price to dealers. †Carriage spring steel.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	13.62½
Tin, 5-ton lots, New York	27.50
Lead (up to carlots), St. Louis, 4.60; New York	5.00
Zinc (up to carlots), St. Louis, 4.97½; New York	5.37½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.00	25.00	20.00
Antimony (Chinese), ton spot	5.50	6.00	6.50
Copper sheets, base	20.75	21.50	20.50
Copper wire (carlots)	16.50	16.50	15.50
Copper bars (ton lots)	19.00	23.00	18.00
Copper tubing (100-lb. lots)	20.50	23.00	20.50
Brass sheets (100-lb. lots)	16.25	16.00	16.25
Brass tubing (100-lb. lots)	18.00	18.00	18.00
Brass rods (1,000-lb. lots)	14.25	16.00	14.25
Zinc sheets (casks), (8% dis. carlots)	11.00	11.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ½), (case lots)	19.50	23.50	17.50
Babbitt metal (best grade)	70.00	37.50	32.00
Babbitt metal (commercial)	30.00	13.50	8.00

—Shop Materials and Supplies

MONEL METAL—Base price in cents per lb., f.o.b. Bayonne, N.J.:

Shot	35.00	Hot rolled machined rods (base)	53.00
Blocks	35.00	Hot rolled rods (base)	42.00
Ingots	38.00	Cold drawn rods (base)	56.00
Sheet bars	40.00	Hot rolled sheets (base)	55.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.50	10.25
Copper, heavy, and wire	9.50	10.50	9.50
Copper, light, and bottoms	8.00	8.00	8.25
Lead, heavy	4.00	3.75	3.75
Lead, tea	3.00	2.75	3.00
Brass, heavy	6.50	6.00	8.00
Brass, light	5.00	4.00	4.75
No. 1 yellow brass turnings	5.25	4.50	5.25
Zinc	3.00	2.00	2.75

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

	New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:			
IC, 20x28, 112 sheets	21 50	......	....
IX, 20x28, 112 sheets	24.00	......	....
IXX, 20x28, 56 sheets	13.75	......	....
IXXX, 20x28, 56 sheets	15.50	......	....
IXXXX, 20x28, 56 sheets	17.00	......	....
"A" Charcoal Allaways Grade:			
IC, 20x28, 112 sheets	18.50	......	....
IX, 20x28, 112 sheets	21.50	......	....
IXX, 20x28, 56 sheets	12.25	......	....
IXXX, 20x28, 56 sheets	14.00	......	....
IXXXX, 20x28, 56 sheets	15.75	......	....

Coke Plates, Bright

Prime, 20x28 in.:		(56 sheets)	
80-lb, 112 sheets	13.60	......	....
90-lb., 112 sheets	13.80	......	....
100-lb., 112 sheets	14 00	6.50	....
IC, 112 sheets	14 30	6.65	....
IX, 112 sheets	16.30	......	....
IXX, 56 sheets	9.15	......	....
IXXX, 56 sheets	10.15	......	....
IXXXX, 56 sheets	11.15	......	....

Terne Plate

Small lots, 8-lb. Coating:			
100-lb., 14x20	7.50	6.25	6.25
IC, 14x20	7.75	6.50	6.50

SHOP SUPPLIES

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	—50%	–60%	—60–5%
$1\frac{1}{8}$ and $1\frac{1}{4}$x3 in. up to 12 in.	—40%	60–10–10%	—55%
With cold punched sq. nuts	—30%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	—40%	....	.....
Up to 1-in. diameter, with cold punched hex. nuts (plus std. extra of 10%)	—30%	....	.....
Button head bolts, with hex. nuts	—20%	$3.90 base	.....
Hex. head and hex. nut bolts	—20%	....	.....
Lag screws, coach screws	—50–10%	....	.....
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	50–10–10%	50–5%
Bolt ends, with hot pressed nuts	—50%	....	.....
Tap bolts, hex. heads	—20%	....	.....
Rivets, $\frac{7}{16}$ in. dia. and smaller. *New list*	–50-10%	60-10-10%	–60-10%
Rivets, tinned	–50-10%	60-10-10%	4½c. per lb. net
Semi-finished nuts, all sizes	—70%	75%	75%
Case-hardened nuts	—60%	....	.....
Washers, cast iron, ½ in., per 100 lb.	$5.00	$5.50 off	$4.50
Washers, cast iron, ⅝ in. and larger, per 100 lb.	4.25	3.75 off	4.50
Washers, round plate, off list per 100 lb.	3 00	....	.....
Nuts, hot pressed, sq. Off list	2.00	3.00	3.00
Nuts, hot pressed, hex. Off list	2.00	3.00	3.00
Nuts, cold punched, sq. Off list	1.50	3 00	3.00
Nuts, cold punched, hex. Off list	1.50	3.00	3.00
Rivets:			
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb	$3.70	3.50	3 68
Cone heads, ditto	3 80	3.60	3.78
$1\frac{1}{8}$ to $1\frac{7}{8}$-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	....
⅞ in. diameter *EXTRA*	0.15	....	....
½ in. diameter *EXTRA*	0.50	....	....
1 in. long, and shorter *EXTRA*	0.50	....	....
Longer than 5 in. *EXTRA*	0.25	....	....
Less than 200 lb. *EXTRA*	0.50	....	....
Countersunk heads *EXTRA*	0.35	....	....
Copper rivets	50–10%	40–10%	40%
Copper burs	25–10%	15%	20%

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb.	.055@.09	.09	.10
Wiping cloths per M., 13¼x13¼	....	55.00	55.00
Wiping cloths per M., 13¼x20½	....	65.00	65.00
Sal soda, 100 lbs	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb	2.55	3.25	2.75
Linseed oil, per gal., 5 bbl. lots	.73	.80	.81
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 100 lb		.80	.80
Coke, prompt furnace, Connellsville	per ton	$3.35@3.50	
Coke, prompt foundry, Connellsville	per ton	4.25@4.75	

Wis., Milwaukee—The Great Lakes Shoe Co., c/o A. K. Stebbins, 81 Michigan St.—power driven shoe making machinery.

Wis., Milwaukee—The Quality Dairy Co., 2437 Hadley St.—refrigeration and dairy machinery.

Wis., Milwaukee—F. Rosenberg Elevator Co., 174 Reed St.—1½ ton cranes.

Wis., Oconomowoc — E. Otto — mortiser and saws for wood-working plant.

Wis., Rib Lake—The Rib Lake Chair & Mfg. Co.—wood-working machinery for the manufacture of chairs.

Wis., Slinger—The Storck Products Co. ice cream making and refrigerating machinery, for branch plant at Beaver Dam.

Mo., Deepwater—The W. S. Dickey Mfg. Co.—machinery and tools for making tile.

Mo., Rockville—The Keystone Products Co., T. A. Finley, Pres.—$2,000 worth of equipment for its soap factory at Joplin.

Mo., St. Louis—The Bd. Educ., c/o C. P. Mason, Secy., Bd. Educ. Bldg.—manual training equipment for proposed junior high school on Hartford and Wyoming Sts.

Mo., St. Louis—Larkin & Pratt, 676-78 Arcade Bldg.—machinery for making syrup, capacity 400 tons of cane per hour.

Tex., Marshall—The Marshall Office Supply Co., 107½ West Austin St., G. W. Duryea, Pres.—complete renickeling outfit for small parts.

Tex., Rotan—The Patton Cement Plaster Co., J. W. Patton, Pres.—complete machinery and equipment for the manufacture of plaster (latest models).

Tex., Waco—Circle A Corp. of America, R. S. Lazenby, Pres.—refrigerating, syrup making, water distilling and bottle washing machinery for carbonated beverages also machinery to carbonate beverages.

Metal Working Shops

NEW ENGLAND STATES

Conn., Stamford — Steinmetz & Levine, Archts., Gurley Bldg., are receiving bids for the construction of a 1 story, 75 x 154 ft. garage, etc. on Grove St., for the Mathison Motor Sales So. Estimated cost, $40,000.

MIDDLE ATLANTIC STATES

Pa., Philadelphia—The Bureau of Public Wks., City Hall, will soon award the contract for the construction of a 1 story, 61 x 108 ft. garage and machine shop. Estimated cost, $60,000. H. B. Sinkler, City Hall, Archt.

Pa., Philadelphia—M. O'Malley, 818 North 16th St., will receive bids until Oct. 25, for the construction of a 1 story, 40 x 140 ft. garage at 1522-24 Parrish St. Estimated cost, $45,000.

Pa., Pittsburg—A. Schmitz, Penn Ave., has awarded the contract for the construction of a 1 story garage on Penn Ave. Estimated cost, $50,000.

SOUTHERN STATES

Ga., Rome—The Bowie Stove Co., manufacturer of ranges, cook stoves, heaters, grates, country hollow-ware, stove hollow-ware, etc., plans to rebuild its plant which was recently destroyed by fire. J. M. Berry, Pres.

MIDDLE WEST STATES

Ill., Sterling—P. W. Kempster will build a 1 story, 50 x 142 ft. garage. Estimated cost, $40,000. Noted Oct. 13.

Ill., Zion—Zion Institutions & Industries, c/o W. H. Clendinnen, Administration Bldg., will build a 1 story, 100 x 140 ft. garage. Estimated cost, $50,000. Noted Oct. 13.

O., Cleveland—R. B. Mehling Co., 1269 East 105th St., is having plans prepared for the construction of a 2 story, 70 x 120 ft. garage and commercial building on Hayden Ave. near Woodward Rd. Estimated cost, $60,000. Private plans.

O., Cleveland—Tenfel Bros., 3317 West 65th St., have awarded the contract for the construction of a 1 story, 40 x 81 ft. garage on West 65th St. Estimated cost, $40,000.

O., Columbus—C. T. Dunkle Motors Co., 4th and Gay Sts., plans to build a 4 story, 125 x 136 ft. service station in downtown district.

Wis., Baraboo—H. H. Mueller, Baraboo, is having plans prepared for the construction of a 2 story, 60 x 85 ft. garage on Main St. Estimated cost, $50,000. E. Tough, 24 East Mifflin St., Madison, Archt.

Wis., Milwaukee—Hanson & Phillips, Kinnickinnic and Logan Aves., have awarded the contract for the construction of a 1 story, 100 x 100 ft. garage on Kinnickinnic Ave. Estimated cost, $40,000. Noted Oct. 13.

Wis., Milwaukee—Kohn Mfg. Co., 3513 North Ave., manufacturer of incinerators, will build a 1 story, 30 x 60 ft. factory on 30th St. Estimated cost, $9,000.

Wis., Milwaukee — The Lincoln Investment Co., c/o H. J. Esser, Archt., 82 Wisconsin St., has awarded the contract for the construction of a 1 story, 80 x 132 ft. garage on Keefe Ave. Estimated cost, $40,000.

Wis., Milwaukee—Stearns Sales Agency, 156 Farwell Ave., plans to construct a 2 story, 50 x 150 ft. garage. Estimated cost, $70,000. Architect not selected.

WEST OF THE MISSISSIPPI

Col., Denver—The Denver Auto Hotel Co., Central Savings Bank Bldg., is having plans prepared for the construction of a 6 story, 100 x 125 ft. garage on Lawrence St. between 14th and 15th Sts. Estimated cost, $150,000. W. W. Bowman, Central Savings Bank Bldg., Archt.

Ia., Davenport—The Crane Co., c/o W. T. Cotter, Mgr., 600 East 4th St., has awarded the contract for the construction of a 3 story factory for the manufacture of plumbing supplies. Estimated cost, $85,000. Noted Jan. 20.

Mo., Clarence—A. Burnett, c/o Clarence Auto Co., will build a 1 story, 100 x 140 ft. garage. Estimated cost, $50,000. Noted Sept. 8.

Mo., St. Louis—A. S. Alschuler, Archt., 28 East Jackson Blvd., Chicago, Ill., will receive bids until Oct. 25 for the construction of a 1 story, 199 x 331 ft. garage on 15th and Walnut Sts., for S. Simon, c/o Williams & Bland, 717 Chestnut St. Estimated cost, $100,000.

General Manufacturing

NEW ENGLAND STATES

Mass., Douglas—Haywood Woolen Co. is having plans prepared for the construction of a 1 story, 50 x 80 ft. factory addition. Estimated cost $25,000. C. T. Main, 201 Devonshire St., Boston, Mass.

MIDDLE ATLANTIC STATES

Pa., Harrisburg—The School Bd., 121-23 Chestnut St., will receive bids until Oct. 24 for the construction of a 3 story, 100 x 100 ft. high school including technical departments and shops. Estimated cost, $150,000. D. D. Hammelbaugh, Secy.

Pa., Morrisville—The Robertson Art Tile Co. has awarded the contract for the construction of a 2 story,, 50 x 100 ft. addition to its factory. Estimated cost, $20,000.

Pa., Philadelphia—Brownhill & Kramer, c/o H. A. Brownhill, 406 Memphis St., have awarded the contract for the construction of a 3 story, 80 x 80 ft. addition to their factory on Memphis St., for the manufacture of hosiery. Estimated cost, $60,000.

Pa., Philadelphia—Queens-Brooks Co., c/o J. S. Queens, American and Diamond Sts., manufacturer of knitting goods, has awarded the contract for the construction of a 5 story, 55 x 200 ft. factory on 5th St. and Huntington Park Ave. Estimated cost, $150,000.

MIDDLE WEST STATES

Mich., Detroit—Beaubien Ice & Coal Co., 4205 West Jefferson Ave., has awarded the contract for the construction of a 1 story ice plant on Baker and Porter Sts. Estimated cost, over $40,000.

O., Cleveland—Pavelka Bros., 2978 East 37th St., manufacturers of sausage, are receiving bids for the construction of a 1 story, 57 x 65 ft. addition to their factory on 37th St. and Bway. Estimated cost, $40,000.

O., Columbus—The Central Tablet Mfg. Co., Harvard Ave., has awarded the contract for the construction of a 2 story, 75 x 100 ft. factory on Harvard Ave. and N. & W. Railroad. Estimated cost, $24,180.

Ill., Centralia—The Chicago, Burlington & Quincy R.R., 542 West Jackson Blvd., Chicago, will receive bids until Oct. 25 for the construction of a 1 story round house, 105 ft. long, and coal chute with mechanical operated machinery, here. Estimated cost, $125,000. W. T. Kuausch, c/o owner, Archt.

Ill., Chicago—Bronson—Canode Printing Co., 626 Federal St., plans to build a 5 story, 50 x 142 ft. printing plant on Washington and Elizabeth Sts. Estimated cost, $150,000. Architect not selected.

Ill., Chicago — Hinckley & Schmitt, 418 West Ontario St., have awarded the contract for the construction of 2 additional stories to their bottling plant. Estimated cost between $75,000 and $100,000.

Ill., Momence—The Merit Tent & Awning Co. plans to build a 2 story factory. Estimated cost, $50,000. Architect not seletced.

Ill., Peoria — The Bd. Educ., c/o G. Mitchell, will receive bids until Nov. 5 for the construction of a 2 story manual training school. Estimated cost, $225,000. F. J. Klein, 331 Main St., Archt. Noted April 21.

Wis., Fox Lake — R. F. Clark, Beaver Dam, plans to build a 2 story, 60 x 85 ft. canning factory on Main St., here. Estimated cost, $45,000. Architect not selected, probably private plans.

Wis., Madison—The University of Wisconsin has awarded the contract for the construction of an addition to its service building and electric sub-station. Estimated cost, $66,366. Noted Oct. 13.

Wis., Manitowoc—The Brewer Mfg. Co., Meadow Lane, has awarded the contract for the construction of a 1 story, 60 x 30 ft. factory for the manufacture of pianos, cabinets, optical fitting tables, etc. Estimated cost, $50,000.

Wis., Milwaukee — The Amer. Hide & Leather Co., 658 Commerce St., plans to rebuild its tannery which was recently destroyed by fire. Estimated loss, $1,500,000. Architect not selected.

Wis., Milwaukee—C. Kalinowski, 1178 7th Ave., has awarded the contract for the construction of a 2 story bakery on 8th Ave. Estimated cost, $40,000.

Wis., Milwaukee—The National Distilling Co., 27th and St. Paul Ave., has awarded the contract for the construction of a 1 story, 35 x 40 ft. addition to still house on 27th St. Estimated cost, $12,000.

Wis., Milwaukee—The Quality Dairy Co., 2437 Hadley St., is having plans prepared for the construction of a 1 story, 20 x 70 ft. addition to its dairy. Estimated cost, $15,000. H. W. Voelz, 86 Michigan St., Archt.

WEST OF THE MISSISSIPPI

Ia., Des Moines — Mennig-McCord, East 26th St. and Dean Ave., have awarded the contract for the construction of a 3 story, 42 x 180 ft. pickle factory at 2553 Dean Ave. Estimated cost, $55,000.

Minn., Minneapolis—The Strutwear knitting Co., 731 East 14th St., is having plans prepared for the construction of a 5 story, 160 x 250 ft. factory on 11th Ave., S. and 6th St. Estimated cost, $200,000. W. A. Strutwear, Secy. Long, Lamoreaux & Thorshov, 1028 Andrus Bldg., Archts.

Minn., Red Wing—W. F. Zimmerman is interested in a syndicate which plans to build a vinegar factory. Estimated cost, $150,000. Architect not announced.

Mo., Deepwater—The W. S. Dickey Mfg. Co. plans to build a 3 story addition to its glazed tile factory. Estimated cost, $20,000. Architect not selected.

Mo., Joplin—The Keystone Products Co., Rockwell, plans to convert a 1 story building on 10th and Main Sts., here, into a soap factory. Estimated cost, $5,000. T. A. Finley, Pres.

Mo., Kansas City—The Artzcraft Broom Co., 1423 Kansas Ave., is having plans prepared for the construction of a 2 story, 65 x 127 ft. factory on 14th St. and Kansas Ave. Estimated cost, $75,000. C. A. Smith, Finance Bldg., Archt.

Okla., Oklahoma City—The Smith Baking Co., 437 Oak St., has awarded the contract for the construction of a 2 story, 100 x 150 ft. bakery on 39th and Oak Sts Estimated cost, $150,000. Noted Sept. 29.

Mo., Salisbury—The Salisbury Sanitary Ice & Supply Co., will receive bids until Oct. 26 for the construction of a 2 story ice plant. Estimated cost, $50,000. Black & Co., Salisbury, Archts.

WESTERN STATES

Cal., Los Angeles—Swift & Co., 922 East 1st St., has awarded the contract for the construction of a packing plant. Estimated cost, $52,000. Noted Aug. 1.

CANADA

Que., Montreal — The Molsons Brewery 906 Notre Dame St., E., has awarded the contract for the construction of a 4 story brewery on Notre Dame St., E. Estimated cost, $144,800. Noted Oct. 6.

American Machinist

Volume 55 NEW YORK, OCTOBER 27, 1921 Number 17

Metallography—The Microscopic Study of The Structure of Metals

The Value of Metallurgical Science in Industry—Uses of the Microscope—Study of Metallic Structures—Results of Microscopic Examinations

By HENRY S. RAWDON
Physicist, National Bureau of Standards, Washington, D. C.

TO ONE interested in the "why and wherefore" of the behavior of metals, the reasons for the variations of properties under different treatments, or an explanation of the deterioration or failure of materials in service, the use of the microscope is of utmost importance. In fact, the examination of the structure of metals forms so large a part of any metallographic study that by many the two are considered synonymous. It is no longer necessary to advance arguments to show the importance of the metallographic method in the testing of metals. The remarkable growth of the science in the last few years, together with the widened scope of its applications, is sufficient evidence of the value and usefulness. From a relatively unimportant branch of physical chemistry it has been developed into a means of investigation of the properties of metals and alloys that is on a par with the older methods of chemical and mechanical testing, and it is very frequently of service in explaining obscure phenomena which are inexplicable from the results of the other and older methods alone.

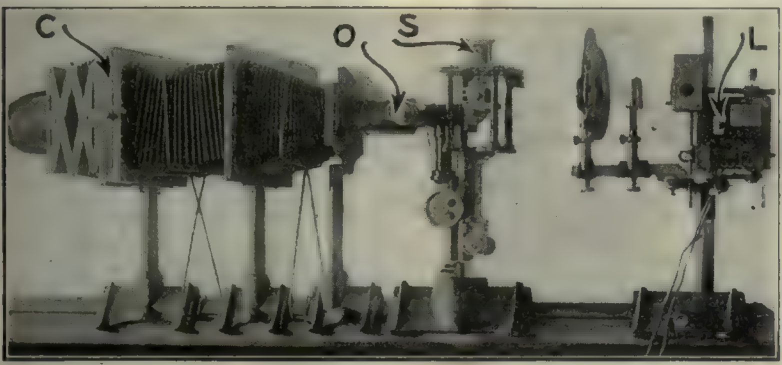


FIG. 1. CONVENIENT FORM OF METALLURGICAL MICROSCOPE

(L) Arc lamp for source of light. (S) Specimen on stage of microscope just above the objective. (O) Ocular for visual observation. (C) Camera for projection for photographic purposes.

Tiemann's[1] definition of the term metallography, as "that branch of metallurgy which treats of the constitution and the structure of metals and alloys and their relation to the physical properties" may be cited as clearly outlining the field covered. However, for a complete metallographic study several other lines of investigation must also be followed in order to establish with certainty both the nature of the physical constituents and the relation which they bear to the physical properties. Thus for example, we need thermal analysis, magnetic analysis, mechanical testing and, of course, chemical analysis. In the present article, however, the discussion must be limited to the structure of the metals and the means of identification of the constituents, together with some typical references to the effect of these upon the properties of the metal itself.

On account of their nature, the microscopical examination of metals cannot be made so easily nor so readily as most other microscopical work. One cannot prepare a section of any metal thin enough to transmit sufficient light to make possible examination in the usual manner by the transmitted light. Instead, the examination of the surface of the specimen must be carried out by means of reflected light, and the apparatus must be constructed with this in view. The principal change which this involves is the insertion of a device in the tube of the compound microscope by means of which light is admitted in the side of the microscope tube and reflected through the lens upon the surface of the specimen to be examined.

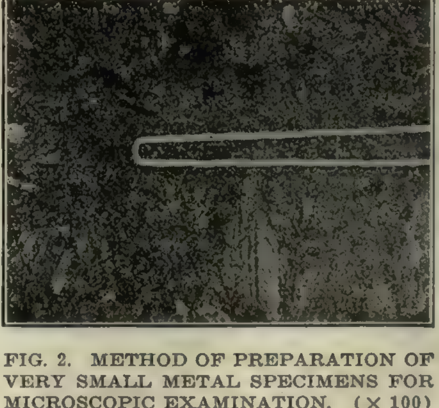


FIG. 2. METHOD OF PREPARATION OF VERY SMALL METAL SPECIMENS FOR MICROSCOPIC EXAMINATION. (× 100)

Some auxiliary devices are necessary, of course, such as a powerful source of light for lighting the specimen, with suitable means for focussing the beam and controlling its intensity, means for leveling the specimen, facilities for photographing the image so that a permanent record may be made, etc. The apparatus may be made more or less complicated according to the number of such accessories which are added. The most convenient and also the most used form of instrument is that commonly designated as the "inverted microscope." This term means that the stage upon which the specimen is placed is located above the lens rather than below it, as in the usual form. Such an arrangement is very convenient, in that the specimen, prepared as described below, is placed upside down above the opening in the stage over the lens; thus it requires no other leveling or adjusting. A rather complicated system of reflectors within the body of the instrument is necessitated by this arrangement, but the results obtained amply justify this complexity. Fig. 1 shows a microscope of this form with the usual accessories and with a specimen in place. The light *L*, properly directed by the lenses and shutters, is focussed on the bottom of the specimen *S*, which is observed through the eyepiece *O* or photographed by the camera *C*.

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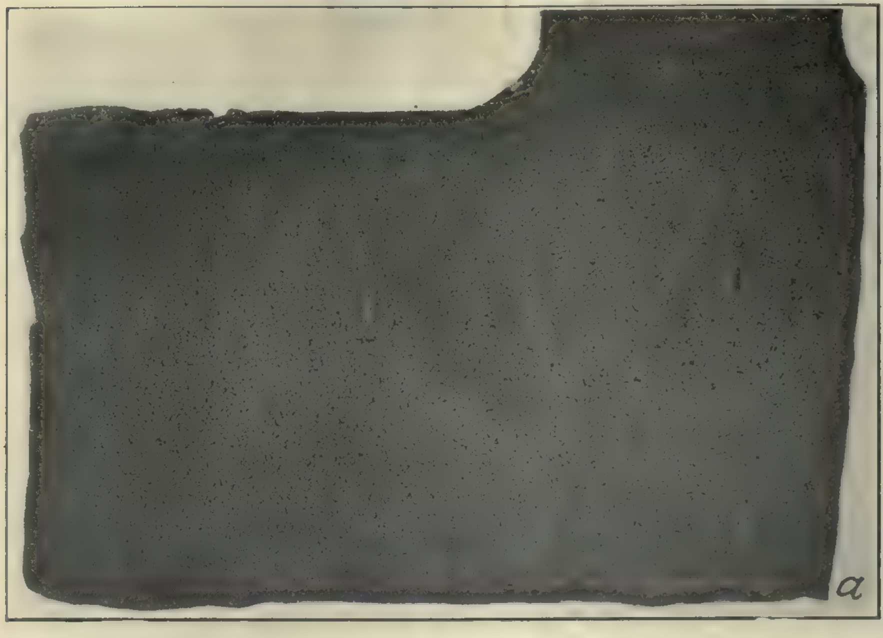
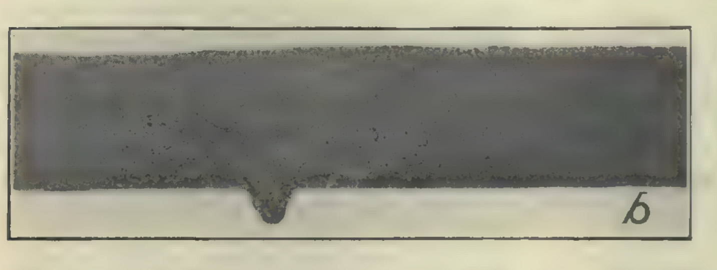
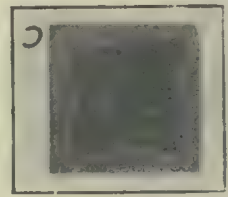
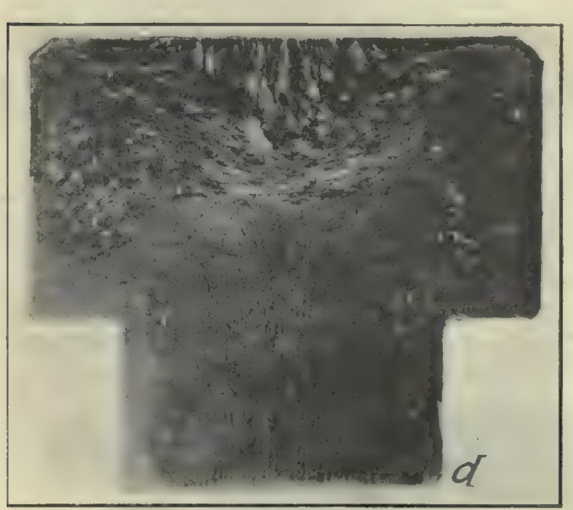
[1] H. P. Tiemann, "A Pocket Encyclopedia." "Steel and Iron"; McGraw-Hill Co.

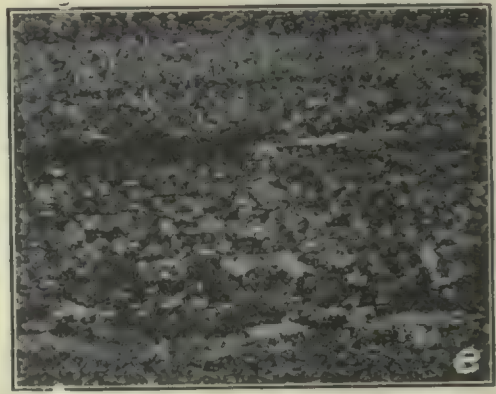
A preliminary rough examination of a rather large area is always desirable before proceeding to the finer details of structure. This examination is usually made without the use of the microscope and is termed a *macroscopic* examination. A surface of at least several square inches, and often a complete cross-section of the piece, for example a rail, is smoothed by means of a file and examined after suitable etching. Features such as chemical unhomogeneity, the result of segregation of similar causes, crystalline heterogeneity, mechanical nonuniformity, and physical unsoundness may be revealed. Very special methods may often be employed in this preliminary examination, which at times may become

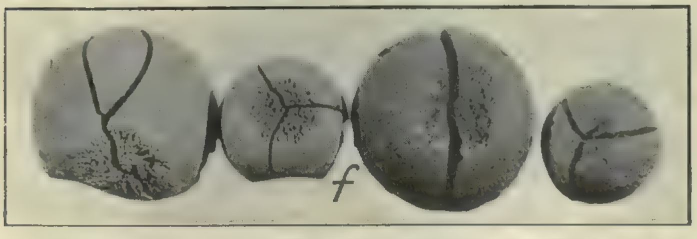












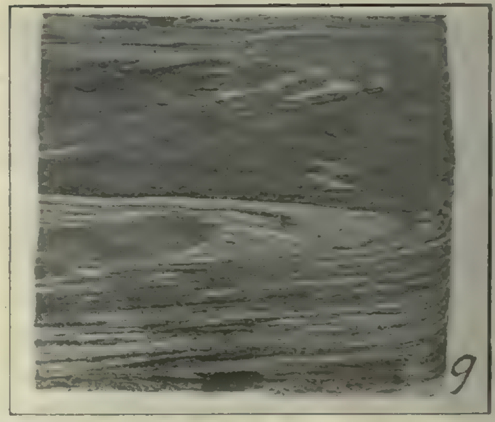
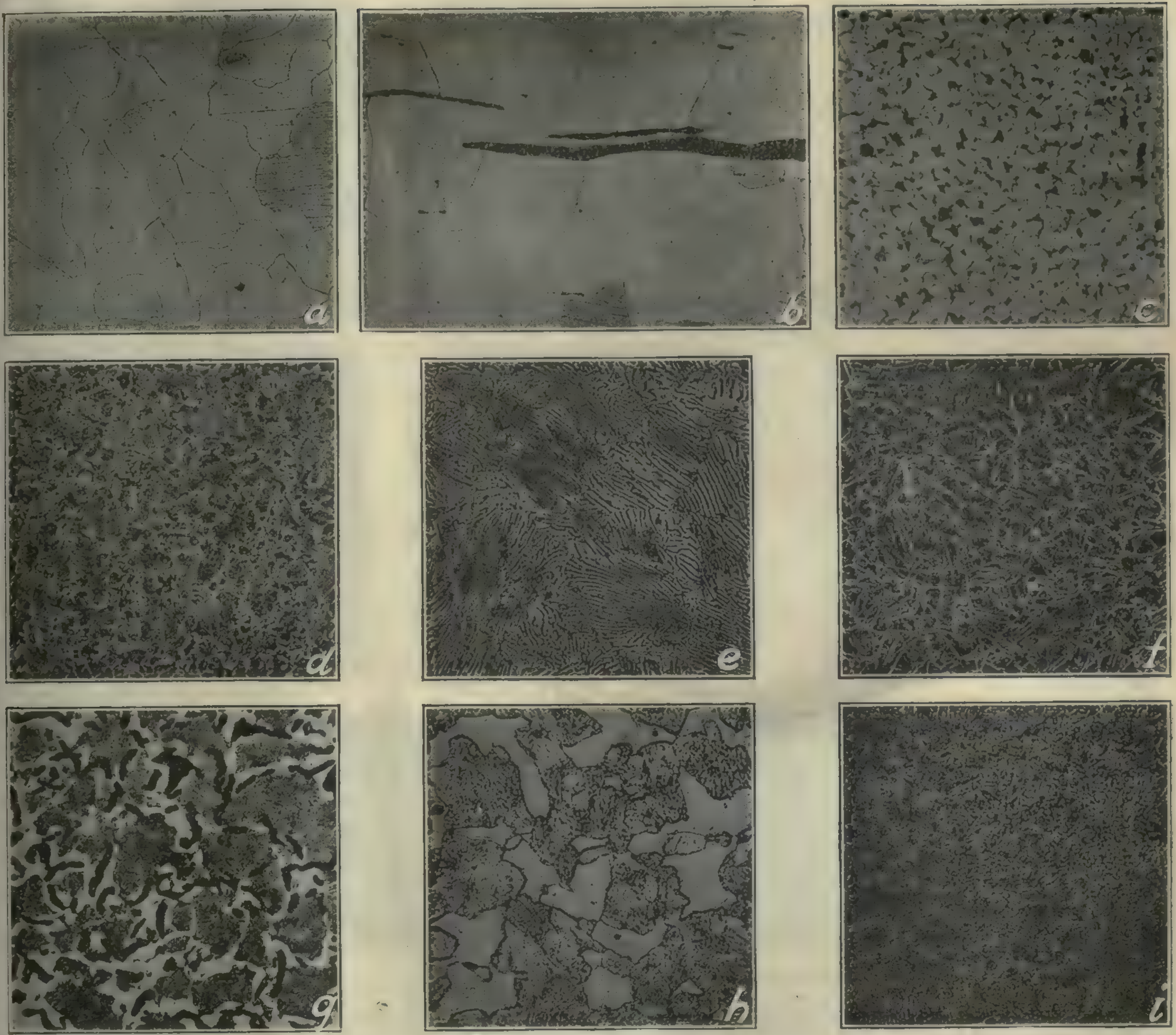


FIG. 3. TYPICAL MACROSTRUCTURAL FEATURES OF ALLOYS

(a) Defective steel casting deeply etched with hot concentrated hydrochloric acid. (× 1.) (b) V-weld in steel plate produced by the oxyacetylene process; etching reagent. (× 1.) (c) Cross-section of a steel bar, the mechanical working which the material received in reducing from the ingot to the size shown was not sufficient to remove the unhomogeneity due to segregation in the ingot. (× 1.) (d) Longidutinal section of a manganese bronze bolt which failed in service. (× 1.) (e) Crystalline structure of wrought iron revealed by etching with ammonium persulphate. (× 3.) (f) Hardened steel balls etched with hot concentrated hydrochloric acid to show process of manufacture. The etching also revealed the presence of high internal stresses caused by the severe hardening treatment. (× 2.) (g) Wrought iron etched with hot concentrated hydrochloric acid shows the additions (light streaks) of steel to the material. (× 1.)



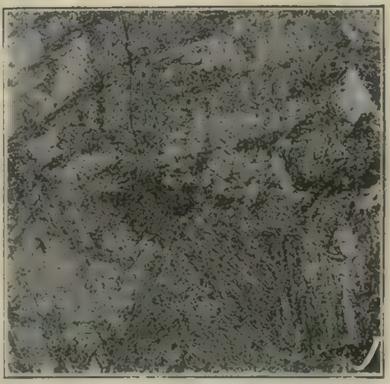


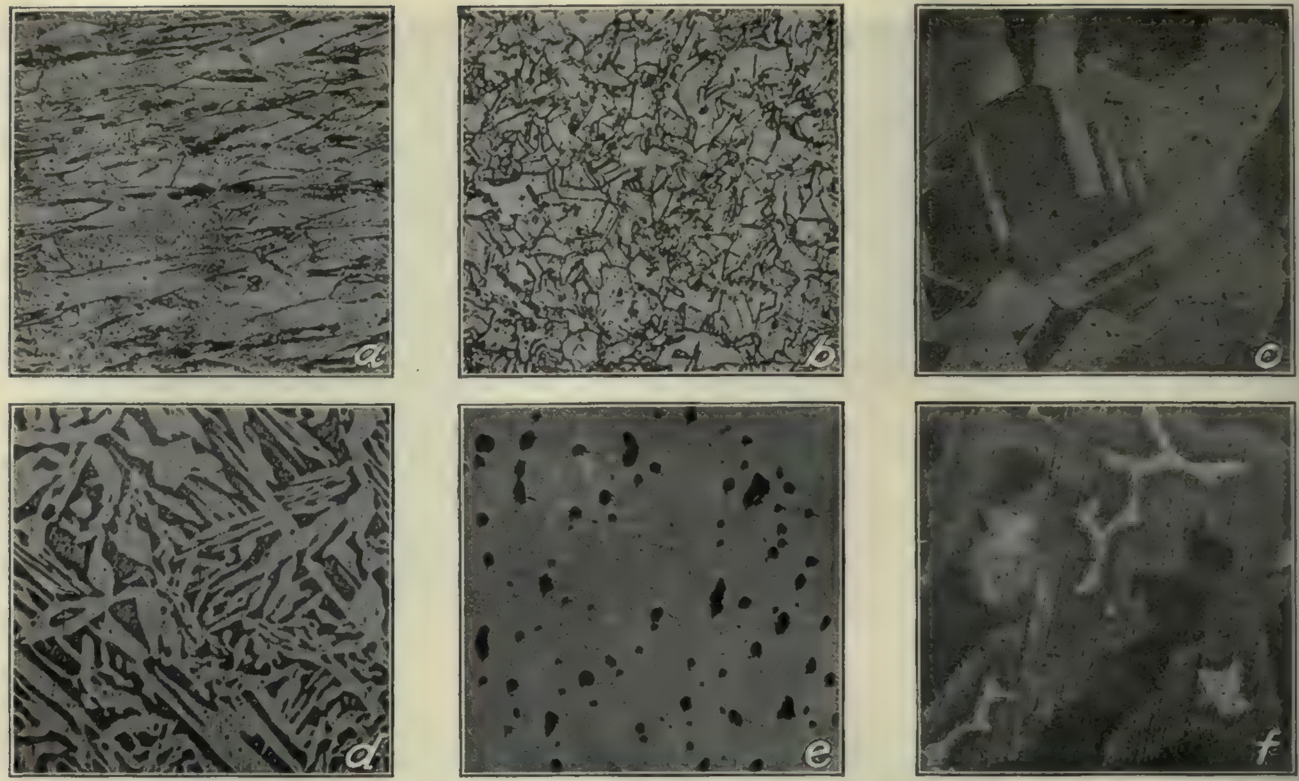
FIG. 4. MICROSTRUCTURE OF TYPICAL IRON-CARBON ALLOYS

(a) Pure iron, ferrite. (× 100.) (b) Wrought iron showing a slag streak. (× 100.) (c) Steel containing 0.24 per cent carbon. (× 100.) (d) Steel containing 0.50 per cent carbon. (× 100) (e) Steel containing 0.85 per cent carbon. (× 500.) (f) Steel containing 1.45 per cent carbon. (× 100.) (g) Gray cast iron, consisting of graphite flakes embedded in a ferrite-pearlite matrix. (× 100.) (h) Steel, 0.50 per cent carbon quenched in water after 15 minutes' heating at 760 deg. C. (1,380 deg. F.) the material has not been fully hardened. A considerable amount of ferrite still remains in the form of the free constituent. (× 500.) (i) Same steel as (h), properly hardened; quenched in water after 15 minutes at 850 deg. C. (1,515 deg. F.). (× 500.) (j) Same steel as (h), quenched in water after 15 minutes at 1,200 deg. C. (2,190 deg. F.). The metal is coarsely crystalline because of the overheating and numerous intercrystalline cracks have formed. (× 100.)

very much more than "preliminary." For example an examination by means of X-rays of pieces thin enough to permit this method of examination often reveals interior defects which could be detected by almost no other means.

In most cases the subsequent preparation of the specimen for microscopic examination is a rather simple matter. A piece is cut from the material to be examined, advantage being taken of the results of the microscopic examination so that it is so chosen as to be representative of the whole. In some cases it may be necessary that several specimens be examined to insure a representative one being chosen. One side of the specimen in flattened, first preferably by filing and then by a series of stages of grinding, emery paper of an increasingly finer grade being used in each succeeding stage. The surface is finally ground on wet, rotating cloth-covered disks with very fine abrasives (emery flour) and finally is polished on another similar disk which is sprayed with a suspension in water of very fine alumina or of rouge (iron oxide). No attempt is ever made to give the surface the bright finish obtained by buffing, for example, in jewelry, table silverware, metallic mirrors, etc. In fact, this is avoided, since the true structure of a metal is not revealed so well by such means as by the series of grindings (cutting) outlined above.

A specimen approximately ½ in. square is the size usually desired, although very much smaller ones may be used if necessary. Pieces even as small as lathe



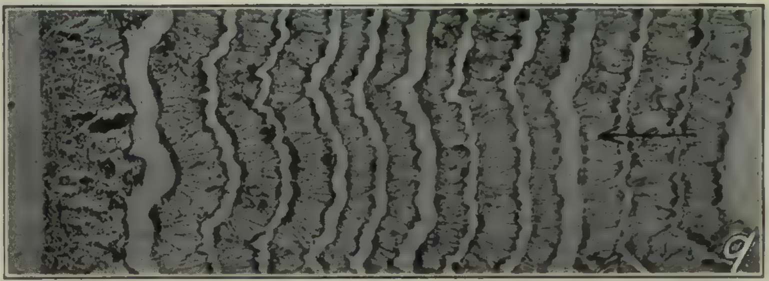


FIG. 5. MICROSTRUCTURE OF COPPER AND SOME OF ITS ALLOYS

(a) Cold-rolled copper, longitudinal section. (× 100.) (b) Same as (a); cross-section of specimen. (× 100.) (c) Brass, 6 per cent zinc, annealed after being cold worked. (× 100.) (d) Brass, 38.5 per cent zinc. (× 100.) (e) Brass to which lead has been added to render it free cutting in the lathe; unetched. (× 100.) (f) Cast bronze, 88 per cent copper, 10 tin, 2 zinc. (× 100.) (g) Cross-section of sheet of metal consisting of alternate layers of electrolytic copper and nickel (light colored). (× 100.)

turnings, or very fine wires, may be suitably prepared. This is conveniently done by heavily electro-plating the small pieces with a deposit of metal (usually copper) and then cutting a section through the resulting duplex specimen, generally after it has been mounted in some sort of matrix (low melting alloy, solder, etc.) for convenience in holding. Fig. 2 shows a specimen prepared in such a way. The strip of copper which in the photo looks like a hairpin was slightly more than 0.001 in. in thickness. In this case an initial layer of nickel was deposited on the surface in order to outline the specimen more clearly. This method is considerably used also for the examination of a metal up to the extreme edge of a flaw or break. The protecting layer of electro-deposited metal serves to hold up the edge during the processes of grinding and polishing, otherwise the extreme edge would be bevelled and rounded off so that it would be impossible to obtain a "fine focus" on such points.

The attempt has been made to develop a method of examination of the material in place so that no cutting of the materal would be required. For this method a spot is polished on the surface to be studied and the examination is made by means of a portable microscope especially designed for the work. However, the method is suitable only for rough work, particularly for preliminary examinations. Furthermore, it has the obvious disadvantage that structure of only the surface metal can be examined, and in many cases this is quite different from the interior.

In a few metals and alloys some features of the structure can be seen on the surface when they are simply polished, as above described; this is due to the differences in color or to the slight "relief" after polishing caused by the difference in appearance or hardness of the various constituents. In by far the greater number of metals, however, the surface must be suitably etched after polishing to reveal the structure. The etching re-agents used differ according to the nature of the metal and the features which are to be revealed. The re-agents so used are numerous. Naturally they must have a slight solvent action upon the material, for example, very dilute acids in the case of steel, ammoniacal solutions for copper and its alloys, etc., but it is the differential attack upon the various constituents or upon the different crystalline grains made by the etching re-agent which reveals the internal "make-up" of the metal.

The details revealed depend largely upon the revolving and the magnifying power of the combination of lenses of the instrument. The magnifying power is usually expressed in linear diameters; by this is meant that any linear dimension would appear increased as many times as the magnification number, for example, a magnification of x 100 would show a line of 0.01 in. length as if it were 1 in. long. The magnification is generally taken as that of the image projected upon the photographic plate.

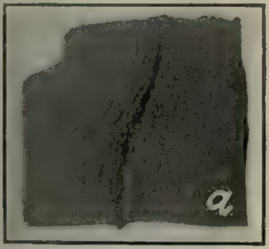
Magnifications not exceeding 500 are usually sufficient for most examinations, 100 being commonly used; but in some special cases higher magnifications are necessary, for example 1,000 or even 1,500. Examinations with magnifications greater than these rarely reveal any features which cannot be seen at the lower ones.

Some of the features which may be revealed by a suitable microscopical examination are shown in Fig. 3, these being photographs of several typical alloys. It is quite evident that the knowledge of the gross structure of these alloys gained by this preliminary examination is very helpful in properly understanding the more minute features revealed by the microscope in exactly the same way that a knowledge of the anatomy of the human frame must be used as a background in which to fit the information gained by a minute study of the histological features of the various tissues making up the framework. Fortunately, however, in the case of metals, the various "tissues" are very limited in number as compared with those making up the body of the common plants or animals.

CRYSTALLINE NATURE OF METALS

An old-time fallacy which still persists in the minds of some is that metals "crystallize" under certain conditions of service, particularly "fatigue." It simply happens that certain types of fracture, for example "fatigue" breaks, may reveal the crystalline condition more strikingly than others do.

The process of solidification of metals is one of crystallization and the metal remains crystalline throughout all subsequent treatments, either mechanical and thermal, to which it may be subjected. The form, size, and perhaps other characteristics of the crystals vary, but the material is always essentially crystalline. Certain metals appear to have a fibrous structure, due to the inclusion of certain non-metallic substances (slag); the metal itself is crystalline, however. To be sure, the crystals of metals lack the definite symmetrical form which this term usually suggests to us; but this is only on account of their manner of formation. By suitable means crystals of metals showing a very definite geometrical form may be secured.



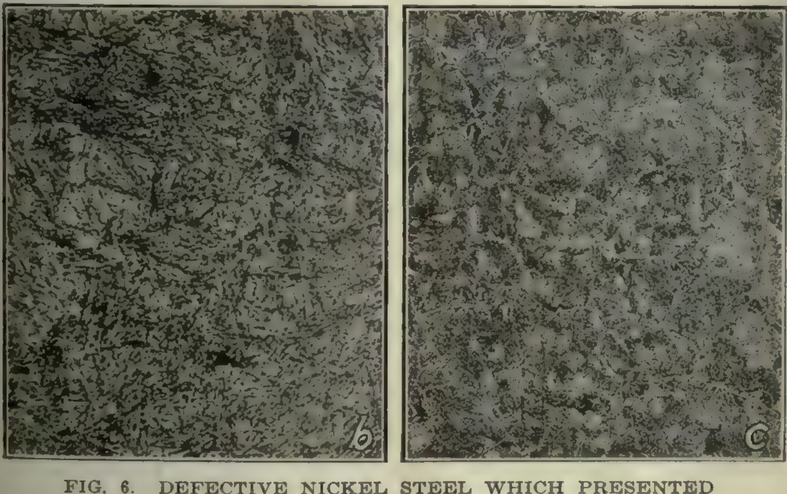


FIG. 6. DEFECTIVE NICKEL STEEL WHICH PRESENTED DIFFICULTIES IN MACHINING

(a) Longitudinal section of forging deeply etched with hot concentrated hydrochloric acid to show hard center. (× 1.) (b) Martensitie structure of the hard core which was of high nickel content. (× 500.) (c) Pearlite-ferrite structure of the outer (normal) portion. (× 1.)

Fig. 4 shows the microstructure of iron and several typical iron-carbon alloys (steels). These micrographs illustrate the crystalline condition which obtains in metals, the constitutional changes which result from changes in chemical composition, as well as structural changes resulting from certain treatments. For the complete study of any alloy system constant reference to the equilibrium or constitutional diagram for that particular system should be made. A discussion of this point is impossible here, however. Alloys such as steels which exist in different structural states at different temperatures, or which show the phenomenon of "critical transformations," may upon heating exist in conditions which are widely different from those ordinarily observed in the alloy. For example, if a steel is cooled very suddenly from a temperature above the critical transformation, the structure normally existing in the metal when above the critical temperature will be retained, at least in part, by the cooled alloy.

Profound changes of the properties of the steel also accompany this structural change. The alloy is in a state of unstable equilibrium and if given a chance, as may be done by gently heating, it will gradually tend to return to a state of stability which is the normal one for ordinary temperature. These changes constitute the tempering and annealing of steel, processes which involve profound changes of structure as well as in properties of the material.

The most useful application that has been made of the microscopic study of metals is in the field of heat-treatment of steels. The development of the alloy steels and the treatment necessary for developing their best properties may safely be said to have been rendered possible in a very large degree by the intelligent study of the microstructure of these materials.

The process of heat-treatment, however, is not peculiar to steel, but applies to all alloys which exhibit transformations at some temperature. The light alloys of aluminum are samples of other alloys to which this applies.

Fig. 5 shows the structure of copper and some of the industrial alloys of this metal and emphasizes the fact that the structural condition may be influenced to a marked degree by the physical state of the alloy, that is, whether cast, wrought or annealed.

Fig. 6 illustrates a typical practical application of the microscopic examination of metals. The specimen shown was a forging for a rifle part made of the usual 3½ per cent nickel steel. It was found to be impossible to drill out the center of many of the specimens of a particular lot. The examination showed that the metal composing the core of the piece, even when the forging was in the annealed state, was "martensitic" in structure although the greater part was in the "ferrite-pearlite" condition. It was then plainly evident that the trouble had arisen in the manufacture of the steel, the nickel not being uniformly diffused throughout the melt. Thus it was proved that it would be impossible to better the condition of the forgings very materially by heat-tratment or by any other processes short of remelting. Subsequent chemical analysis of the core confirmed the conclusion drawn from the microscopic examination and showed that the nickel content of this portion was high enough to render it martensitic although the average nickel content of the specimen as a whole was not far above that desired.

Lack of space prevents further detailed reference to applications of the structural examination of metals. However, some of the purposes for which examinations of this kind may be made are summarized herewith.

(1) Supplement to chemical analysis. A preliminary survey will often show how and where samples for the chemical analysis of a metal should be taken in order that they may be representatve of the piece. The relative magnitude and nature of portions too small to be sampled separately, as for example, metallic coatings, may be demonstrated. The form in which different chemical constituents occur throughout a metal, as distinct constituents of a definite composition, or as "foreign" inclusions which do not truly form a part of the metal or alloy, can also be determined.

(2) Relation to heat-treatment. The microscopic examination is often necessary to show quickly whether a steel has received the proper treatment, and if not what change should be made in order to produce a better structure and better properties. Some processes such as carburization can be investigated only by means of the structural examination, others, for example annealing and grain refinement of large forgings, are also most readily controlled by this process.

(3) Metallurgical processes and materials. In certain cases the examination of the structure is the only sure method of determining what the real nature of a material is and the process by which it has been manufactured. Wrought iron may be cited as an example. The nature of the mechanical treatments given a material may often be revealed by a suitable examination, and the efficiency of the treatment determined thereby.

(4) Service deterioration of alloys. The gradual deterioration which occurs in some alloys in service, for example the swelling and cracking of certain zinc alloys, can often be best remedied after a careful examination of the structure has been made. Thus it is possible to determine the "mechanism" by which deterioration occurs, so that a suitable remedy can be suggested.

(5) Failure of metal parts. In the "post-mortem" study of failed metals, the microscope plays a very important part. The determination of the most probable cause of the failure requires a broad knowledge of the manufacture, properties, and structure of metals, both sound and unsound. The structural examination forms an essential part of the examination and is often the most enlightening of all.

(6) Relation to mechanical properties. Inferior mechanical properties of a material shown under test are often explained by a structural examination of the test bars. The microscopic examination is of particular value in such cases.

(7) Structural diagrams of alloy systems. These diagrams are of fundamental importance in the study of alloys and the microscopic examination plays an important part in their determination.

In addition to the above, the structural examination aids in a great many miscellaneous ways, each particular specimen taken up having characteristics peculiar to itself. The study of the structure of metals is, indeed, a most fascinating one. In the above discussion, however, the attempt has been made to present only a few "practical" aspects of the subject rather than the academic or strictly scientific phases.

Power and Fuel Used by Machine Shops and Foundries in "Superpower Zone"

By H. Goodwin, Jr.

All engaged in the machine industry know the great progress of electric drive in the past year and of its accelerated progress in most recent years. Shops supplied with energy by a large central station know its convenience and economy. Other industries have been progressing in like manner though the machine shop is quite in the lead. This is because of the fundamental and evident economies of the application of purchased power to this industry. Statistics show that the largest as well as many of the smaller shops place reliance almost entirely upon purchased electric power and are continually increasing the proportion.

This development led to the questions: "What should be the ultimate logical development of the central stations to carry all the industries and railroads that could economically be so electrified? What would be the conservation of our fuel thereby?" A comprehensive electrical "Superpower System" was proposed for the North Atlantic Seaboard, "the Finishing Shop of America." A special survey under the U. S. Geological Survey was made to determine the feasibility and economy of the scheme and the report will shortly be issued.

The Census Bureau co-operated and prepared in advance some statistics in special form on all the different industries. Much of this is of great interest to the machine industry and some of it is here presented. The table gives, in a new analytical form, the use of power and fuel in machine shops and foundries. Some shops that would come under this general classification have been separated for particular purposes and will be shown individually in the Superpower Report. Such are: blast furnaces, rolling mills, locomotive factories, vehicles, railroad repair shops, electrical machinery and shipbuilding. But the table here presented is typical and covers the great mass of machine shops and foundries.

The table is in great detail, but a little attention should make its meaning clear. The column headings under "Power Supply Equipment" are all self-explanatory. The "Electric Motor" summary indicates the degree to which the industry has been electrified and includes the "Electric motors operated by purchased energy" in the preceding columns. Under "Fuel Used" the "Total Equivalent Bituminous" should be explained. The proportion of anthracite and bituminous varies in different groups, so it is necessary to reduce them to common terms. Careful investigation including all factors showed that on the average one long ton of anthracite as burned by the industries was equivalent to 0.9 short ton bituminous. This factor was applied and the "Total Equivalent Bituminous" determined.

Looking back, now, to the first two columns of the table, the features of most particular interest are found. The bottom line shows the grand total of power and fuel for the machine and foundry industry, and above it is separated into four different groups of plants, those using (1) no power, (2) steam power only, (3) purchased electrical power only, (4) all other power. The sub-total for each group is given and each is then separated into three other groups by plant size, the dividing lines being 200 hp. and 500 hp. total installed capacity. It is to be noted that these divisions have been carried right through the power equipment and fuel, so that the amount of fuel associated with any group of

POWER AND FUEL USED BY MACHINE SHOPS AND FOUNDRIES

Grouped by Character of Power Supply from Data of 1919 Census of Manufactures

Character of Power Supply — Plant Size, Hp.	Establishments — No.	Establishments — Average, Hp.	Establishments — Aggregate, Hp.	Power Supply Equipment — Prime Movers — Total, Hp.	Prime Movers — Steam Engines, No.	Prime Movers — Steam Engines, Hp.	Prime Movers — Steam Turbines, No.	Prime Movers — Steam Turbines, Hp.	Prime Movers — Internal Combustion Engines, No.	Prime Movers — Internal Combustion Engines, Hp.	Prime Movers — Water-Wheels No.	Prime Movers — Water-Wheels Hp.	Operated by Purchased Energy — Total Hp.	Operated by Purchased Energy — Electric Motors No.	Operated by Purchased Energy — Electric Motors Hp.	Operated by Purchased Energy — Other Hp.	Electric Motors — Total No.	Electric Motors — Total Hp.	Electric Motors — Run by Current Generated in Establishment, No.	Electric Motors — Run by Current Generated in Establishment, Hp.	Fuel Used — Coal — Anthracite, Long Tons	Fuel Used — Coal — Bituminous, Short Tons	Fuel Used — Coal — Total Equivalent Bituminous, Short Tons	Fuel Used — Coke, Short Tons
No power......	407	....	......	......	....	......	...	......	....	.....	...	.....	......	......	......	.....	......	....	......	......	4,230	3,304	7,114	1,077
Steam power only:																								
1-200........	452	71	32,166	32,166	535	31,713	9	453	....	.....	...	.....	......	......	......	.....	1,213	8,713	1,213	8,713	69,628	153,924	216,564	48,561
201-500......	87	333	29,030	29,030	174	27,045	16	1,985	....	.....	...	.....	......	......	......	.....	1,900	19,738	1,900	19,738	40,664	105,987	141,987	24,465
501 and above	72	1,920	138,052	138,052	337	70,878	79	67,174	....	.....	...	.....	......	......	......	.....	9,491	133,800	9,491	133,800	243,808	598,265	817,865	113,638
Sub-total....	611	326	199,248	199,248	1,046	129,636	104	69,612	....	.....	...	.....	......	......	......	.....	12,604	162,251	12,604	162,251	354,100	858,176	1,176,416	186,664
Purchased electric power only:																								
1-200........	3,701	26	95,580	......	....	......	...	......	....	.....	...	.....	95,580	13,971	95,580	.....	13,971	95,580	......	......	66,177	102,742	162,242	109,625
201-500......	142	312	44,489	......	....	......	...	......	....	.....	...	.....	44,489	4,158	44,489	.....	4,158	44,489	......	......	24,835	58,478	80,778	31,114
501 and above	103	1,050	118,676	......	....	......	...	......	....	.....	...	.....	118,676	10,144	118,676	.....	10,144	118,676	.....	....	32,453	147,478	176,578	63,708
Sub-total....	3,946	655	258,745	......	....	......	...	......	....	.....	...	.....	258,745	28,273	258,745	.....	28,273	258,745	......	......	123,465	308,698	419,598	204,447
All other power:																								
1-200........	1,341	40	54,293	38,753	319	16,741	7	286	960	15,827	167	5,899	15,540	1,654	13,033	2,507	2,331	17,617	677	4,584	43,195	101,056	140,056	38,735
201-500......	165	320	52,501	32,872	215	24,069	12	785	56	2,978	75	5,040	19,629	1,726	19,454	175	2,686	30,564	960	11,110	40,088	137,558	173,558	39,182
501 and above	155	2,290	354,363	208,708	465	111,465	54	77,578	63	10,622	71	9,043	145,655	9,093	145,455	200	14,068	206,497	4,975	61,042	152,280	931,306	1,068,000	95,199
Sub-total.. .	1,661	278	461,157	280,333	999	152,275	73	78,649	1,079	29,427	313	19,982	180,824	12,473	177,942	2,882	19,085	254,678	6,612	76,736	235,563	1,169,920	1,381,614	173,116
Total (power)	6,218	148	919,150	479,581	2,045	281,911	177	148,261	1,079	29,427	313	19,982	439,569	40,746	436,687	2,882	59,962	675,674	19,216	238,987	713,128	2,336,794	2,977,628	564,227
Grand total. .	6,625	....	919,150	479,581	2,045	281,911	177	148,261	1,079	29,427	313	19,982	439,569	40,746	436,687	2,882	59,962	675,674	19,216	238,987	717,358	2,340,098	2,984,744	563,304

prime movers or motors can immediately be determined.

Several interesting comparisons can be made. The total horsepower of plants purchasing all their energy is considerably greater than those depending on steam only, being 258,745 hp. as against 199,248 hp. The coal used by the former is 419,598 tons per annum (for other purposes than power development, such as heating) is 1.6 tons per hp., while the latter use 1,176,416 tons, or 5.9 tons per hp. Figuring that a modern central station can supply the motors by burning 1 to 1.5 tons per hp. per year shows great economy in favor of the central station. The same method may be applied to each line in detail, showing for the industry, by and large, the great economies possible.

Attention is invited to the fourth column, showing the average horsepower size of the plants. The average for all groups is 148 hp. This compares with 110 hp. for all industries. The average size of units is not given but may easily be determined. There are 2,045 steam engines with total capacity of 281,911 hp., giving an average size of unit of 138 hp. In all industries there are 33,379 steam engines with a total of 4,255,868 hp., giving an average size of unit of 128 hp. These comparisons can be carried on through the various size plants showing small average size units in even the largest plants and lack of reserve in many other plants, etc.

These and other data presented by the reports should be welcomed by the industry as showing in considerable detail the general average condition of the industry today and pointing the way for future progressive development.

Traffic in French Morocco Handled by Motor Trucks

It is interesting to note the development of improved means of transportation, says the *Farmers' Journal*, a publication devoted to the agricultural industry in East Africa. Owing to the absence of railroads, the greater part of traffic in French Morocco is carried on by motor trucks of 3½-ton and 5-ton capacity. Because of the wide extent of the country and the difficult nature of some of the roads, combined with long distances from service stations, the outstanding factors of trucks considered for transportation uses in that country are, above anything else, reliability and service. It is desired that extra-size gasoline tanks and a box for spare parts be incorporated in the truck. It should have a cooling system of extra capacity because of the extremely high temperature encountered. Particular attention to spring suspension should also be given, owing to the weight of loads carried and the poor condition of many of the roads.

European Aerial Lines

Twenty aerial lines, with a total length of 6,000 miles, are in operation in Europe. France holds first place, with lines covering 2,900 miles; Germany comes second, with 2,000 miles; and England third. In addition to these lines there are many local lines, in which Italy leads with 1,260 miles. There are plans for further development of the European aerial system, especially on the part of the French, who are anxious to establish a line between Paris and Constantinople and one between Paris and Toulouse, the latter to form part of an international line 1,800 miles long.

Economic Cycles

Business Cycles Have Long Been Recognized but Not Understood —How They Operate—Elastic and Inelastic Demand

BY ERNEST F. DUBRUL
General Manager, National Machine Tool Builders' Association

ONE cause for frequent business failures is the lack of knowledge by many business men of the inevitable occurrence of cycles of prosperity and depression. Business men who do not study the economics of business cycles are always much surprised when a depression comes on.

In 1776 Adam Smith published the first comprehensive survey of economic theory when he brought out his book, "The Wealth of Nations." His book has been a classic ever since it came out. It set out fundamental principles that have been confirmed, though more clearly and definitely analyzed, from year to year as more and more light was thrown on the operation of economic forces.

Adam Smith recognized the operation of the business cycle. Following Adam Smith, David Ricardo, a retired banker, wrote on "The Principles of Political Economy," and he, too, recognized the occurrence of cycles in business. He commented on the fact that most men over-estimate the height of an economic wave and also over-estimate the depth of an economic depression. Few men realize that the economic cycle is fundamental in human and physical nature.

The slump after the boom is caused by overproduction in the economic sense. Not that people do not want, or do not desire all the goods that were produced, but economic demand, which is demand backed up by purchasing power, becomes restricted by the high prices which demand itself created at the height of a boom.

Price is the regulator of both supply and demand. When prices are high, supply is increased to get the profit supposed to exist at the price. At the same time, demand is decreased because of the high price. In the same way, when prices are low demand is increased because of the low price, but supply is decreased. The economic balance between demand and supply is continually wavering; it is as changing in its general characteristics as the waves of the ocean. Even if for one given kind of manufactured goods supply and demand were so thoroughly adjusted that one would exactly meet the other at any given moment, we would still have the economic cycles, due to such variations in crops from year to year as depend on weather conditions.

EXCHANGE BASIS OF ECONOMIC SYSTEM

All of our economic system is based on exchange of product for product. Money is merely the medium of exchange, and price measures in money the exchange value of one man's bodily, mental, and moral effort in making a product or rendering a service which he exchanges for that of another. When there is large production there is more product to exchange, and all are better off than when the total production is small.

Manufactured goods are produced very largely in advance or in anticipation of demand. The more complicated the process of manufacture, the further ahead must provision be made so that the estimated amount of goods required will be brought to the consumer at the time when it is estimated he will have other products or services to exchange for these goods.

It is manifestly impossible to exactly gage the total quantity of automobiles, hats, shoes, or other consumption goods that can be exchanged for the crop of a given year. If the crop is exceedingly large it will create a large demand. If the crop is small, and the stock of manufactured goods is too large for the farmer's purchasing power, the market then will become glutted, and the manufacturer must wait for the market to absorb the surplus.

ECONOMIC DISCUSSION VALUABLE

Economic discussion clarifies fundamental theories of price and the relation of price to supply and demand. In actual practice there are many variable forces of different kinds that are in operation at any one particular time, so that many people sometimes think that economic theory is all wrong. We hear a lot of loose talk about supply and demand and their effect on price, but many men who use the words do not really have a very clear conception of the operation of the laws of supply and demand.

It is well known that demand for some commodities decreases very rapidly with relatively small increases in price, and conversely, relatively small decreases in price greatly stimulate the demand for such commodities. In economic terms this is expressed by saying that such commodities have an elastic demand schedule.

Many people do not realize that other commodities are subject to an inelastic demand schedule, and that at some prices demand for the same commodity may be very inelastic, though at lower prices it may be very elastic. Every demand schedule could be plotted on a curve if the full information were available.

In the upper ranges of prices even elastic demand schedules become inelastic; that is, there are some people who will buy butter no matter what the price is, and relatively large increases in price in the upper ranges do not greatly diminish this limited demand. In the lower ranges every small increase in price greatly decreases the demand, and conversely. When butter is up in the high ranges small decreases do not greatly stimulate demand, but as prices come down lower and lower every small decrease greatly increases the demand.

On the butter curve there are some points where the inelasticity is very decided, and other points where elasticity is very marked.

There are other commodities in which demand is inherently extremely inelastic; that is, demand is not greatly affected by mere price variations. Coffins would be a very good illustration of inelastic demand. How many more coffins would this country use if they were sold for half their present price? Coffin consumption is not dependent on price reduction—it depends on the number of deaths. There cannot be any speculative buying of cheap coffins by the consumer. There have been times when undertakers speculatively bought coffins ahead because they were relatively cheap and being temporarily sold below the cost of production. Even under such circumstances, however, coffins being subject to change in style, this speculation is extremely limited.

Even in the coffin business there are cycles, because more people die in winter and spring than in the summer and fall. Coffins also have larger cycles that actually conform to the general business cycles. Mortality statistics show that fewer people die per thousand of population in hard times than die in good times. The explanation given for this curious situation is that in hard times people live more carefully and more morally; they do not over-eat, and they do not rush themselves to death. Whatever the reason, the fact remains, so that a coffin business has to be operated in accord with major and minor cycles if it is to be successful.

HANDLING ELASTIC AND INELASTIC DEMAND

A business dealing with an article having an elastic demand must be handled quite differently from a business dealing with an article subject to inelastic demand. Just as demand is elastic and inelastic according to the nature of the article, so is supply. The coffin busness, for instance, is one that practically has to carry a full organization over the summer and fall periods of inactive demand in order to be able to supply the big demand in the winter and spring. Any sudden call for coffins during the summer and fall can be easily taken care of. Yet when the influenza epidemic created a sudden and very much larger peak demand for coffins there was a relative shortage of supply at that time. The coffin factories had to work night and day, going out and getting all kinds of help wherever they could.

There were some coffin manufacturers who overestimated the influenza epidemic, and when the epidemic was over they found themselves loaded up with material and trimmings that they had overbought. Some of them, perhaps, found their finances strained, because of this excess of stock on hand, and they perhaps tried to realize on this stock by getting cash to replace the stock. If they offered low price coffins in exchange for cash, some undertakers were able to speculate a little by buying coffins below the cost of production. When their own storage facilities were filled up and their financial resources were used up the undertakers had to stop buying. Even lower prices could not have induced additional buying. Then the coffin factories were relatively dull till this over-production was used up. Every business has its own problems due to its own conditions of supply and demand. Mass production with low costs enables one to reach more and more buyers of automobiles and to build a large and profitable business on that condition, but the man who would try it in coffins would spill his financial brains by trying to butt through an economic stone wall.

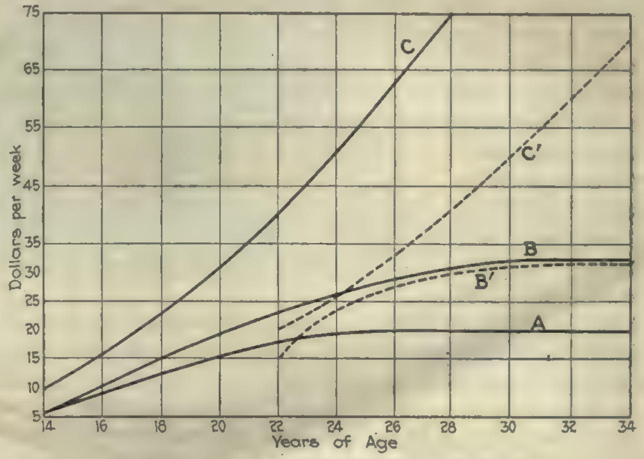
That all seems to be very plain, yet some coffin makers have been known to try to stimulate their business by making low prices with the idea of increasing their volume. And the sheriff's flag was hung out in front of the factory.

What Are the Worker's Prospects in the Machinery Building Industry?

By A. W. FORBES

There have been a great number of articles lately about reducing wages and salaries in our shops, statements that wages must come down, and replies by labor organizations that they are still below what they should be, but very few of the articles are specific as to what they consider a fair wage.

I have prepared the accompanying chart showing my views as to what wages should be expected in the machinery manufacturing industry, showing the increases that should be expected by various classes of boys.



WAGE RATES IN THE MACHINE SHOP

Curve A: A dull boy but not a defective starting machine work at 14 years of age.

Curve B: An average boy starting machine work at 14 years.

Curve C: The exceptionally bright boy starting machine work at 14 years.

Curve B′: An average boy entering the machine industry after graduating from college or technical school.

Curve C′: The exceptionally bright boy entering the machine industry after graduating from college.

Curve A′ is not given, as a dull boy can not get through college, at least not the grade of dullness which is represented by curve A, the one who will spend his life as a machine operator.

Curve C might as well be omitted as all of this class go through college. This is the class from which our great leaders of industry have come in the past. Now they find a way through college some way even if they have to pay all their expenses and contribute to the support of a family at the same time.

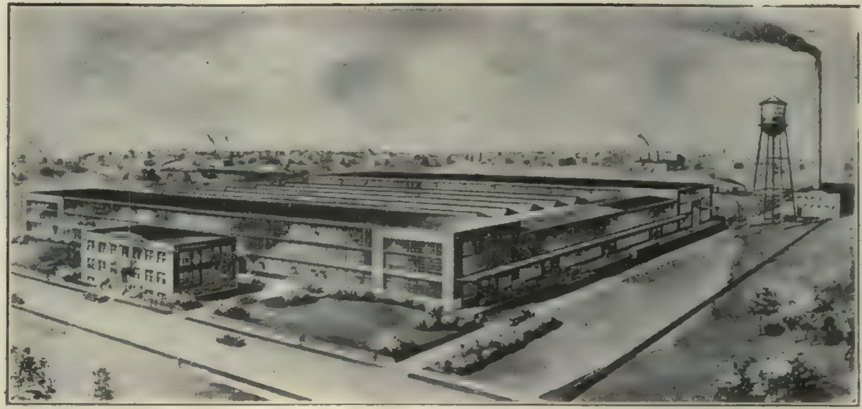
It will be noted that I have drawn the curves for the college or technical school graduate consistently below those for the boys of the same ability who start work at 14 years of age. Many will disagree with this, but I am satisfied that whatever the advantages of the college education are, they do not increase the size of the pay envelope, but rather decrease it, especially with the brightest boys.

These curves are, of course, upset by the conditions of the past six years, and will also be upset by a person changing from one industry to another, as often the experienced man in a new job is not worth as much as the boy who has not so much to unlearn. The curves are merely intended as averages for average conditions.

A Machine Tool Shop of Unusual Construction

Three Monitor Houses Provide Excellent Crane Facilities—Saw-Tooth Interior Gives Excellent Lighting Facilities and Ventilation—An Unusual Shop

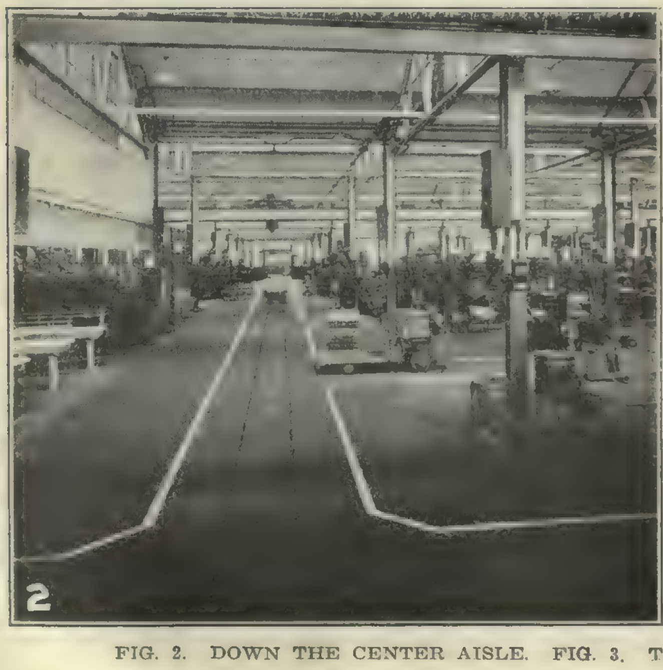
BY FRED H. COLVIN
Editor, *American Machinist*



THE improvements which have taken place in machine shop construction can hardly be better exemplified than in the new plant of the Colburn Machine Tool Co., Ivanhoe Road, Cleveland, Ohio. Before deciding on the plans for the new shop, all the advantages and disadvantages of the former plant at Franklin, Pa., were carefully considered, in addition to making a very careful study of the best plants in various parts of the country. The result is a remarkably pleasing combination of saw-tooth and monitor construction. The whole plant shows extremely careful planning and the results will speak for themselves when the plans and the illustrations of the interior are considered.

The general construction of the shop is shown in the headpiece, the monitor roof section being in the form of a letter U while the saw-tooth portion is in the center. At the right-hand end is a shipping platform 282 ft. long with a spur track so that raw material can be received and finished product shipped as expeditiously and with as little handling cost as possible. The office, or administration building is in front of the middle of the long side of the shop, and connects directly with the center of the long erecting bay. Some idea of the lighting can be had, by noting the number of windows on each side, while the saw-tooth roof lights up the center of the shop in splendid fashion. This will be more convincingly shown in the illustrations of the interior. While no general interior view can give an adequate idea of such a shop as this, Fig. 2, taken from the front and looking along the center aisle toward the stockroom, gives some idea of the construction of the central or saw-tooth portion. This, coupled with Fig. 3, which shows the portion of the rear head-house, occupied by the stock bins for storing small parts, gives a good idea of the lighting obtained in the two sections of the shop.

Fig. 2 shows the spacing of the steel columns and one of the large cranes on its runway. The narrow track down the center aisle, enables transfer cars to be used so that material can be moved from one aisle to another, without being carried to the head house and handled by the large crane which serves it. It also runs through the stockroom and into the storage yard at the back. The flooring is of impregnated wooden blocks and aisle boundary marks are carefully maintained both to assist in the transportation of materials and to maintain a neat appearance by insuring orderly piling of castings and other material. There is a clearance of 15 ft. 8 in. to the bottom of the roof truss and



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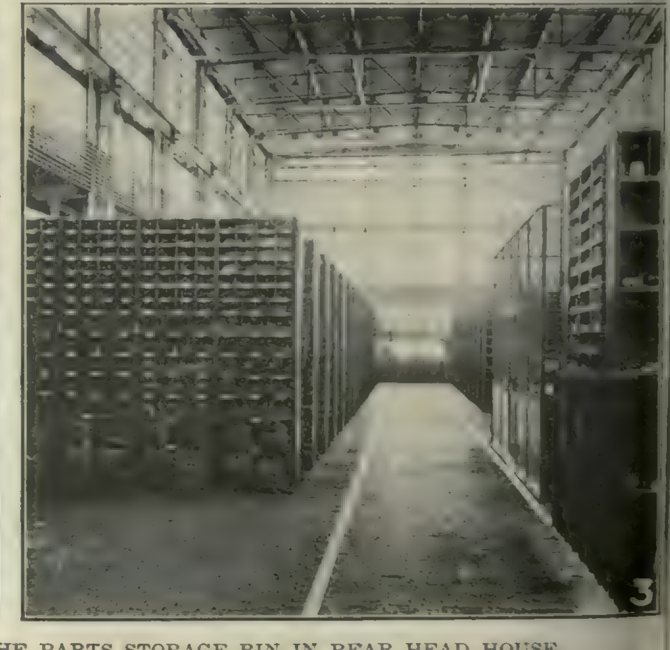

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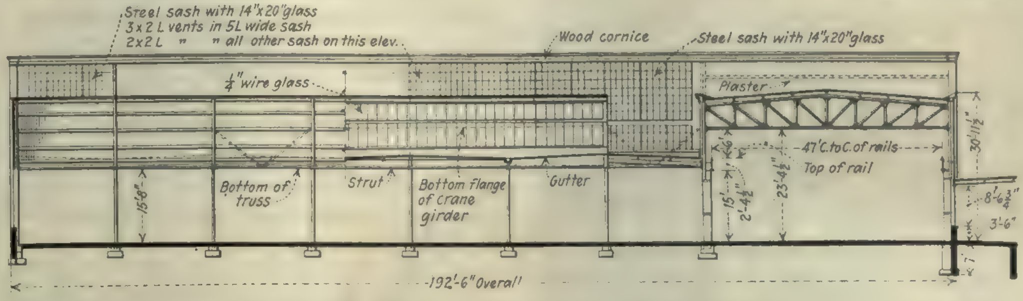
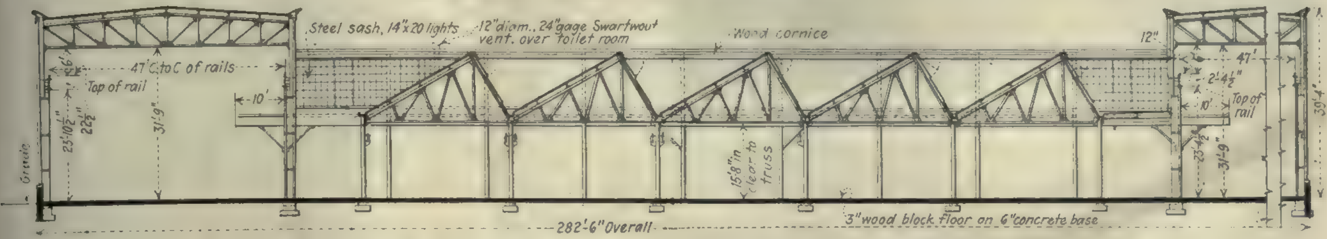
FIG. 2. DOWN THE CENTER AISLE. FIG. 3. THE PARTS STORAGE BIN IN REAR HEAD HOUSE

12 ft. in the clear to the bottom of the beams which form the crane runway.

Fig. 2 shows the washroom with toilet above, the shop motor crane just off the main aisle, a car on the center track, the electric terminals on the columns, and the general appearance of the central portion.



Longitudinal Section Through Sawtooth Building



Cross Section Through Sawtooth Building and Head Houses

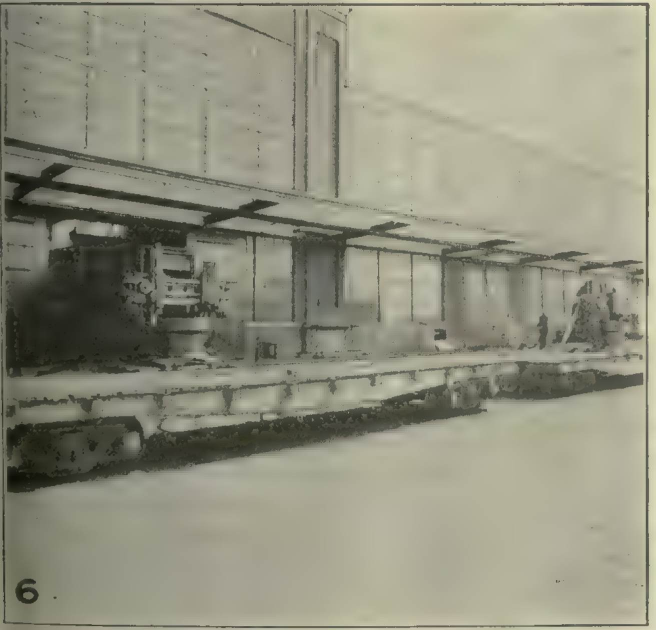
FIG. 5. SOME DETAILS OF THE BUILDING CONSTRUCTION

The head house shown in Fig. 4 is 31 ft. 9 in. to the bottom of the roof truss and 23 ft. 10½ in. to the bottom of the crane rail. The span is 47 ft. center to center of crane rail. The volume of light obtained in this monitor construction can be readily seen. The heating coils in both sections are overhead as can be seen in both Figs. 2 and 3.

The plot of ground allows for considerable expansion, in such a manner as to continue the same method of construction. The present shop building is 312 ft. front by 282 ft. deep. Future expansion will be in the direction of depth, so that what is now the rear head house will be a central bay with a saw-tooth roof section between this and the new head house at the rear.

The floor plan of the present building is shown in Fig. 4 with each department noted and the crane service also given in each section of the shop. The construction of both the head houses and the saw-tooth section is shown in Fig. 5, the main dimensions are given and show every evidence of careful planning. The shipping platform at the end of the building extends the whole depth of the building and is 12 ft. wide.

A view of this is shown in Fig. 6 with two flat cars in position and shows the way in which large boring mills and other machine tools can be easily loaded. The winch at *A* is driven by an electric motor under the platform and by the use of snatch blocks and other tackle it is an easy matter to pull machine tools out of the shop and on to the cars with very few men. By simply moving the snatch block to various "eyes" which are provided for it, heavy material can be unloaded from the cars in the same way, or the cars themselves can be moved to any desired position easily and quickly. The cement road in front of the cars is for truck service



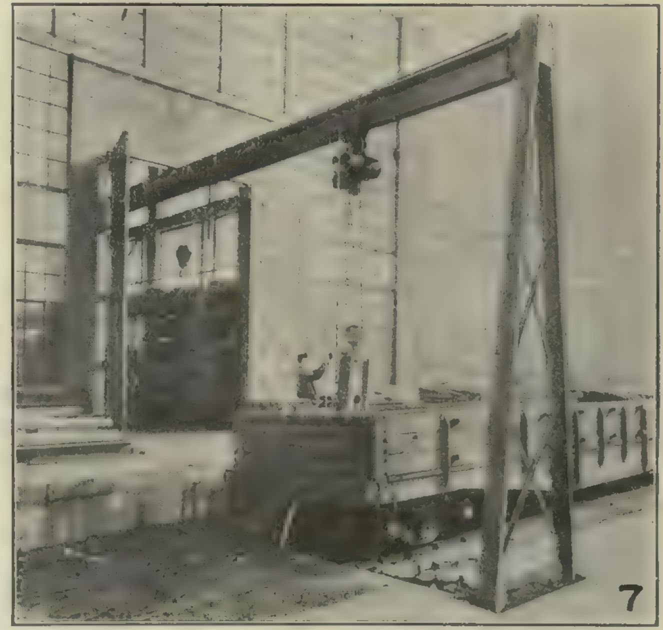


FIG. 6. HANDLING HEAVY MACHINES ON THE LOADING PLATFORM. FIG. 7. UNLOADING RAW MATERIAL FOR STOREROOM

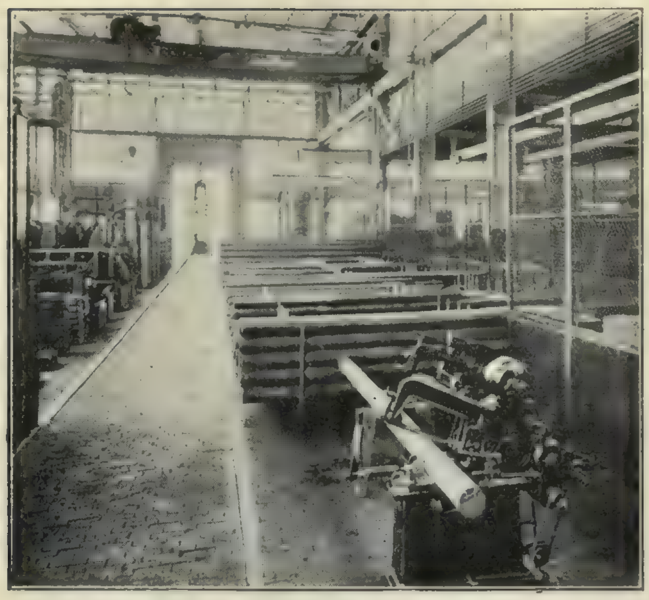


FIG. 8. THE BAR STOCK STORAGE

and the rack at *B* is for rollers used in moving machines, keeping them out of the way, but always within easy reach.

At the back end of the platform a traveling hoist is provided as shown in Fig. 7, for unloading material from the cars into the stockroom. This is of ample capacity for handling any material which may be necessary and provides a direct means of getting material into the shop through its proper channels. One of the eyes used in connection with the winch for moving material is shown at *A*.

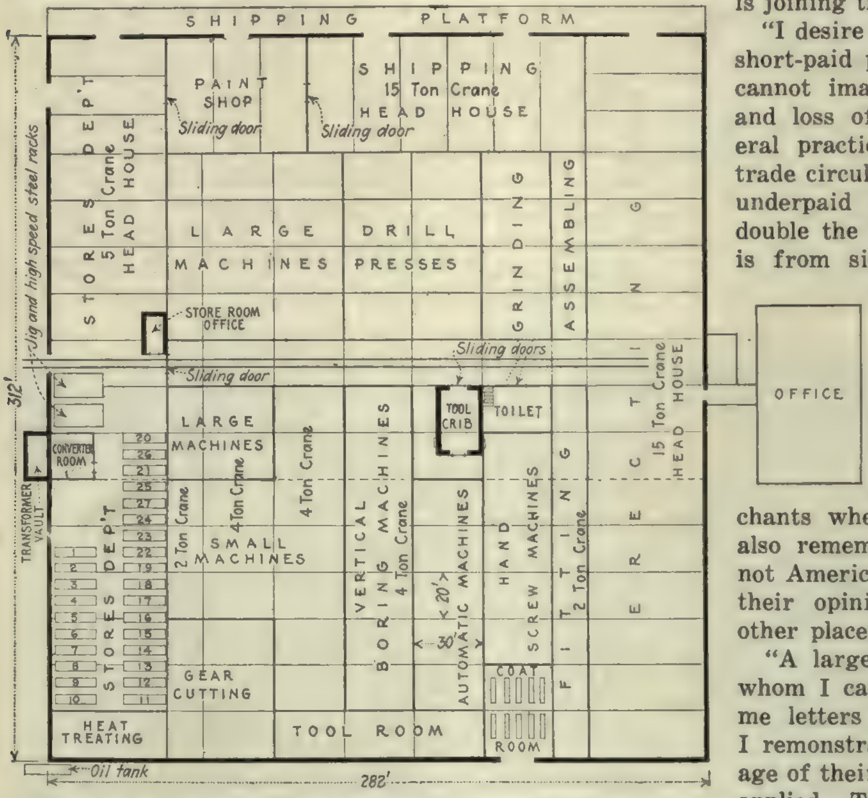


FIG. 4. FLOOR PLAN OF SHOP AND TOOL LAYOUT

Another view showing how this unloading crane handles material into the storage bay is shown in Fig. 8, the crane being seen in the open doorway. This also shows the arrangement of the bar stock on the right with the hacksaws for cutting it up located in a convenient position. On the left and also at the extreme right of the storage bay may be seen castings for drilling machines and boring mill bases, these being readily handled by the 5-ton Cleveland crane as soon as they are placed inside the storeroom door. This view also shows the extension of the crane runway from the head house beside the shipping platform so that material can be readily transferred from one crane to the other.

This article is confined mainly to the planning and construction of this building, the George S. Rider Company being the designing engineers, while the builder is the Hunkin, Conkey Co., both of Cleveland. Some of the other interesting features of this plant will be shown in the second article.

The American Short-Postage Habit

It seems like a petty question—that of the short-postage malady which prevails in the United States—but it doesn't appear to diminish. American business houses continue to slap the old two-cent stamp on all their letters and let them go. In some cases when their attention is called specially, they blame the office boy or the mailing clerk. It's nearly always "George" that does it.

E. B. Filsinger, export manager for Lawrence & Co., members of the American Manufacturers Export Association, recently received a letter from C. C. Woolward, American vice-consul at Cape Haitien, Hayti, on the subject of short-paid letters from the United States. (The Hayti case is in no degree isolated—Hayti simply is joining the chorus of nations.)

"I desire to call your attention to the question of short-paid postage," writes Mr. Woodward. "You cannot imagine the amount of adverse criticism and loss of business that results from the general practice of American firms in sending out trade circulars, advertising matter and letters with underpaid postage. The amount of penalty is double the amount of postage that is short. This is from six cents up. Six cents is not much, but 100 letters at six cents mean $6, and the trouble is that the merchant receives the 100 letters. When you remember that America is the only country in which the business houses do not know the postage rate, or pay no attention to it, you will understand the feeling of the merchants when they receive your mail. You must also remember that most of these merchants are not Americans and they do not hesitate to express their opinion publicly in the clubs, hotels and other places.

"A large department store in New York, with whom I carry on a deposit account, always sends me letters in envelopes with short-paid postage. I remonstrated with them, and sent them a package of their own envelopes with the penalty stamps applied. They wrote me a very nice letter in reply and allowed me full credit for the entire amount of short postage, placed the letter in an envelope with a two-cent stamp, and I was obliged to pay the penalty to receive their apology—and, to cap the climax, they sent me a Christmas card on which I was obliged to pay the penalty.—*The Review of the American Chamber of Commerce in France.*

Organization and Management of the Small Shop

VIII. Small Shop Office Work—Why Bookkeeping Is Essential—Classifications of Entries —Functions of the Commercial Agencies—Value of Credit

By E. W. LEACH

THE phrase "small shop office work," may suggest to you and to me widely varying types of activity with as great a difference between them as there is between black and white. To the writer, in his first year's experience as a small-shop owner, office work meant an evenings and Sundays proposition. There was too much work of other nature to be done during working hours to spend any of that time in the "office," and so the business was built, the market developed, the sales made, and the many details of office routine taken care of purely as a "side-line job." In my own personal instance, I am not sure that that was the wisest course; in fact, later troubles proved that if more attention had been given to the office end of the business, our sailing would have been smoother.

Mechanical men entering business are too often apt o discount the real importance of other phases of usiness practice besides actual shop work with which hey are familiar. Unless their training has been unuually broad, they are almost certain to have a prejudice n favor of their own narrow line of experience. The ld question always bobs up; which is more important, ffice work or shop work? And it reminds me of a ebate I heard one time on the subject, "Which is the nore useful to man, a piano or a cow?" The speakers vere really serious in presenting their arguments, but fter all had been said and done, the thing just about immered down to the simple fact that they both have heir proper place. And that's true of office work and hop work. In small shops, especially, one must be areful to see that the office work is not sidetracked nd neglected. There is something more to a manufacuring business than merely making things. Your cusomers do not judge your company entirely by the rticle they buy of you. Their opinion of your company nd the prestige you enjoy with them depends also pon the businesslike way in which the several details ncidental to their transactions with you are handled.

Possibly the first part of office work to receive the ttention of the small-shop manager is "keeping books." shall not attempt here to give an outline on how open and keep a set of books, for it would be imossible to touch even the high spots of such a subject an article of this length. I shall leave that to other riters, but I shall try to give some information about eeping books that will make the general nature of at job much more easily understood.

For your own good, do not be content with anything t a real, honest-to-goodness set of double-entry counts. Double-entry bookkeeping holds a bug-bear r some people much like higher mathematics; but is no more terrifying to the man who understands than cutting sixteen threads to the inch is to an d-time lathe operator. Unless you are an experienced countant, you should have someone open your set of oks and start them off. In double-entry bookkeeping, ur books are "opened" by preparing a statement of e condition of your business. This will show your sets and your liabilities; that is, it will show what you have and what you owe. In actual fact, however, some items will be included under liabilities that are not in the same class as your notes or contracts or accounts payable.

Cash invested and capital stock issued, for example, are listed as liabilities. It can be considered from one standpoint that the company owes you for the money you invest in the company, although it is understood that that money is not to be paid back to you as a loan to the company would be paid. Such investment is made a liability purely so that the opening statement will be "in balance"; that is, so that the total assets and liabilities will be the same.

The preparation of this statement and the determination of the several accounts into which various items shall be charged is an important bit of work, and should be done right by a competent person. After the books have been opened, it is not such a difficult job to keep them going by making the entries, and that is something you should be able to do yourself, if you do not plan to have other persons in the office. This statement starts your books out in balance. Entries that you make later as each transaction comes up are merely additions to this statement to keep it always up to date. For example, you might have an item "Equipment" in your original statement at $1,000, meaning you had that much equipment when you started out. If you bought a drill press for $200 later on, you would enter that amount and charge it to equipment, so that your equipment account would then show a total of $1,200. Your cash account would be brought up to date by being $200 less; or, if you did not pay cash for the machine, you would have accounts payable of $200.

"Double entry" means that each figure is always entered twice—once in the debit or left-hand column of some account, and again in the credit or right-hand column of some other account. This keeps the books always balanced, and makes it easy to prepare what is called a "Trial Balance." A trial balance "proves" your books; that is, it shows whether they really are correctly balanced.

From one standpoint, all book entries can be divided into two classifications, those involving cash and those not involving cash. Cash, from the bookkeeper's point of view, is of two kinds, cash received and cash paid out; or, as he would put it, debit cash and credit cash. Debit cash, or cash received, is usually listed each day in a cash book. Credit cash, or cash paid out is recorded on the stubs in your check book. A journal is strictly a book in which those transactions not involving cash are entered from day to day. Ofttimes, however, the journal and the cash book will be combined into one.

All items are listed in the journal each day as they occur. Then at any convenient time these items are transferred by copying or "posting" them into the ledger. In the ledger items are sorted out according to the several accounts. Items in the cash book and the check book are also posted into the ledger. In small-shop practice, one ledger will at first serve all purposes. After the volume of business increases considerably, you will probably have three different ledgers—a sales ledger, in which are kept your various customers' accounts or accounts receivable; a purchase ledger, in which are kept accounts of the companies to whom you owe money or your accounts payable; and a general ledger, in which are kept such accounts as taxes, interest, dividends, rent, and such items.

Where a combined cash book and journal is used, all items are first entered in this book, both those that do and do not involve cash. Debit cash is credited in another column on the same page by listing it under accounts receivable or whatever account it should be credited to. Credit cash is entered by listing the persons or companies to whom the checks are made out, showing the amounts of the checks under credit cash, and debiting the proper account to which this check should be charged. On such a page, there are usually six to ten columns for the most common ledger accounts, such as payroll, merchandise purchases, office expense, advertising, heat, light and power. Taxes and other similar accounts are not used so often, so checks made out for such purposes are debited to a column listed "General Ledger."

Copies of the invoices sent out to your customers should be kept in some sort of binder. The amounts on these invoices are posted directly to the proper individual accounts receivable. I know of one company rated at more than half a million dollars that keeps no purchase ledger. Invoices as they are received in the mail are sorted out and those from each firm are kept together. When the monthly statement arrives it is pinned to the invoices and put through for payment.

Each month you should take a trial balance of your accounts. A trial balance is merely a listing of the balances of your various ledger accounts. It shows that your book entries are correct; but in itself, it indicates nothing about the financial condition of your business. A comparison of trial balances for several months can show certain things to suggest whether you are gaining or losing ground. For example, it will show whether certain expenses are increasing out of proportion to sales. Most information that you will use as an index to your financial situation must be had by preparing special statements according to your own particular preference.

Financial Statements

The most common form of financial statement is a statement of assets and liabilities. This shows the net worth of the business, and a comparison of such statements from month to month can provide valuable information. One common special statement is one that shows your accounts receivable. It is made out each month at the time the statements are made out and mailed and it lists the balances shown on the individual monthly statements. You know the credit limits of your customers, and this statement will tell you if any of them are getting beyond a reasonable and safe amount.

Another detail that you should watch carefully is past due accounts. A statement each month at least (and oftener if conveniently possible) should be made up showing the total accounts receivable, the amount 30 days past due, the amount 60 days past due, and the amount 90 days past due.

The ratio of merchandise purchases to sales is important. If your product remains fairly uniform, there should be but little variation to this ratio. If it becomes much larger than usual, it means that you have bought more than was necessary in that month, and that during the next month you should make an effort to hold your purchases down.

After you have several men on the weekly payroll, the ratio of indirect labor to direct labor will be important. This ratio tells whether your "non-productive" labor is increasing, and of course that is an item of expense that you want to keep down as small as possible.

Whole volumes have been written on the uses of the steel square, and yet some carpenters use one only as they would a foot rule. So it is with your books. If they mean to you merely a necessary evil that has been handed down to present business men from past practice, you are overlooking a big opportunity for a real insight into and a real study of the activities of your shop. Your books can tell you a lot of things if you will only let them. They can tell you if you are making good or if you are going to the bad. They can show you the leaks that are eating into your profits. One businessman said that the average manager has not so much to fear from outside competition as from inside bungling. Clean-cut, informative statements taken from your accounts will not only show where the leaks are occurring, but they will indicate where leaks are likely to occur, and will forewarn you in time so that you may take steps to prevent errors and losses.

The Commercial Agencies

Shortly after you have opened your shop, you will be asked to furnish financial statements showing the worth of your business to the commercial agencies, Dun and Bradstreet. It is hard to conceive so foolish a viewpoint, but some small shop owners reply to such a request, "Why, it's nobody's business how much we are worth." If they could but realize how they are only hurting themselves by so doing, they would never follow so shortsighted a policy. By all means co-operate with the agencies by furnishing this information. One of your biggest jobs during the first year will be for you to establish a credit. The business of the world is done on credit. When companies extend you credit, that is when they permit you to purchase goods from them without insisting that you pay cash, it simply means that they trust you, that they have confidence in your good faith and your business integrity.

Concerns do not extend credit by guesswork. They must have information of some sort to show that they are actually justified in believing that you will pay your debts when they are due. The books of the commercial agencies furnish such information. Dun and Bradstreet publish books four times a year, listing every business concern in the country whose name they can obtain. This listing also shows the kind of business in which that company is engaged.

The important part of the listing, however, is the estimated worth and the grade of credit. The estimated worth is the portion of the worth of your business as shown on your financial statement that they believe should be taken into consideration by companies who are considering extending you discounts and terms. I express it in that way for a very good reason. I you turned in a statement listing plant and equipmen at $5,000, accounts receivable at $3,000, and patents and good-will at $67,000, you must not expect to have your net worth listed at $75,000. You'll understand why, if we assume that such a statement were accepted in full and you were given a $75,000 rating. Suppose some jobber extended you credit on that basis, and permitted you to make purchases totaling $20,000. Suppose further that your product proved unmarketable, and your company was declared insolvent. You could turn your plant and equipment into cash and you could collect your accounts receivable, but your patents and good-will would not be worth a cent. That would leave $12,000 on that account that you could meet from the real assets of your business. The point is that padding a financial statement never accomplishes any good, and it is a practice that seldom "gets by." However, at intervals when there may have been increases in your net worth that will affect your rating, you should surely send a statement in to the agencies so that they will have the most recent information about your condition.

ESTABLISHING A CREDIT RATING

Your grade of credit is listed in Bradstreet's as good, fair or undetermined; in Dun's as first, second, third or fourth. It is based upon your performance in meeting obligations promptly when due, upon the general nature and conduct of your business, and upon the character and past experiences of the members of your company. Just incidentally, that throws out the suggestion of another reason why you should be careful in choosing your business associates. If one of your partners has a record of having been a failure in other business ventures, his personal record will have a limiting effect on your credit standing.

Those concerns who use the service of the commercial agencies not only receive these books each three months, but they are also entitled to call for a certain number of special reports on particular firms. These reports show complete financial statements, they outline the history of the firm, they tell if the company has ever been insolvent or suffered loss by fire, they say a word about each member of the company, and they sometimes give remarks and opinions about the credit standing of the company, quoting from people with whom that company has accounts.

Remember that these agencies are purely impartial. They hold no interest in your company nor in your competitors. They are not especially interested in writing a report that will be unusually complimentary or derogatory. They are only concerned in presenting the actual facts as they believe them to be. Of course you want a good rating, and you want to know that the report on your business is one that will inspire other business men to have confidence in you.

That good rating and that good report are entirely under your own control. You can have them and enjoy the benefits that follow as a natural result if you are able to furnish the sort of financial statement that indicates a healthy growing business, a business conducted on sound principles and policies, and by men of character who play the game with both hands above board and all cards on the table.

Industrial Administration in Manchester "Tech," England

The Municipal College of Technology, Manchester, England, has recently opened a "Department of Industrial Administration," with the following objectives, to use the words of authorities of the college: (1) To investigate all problems relating to industrial management and to collect and co-ordinate the information obtained, with a view to assisting in the building up of a science of industrial administration; (2) to put all knowledge so gained at the disposal of the business community, and in particular to organize classes and lectures for managers, workers and students.

The subjects to be studied in the Department will be as follows:

Industrial History: Mediaeval Guilds (statute of apprentices, domestic system, colonial expansion); Industrial Revolution (mechanical inventions and improvements in transportation); Factory Legislation (trade unions and employers' associations, co-operative movement, health insurance, unemployment insurances).

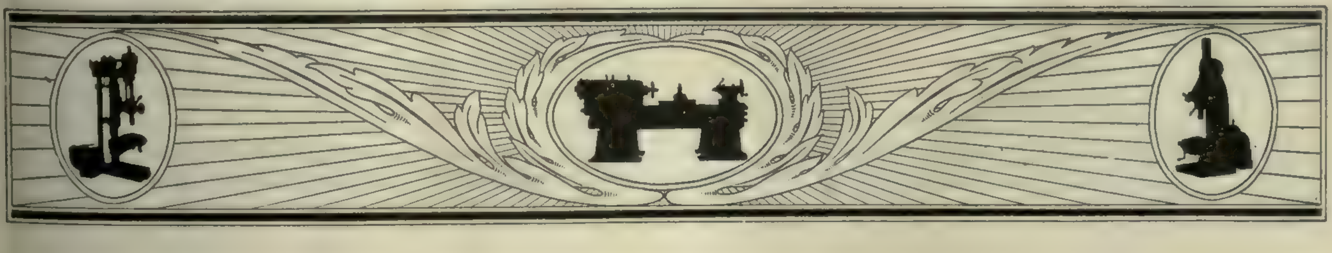
Labor Aspirations: Trade unions (conciliation and arbitration, national industrial councils, trade boards); State Socialism: (Guild Socialism, syndicalism, communism and bolshevism.)

Economics: General principles (production, labor and machinery, unemployment, exchange, credit and interest, distribution); Organization of Industry and Commerce (competition, localization, combinations, company formation, foreign trade); Industrial Finance (gold and paper money, inflation, index numbers, banking, company funds, foreign exchange).

Technique of Management: Types of management (departmental, functional, committee); Employment (selection, education, training, discipline, works regulations); Routine (planning, progressing, graphical and statistical control, cost accounting, time and general offices); Experimental (progressing, rate fixing, time and motion study, fatigue).

Personal: Incentives (time, pieces, premium plans, sliding scale, profit-sharing, co-partnership, promotion); Working Conditions (security of tenure, sick benefits, pensions, holidays, safety and first aid, hygiene and sanitation, welfare, canteens, etc.); Inter-relations (Internal publicity, personal contact, community interests, works' committees, spheres of activity, relation to management); Education (continuation education, apprenticeship schemes, general adult and vocational training); Recreation (cultural, sports, handicrafts).

Taking into account the general interest in industrial management, which is felt now both in this country and in Europe, one cannot fail to notice that the new department of Manchester College meets this interest with a very complete program.



The Design of Springs

Control of the "Spring Criterion"—Formulas for Leaf Springs Constrained at One or Both Ends—Characteristics of Coil, Spiral and Buffer Springs

By JOSEPH KAYE WOOD
Engineer, Western Electric Co., Inc., A. T. & T. Co.

IN THE previous article by the author on page 46 of the *American Machinist,* two general formulas for single flat springs were derived from the fundamental equations for the flexural deflection and strength of a beam. The two formulas referred to are:

$$\text{Deflection } F = \frac{\psi P l^3}{E b_m d^3} \qquad (1)$$

$$\text{Spring Criterion } \frac{Fd}{l^2} < \phi \frac{S}{E} \text{ Material Index} \qquad (2)$$

where ψ and ϕ are constants depending upon the form of the spring. Or, as the thickness d is necessarily kept constant for commercial reasons, the constants depend directly upon the relation between the principal breadths b_e and b_m of the spring. For similar "economical" spring forms which give nearly uniform distribution of stress, the values of ψ and ϕ are four times greater in the case where only one end of the spring is constrained than in the case where the two ends are constrained. To constrain the loaded end of a flat spring means to keep the plane of the flat part which is clamped or imbedded parallel to the plane of the other stationary and imbedded flat part while the spring is being deflected. If these two parts are not parallel, then the corresponding ratios of the values of ψ and ϕ will be greater or less than four, according to the angle which the planes of these two parts make with each other. The value of ψ may be determined from the following expression:

$$\psi_1 = \frac{12\, b_m}{b_e + 2\, b_m} \text{ for one constrained end;}$$

and, $\psi_2 = \frac{\psi_1}{4}$ for two constrained ends.

The value of ϕ may likewise be determined from:

$$\phi_1 = \frac{\psi_1}{6} \text{ for one constrained end;}$$

and, $\phi_2 = \frac{\psi_2}{6}$ for two constrained ends.

In this article it will be shown that all springs of the flexural type, that is, all springs which are deflected by a bending moment, may be designed by formulas of the same general form as formulas (1) and (2). Hence, the expressions for ψ and ϕ will now be derived for the following springs:

(a) Leaf spring with one constrained end,
(b) Leaf spring with two constrained ends,
(c) Coiled spring,
(d) Spiral spring,
(e) Buffer spring.

In considering these springs the same symbols employed in previous articles will be used, these symbols being:

F = Deflection in inches;
P = Load in pounds;
l = Length of spring material in inches;
d = Thickness or diameter of material in inches;
b_m = Uniform or maximum breadth of material in inches;
b_e = Minimum breadth of material in inches;
S = Maximum safe fiber stress in pounds per square inch;
E = Modulus of elasticity in pounds per square inch;
n = Number of spring units.
ψ and ϕ were previously described.

(a) Leaf Spring with One Constrained End:

We have previously shown that the formula for the deflection of a triangular-shaped spring is

$$F = \frac{6\, P l^3}{E b_m d^3} \qquad (3)$$

Now, if a certain triangular-shaped spring has a breadth B equal to some whole number, say n, times b_m in the formula, then the formula for this spring may be written as follows:

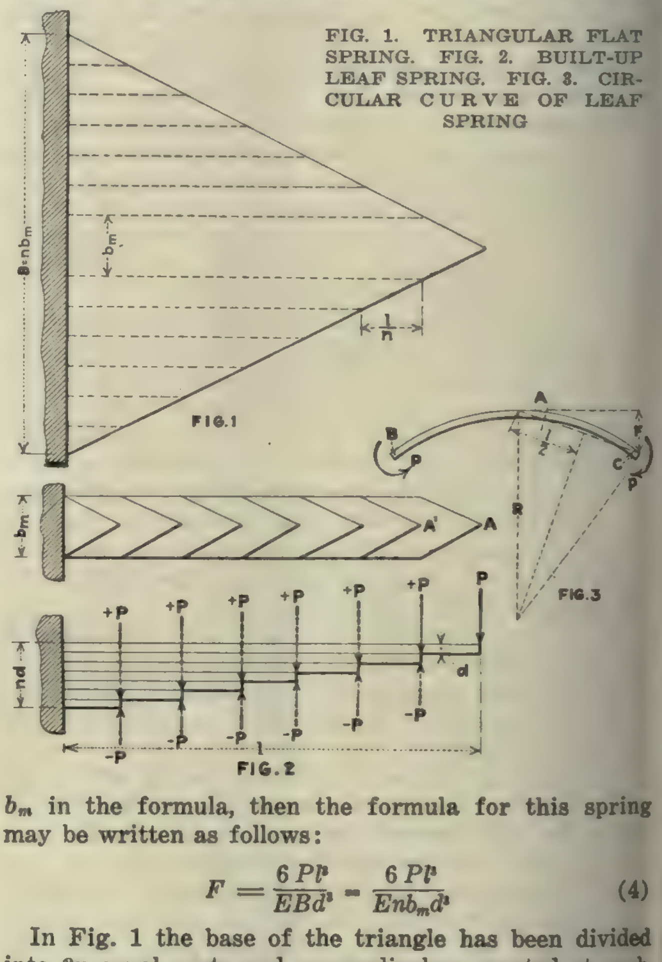


FIG. 1. TRIANGULAR FLAT SPRING. FIG. 2. BUILT-UP LEAF SPRING. FIG. 3. CIRCULAR CURVE OF LEAF SPRING

$$F = \frac{6\, P l^3}{E B d^3} = \frac{6\, P l^3}{E n b_m d^3} \qquad (4)$$

In Fig. 1 the base of the triangle has been divided into $2n$ equal parts and perpendiculars erected at each point of the division. By super-imposing the parts on top of each other the spring pile-up shown in Fig. 2 is produced. In applying a load P at the end of the longest part, a deflection F will be produced, the value of which may be determined from formula (4). The fact that the deflections of this composite spring will be equal to the deflections of the single triangular-shaped spring from which the parts of the former are cut may be better understood when it is considered that each small particle of the material of the composite spring has the same external moment, is the same distance from the neutral plane and has the same approximate curvature as it would have as a single triangular-shaped spring. However, a more rigorous proof of this fact will now be given. The fundamental equation of the elastic curve is as follows:

$$R = \frac{EI}{M} \qquad (5)$$

in which R is the radius of curvature, I the moment in inertia of a normal section and M the applied moment. If the rate of change of direction of the neutral plane is uniform, then the curve is circular. As shown in the previous article, the curve of the neutral plane of a deflected triangular-shaped spring changes uniformly in direction because every particle in its length is distorted an equal amount. Hence the resulting curve must be circular. Now, if a certain length of flat material is acted upon at both ends by equal and opposite couples, as shown in Fig. 3, the resulting curve of the neutral plane will be circular also, because all particles are bent an equal amount. This may better be seen by taking any point A and considering the forces necessary to maintain equilibrium. At section A the part AB will exert a couple on part AC equal and opposite to the couple at C, and the part AC will exert an equal and opposite couple on the part AB, and likewise for any other section considered. Consequently, this proves that the entire spring is bent uniformly into the arc of a circle. So much for the single triangular-shaped spring.

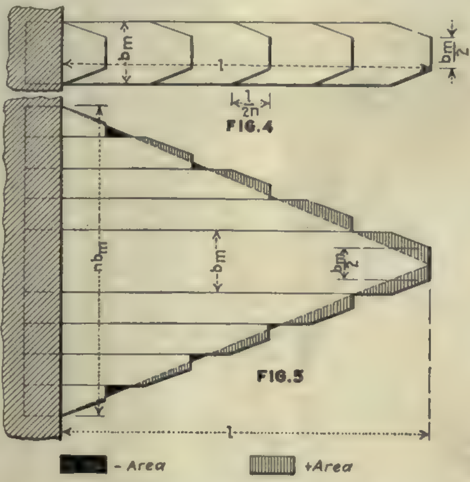


FIG. 4. APEXES OF LEAVES REMOVED. FIG. 5. SINGLE LEAF EQUIVALENT TO SPRING IN FIG. 4

Now, referring again to Fig. 2, the load P bends the triangular portion AA' of the lowest unit into the arc of the circle whose radius is

$$R = \frac{EI}{M} = \frac{Eb_m d^3}{12\,Pl/n} \qquad (6)$$

The end of the rectangular portion at A', which is on the circular arc, will exert a pressure P against the apex of the triangular portion of the next spring unit, because at any section in the same arc the bending force is the same. This in turn will bend the portion $A'A''$ into the arc of a circle whose radius is equal to that above, and so on for the entire spring. Thus we have all upward pressures exerted on the outer ends of the rectangular portions equal and opposite to all except one of the downward pressures exerted on the apexes of the triangular portions. Consequently, we have exactly the same conditions as with a single triangular spring having a base equal to nb_m and a length equal to $n\frac{l}{n} = l$ and a radius of curvature equal to

$$R = \frac{EI}{M} = \frac{Enb_m d^3}{12\,Pl} \qquad (7)$$

due to a load P applied at the apex. Formula (7) is identical with formula (6), which is the radius of curvature for all the spring units of the composite spring.

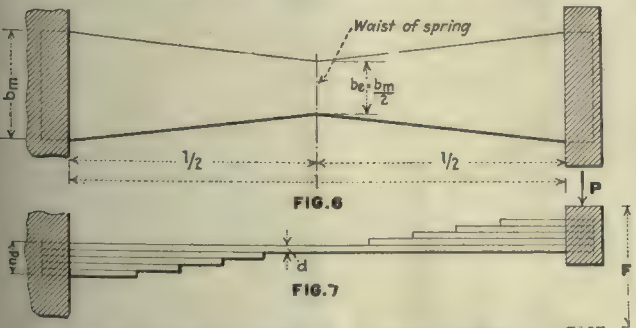


FIG. 6. TRIANGULAR SPRING CONSTRAINED AT BOTH ENDS. FIG. 7. BUILT-UP, DOUBLE-CONSTRAINED SPRING

The expression for the deflection F in terms of the radius R is derived as follows:

Referring to Fig. 3, it is found from similar triangles that $F : l = l/2 : R$, which gives

$$F = \frac{l^2}{2R} \qquad (8)$$

From formulas (8) and (7) we get

$$F = \frac{6\,Pl^3}{Enb_m d^3} \qquad (9)$$

which is identical with and proves formula (4). This then is the formula for the deflection of a leaf spring having one constrained end. Instead of making the ends of the spring units triangular in shape, the thickness toward the end may be made parabolic in order to secure uniform bending. This spring is also covered by formula (9). However, shaping the material in this way would not be commercial, except in the case of large springs such as are used in automobiles.

In the automobile industry the matter of so-called elliptical springs, which are double-leaf springs, has been made the subject of extensive investigation in which the clamping of the leaf units together, the initial distance between the leaf units before clamping, and the coefficient of friction between the leaf units enters largely into the calculations of their dimensions.

In practice, the apexes of the leaf units are cut off, as shown in Fig. 4. However, formula (9) is used for this spring, the approximation being in error by about 5 per cent or less where the number of spring units is greater than four. The extent of the approximation is shown graphically in Fig. 5.

(b) Leaf Spring with Two Constrained Ends:

In a previous article by the author it was shown that an economical spring or a spring having nearly uniform bending and constrained at both ends should have the shape shown in Fig. 6. This spring can be considered as consisting of two springs of length $l/2$, each deflected an equal amount but in opposite directions. In order to economize in space we may make each half section a leaf spring with the pile-ups of leaf units on opposite sides, as shown in Fig. 7. We may do this because we have shown that the deflection of the leaf spring would be equal to that of the single spring from which it is made, for the same load P. This spring may then be designed by the formula used for a single unit of this type of spring where the breath b_m is equal to n times the breath b_m of the leaf spring. The formula may then be written as follows:

$$F = \frac{2 \times 6\,P}{Enb_md^3} \times \left(\frac{l}{2}\right)^3 = \frac{3\,Pl^3}{2\,Enb_md^3} \qquad (10)$$

This is the formula for deflections of leaf springs having two constrained ends.

SPRING CRITERION FOR SPRINGS (*a*) AND (*b*)

The flexural strength of the leaf springs covered in (*a*) and (*b*), which may be easily derived in the regular manner is as follows:

$$S = \frac{6\,Pl}{nb_md^2} \qquad (11)$$

By equating the allowable maximum work to the resilience as outlined in the previous article, or doing that which is a short-cut and substituting P in formulas (11) and (9) respectively, we get

$$\textit{Spring Criterion}\ \frac{Fd}{l^2} = \phi\,\frac{S}{E}\ \textit{Material Index}$$

Where $\phi = 1$ for the leaf spring having one constrained end,

and $\phi = \frac{3}{4}$ for the leaf spring having two constrained ends.

(c) Coiled Spring:

In Fig. 8 is shown a single coil bent and "set" in the form of a circle whose radius is R. By applying a force P at the end A, while keeping the other end C stationary, which constitutes two equal and opposite couples, so that the elastic limit of the material is not exceeded, the circular coil is bent into a smaller circular coil of radius R_o. In the discussion on the previous types of springs it was brought out that if the loads are applied in such a way when bending a material as to make the neutral plane circular, the bending will be uniform throughout the entire length, or in the case of uniform cross-section the bending moment will be constant. Hence, we may consider the effect of the lever distance D shown in the sketch as simply increasing the couple applied; as, for example, if the load be P then the couple applied will be twice as great if the lever distance D is made 4 in. instead of 2 in. In the diagram, the point of application of the load P travels in the circumference of a circle whose radius is equal to the lever distance D and the ends are not constrained, the latter condition being sometimes only approximated in practice. However, in any case, the approximation of this condition will not cause any appreciable error in the calculation of the spring's dimensions.

From equation (5) of the elastic curve

$$\frac{1}{R} = \frac{M}{EI}$$

the relation between $\frac{1}{R}$ and M may be shown by a straight line curve as in Fig. 9, where oc is the initial curvature of the coil $\frac{1}{R_o}$ before being deflected by a moment M_p. The moment necessary to produce the initial curvature $\frac{1}{R_o}$, which may be designated as M_o, is equal to $\frac{EI}{R_o}$. Therefore the curvature $\frac{1}{R_p}$ produced by a moment M_p may be written as follows

$$\frac{1}{R_p} = \frac{M_p + M_o}{EI} \qquad (11)$$

Substituting the value of $M_o = \frac{EI}{R_o}$ in this equation gives

$$\frac{1}{R_p} = \frac{M_p + \frac{EI}{R_o}}{EI} = \frac{M_pR_o + EI}{EIR_o}$$

or, $R_oEI = M_pR_pR_o + R_pEI$

Multiplying this by 2π gives

$$(2\pi R_o)EI = (2\pi R_o)M_pR_p + (2\pi R_p)EI$$

Now $2\pi R_o$ is the length l_o of the loop before deflection, and $2\pi R_p$ is the length l_p of the loop after deflection.

Furthermore, $l_o - l_p = F_r$, the deflection or overlap of one end upon the other end, which for n coils would be equal to nF_r. Only one coil, however, is being considered now. Therefore, the last expression becomes

$$F_rEI = l_oM_pR_p$$

Or, transposing, we get

$$\frac{F_r}{R_p} = \frac{M_pl_o}{EI}$$

From similar sectors, shown in Fig. 8,

$$\frac{F_r}{R_p} = \frac{F}{D}$$

Therefore, by substituting and dropping all subscripts we get

$$F = \frac{MDl}{EI} = \frac{PDDl}{EI}$$

Or, $$F = \frac{PD^2l}{EI} \qquad (12)$$

If we designate ω equal to the ratio $\frac{R}{D}$, then l will equal $2\pi D\omega$ and if there are n coils the total F will be "n"

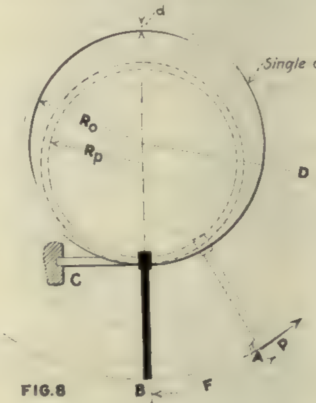


FIG.8

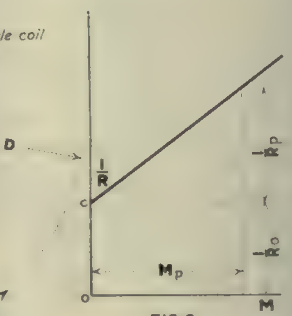


FIG.9

FIG. 8. ACTION OF SINGLE-COIL SPRING. FIG. 9. RELATION BETWEEN CURVATURE AND MOVEMENT

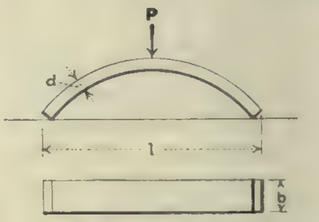


FIG.11

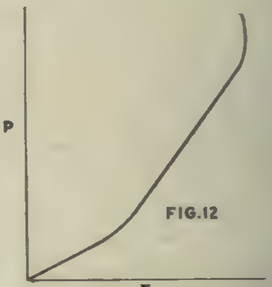


FIG.12

FIG. 11. BUFFER SPRING. FIG. 12. PRESSURE-DEFLECTION CURVE FOR BUFFER SPRING

times greater. I equal $\frac{bd^3}{12}$

Hence, we have

$$F = (24\,\pi n\omega)\,\frac{PD^3}{Ebd^3} = \psi\,\frac{PD^3}{Ebd^3} \qquad (13)$$

as the general formula for coiled springs in flexure. It must be remembered in connection with this formula that the deflection F is measured in length units in the arc of a circle whose radius is equal to the lever distance D. Here $(24\,\pi n\omega)$ equals ψ.

(d) Spiral Spring:

A considerably greater amount of resilient energy in a given space may be obtained from the spiral type of spring than from the coiled type, for which reason they are chosen as storage "tanks" for the necessary energy to run a clock or similar mechanism 24 hours or more continuously.

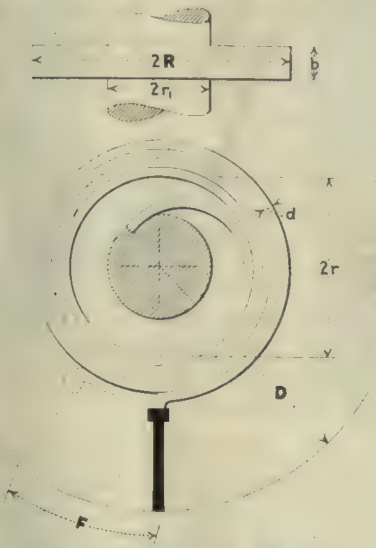


FIG. 10. ACTION OF SPIRAL SPRING

The principles upon which the formula for this type of spring is based are similar to those of the coiled type, and the formula may be derived in the same manner. Both formulas, however, may be derived in a slightly different manner, which will now be demonstrated in deriving the formula for spiral springs. A certain length l of material is formed into a spiral and "set," as shown in Fig. 10. The application of a bending moment M, which may be called a multiplied couple, will change the radius of curvature of each 360 deg. of the neutral plane an equal amount; or, in other words, will change the rate of change of direction γ, which is approximately constant for the entire length. Hence, we may write

$$M = \frac{EI}{R} = EI\gamma = \textit{Constant} \qquad (14)$$

Now let β equal the total change in rate of change in direction or angular distorsion and $\gamma\delta l$ the angular distortion for each element δl. Then we have

$$M\delta l = EI\lambda\delta l = EI\delta\beta$$

By integration,

$$Ml = EI\beta$$

or,

$$\beta = \frac{Ml}{EI}$$

Now,

$$\beta = \frac{F}{D}$$

$$\therefore F = \frac{M\,D\,l}{EI} \qquad (15)$$

which gives precisely the same formula as for the coiled spring. Substituting, since

$$l = 2\pi\,\frac{(R + r)}{2}\ n \text{ approximately,}$$

$$M = PD, \text{ and } I = \frac{bd^3}{12},$$

we get $F = \dfrac{12\,\pi n PD^2(R + r)}{Ebd^3}$ (16)

Furthermore, let $m = \frac{r}{R}$, and $\omega = \frac{R}{D}$

Substituting gives

$$F = (12\,\pi n\omega m)\,\frac{PD^3}{Ebd^3} \qquad (17)$$

as the general formula for a spiral spring where the deflections F are measured on the arc of a circle whose radius equals D. Here $(12\,\pi n\omega m)$ equals ψ.

Round Section for Cases (c) and (d):

Where material of round cross-section is used, for case (c) with coiled springs change b to d and multiply ψ by $\frac{16}{3\pi}$, and for case (d) with spiral springs change b to d and multiply ψ by $\frac{32}{3\pi}$.

Flexure Formula for Cases (c) and (d):

As the bending moment is the same at any point in these springs, the weakest section is also liable to be at any point. But the flexure formula for both cases is derived in precisely the same manner as for all other types of springs in flxure. Hence, the formulas are given below in their final form. For cases (c) and (d):

$$P = \frac{Sbd^2}{6\,D} \text{ for flat section;}$$

and,

$$P = \frac{Sdd^2}{32\,D} \text{ for round section}$$

Spring Criterion for Cases (c) and (d):

Using precisely the same method as in deriving the spring criterion for other spring forms the following relations are derived:

$$\textit{Spring Criterion } \frac{Fd}{D^2} < \phi\,\frac{S}{E}\ \textit{Material Index,}$$

For (c) Coiled Spring,

$$\phi \text{ equals } \frac{\psi}{6} = 4\,\pi n\omega \text{ for flat section;}$$

and,

$$\phi \text{ equals } \frac{\pi}{32}\,\psi = 4\,\pi n\omega \text{ for round section.}$$

For (d) Spiral Spring,

$$\phi \text{ equals } \frac{\psi}{6} = 2\,\pi n\omega m \text{ for flat section;}$$

and,

$$\phi \text{ equals } \frac{\pi}{32}\,\psi = 4\,\pi n\omega m \text{ for round section;}$$

(e) Buffer Spring:

This spring is simply a curved flat piece of material with the load P applied in the center as shown in Fig. 11. The formula is that of the simple beam, namely

$$F = \frac{Pl^3}{4\,Ebd^3}$$

and

$$\textit{Spring Criterion } \frac{Fd}{l^2} < \phi\,\frac{S}{E}\ \textit{Material Index}$$

where

$$\phi = \frac{l}{6}$$

However, where b is considerably larger than l it complicates the formula of this particular type of spring. The pressure-deflection curve of such a spring is shown in Fig. 12. This special case will be covered in a special article.

The next article will be a summation of the design of all types of springs covered in this series of spring articles, including a universal spring chart for springs in flexure and some very useful constants covering various spring materials. The use of the chart ought to greatly simplify and reduce the laborious calculation work in spring design.

Making the Coventry Self-Opening Diehead

Materials Tested in an Up-to-date Laboratory—Parts Inspected and Sent to Storeroom for Re-issue After Each Operation—Accurate Broaching

SPECIAL CORRESPONDENCE

THE manufacture of the Coventry dieheads by Alfred Herbert, Ltd., is carried out in a self-contained factory at Edgwick on the outskirts of Coventry, England. The shops are of the latest single-story construction, the personnel being housed under the best workshop conditions, and the equipment specially installed for dealing with this particular product. A large and modern laboratory for carrying out chemical and physical tests has just been erected, superseding the original building. Here all the raw material entering into the construction of the dieheads is subjected to the necessary tests. Neither time nor expense is spared to carry out the most rigorous tests on raw material prior to entering the shops. After analysis under the personal supervision of the chief chemist, the material is subjected to special heat-treatment, so as to insure the maintenance of uniform quality throughout.

After heat-treatment the forgings are tested for hardness by the Brinell method, special apparatus being employed. Fig. 1 shows some diehead forgings being tested. The mechanism on the wall immediately above the machine provides a means for rendering the efficiency of the test independent of the operator. By special adaptation the load is always applied at the same rate and automatically maintained for the same length of time. The forgings or other raw material having passed a stringent inspection test are now neatly stacked in the stores to be later issued against shop orders. An electric truck service conveys the material from the stores to the required spot, where it is again stacked so that the shops may be kept in spick-and-span order.

Fig. 2 shows the diehead complete while Fig. 3 shows the body which carries the dies and in which they fit directly without the intervention of carriers or shoes. The first operations are rough- and finish-turning for grinding, drilling and chamfering. The body is next supported on an arbor between centers on a universal grinding machine. The keyseating operation follows, and is performed on a duplex keyseating machine; keys are next fitted into the shank, and the work is located in relation to these keys for all subsequent operations. The body is then taken to a horizontal milling machine for milling the die slots. Fig. 4 depicts this operation. There are two milling operations at this stage, roughing and finishing. The fixture is designed for accurate indexing in four positions. The finest limits of accuracy are called both for width and location of slots and to insure this the slots are finally finished on a broaching machine, the body being held in a special fixture, as shown by Fig. 5.

Drilling the four holes for the front plate screws is the next operation, and then the front face of the body is surface ground. The fixture will hold twenty-five bodies at a time, the bodies being accurately located on studs. The fixture is placed on the magnetic chuck of the grinding machine and is of ample dimensions to preclude any possibility of distortion. After every operation a rigid inspection takes place, and in each case the finished part goes into stores for re-issue, so that the Progress Department may keep correct track of all work in progress.

In Fig. 6 is shown the external scroll which fits over the body. Its function is to close the dies and to take their end pressure when working. The external scroll is machined from a steel blank cut from the bar. The first operation is the roughing out of the shoulder to provide a true grip for the subsequent machining operations also the rear face is turned, rough drilled and chamfered. The next machining operation is putting in the annular recess at the back which takes the opening springs.

The next is a milling operation. The scrolls which locate the ends of the dies are milled on a Herbert No. 3 vertical milling machine in a special four-position indexing fixture. The fixture is offset from the center of the circular table to give the correct curve. Fig. 7 is a rear view of the scroll. The annular recess for the reception of a hardened abutment or tooth will be noted. A subsequent operation is the surface grinding of the back face with the hardened tooth in position in the annular slot.

THE INTERNAL SCROLL

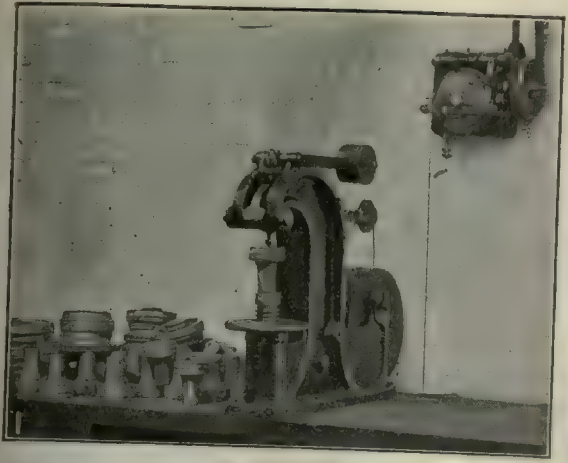
Fig. 8 shows the internal scroll which is attached within the external scroll. It is furnished with four cam-shaped projections which engage the notches in the back of the dies for positively withdrawing them from the work when the diehead opens. The internal scroll is made from a steel bar. A bar long enough for a dozen rings is chucked in a capstan lathe, turned, bored and cut off, an allowance being left for grinding. The scrolls are now placed on a mandrel and ground externally on a 12 x 36-in. universal grinding machine.

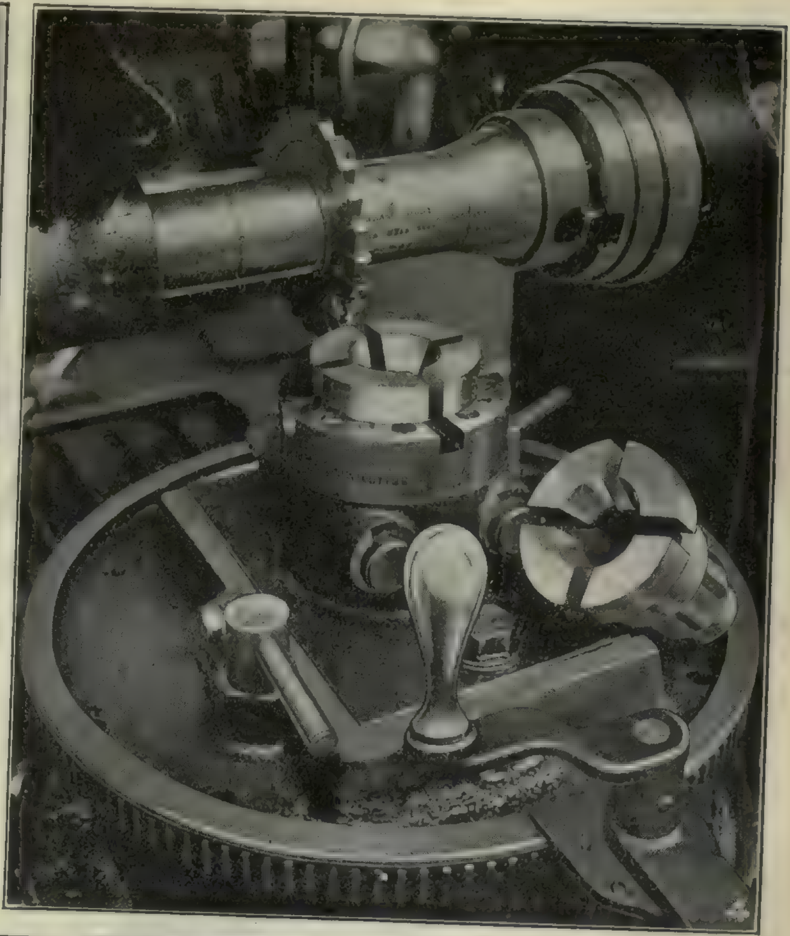
The next operation is milling the landing slots to afford clearance for the subsequent milling of the scrolls. Fig. 9 shows the finished milling of the scrolls on a No. 3 Herbert vertical milling machine. The fixture is also used for milling the curves on the outer scrolls, a special adaptor being fitted.

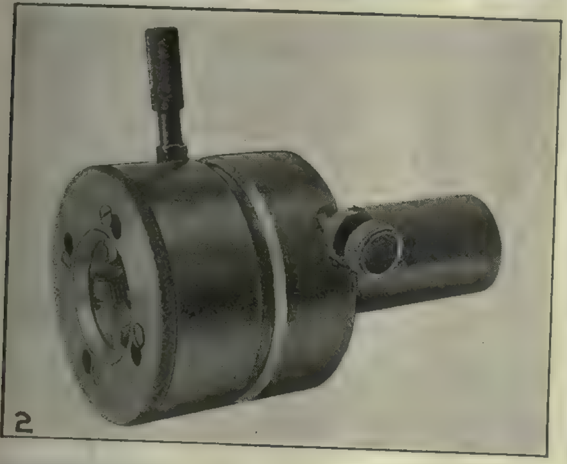
The front plate is of steel hardened and ground. It is attached to the body by four screws and is furnished with elongated or bayonet holes which permit of its rapid withdrawal without completely withdrawing the four holding screws. Fig. 10 shows the rotary surface grinding of one of the front plates. The plates are machined from a bar. A bar long enough for a dozen plates being bored and turned before cutting up into individual plates. The outside of the plate is knurled, the rear face is formed and the external diameter chamfered.

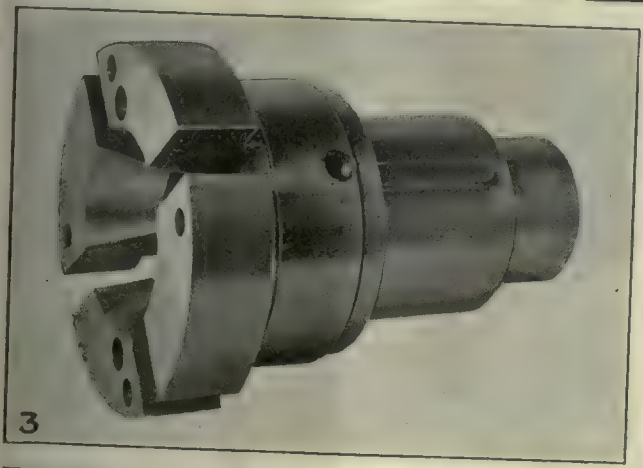
THE SHANK

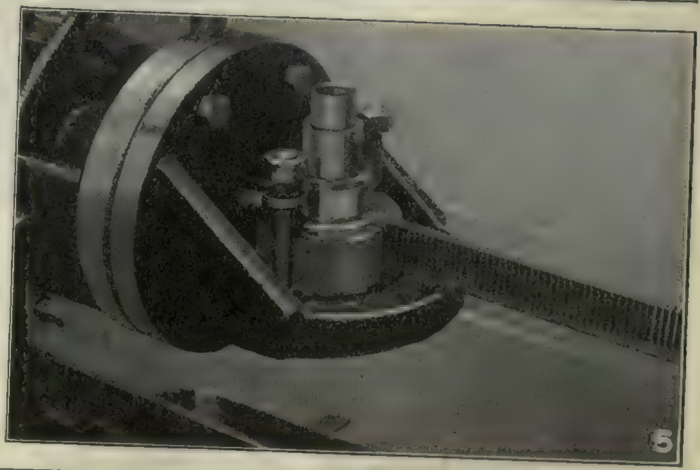
Fig. 11 shows the shank end of the diehead. The shank comes to the lathe in the form of a high-carbon steel forging. The forging is chucked by the big end, and is rough turned and drilled with a special box tool, as shown in Fig. 12. Another box tool is swung into

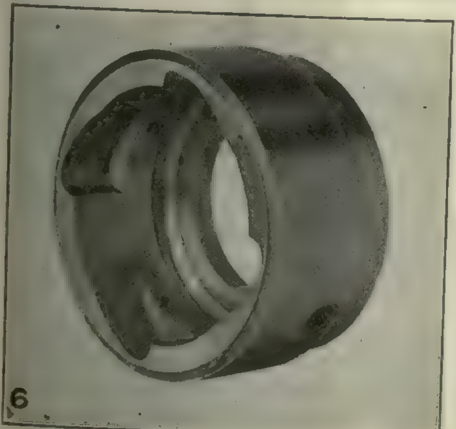


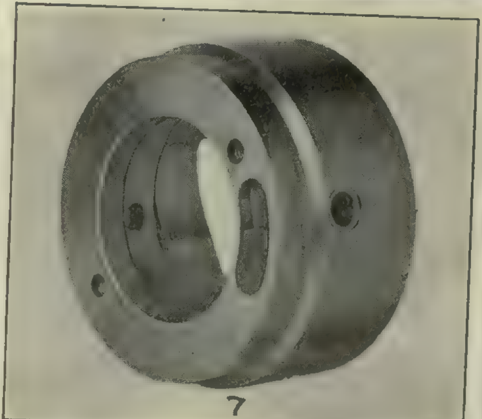












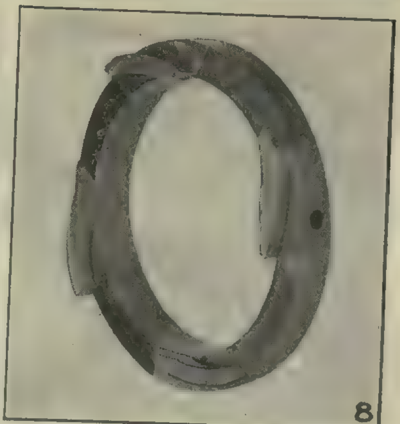


FIG. 1. TESTING THE FORGINGS. FIG. 2. A COMPLETE DIEHEAD. FIG. 3. THE BODY IN WHICH THE DIES ARE CARRIED. FIG. 4. MILLING THE DIE SLOTS. FIG. 5. FINISHING DIE SLOTS BY BROACHING. FIG. 6. THE EXTERNAL SCROLL. FIG. 7. THE EXTERNAL SCROLL (REAR VIEW). FIG. 8. THE INTERNAL SCROLL

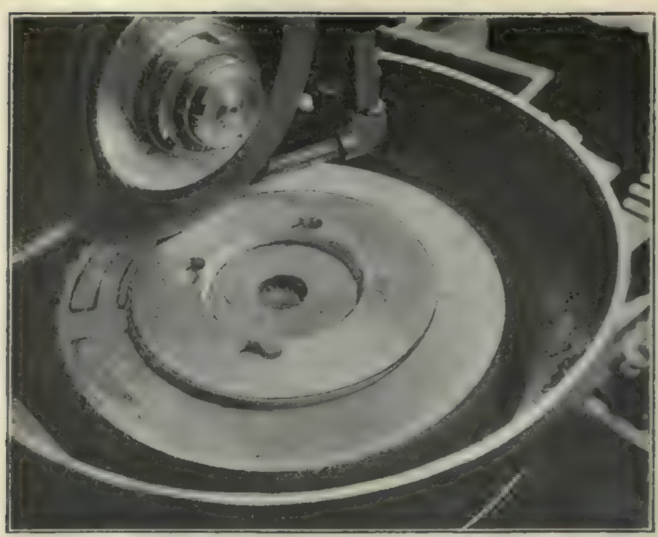


FIG. 10. GRINDING A FRONT PLATE

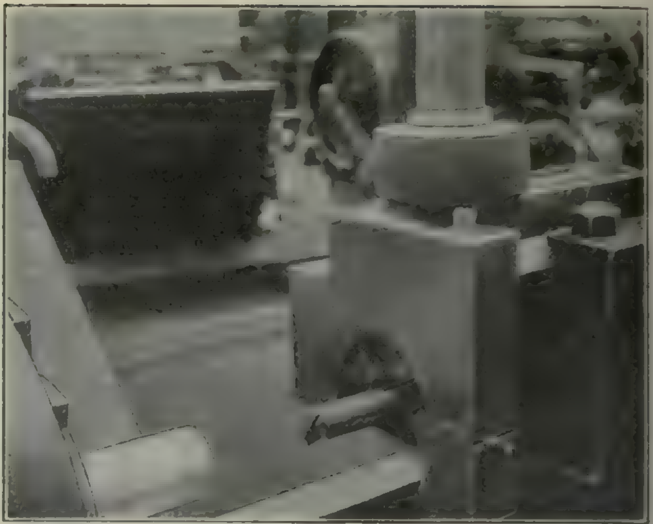


FIG. 12. MACHINING THE SHANK

position when finish turning and rough reaming takes place. It is then rechucked in soft jaws on a capstan lathe and finish machined for external grinding as shown in Fig. 13 which also shows an interesting capstan tool layout, attention being drawn to the trepanning tools. The job arrives at the machine, as per the sample on the feed shelf, the finished job being as per sample on the top of the turret.

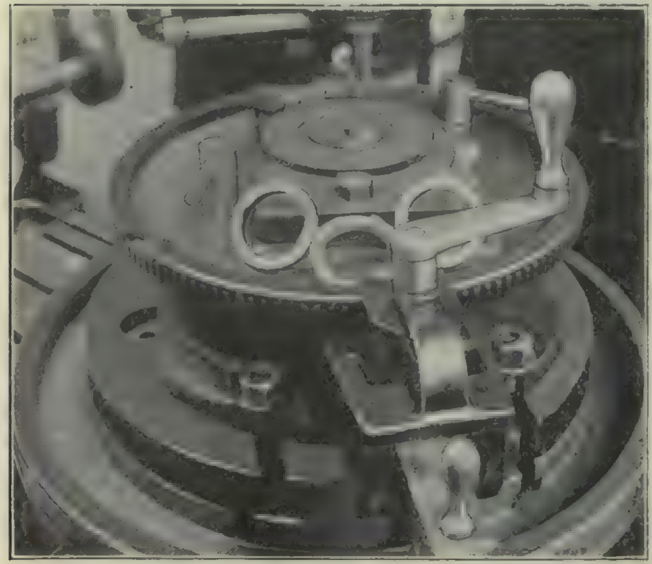


FIG. 9. MILLING THE INTERNAL SCROLL

A subsequent operation is grinding, see Fig. 14. The shank is placed on a mandrel similar to the one shown on the table of the grinding machine. The machine in question is a Herbert 12 x 36-in. universal grinding machine and the abrasive wheels used throughout the factory are of the Norton make. The next operation is on a Pratt & Whitney thread-milling machine where the boss for the adjusting ring is externally threaded, as shown in Fig. 15, where a finished piece of work may be seen at the top of the cutter head. Subsequent operations include drilling on sensitive drilling machines, the shanks being held in special jigs and a slotting operation on the body for the keyways.

The various units are assembled by fitters who have become specialists in the work, as they are constantly engaged in this one business of assembling "Coventry" dieheads. The various units going to make the complete "Coventry" diehead are issued against shop orders from the finished parts stores. Immediately a diehead part is machined from the rough it is placed in a wooden receptacle, and when such part is not being operated upon it is replaced in the box until it is finally completely assembled. The part is thus effectually protected from damage in its passage through the various processes.

An efficiency chasing system enables the finished stores department to keep a correct track of all work in progress. By this means the flow of work through the shops is regulated in an efficient manner.

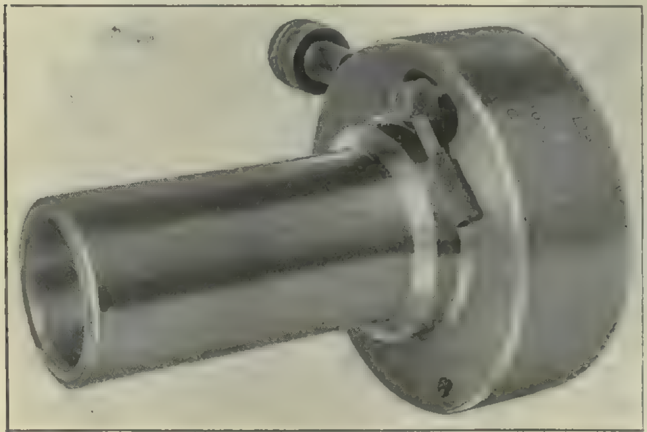


FIG. 11. SHANK END OF DIEHEAD

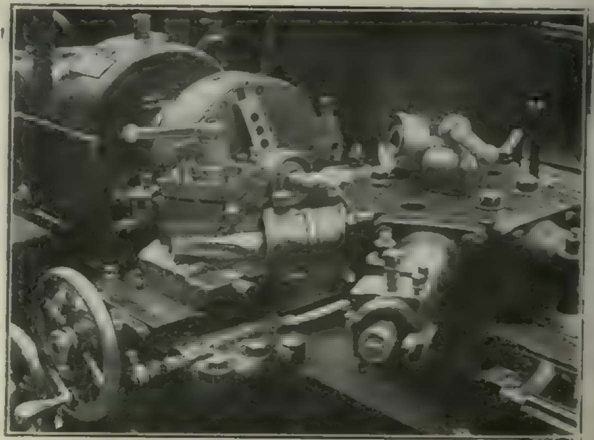


FIG. 13. FURTHER OPERATIONS ON THE SHANK

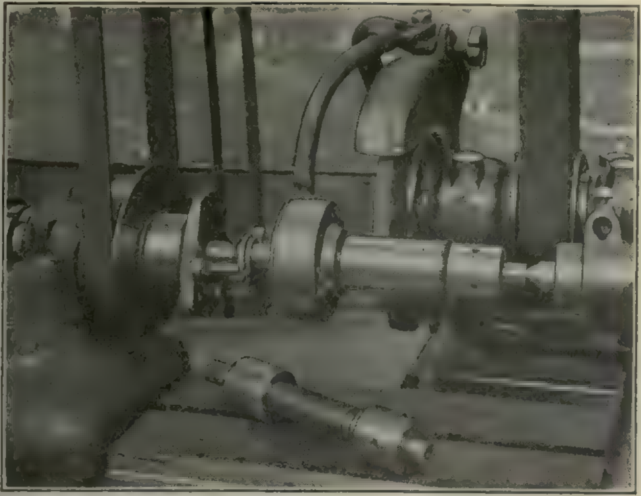


FIG. 14. GRINDING THE SHANK

To insure accuracy of form and pitch all the tools used in producing the milling cutter which cuts the teeth of the dies are made on specially designed machines and subjected to a rigid inspection after each operation, under a projection machine which magnifies the image 50 times full size and provides means of testing pitch to 0.0001 in. Very close limits of accuracy are laid down and rigorously enforced. These milling cutters are hardened in a special type of electric furnace which prevents oxidization and reduces distortion to a minimum.

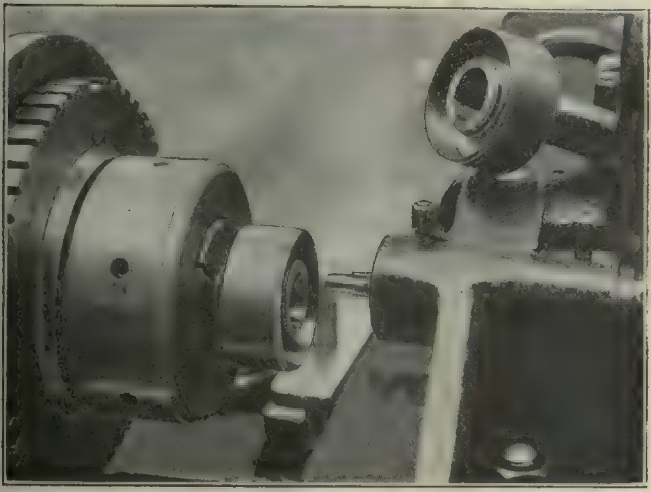


FIG. 15. THREAD MILLING FOR THE ADJUSTING RING

The teeth of the "Coventry" dies are straight, that is, they are produced by a milling cutter which traverses straight across the die. The result is that the straight-cut dies will produce accurate, well-finished threads. An important feature of the straight-cut die is that all four dies can be mounted in a very simple fixture and accurately sharpened at one operation.

All dies are made of high-speed steel except dies for copper which last longer when made of carbon steel.

Whittling Iron

The following interesting article is No. 19 of the research narratives issued by the Engineering Foundation:

In 1545, the *Mary Rose* capsized off Spithead, England. She carried some wrought-iron guns and cast-iron shot. After 292 years in the sea, on being brought into the air, the shot gradually became red hot, then fell to pieces. A similar fate overtook the *Royal George* in 1782 in the same locality, and 62 years later some iron guns were recovered from the wreck. After 133 years' submergence, some cannon and shot were brought up from the *Edgar*, also. It is recorded that the cast iron from the latter two vessels was generally soft, so that it could be cut with a knife, resembling plumbago. Wrought iron on these ships was not so seriously injured. While in this soft state, some of the old cannon were taken carefully to the Tower of London. In the Minutes of the Proceedings of the (British) Institution of Civil Engineers, about eight years ago, Major General Pasley records that after a time these cannon resumed their original hardness. The same authority declares that iron parts of pumps immersed in mineralized waters were similarly affected. Another authority states that the old guns mentioned were again fired. Cast-iron piles along the English coast likewise deteriorated.

In the Transactions of the American Society of Civil Engineers for 1915, Marshall R. Pugh narrates that "the cast-iron guns from some ancient pirate ship were brought up from the ocean depths off Holyhead in 1822, after the lapse of a century. They were quite soft, but hardened so much on exposure to the air that they were used to fire salutes to King George IV when he passed through Holyhead on his way to Dublin. These old guns were said to have given louder reports than any others!"

Old sea tales might be multiplied. Modern ship-builders, too, state that in repair work, cast-iron parts exposed to sea-water are frequently found in the condition described, at least in spots.

Iron pipes along the seaboard are so deteriorated by salt water as to need replacement, in some places, within a few years, whilst in other places a generation or even two may pass. This deterioration appears to be more rapid in tidal marsh land than in seaways. It has been learned, also, that coal ashes and certain industrial wastes deposited on the land, through leaching, cause the same unfortunate results. Likewise, pipes and other iron objects in alkaline, acid or saline soils, in many localities suffer deterioration. All kinds of iron are not affected, nor is the action uniform.

Narratives of such troubles could be written for many parts of our country and other countries. A little knowledge has been gained about this form of corrosion, and some methods for avoiding it partially have been developed. However, it is still a menace to many iron objects, jeopardizing valuable property, and, indirectly, human lives.

A more thorough investigation than has ever been undertaken is demanded. Engineering Foundation is endeavoring to organize a research that will get valuable results. Information concerning the trouble must be countered by scientific knowledge of causes and means for avoidance or resistance. Manifestly, it is undesirable to have iron in pipes or structures become soft enough to be whittled with a jack-knife and in extreme cases, as soft as putty.

Safety Code for Compressed Air Machinery

The American Society of Safety Engineers has been designated as sponsor for a safety code for compressed air machinery by the American Engineering Standards Committee. The code will include rules for the construction and use of compressors, tanks, pipe lines, and the utilization of apparatus where compressed air is the active agent. In accordance with the usual procedure, the code will be formulated by a sectional committee composed of representatives designated by the various bodies interested.

This work is being undertaken as part of a comprehensive program of safety codes in process of formulation under the auspices and rules of procedure of the American Engineering Standards Committee. The American Society of Safety Engineers was appointed sponsor for the code on the recommendation of the National Safety Code Committee.

Metal Cutting Tools—XVII

BY A. L. DE LEEUW

(Continued from last week's issue.)

IN THE foregoing chapters an attempt was made to point out the principles involved in the cutting action of metal cutting tools without making much effort to go into details of construction. To do so would involve the cataloging of thousands of different tools, many of which have points of merit for the particular duty for which they were developed. It was intended to point out these principles and particularly the difficulties one may meet when constructing tools without due regard for them.

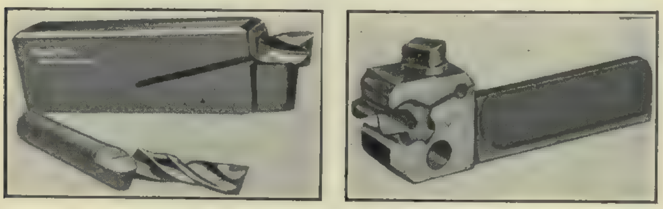


FIG. 293. (RIGHT) MONTSTREAM'S "TWISTO" TOOLBIT AND HOLDER. FIG. 294. (LEFT) MARTIN DRAWN SECTION LATHE TOOL

Some tools are constructed with an eye to better cutting qualities, others with a view of adapting them to some particular class of machine, still others for the purpose of quick replacement. Others again with a view to economy of tool steel, and again others so as to make them readily into combinations of tools. All of these considerations have merit but it would not be possible to describe all of the tools constructed so far, or even a small portion of them. However, there are a few existing tools which have certain points of general applicability or which embody some principle which makes them of general interest and a few of them will be pointed out here.

One of them is the lathe or planer tool made up out of drawn steel, shaped in such a way that some of the required angles are present without further effort, or which presents a number of cutting edges, or which permits of the simplest kind of grinding for the purpose of resharpening. Such tools, though generally not adapted to the very heaviest kind of cutting may be very useful from the standpoint of simplicity in regrinding or from the standpoint of economy in the use of tool steel. Figs. 293 and 294 show such tools.

Whenever an operation becomes standard in one or more industries it will be found that standard tools will be developed, specially adapted to that operation. Fig. 295 shows a case in point. The tool shown here is the so-called bridge reamer. It is used for reaming out the holes in steel plates which are to be riveted together. Such holes may have been either punched or drilled, but in either case the degree of accuracy in regard to the size of hole and its location is of a rather low order and when the plates are bolted together preparatory to riveting it will be found that in many cases the two opposing holes do not match. The bridge reamer is used to bring the holes into alignment. It is provided with a taper part small enough at the end to enter the two holes even when there is a maximum of error. The taper part gradually removes the overlapping metal and the straight part then brings the holes to size. Such reamers must be able to stand very rough usage but do not require a high degree of accuracy. Many makes of bridge reamers are not even ground after hardening.

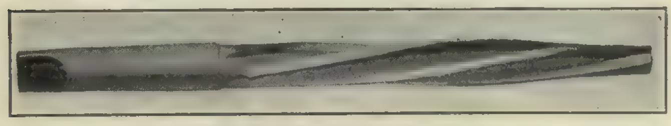


FIG. 295. BRIDGE REAMER

Another standard tool for a special operation is the well-known center drill shown in Fig. 296. As a rule these drills are made double-ended as a matter of economy. Each end consists of a short drill and a countersink.

Many other examples of tools might be found which were originally designed for some special purpose but which have become standardized by the fact that they are in common use in some industry.

Another development caused by the same conditions but along a different line is the introduction of built-up tools. As an example, a counterbore might be cited. A great many combinations of sizes of hole and counterbore are possible, and any shop should be in a position to make any of these combinations. This requires a great many tools and becomes a handicap to the small shop. The built-up counterbore permits of making unlimited combinations with a few standard tools. Fig. 297 shows such a system of built-up counterbores as made by the Pratt & Whitney Co. The elements of such counterbores are the pilots, the counterbores and the shanks. This is going a step further than merely providing for the various combinations of sizes of holes and counterbores, by making allowance for the use of the tool on various machines.

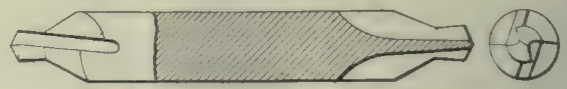


FIG. 296. CENTER DRILL

A development along still another line is found in the tools with adjustable or interchangeable tool points or blades. The well-known lathe or planer toolholder such as the Armstrong, Lovejoy, O. K., Ready and Williams are instances of this development. In recent years this method of using interchangeable blades has been somewhat extended in other fields. In some cases provision is merely made for the removal of old and worn out blades and the substitution of new ones. In other cases a large part and generally the most expensive part of the complete tool is provided with a number of interchangeable blades to be used for various sizes or purposes. The Gisholt reamer, illustrated in Fig. 298, allows for the renewal of the blades and permits, to a certain extent, also of using the same body for more than one size. However, as a rule this tool is merely made with an eye to the renewal of the blades and not for the purpose of making it universal for all sizes. On the other hand, tools like the Davis boring bar or the Kelly reamers are constructed with the view of using simple tools of various sizes in a holder so

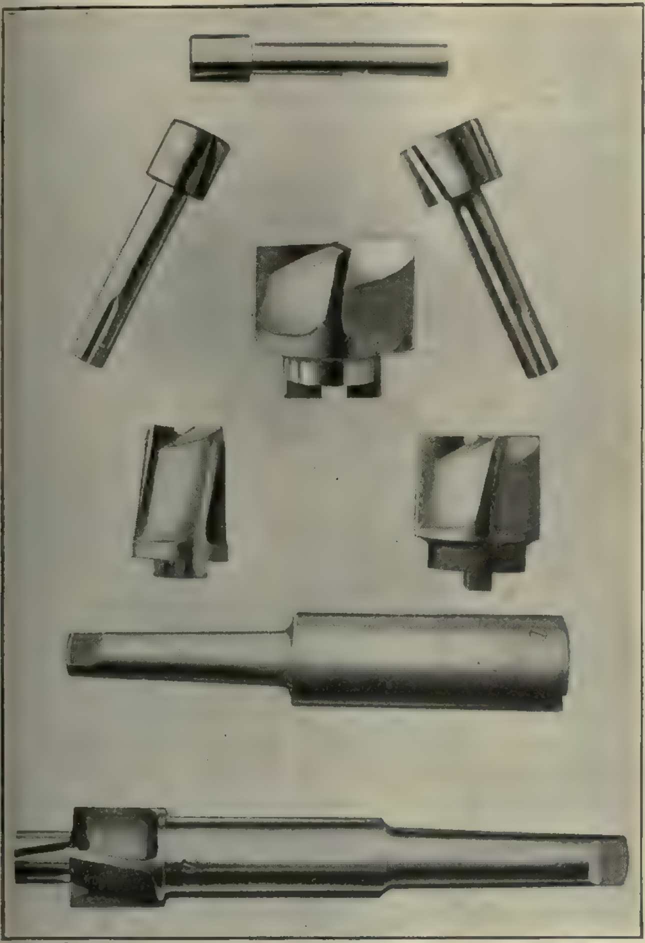


FIG. 297. BUILT-UP STANDARD COUNTERBORE

constructed as to permit of the ready adjustment of inserted blades. Some of the Davis boring bars have been illustrated in the chapter on boring tools.

Fig. 299 shows a Kelly floating reamer and Fig. 300 a complete outfit of reamers and bars as furnished by the Kelly company to meet the demand for all sizes from 1 to 5⅝ in. A few holders or bars and thirty-five sets of roughing and finishing tools make combinations possible for any imaginable size between the outside limits. This result is reached by the interchangeability of the tools in the bars and by the fact that each tool has an individual adjustment of ⅛ inch.

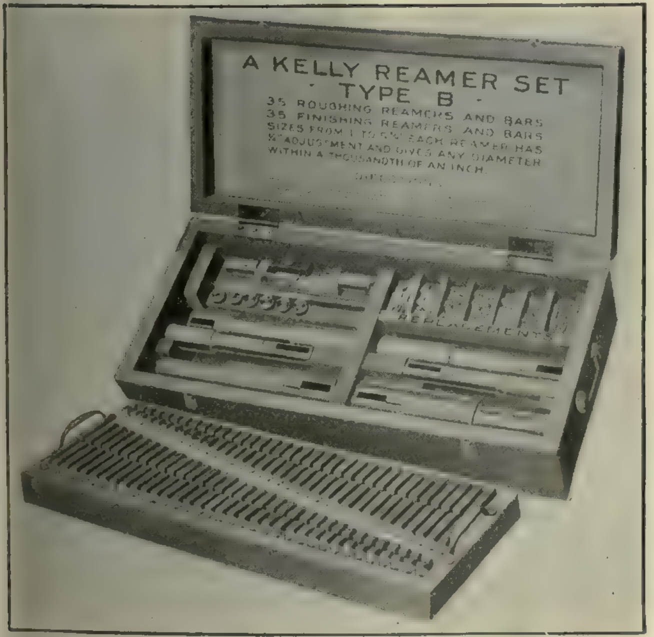

A KELLY REAMER SET
TYPE B
35 ROUGHING REAMERS AND BARS
35 FINISHING REAMERS AND BARS
SIZES FROM 1 TO 5⅝" EACH REAMER HAS
⅛" ADJUSTMENT AND GIVES ANY DIAMETER
WITHIN A THOUSANDTH OF AN INCH
REPLACEMENTS

FIG. 300. COMBINATION REAMER SET

Standard outfits such as the one shown above are of rather recent origin. Until relatively a few years ago the machine shop used either standard tools with practically no adjustable features or tools constructed by or for them and adapted to some special operation only. The new line of adjustable tools is the result of the advance in manufacturing methods. The most advanced methods of manufacture, at least so far as production goes, were naturally found in shops where quantity manufacture was carried on. Gradually it began to be recognized that such methods could be employed even where the quantities were not so large as to justify the making of expensive special tools. The result was the gradual introduction of adjustable reamers, milling cutters with removable blades, multiple planer toolholders, threading dies adapted to a number of sizes, boring bars and combination tools.

A milling cutter which has the feature of ready adjustability of the cutting blades is shown in Fig. 301. The blades are grooved and are held in position by a grooved wedge. After resharpening this cutter a number of times and when the point has been reached where the blades do not project a sufficient amount beyond the body, the wedges are knocked out, the blades advanced one or two notches, and the wedges reinserted. This cutter is made by the Lovejoy Tool Company.

It is well to remark here that one should not expect too much from such adjustable tools. It is a disappointment to some people that a reamer must be resharpened after the blades have been set out, yet it is not reasonable to expect that this will not be necessary. With adjustable boring bars it may be perfectly proper to take a cut after the blades have been adjusted and without resharpening, but for a roughing cut only. To get the best results with a finishing cut it is advisable to resharpen the tool. Even with such tools as an inserted blade milling cutter one must not expect good results unless the cutter is sharpened as a whole. It is possible to take a cut without doing this, but the feed would have to be much reduced and the cutter would dull much sooner.

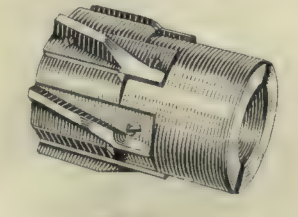


FIG. 298

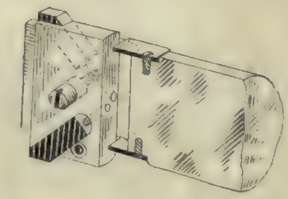


FIG. 299

FIG. 298. GISHOLT REAMER. FIG. 299. KELLY REAMER

In the chapter on reamers attention was called to the advantages of the spiral reamer. A peculiar adaptation of the principle is found in the taper pin reamer as made by the Gammons Holman Co. (see Fig. 302), which resembles a small helical mill and has, in fact, the same general action.

The small milling cutters used in the Anderson die cutting machine are another adaptation of the helical mill. They are shown in Fig. 303. In this case they are used as true milling cutters; they are so small and inexpensive that they are not supposed to be resharpened.

Fig. 304 shows a milling cutter particularly adapted to slotting and of a construction somewhat different from that recommended for this purpose in the chapter on milling cutters. The general underlying principle, however, is the same. Alternate teeth cut the sides of the slot and besides are set at right- and left-hand spirals so as to have rake on the side which is being cleaned up. Such cutters are well adapted to the purpose, provided no very heavy cuts are taken. Heavy cuts have a tendency to move the cutter back and forth on the arbor, and to cause a rough finish. For moderate sized slots they are quite successful.

An interesting boring tool is shown in Fig. 305. It is made by the Skelton Tool Co. As will be seen from the illustration it can be ground an almost unlimited number of times and will always present the same cutting angle by grinding it on the face. Such tools have been used by the writer for a number of years either before the Skelton tools were brought out or at least without knowledge of their existence. The advantage of this tool over the customary construction must be obvious. In the ordinary construction we have a small bar with a still smaller piece of tool steel inserted in it, which must necessarily be very frail and can only be held in that bar by some small set screw or similar delicate construction. On the other hand, the Skelton tool is made all in one piece and does not need to be of delicate construction as it can be made almost as large as the size of the hole to be bored. It might seem that the first-mentioned construction has the advantage of an adjustability which the Skelton tool does not possess, but this is only apparently so. In the first place, it is exceedingly difficult to set out a delicate tool point to a predetermined diameter. It becomes a matter of trying and re-trying and measuring of the hole. The Skelton tool calls directly for the kind of construction which should be furnished for every boring bar, namely, an adjustable slide or holder. The amount of adjustment required after grinding is exceedingly small, as the reduction in diameter is merely due to the taper of the tool, so that if a few thousandths are ground off the front of the tool there may be a reduction of ¼ to ½ of a thousandth in diameter of the hole.

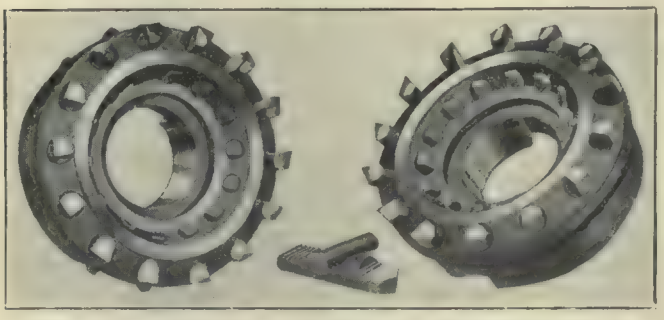


FIG. 301. LOVEJOY ADJUSTABLE MILLING CUTTER

Another tool which is rather out of the ordinary is the one shown in Fig. 306. It was constructed by the author with the idea in view of testing out the possibility of making tools with very fine contained angles. Such tools are particularly useful for finish turning long and slender work, provided that it does not have to come up to a square shoulder. The tool is merely a round piece of steel cupped out at the top and provided with a shank and shoulder. The shank fits in the top slide of the lathe and is held in position by a setscrew. The upper part is turned taper so as to provide the clearance angle. The writer has used these tools with a contained angle of 27 deg., which is very much below the corresponding angle of ordinary lathe tools. A tool of this description with such a very fine angle must, of course, be free from all vibration. The slightest vibration would break out the cutting edge, and for that reason it is not set in a long, projecting toolholder but direct into the heavy casting of the toolslide. Though it is true that such a tool cannot stand vibration, on the other hand it is also true that such a tool does not cause vibration.

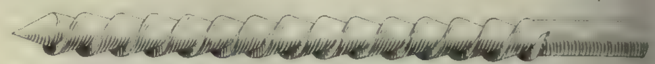


FIG. 302. TAPER PIN REAMER RESEMBLING SPIRAL MILL

The cutting action proceeds very smoothly and though relatively fine finishing cuts may be taken the chip will come off in a continuous ribbon without breaking up, showing that there must be a complete absence of vibration. Work which would require a back rest, if cut with an ordinary tool, can be cut without a back rest with this tool, and it will be found that there is an almost complete absence of spring in the work. This is clearly shown by the fact that there is practically no difference in size between the ends and the center of the work. The sharp angle of the tool causes it to work with very small power consumption, which explains why it does not break down at once. When the cutting edge becomes slightly dull it is liable to crumble. However, all that is necessary is to loosen the setscrew, turn the tool through a slight angle, and tighten up again, and a new part of the tool is being presented to the work.

The tool with which the writer experimented was 1¼ in. in diameter, so that its circumference was almost 4 in. When taking a cut 0.030 in. deep about 0.195 in. of the circumference was in action, so that theoretically it would be possible to shift the tool sixteen times before it was entirely out of action. However, when shifting this way it is not necessary to reset to diameter; so that the operation of changing over is a very short one. To regrind the tool, all that is necessary is to take some off the outside, in other words, reduce its diameter slightly. It was found that fairly heavy cuts can be taken at ordinary speeds, and that light cuts can be taken at very much increased speeds, due probably to

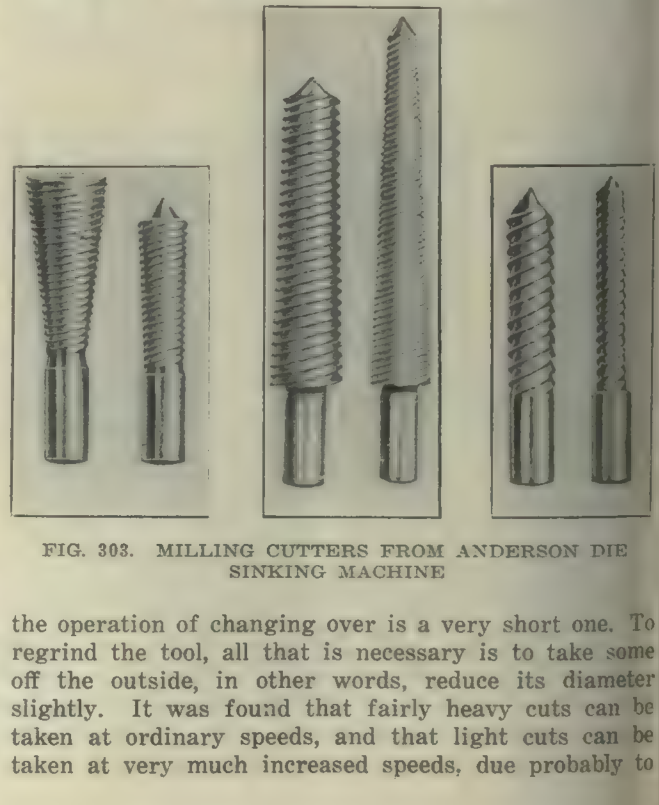


FIG. 303. MILLING CUTTERS FROM ANDERSON DIE SINKING MACHINE

the absence of vibration. The possible speed was still further increased by running a copious stream of lubricant onto the work. The little cup on top of the tool was always filled with lubricant, thus cooling the chip after it came off the work and assisting materially in the general cooling action. A tool of this description might be made with a much extended shank and provided with, say, a worm wheel driven by a worm, so as to give it a rotating motion. In this manner no single point of the cutting edge would be kept in contact with the work for any length of time and it would be possible to obtain even higher cutting speeds or, if keeping the same cutting speeds, to make the tool stand up much longer.

CONCLUSION

The great improvements which have been made in machine shops in recent years have been mainly in machinery, handling devices and systems of control. Though many improvements have also been made in cutting tools, yet a wide field has been left for further development. Whatever improvements have been made so far, outside of the great change caused by the invention of high-speed steel, have been in the nature of toolholders, of combinations of tools and of means for handling and adjusting them; the tools themselves have changed very little from what they were a generation ago. This is probably caused by the fact that our present-day tools are the result of slow evolution. Our planer, lathe and boring mill tools have developed from the old-time hand tools by such imperceptible stages, and the machines on which they were used have developed with them in such perfect unison, that there was never the need of developing tools along entirely new lines. When a new method of machining was invented requiring at the same time a new machine and a new tool, then there was a sudden striking development. Instances of this kind may be found in the gear and thread hobbing machines. The entire operation was new, and machine and tool were developed together. But in the lathe, boring machine or planer such need did not exist and the tools are still what they always have been with hardly any apparent change.

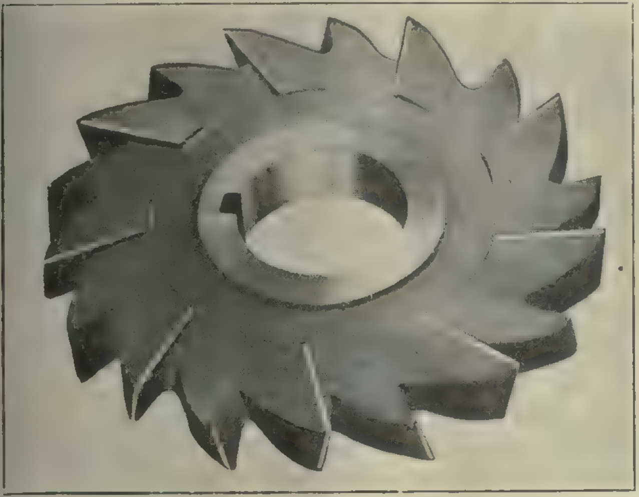


FIG. 304. SLOTTING CUTTER

We are all aware of the fact that nothing limits the performance of a tool so much as overhang, and yet our lathes and planers are so constructed that there is no possibility of avoiding this injurious feature. Nor do we have any means of setting a tool in a lathe to diameter or to height or to the proper angle. In short, we still depend entirely on the skill of the individual operator for the correct setting of his tool. Human inertia is still holding up the use of machines for the correct sharpening of planer and lathe tools and, in all probability, such tool-grinding machines will be the exception rather than the rule in the average shop until the machine in which the tool is to be used has been provided with means for setting it so as to make the proper use of the proper angle.

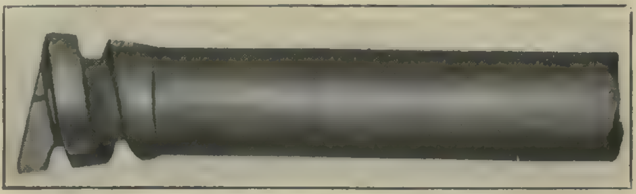


FIG. 305. SKELTON BORING TOOL

There has been an unlimited number of improvements and developments of metal cutting tools, but not in the line of their essential requirements. It might be asked what are the essential points which should be improved. To answer this question we must forget for a moment all practical considerations and place ourselves in fairyland where all our wishes will be fulfilled and where no difficulties and obstacles exist; and this is the kind of metal cutting tool we would get in fairyland, provided that fairies know what metal cutting tools are:

The tool would require very little power to remove a given amount of metal. In fact, no power would be required at all except that which is necessary for the separation of the chip from the work.

The pressure exerted by the tool against the work would be so slight as not to cause any perceptible spring, and as a consequence, machine tools could be of very much lighter construction and easier of manipulation, without danger of distortion or vibration.

Tools would be made with very small contained angles, and yet would not break down under the cut.

Unlimited speeds would be permissible.

Feeds would only be limited by the depth of scallops we would get in the work and, this being a matter of geometry, it would be beyond the power of even the fairies to change this.

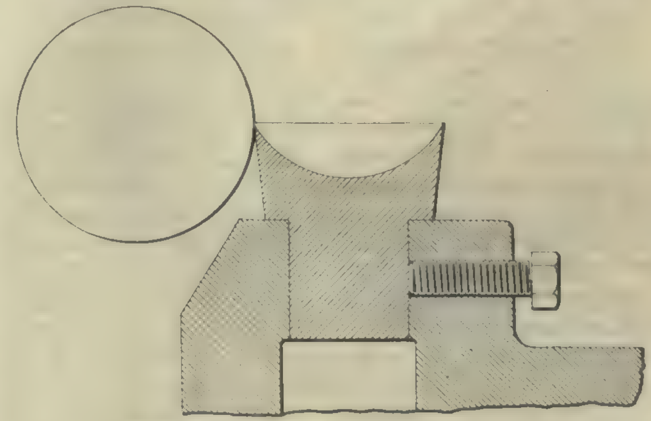


FIG. 306. CUPPED TURNING TOOL

Of all these desirable things but a very small portion has come to us. It still takes an inordinate amount of power to remove metal; it is still impossible to make metal cutting tools with fine edges; we still must make machine tools excessively heavy and clumsy in order to minimize the effect of our clumsy cutting tools.

Except what the invention of high-speed steel has done for us we have made but very little progress along the lines of speeding up. With the exception of the effects of stream lubrication in milling, and the rotary lathe tool, no experiments along this line are known to the author. And yet there is no real reason why metal should not be cut as fast as wood and the limit of the speed with which wood can be cut is merely the limit of speed of the machine and the requirements of balancing. It might be said that there is such a limit in metal cutting because a tool becomes too hot, but we must not forget that the tool becomes hot because of the faulty conditions that still exist in the tool.

There are but a few recent developments which can be mentioned here as being improvements in the essentials of cutting tools. Among them are the developments of the Gun tap, the Bath finishing tap, the Vauclain twist drill in which the central web is no longer the cause of crushing of metal at the center of the hole, and the wide spaced milling cutters. Beyond this all other developments and improvements have been along the lines of manipulation, setting, combination, etc. And though we should be thankful for all such improvements and should look forward to more of them, yet the real field of improvements in metal cutting tools by careful analysis of their elements has barely been touched.

Notes on the Design of Shaving Tools

By HUGO F. PUSEP

(Continued from last week's issue.)

IN DESIGNING dies for shaving only a part of the contour of a blank the designer will have to analyze each problem separately. It is to be assumed in the first place that if a blank is to be shaved, there is reason for accuracy and interchangeability. Also, that a common blanking die has been employed for producing the blanks and therefore as the blanking die wears or is ground at each resharpening the blanks will naturally vary somewhat along their contour. This probable variation must be taken into account while designing the shaving dies so as to allow for the proper balancing of the shaving operation.

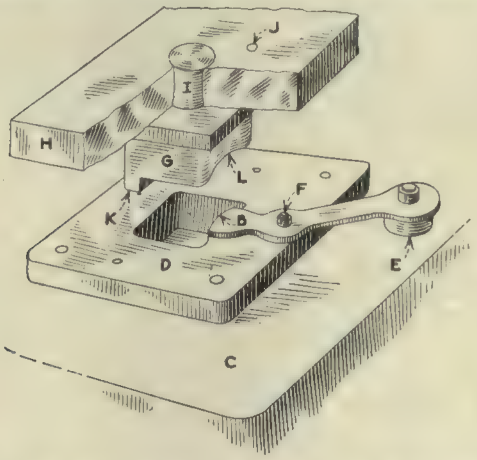


FIG. 6. DIE FOR SHAVING A PART OF THE CONTOUR

One of the most simple dies for shaving part of a contour is shown in Fig. 6. The blank *A* is the product of a progressive die and therefore has the two holes already pierced. In this case the pierced holes are used for locating the blank for shaving the contour *B*. Wherever pierced holes can thus be utilized they afford an excellent method of always keeping the shaved contour in correct relation to the rest of the blank.

Although the die shown in Fig. 6 is somewhat simple, it has all the characteristics of any shaving die of this type. The cast-iron die-shoe *C* has on its upper face a hardened tool steel insert *D*, screwed and doweled into a milled pocket. A shouldered stud *E* set into the die-shoe, and the pin *F* driven in the insert, form the locating medium for the blank. The shaving punch *G* is held to punch holder *H* by a drive fit on shank *I* and is further secured by the dowel pin *J*.

The opening in the insert of the die is finished first and, after hardening and correcting it by honing to the degree of accuracy desired, the insert is permanently fastened with the screws and dowels shown. Next the shank of the punch is turned to size and driven into the punch holder and, after machining the punch very near to the size of the die opening, it is sheared into the die.

Before hardening the punch a part of it towards the shaving edge is cut away as shown, leaving a heel as at *K*. The purpose of this heel is to enter the die opening before the shaving edge *L* comes into contact with the blank so that there will be no tendency for the punch to deflect during the actual shaving of the contour *B*, with consequent detriment to the accuracy and finish of the shaved part of the blank.

Balancing the Shaving Operation

Dies that shave a part of the contour of a blank must be designed so that the blank is properly "balanced." A study of Fig. 7 will make this term quite clear. At *A* is shown an abbreviated plan view of the shaving

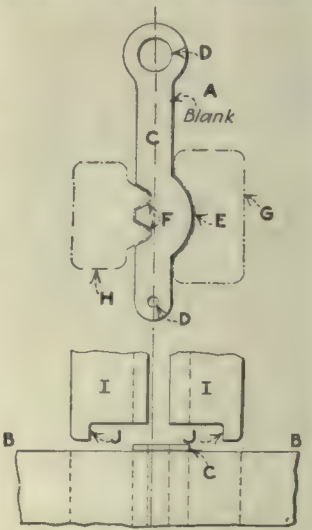


FIG. 7

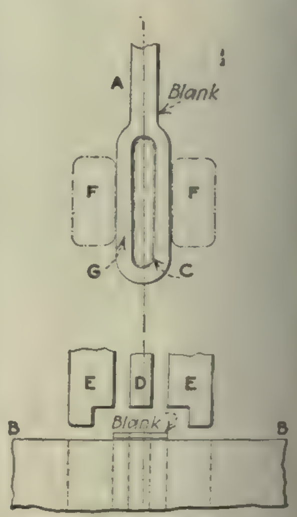


FIG. 9

FIG. 7. A BALANCED DIE SHAVING TWO OPPOSITE PARTS OF CONTOUR. FIG. 9. SUPPORTING SIDE WALLS OF SLOT AGAINST PRESSURE OF SHAVING PUNCH

die and at *BB* a section of the punch and die combined. The blank *C* is located from the pierced holes *DD* and is to be shaved along the circular contour *E* and also around the two notches *F*. Die openings are shown in view *A* by the dotted outlines *G* and *H*. Punches *II* have heels *JJ* which enter the die openings in advance of the shearing edge and guide them during the shaving operation.

In this case the blank is shaved at two opposite points of its contour and is, therefore, not subject to deflection in either direction. Had this blank, however, been shaved on one side only, the shaving punch would have had a tendency to bend the blank away from itself during the shaving. This is especially true after the shaving punch has become slightly dulled. The result of this would be an inaccurate contour after the blank has resumed its original position at the completion of the shaving operation. In this example no such inaccuracy occurs because the two shaving punches *II* "balance" each other and hold the blank perfectly.

In a case where the shaved blank does not balance itself some other method must be used to retain the accuracy of the shaved contour. The sketch, Fig. 8, shows an end of a lever blank *A*, the elongated slot *B* of which is to be shaved. The die opening in this instance is worked out as shown by the dot and dash lines *C*; the shaving punch being also of the same form. Although only the straight sides and the bottom of this slot need to be accurate, the die is so constructed that a shaving cut is likewise taken off the radii *DD*. By making the die in this manner any tendency for the forks of the blank to spread while the slot is being shaved is eliminated.

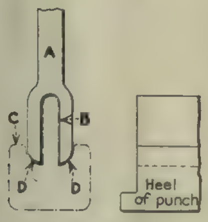


FIG. 8

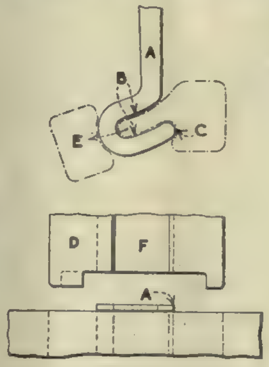


FIG. 10

FIG. 8. ANOTHER METHOD OF BALANCING A SHAVING DIE. FIG. 10. TO PREVENT THE BLANK FROM BECOMING DISPLACED

Shaving Dies with Supporting Punches

The plan view *A* and section *BB* in Fig. 9 show how it is possible to prevent a blank from spreading when a slot *C* or similar contour, the walls of which are comparatively springy, is to be shaved. Here we use three punches; the slot shaving punch *D* and the two supporting punches *EE*. The purpose of the latter is to shave along the outsides *FF* of the slot walls; extra stock being left at these points for the purpose. In this way the slot walls *G* are rigidly confined between the slot shaving punch and the two supporting punches. The cutting edges of all three punches must be ground to the same height, so that they may begin cutting simultaneously.

Sometimes a modification of methods shown in Figs. 8 and 9 must be employed, as will be seen by studying Fig. 10. Here is a hook in the end of blank *A* which must be shaved along edges of the radial slot *B*. The end of the hook is kept from spreading by continuing the shaving cut around the radius *C*. Although this method will prevent the spreading of the hook it will not insure against the blank being pushed bodily in the direction of the dotted arrow. For this reason an additional supporting punch *D*, working in the die opening *E*, is provided. This punch takes a shaving cut along the back of the hook in concert with the slot shaving punch *F*; thereby interlocking the blank between them and insuring accurate results.

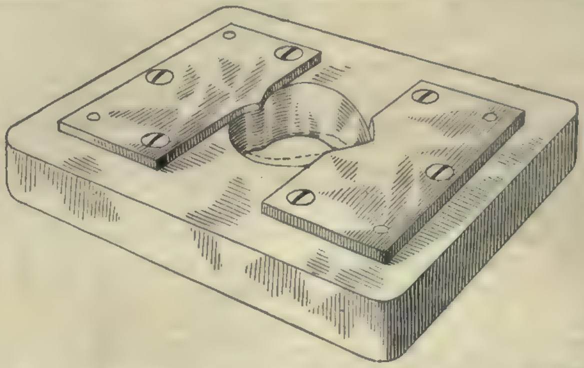


FIG. 11. THE USE OF NESTING PLATES OR SET-EDGES

Various Methods of Locating Blanks for Shaving

What is known as "nesting" a blank is shown in Fig. 11. It consists of two nests, or "set-edges" as they are often called, which are made of hardened tool steel to resist wear better. The die shown in this sketch is of the push through type, the blank being a heart-shaped cam with a central hole. The set-edges are of the same thickness as the blank, and filed to fit the contour of the rough blank at opposite points. Then the screw and dowel holes are transferred from the hardened die and finally the set edges hardened and secured to the die.

While the shaved blank is pushed into the die, the shavings remain on the edges of the die and are brushed off after each stroke of the press. Where compressed air is available, a nozzle set close to the die face and arranged so that it will emit a blast of air as the punch is ascending, will dispose of shavings very effectively. These shavings very rarely resemble a continuous ring, but mostly break up into fragments and therefore seldom give trouble by clinging to the punch. There are some shapes of blanks, however, such as gear teeth or narrow slots along the contour, that will cause the shavings at these points to ride up the punch. Trouble from this source may be very effectively prevented by providing a simple spring stripper that will push the shavings off the punch at each stroke of the press.

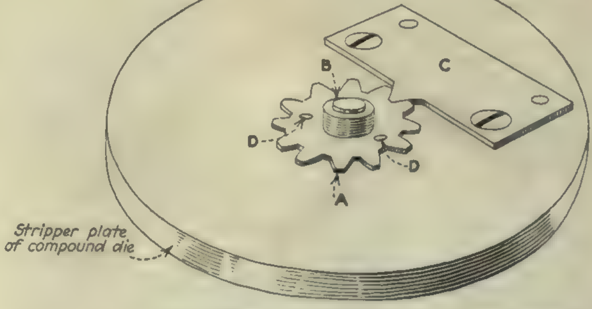


FIG. 12. A LOCATING PLATE ON THE STRIPPER OF A COMPOUND DIE

A safe rule to go by in designing set-edges is to have as little of them in contact with the blank as practical and still be sure of positively locating it. By so doing the loading and unloading is made easy; also the keeping of the die clean during the shaving operation becomes a much more simple task. A study of Fig. 11 shows that while the contact of the set-edges with the blank is a safe minimum, yet the latter is securely held against moving in any direction. It is these minor details that if the designer does not watch them will cause heavier operating expenses and consequently costlier product, if not the loss of markets to the manufacturer.

A method of locating a gear blank for shaving in a compound die is illustrated in Fig. 12. Here the blank *A* is centered over a pin *B* which is a drive fit in the punch. The single set-edge *C* has a projection fitting into one of the tooth spaces as shown. In this way the blank is always lined up correctly in relation to the teeth of the punch. As the holes *D* are pierced simultaneously with shaving the teeth it does not matter which tooth in the blank is used as a locator.

When a blank is comparatively symmetrical in contour it is often impractical to nest it for shaving. Such a blank is shown in Fig. 13. The high point *A* in this case is the only deviation from a perfect circle. The contour of this cam blank will have to be shaved all around; also the hole *B*. In order to do this successfully the following method of procedure is recommended. The rough blank is produced in a progressive piercing and blanking die which pierces the two holes *C C* and the large central hole *B*, the latter being left undersize for a subsequent shaving operation. These locating holes are pierced in order to facilitate the second operation, which is that of shaping the contour of the cam by shaving it all around. In planning the sequence of operations of various blanks it is often necessary to pierce one or two holes for locating purposes. Care must be taken to place these holes in such a position that they do not interfere with the function of the part in the assembled machine.

ADVANTAGES OF TWO SHAVING OPERATIONS ON ONE BLANK

Where smoothness and accuracy in contour are the primary requisites it is advisable to shave a blank twice. As a general rule any blank of half-hard stock and 0.080 in. in thickness or over should be shaved twice, if permanency of shaved contour is desired. For a more thorough understanding of the fundamental reasons for this let us refer to the diagram in Fig. 14. The ragged edge of the rough blank presents a series of irregular ridges, which it is our object in shaving to cut off. If the line *A* represents the finished contour of the blank, then in order to cut off the ridges in one operation we have to take a cut which is represented as of thickness *B* at some points, so that we may eliminate all the torn surface. There is, however, a limit to the thickness of a shaving cut; or in other words, if it is attempted to shave too much at once the resulting surface instead of being smooth, will be more or less rough.

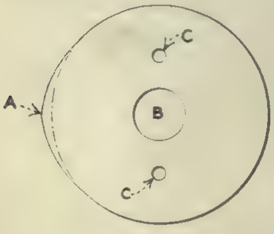


FIG. 13

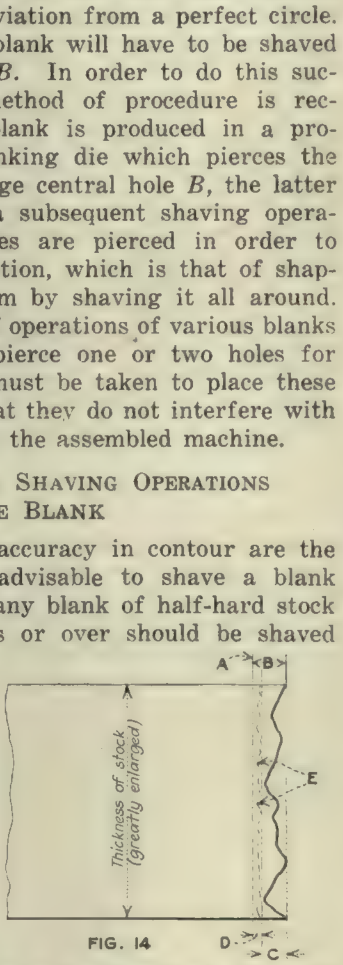


FIG. 14

FIG. 13. ON SOME PIECES IT IS NECESSARY TO PIERCE SPECIAL HOLES FOR LOCATING. FIG. 14. STUDY OF CONDITIONS THAT MAKE SECOND SHAVING OPERATION NECESSARY

The object of the first shaving operation then is to remove most of the stock, leaving only a light finishing cut for the second shaving die. So instead of removing the entire stock *B* in one operation we would have the first shaving die to take the cut *C*, representing about two-thirds of the entire stock to be shaved. The resulting contour, if examined closely, will show some small ridges *E*. When the remaining stock *D* is removed in a second shave the contour of the blank will be left of mirror-like smoothness and finish. With two shaving operations it is entirely possible to shave the contour of blanks ⅜ in. in thickness, and to obtain a finish and accuracy not even excelled by careful milling.

TABLE I

Allowance for one Shaving Operation

MATERIAL	SOFT STEEL	¼ HARD STEEL	½ HARD STEEL	¾ HARD STEEL	HARD STEEL	GERMAN SILVER AND BRASS
Allowance in percentage to thickness of stock	5%	6%	7%	8%	9%	9%

NOTE:– Mimimum allowance for one shaving operation is 0.002

TABLE II

Allowance for Two Shaving Operations

MATERIAL		SOFT STEEL	¼ HARD STEEL	½ HARD STEEL	¾ HARD STEEL	HARD STEEL	GERMAN SILVER AND BRASS
Allowance in percentage to thickness of stock	1st shave	4%	5%	6%	7%	8%	8%
	2nd shave	2%	$2\frac{1}{2}$%	3%	$3\frac{1}{2}$%	4%	4%
Total allowance for two shaving operations		6%	$7\frac{1}{2}$%	9%	$10\frac{1}{2}$%	12%	12%

NOTE I:– Minimum allowance for 1st shaving operation is 0.003
" " " 2nd " " " 0.015

NOTE II:– Wherever a supporting punch is used, allow 9% of thickness of stock for the supporting punch to shave at each operation.

Finishing precision machine parts by shaving is by no means a new industry. Strange to say, however, there is no uniform rule as to the amount of stock to leave for shaving, taking into consideration the thickness of the shaved blank and the quality of material. The first step toward this standardization made, according to the writer's knowledge, was in a form of tables published in the last edition of the "American Machinist's Handbook" where the allowances for one and two shaving operations are given for various grades of steel, etc., up to 0.125 in. in thickness.

In many shops this question of allowances is left to the individual diemaker. Now an experienced diemaker can acquire the knack of leaving just enough for the shaving operation but it is a purely personal knowledge and will have to be learned over again by every would-be diemaker. This process, naturally, means many a spoiled die, which is money thrown away. Even in the tool designing departments of up-to-date factories wide discrepancies occur in shaving allowances specified by different designers.

The accompanying Tables I and II give the proper allowance for one or two shaves. These tables are compiled upon a percentage to thickness of stock basis for different hardnesses of steel and also for german-silver and brass. In this form they can be instantly applied to any stock by performing only one multiplication, that of thickness of a known quality of stock by the given percentage.

As an example: What is the shaving allowance of 0.0625 in. half-hard steel? Answer: 0.0625 x 0.07 = 0.004375. We discard the three last figures because they are equal to less than one-half thousandth. If the figures following the 4 had been more than a half thousandth our allowance would be 0.005 inch.

From the foregoing example it will be seen that the simplest of arithmetic is all that is required. From these tables of percentages other and more extensive tables can be worked out if desired, giving after each thickness of stock the proper allowance in thousandths of an inch. These tables can then be blueprinted and given to individual designers and diemakers

The footnote at the bottom of Table I means that nothing less than that 0.002 in. should be left for one shaving operation, notwithstanding the fact that the calculation shows a smaller quantity. Two thousandths has been found by practice to be about the least amount that can be shaved successfully in one shaving operation. The first footnote under Table II signifies the same thing in relation to a double shaving operation, with the exception that the minimum for second shave is 0.0015 inch.

As the metal removed by the supporting punch is primarily for support only, the allowance for this is made 9 per cent of thickness of stock, regardless of quality or hardness of stock as indicated by second footnote under Table II.

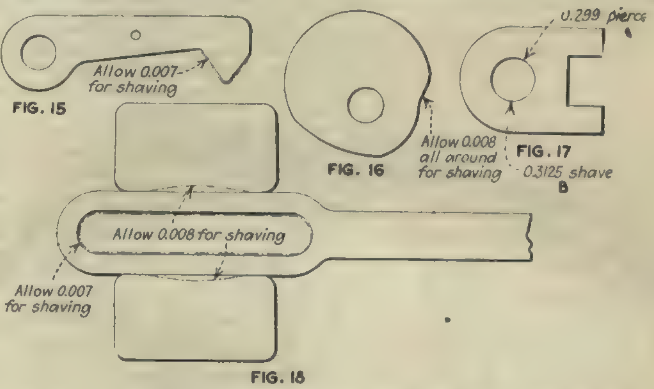
By standardizing the shaving allowances, any quality of finish can be duplicated whenever necessary, and the time lost in arguments between the diemaking department and the drafting room can be used for more productive purposes.

How to Show Shaving Allowances on Drawings

Even with complete tables of shaving allowances in both the designing and the diemaking departments there is always the possibility of misunderstandings unless some uniform method of showing the allowances on die drawings is adopted. Figs. 15 to 18 illustrate several ways of doing this. With slight changes of wording to suit the phraseology of the individual shop they represent fair examples toward uniformity.

Fig. 15 shows a pawl blank with the dot and dash marking where the shave is to take place. An arrow from a note, pointing to this place, will prevent any one from misunderstanding the meaning of the designer. The dot and dash way of showing the part of contour to be shaved is standard in many shops. When a blank is to be shaved all around it is not necessary to inclose it in the dot and dash line, but a note, as in Fig. 16, and the arrow are sufficient.

One of the most common causes of mistake is the way in which the shaving allowance of a round hole is usually indicated. If the blank shown in Fig. 17 is of half-hard 0.093-in. sheet steel and must have a hole pierced which afterward will be shaved to 0.3125 in. in diameter, subtract 14 per cent of thickness of stock from finish diameter of hole and indicate as shown at *A*. Any other note in this case would be misleading. When shaving a hole to size indicate as at *B*.



FIGS. 15 TO 18. METHODS OF DESIGNATING SHAVING ALLOWANCES ON DRAWINGS

The correct way of indicating shaving allowance in an oblong slot is illustrated in Fig. 18. Here the standard dot and dash line is used both for the slot and the allowance for supporting punches.

These few examples of indicating shaving allowances are for the purpose of impressing upon the designer the importance of making his meaning so clear with short and to-the-point notes that there will be no possibility of a misunderstanding; no one disputes the fact that a mistake made in the shop is far more expensive than the one made in the drafting room.

Copper Resources in U. S.

Recently when an estimate of the surplus copper stocks in the United States was requested of the United States Geological Survey, definite information was not available. Since then Director Smith has had the opportunity of examining the production statistics of the copper producers as compiled by their own agency. These include details of the stocks of copper on Sept. 1, and Director Smith reports that these show the available supply of copper, including both the pig copper at the smelters and the refined copper ready for the market, as 405,051 short tons. Nearly one-half of these stocks, however, was held at the refineries in trust for the Copper Export Association for export alone, and is thus not available for domestic consumers. These figures do not include the working stocks of copper in transit and in process of refining, which are now much lower than at the beginning of the year and apparently are reduced to a minimum.

Ideas From Practical Men

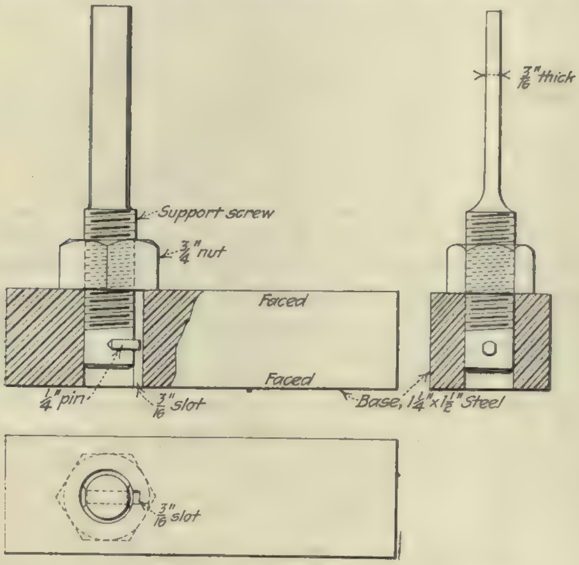
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

A Cutting-Off Tool Support

By Walter Cantelo

The article by A. J. Cawse on page 150 of the *American Machinist*, entitled "Support Your Cutting-Off Tool Solidly," reminds me of a somewhat similar condition I was up against during 1913.

The work being·performed was the manufacture of 4.70-in. shrapnel cases, which were machined complete and then cut off from heat-treated steel bars that had been rough machined to approximately 5 in. in diameter before being heat-treated. The physical qualities of the metal in the bars were about as follows: Elastic limit, 90,000 lb. per square inch; tensile strength, 130,000 lb. per square inch; elongation in two inches, 17 per cent; contraction of area, 45 to 50 per cent.



SUPPORT FOR CUTTING OFF TOOL

The cutting qualities of the metal were much more severe on the tools than would be met in machining annealed tool steel and since the work was done on a piecework basis it was necessary that as little time as possible be wasted on each operation. Among other things that had to be given careful consideration was a method of supporting the cutting-off tool rigidly and as nearly under the cutting point as possible, in order that the power crossfeed could be used and the cutting-off hurried along with little tool breakage.

The form of support finally used for the work was as shown in the illustration. The base was cut off from a steel bar of 1½ in. square section, and after facing it on opposite sides, the hole was drilled to form a sliding fit for the ¾-in. supporting screw, and a slot was cut the full length of the hole to engage the stop-pin in the screw.

The screw was made from a grade of steel that could be oil hardened and tempered, to stiffen it and prevent bending and upsetting as far as possible. A hole was drilled near the lower end of the screw for a ¼-in. stop-pin, and after the pin was driven into the screw, the portion projecting was filed to slide freely in the slot. The nut was made a close fit for the screw and faced on the lower side to reduce springiness to a minimum.

In action, the base rests on the cross-slide of the lathe with the screw directly below the blade of cutting-off tool near the cutting end and adjusted to bear lightly against the under side of the blade.

This form of support gave us fine results and I am glad to pass the idea along for anyone that may care to try it.

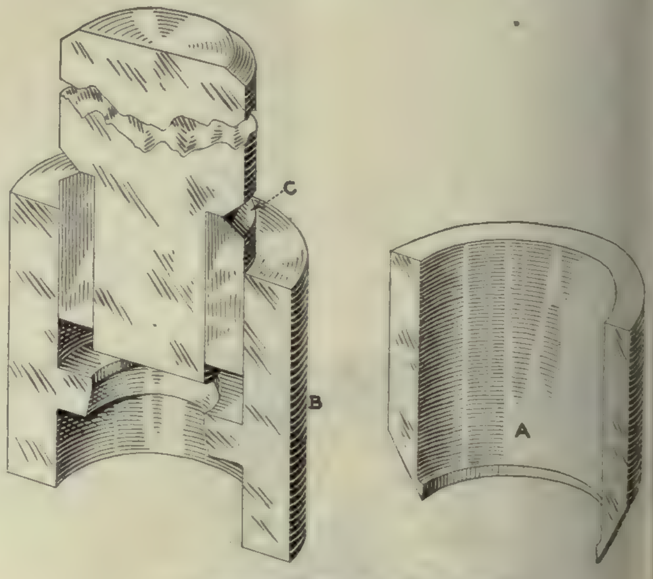
An Improvised Set of Washer Tools

By George Wilson

It not infrequently happens that a few washers of odd size and thin stock—either fiber, metal, or other material—are required for a special purpose, and with no punch press available the job of producing them is a bothersome one. Needing a hundred or so of such washers 1⅛ in. in diameter, 1/32 in. thick, and with a ¾-in. hole, I made the tools shown in the illustration to get them out.

As the material used for the tools was mild steel, case-hardened in the usual manner, and all the work of making them was done in the lathe, the entire cost of the job was less than it would have been for even a makeshift method of making the washers that would not have produced results nearly so satisfactory.

A ring punch *A* was made, with the hole of the correct size to cut the blanks properly, and bevelled upon the outside to secure a keen cutting edge. This was used by laying a sheet of the material upon a babbitt block, setting the punch upon it, and striking with a



IMPROVISED WASHER TOOLS

lead mallet. The hole through the punch was tapered slightly toward the upper end to permit the blanks to pass through easily.

The tool for making the hole in the washers was a little more complicated. A piece was bored as at *B* to fit the blanks and a shouldered punch fitted to slide neatly therein. A shoulder at the bottom of the full-sized hole was bored to the size required for the hole in the washers and the cutting end of the punch fitted to it, leaving about 0.003 in. clearance. This hole was also tapered slightly toward the bottom to allow the punchings to go through without sticking.

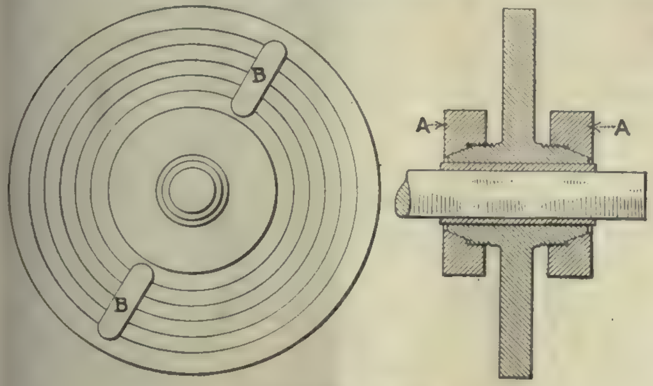
To strip the washers from the punch, the sleeve *C* was made to fit over it. The corners of the shoulder of the punch and the upper end of the sleeve were bevelled to allow for the insertion of a screwdriver, by which means the washers were easily stripped off the punch without bending them.

The device was used in an arbor press and completed the job very quickly and satisfactorily.

A Balancing Disk

By P. H. White

The balancing of high-speed rotating parts is an art which determines in a large measure the smoothness with which the completed mechanism will run. The standing, or static, balance, may be accomplished very simply by mounting the part on its shaft and placing the latter upon parallel straightedges as is ordinarily done with pulleys and flywheels. To obtain the proper running balance, the disk shown in the accompanying illustration has been designed.



BALANCING DISK

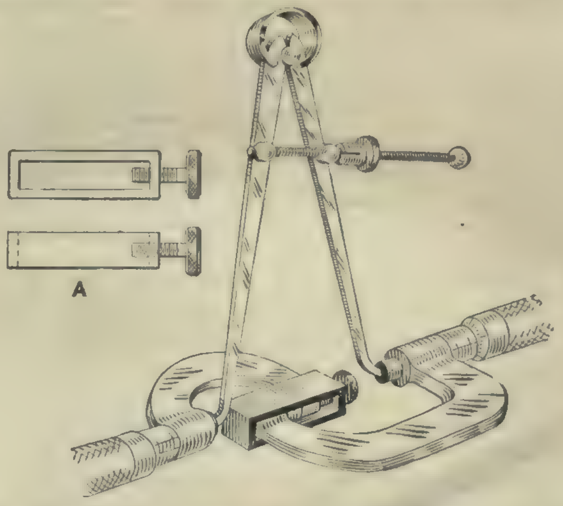
In using this disk it is necessary, of course, that the device itself be in perfect running balance and that it be mounted concentrically with the axis of rotation of the part to be balanced. As shown in the illustration, the disk is made with a projecting hub on each side which is bored out to the desired size to form a turning fit on the shaft which is being balanced. The inner part of the hub is threaded to take the nuts *AA*. The outer ends of the hub are tapered, as are also the outer end of the bore of the nuts. Both ends of the hub are split in four places to allow them to spring slightly. By tightening the nuts, the tapered portion forces the ends of the hub tightly to the shaft.

The two radial slots *BB* are used for clamping the necessary balancing weights. The concentric rings marked on the face of the disk serve to locate the balancing weights at a given distance from the axis. By using split bushings the disk may be adapted to several different sized shafts.

Setting Inside Calipers Accurately

By Earl Stevens

To set inside calipers accurately for measurements above 2½ in., given a 1- and a 2-in. micrometer, it is only necessary to make the small clamp, shown at *A* in the sketch, to hold the two frames together. The clamp is simply a piece of ⅜-in. round cold-rolled steel with a suitable slot to slip over the frames, and a setscrew to supply the clamping pressure.



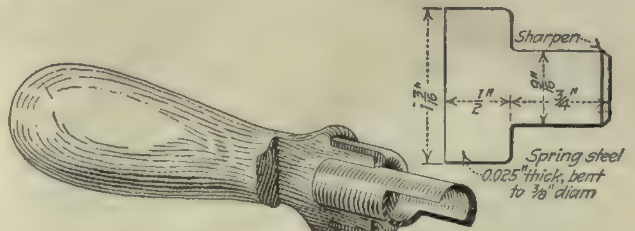
USING TWO MICROMETERS TO SET INSIDE CALIPERS

Cutting Index Marks in Handbooks

By John S. Carpenter

When I want to use a handbook, I usually want to find the place quickly and I haven't time to wade through a table of contents at the back of the book. Some time ago, an ingenious friend of mine made a punch for cutting semi-circular index marks in the edge of a book so one can find the place very quickly and also make an index to suit his own peculiar needs. As shown in the sketch, the device consists of a file handle with a good ferrule and an inserted cutter made of thin spring steel. One edge is to be sharpened and that from the inside of the curve, in order to do a neat job of cutting. Having drawn the temper and shaped out the cutting piece, sharpen the edge and bend the cutter around a piece of ⅜ in. round rod. Then re-temper and insert in handle. The cutting edge will have to be touched up slightly, for it must be sharp.

In cutting the index marks, open the book to the place wanted and insert heavy fiber paper to cut on. Slope the edge of the book so that when you cut through the pages by means of light blows of the hand on the handle, you cut vertically. When you index your book, cut the marks so that they all face toward the front of the book.



DETAILS OF PUNCH

EDITORIALS

The Metric Bill Once More

HEARINGS have been held in Washington by Senator McNary on Senator Ladd's bill to make the metric system compulsory after ten years. Pro- and anti-metric enthusiasts are going through once again the arguments for and against this system of measurements which commends itself to many by reason of its decimal divisions.

As we see it, little can be added either way to what has already been said regarding the merits of the metric system. What the Senate committee must decide is whether or not it is possible by legislation to force the adoption of a system of weights and measures of which more than nine-tenths of the American people are utterly ignorant. We have seen several attempts to enforce laws and even constitutional amendments passed by reason of the organized activity of a vociferous minority. The result has not been an unqualified success and the expense has been stupendous.

If this bill passes it must overcome not only the passive resistance of the great mass of the people but also a very active organized resistance on the part of those who are bitterly opposed to it. The experience in other countries which have tried to force its adoption by legislation should point a lesson to our own legislators.

One other point deserves mention. Congress has been sitting in special session for some months now to pass vitally important taxation, tariff and transportation bills. So far no results have been obtained worthy of mention. The people of the country are growing restless under the delay and the Congressman with his ear to the ground will hesitate to take time from important business to consider such a doubtful plan as the overturning of our long-established system of weights and measures. It would seem that the metric advocates were ill-advised to push their program at such a time. There are many, however, who will shed no tears if the Ladd bill dies in committee.

Is Your Coal In?

SOME weeks ago we recommended to manufacturers the immediate purchase of at least a large part of the winter's coal supply. Later developments indicate clearly that we were right. The man, or the company, who has not three months' supply in his storage pile is quite likely to wish that he had before the winter is over.

The threatened railroad strike, if it is carried through, can make a bad matter very much worse. According to the prophets all signs point to a severe winter. And last but not least, the possibilities of an early and amicable settlement between the coal operators and the miners of the inevitable differences over the new wage schedules, are remote. Next spring both anthracite and bituminous contracts expire together. Is it necessary to say more?

Our purpose in publishing these lines is not to shout, "I told you so," but to urge action if and when the rail strike has passed into history, before another calamity befall.

An Ill-Advised Strike Order

THE universal condemnation of the order to tie up the railroads of the country by a nation-wide strike of the brotherhoods should be food for thought for the men who called it. People have not forgotten how the Adamson law got on the statute books, nor have they forgiven those responsible.

Aside from the merits of the trainmen's case, which are visible to but few outside the union ranks, the wisdom of calling a strike at a time like this is open to grave question. If, as some labor men claim, there is a conspiracy on the part of the railroad executives to crush the unions, then the unions are certainly playing straight into the hands of the enemy by taking a position which alienates public sympathy so effectually.

It is extremely unfortunate that such an attitude exists between the men and the railroads, for it can more than undo all the good that has been accomplished by the efforts of President Harding and Mr. Hoover to bring capital and labor together to discuss the common dangers in the unemployment situation. Not only this, the crippling effect of a transportation tie-up on our slowly reviving business would be a setback that would take months to recover from.

We find it hard to believe that there is not a certain element of bluff in the statements made by both sides. The executives who are talking about a fight to a finish must realize that even if they won such a fight they would not be far from a finish themselves when it was over. Their finances now are in a precarious condition. What would they be after a strike?

On the other hand the labor leaders have admitted that public opinion would be against them. They must know that a strike has never been won permanently in the face of that same public opinion. Add to this the fact that they are striking against a decision of the Railroad Labor Board, the governmental body legally appointed to arbitrate wage controversies, but without power to enforce its decisions, and their situation certainly appears to be most unsound.

As this is written there are rumors that some sort of a settlement is in sight. We sincerely hope that they may be well founded and that before we go to press the strike will have been called off. It will be a dark winter indeed if men do not come to their senses soon.

What Are the Worker's Prospects in the Machinery Building Industry?

UNDER this title we show on another page a set of curves giving wage rates at various ages of boys starting in work in a machine shop and a letter describing them. Two series of curves are included, one for boys with college or technical school educations; one for boys without. The author concludes that, for the average boy, a college education is more of a hindrance than a help as far as earning a living in the shop is concerned. This conclusion is certainly open to question and we hope to hear from those of our readers who have strong opinions on the matter.

Shop Equipment News

"Ohio" Constant-Speed-Drive Milling Machines

The Oesterlein Machine Co., of Cincinnati, Ohio, has recently introduced to the market a complete line of milling machines of the constant-speed-drive or all-geared type. The line consists of No. 1, No. 2, No. 2 heavy, No. 3, No. 3 heavy and No. 4 sizes, each size being made in both plain and universal types. Fig. 1 shows the No. 2 plain machine, and Fig. 2 the No. 3 heavy-duty universal one. The maker states that the fundamental idea underlying the development of the design has been to produce a machine with all of the features essential to modern milling practice, but to secure these features by reducing the number of parts to the minimum and increasing the strength of the necessary parts to the maximum.

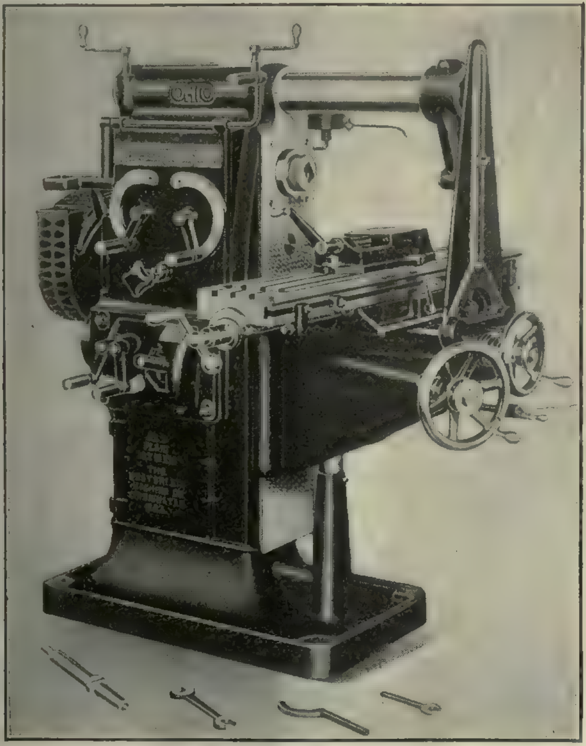


FIG. 1. "OHIO" NO. 2 CONSTANT-SPEED-DRIVE MILLING MACHINE

The speed-change mechanism consists of but fifteen gears, from which sixteen geometrically arranged speeds are obtained. Only one shaft is employed in addition to the spindle and the pulley shaft. In obtaining eight of the spindle speeds, power is transmitted through a three- or four-gear train, but no quadrants or similar mechanisms are employed for any speed. This simplification of the speed mechanism is said to give a low power consumption in the machine. The no-load power loss of a No. 2 machine varies from 0.18 to 0.30 hp. between the extreme spindle speeds of 16 to 384 r.p.m. This power loss is stated to include that in the feed box set at the highest rate of feed, and in the feed mechanism within the knee, and may, therefore, be regarded as practically the entire no-load power loss.

The speed changes are secured by means of two two-position levers and a four-position knob, the latter controlling the selection of four adjacent spindle speeds. All speed changes may be made without stopping the machine. All gears in the machine are made from low-carbon forgings and put through an annealing, carburizing and hardening process that is said to produce a surface so hard that it cannot be filed, and a gear so tough that it cannot be broken with a machinist's hammer. All gears are sandblasted to remove furnace scale.

The automatic lubrication of the machine is effected without pumps or any extra moving parts, employing a system of three reservoirs. The first reservoir is cast in the top of the column beside the overarm. Into this fresh oil is poured. The oil seeps through felt and down tubing both to cavities cast under the main spindle bearings, and to the intermediate shaft bearings and to the driving pulley. Wicks dip into the cavities under the spindle and carry oil to the bearings proper.

It will be seen that only new oil is admitted to the bearings that are heavily loaded. The oil that passes through these bearings collects in the second reservoir below the pulley shaft, where it is distributed to the speed gears and minor bearings by splash lubrication. The overflow from the second reservoir passes to the third reservoir, which is the feed box. The feed-box parts are oiled by splash lubrication.

The capacity of the first reservoir is sufficient to supply the machine for about two months of ordinary service, it is said. Provision is made for correcting

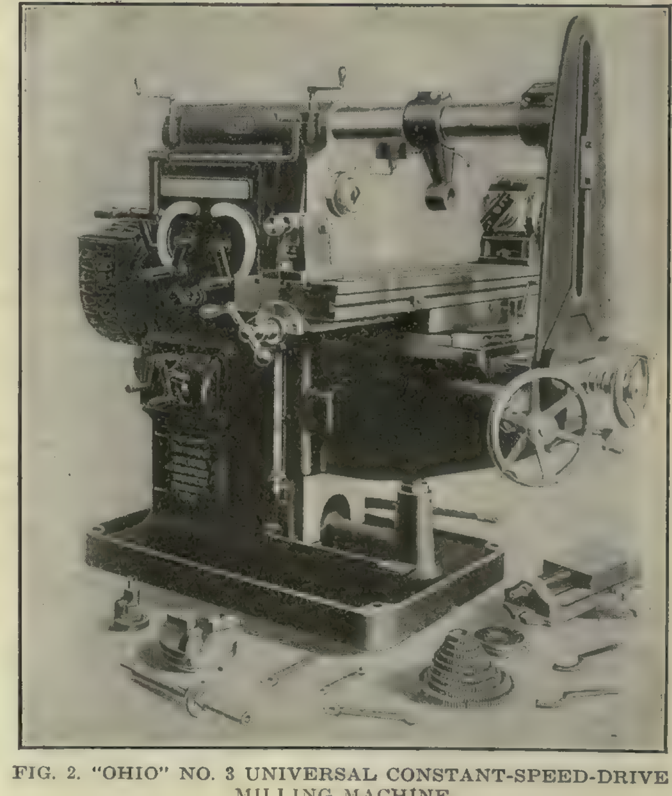


FIG. 2. "OHIO" NO. 3 UNIVERSAL CONSTANT-SPEED-DRIVE MILLING MACHINE

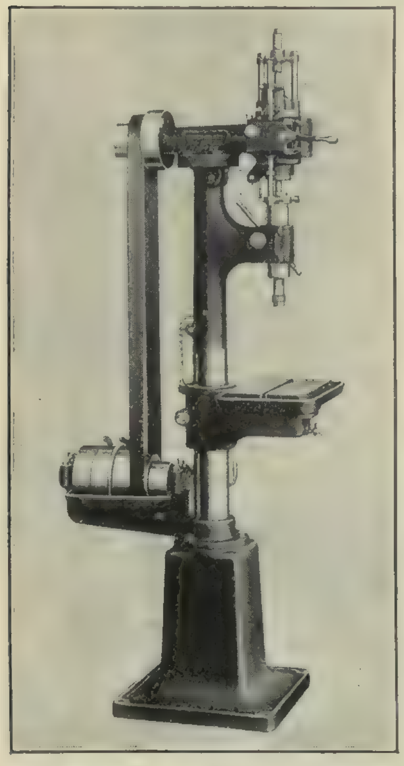
the level of oil in the third reservoir, should this level decrease. This replenishing is accomplished by adding new oil, and is necessary not more than twice a year.

The driving pulleys are 14 in. in diameter and run at 400 revolutions per minute. Use is made of the high belt velocity by controlling the operation of the machine by tight and loose pulleys, thus avoiding the necessity of a clutch. A brake for quick stopping of the spindle is incorporated in the belt shifter in such a way that the belt is partially carried to the loose pulley and the brake applied to the tight pulley by a spring plunger release.

The feed box is driven off the pulley shaft, producing feeds in inches per minute. The feed box, knee and table are similar to the design previously developed by the company and used in its cone-type milling machines. A phosphor bronze of from 28 to 32 points scleroscope hardness is used for all bearings and feed nuts throughout the machine.

Cincinnati Hy-Speed Machine Co. Automatic Tapping Machine

The Cincinnati Hy-Speed Machine Co., Cincinnati, Ohio, has recently developed and placed on the market a line of automatic tapping machines, shown in the accompanying illustration, and sold under the name of "Hy-Speed." Among the features to which the maker calls attention are the patented spindle lead and automatic reversing mechanism. With the use of the spindle-lead device, the tap is brought forward and returned in a positive way, without the necessity of attention from the operator. It is said that the hole is tapped accurately without danger of stripping the thread or breaking the tap. One half turn of the stop plunger at the side of the control handle changes from semi-automatic to fully automatic operation. When set for semi-automatic work, the spindle travels forward, reverses automatically and stops at the end of the return stroke. To start forward again, the operator pulls down the control lever. When set as fully automatic, the stop plunger is withdrawn and the spindle then automatically reverses at each end of its travel. The spindle can be stopped at any point, reversed, and again brought forward by the use of the control lever.



"HY-SPEED" AUTOMATIC TAPPING MACHINE

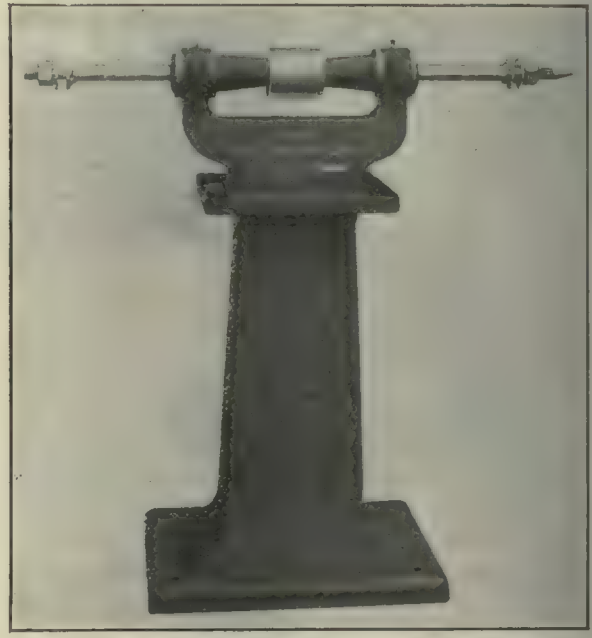
Adjustable trip dogs with limit stops on the trip rod regulate the depth of tapping. The chuck is driven by a clutch on the spindle end, and is locked in position. S. K. F. ball bearings are used throughout the machine. The square table has a T-slot. A coolant pump and tank can be attached to the base.

The machine is regularly made for right-hand tapping; but an attachment can be furnished for left-hand tapping, being fastened to the end of the rack sleeve. The machine is built with from one to three spindles in two sizes, the maxamum capacities being ½ and ⅞ in., respectively, in steel. The small machine is equipped with tight and loose pulleys, as shown, while the large one has single-pulley drive. In addition to the floor type, the machine is built for bench use, or equipped with belted motor drive.

Blount Ball-Bearing Buffing Machine

The J. G. Blount Co., of Everett, Mass., has just brought out a line of ball-bearing buffing machines, built in three sizes. The illustration shows the No. 5 machine, which is of the medium size.

The machine is very similar to the regular style of buffing machine made by the concern, but is equipped with S.K.F. ball bearings in dust-proof mountings. The bearings are secured to the spindle by light drive fits and also by locknuts. The spindle is of high-carbon steel, ground to size, and balanced before fitting to the head. A taper point is fitted to the right-hand end for use with small wheels.



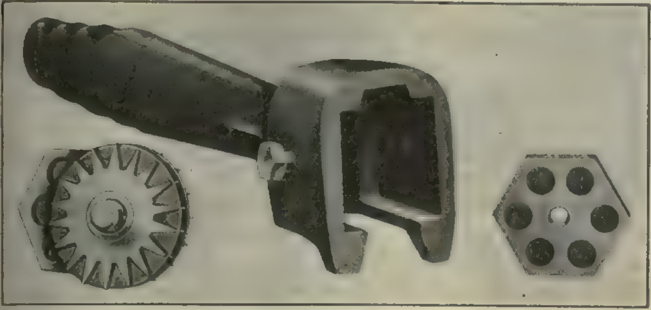
BLOUNT BALL-BEARING BUFFING MACHINE

The head is regularly mounted with the pan on the column, the parts being bolted together. The head can be furnished separate for mounting on a bench, if desired. A countershaft may be furnished in either the regular self-oiling type, or with Hyatt roller bearings.

Desmond-Hex Grinding-Wheel Dresser

The Desmond-Stephan Manufacturing Co., Urbana, Ohio, has recently brought out the Desmond-Hex grinding-wheel dresser, the principal feature of which is the fact that it provides a number of interchangeable bearings for the pin carrying the cutters. It is stated that the chief weakness in the type of dresser formerly made, which carried the pin or spindle in hardened steel bushings mounted in the handle, is that the bushings eventually wear and become loose. Although the bushings are replaceable, the holes containing them usually become large, so that the handle itself must be discarded.

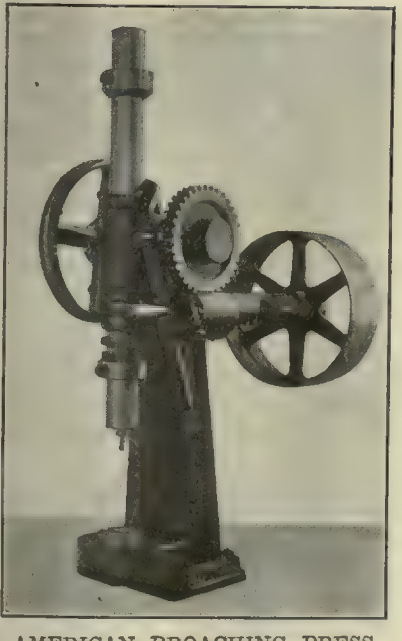
The handle of this dresser, however, is channeled on the inner sides of the head to hold removable, hardened, hexagon nuts having six holes drilled partially through each. The holes in these nuts serve as bearings for each end of the spindle carrying the cutters, the arrangement being shown in the accompanying illustration. Each nut is held in place by a setscrew from the outside that fits a tapped hole in its center. When the holes in which the spindle is running become worn, the nuts are removed by loosening these screws, and turning the hexagon so that the next pair of holes comes into use, the spindle being placed in them. In this way six pairs of bearings are available with each set of nuts, and the nuts can be replaced when all the holes have become worn.


DESMOND-HEX GRINDING-WHEEL DRESSER

The dressers are made in two sizes, the No. 1 size taking the ordinary standard cutters 1½ in. in diameter, and the No. 2 size carrying seven cutters 2⅜ in. in diameter and being intended for use on large and coarse wheels.

American Broach and Machine Co. Power Broaching Press

The accompanying illustration shows the power broaching press recently placed on the market by the American Broach and Machine Co., Ann Arbor, Mich. The machine is of the bench type. It is operated by a 2½-in. belt on a 10-in. pulley, the pulley revolving continuously in one direction. The power is transmitted through a worm and worm gear of 30-to-1 speed ratio, and thence through a steel pinion and rack. The ram is 2 in. in diameter with the rack teeth cut directly on the back of it. The worm is arranged to automatically disengage at a predetermined point in the stroke, which point is adjustable by means of a collar at the top of the ram. The return of the ram is effected automatically by means of a weight and cord, the latter being wound in a groove in the periphery of the handwheel. The machine has a stroke of 14 in. The bore in the table is 2½ in. and is central with the ram. The machine is suited for operating push broaches, for pressing mandrels in and out, for pressing in bushings, and for numerous operations often performed by hand.


AMERICAN BROACHING PRESS

Critchley Expansion Reamer with Adjustable Pilot

Chadwick & Trefethen, 32 Bow St., Portsmouth, N. H., has recently placed on the market a style of its Critchley expansion aligning reamer, especially adapted to the reaming of piston-pin holes in automotive-engine pistons when making repairs that involve oversize pins.

In addition to the six blades usual to this type of reamer, the tool carries upon an extension of the body three shoes of such shape that they slide in the same grooves as the blades, although their combined surfaces cover nearly the complete circumference. The shoes form a substantial pilot to center and align the reamer when entering the hole to be reamed. The ends of each shoe are beveled to fit the concaved adjusting nuts used to confine the blades. By moving these nuts, the size of the pilot may be increased or diminished to suit the hole to be reamed.

CRITCHLEY EXPANSION PISTON REAMER

In addition to the pilot, the upper third of the cutting blades is ground to a true circle of a size to just fill the newly reamed hole, thus providing a bearing both before and behind the cutting blades. The reamer is made in ten sizes ranging from a minimum of $\frac{19}{32}$ in. to a maximum of $\frac{17}{32}$ in., each reamer expanding $\frac{1}{16}$ in. All parts are made to gage.

American Goods Held in Argentina

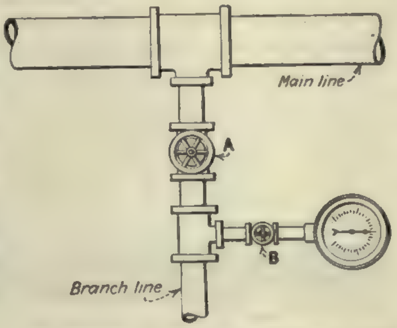
The inventory of the commodities and the value of merchandise held in the customhouse in Buenos Aires, which Commercial Attaché Edward F. Feely has been conducting for some time, has finally been completed. The returns of all banks show that the total American collections outstanding on Jan. 1, 1921, amounted at par to 35,000,000 gold pesos, aside from the merchandise covered by New York credit, which was estimated at approximately $10,000,000 United States currency. The total American collections outstanding of all banks was 24,000,000 gold pesos on June 30, while by August it had been reduced to 17,500,000 gold pesos, and had reached 14,000,000 gold pesos on Sept. 30. Liquidation during the months of July, August, and September was made at the average rate of exchange of 147, the current rate Oct. 11 being 133. The invoice value of the refused merchandise amounted on Oct. 1 to 6,250,000 gold pesos (at par) and bankers are generally agreed that a reasonable fall in exchange will eliminate the greater part of this amount. Paper pesos deposited to guarantee accepted drafts are estimated at the equivalent of 8,000,000 gold pesos. A more detailed report of Mr. Feely's investigation has been mailed to the Bureau of Foreign and Domestic Commerce and will be published later.

Care of Compressed Air Lines

By John S. Watts

Probably the greatest loss in efficiency in compressed air systems is due to the loss by leakage at the joints of the piping and at the valves. That this loss is in nearly all cases a serious one, is shown by the fact that the air pressure falls rapidly whenever the compressor stops. In my experience with the average system, the time which elapses from the stopping of the compressor until the air pressure has been completely lost, is seldom over twenty minutes. I have known cases where it has taken the full output of one large compressor to simply keep pressure on the line when no tools were using air.

The locating of leaks in air piping is, owing to their not being visible, a tedious job and unless there is some way of checking up the tightness of small parts of the system individually it is practically impossible to keep an extensive line of piping, with the usual ramifications inherent to the system, in any kind of freedom from leaks. The average practice seems to be for the superintendent or some other official to order any leak that he happens to notice in passing, to be repaired, which is not apt to lead to much in the way of economical results as the smaller leaks usually make the most noise. If a man is apportioned to the work of locating leaks and stopping them, he is very apt to confine his attentions to the main lines, and leave the smaller branch lines, which are really the worst offenders, to their fate as being beyond all redemption.



APPLYING A GAGE WHILE THE PIPES ARE UNDER PRESSURE

Strange as it may seem, there is a widespread belief among the men who run air operated machines that air being free, its waste involves no monetary loss and is therefore of no consequence so long as the pressure is not thereby reduced below that at which the tools will work. This misapprehension tends to make the operators careless about shutting off the air from tools not in use, and about closing valves. It is no uncommon thing to find a valve left wide open after a machine has been disconnected from the line. It would be money well spent to educate the men to an understanding of the cost of an air leak in dollars and cents.

For an executive to make a point of trying to observe the leaks caused by this carelessness and remonstrate with the guilty party seems an obvious duty, but the carelessness is so general that one is apt to form a habit of listening for air leaks until it becomes almost an obsession, and interferes with the carrying out of more important duties.

To attempt to get a check upon the tightness of the system by having a watch kept on the gage on the air receiver gets us nowhere, as the air piping is generally so scattered and tortuous. While the receiver gage tells us the state of the system as a whole, by the rapidity with which it falls when the compressor stops, the total leakage is made up of so many small leaks scattered all over the plant, that one seems never able to get them all stopped, because as fast as we close one leak, another or a dozen more start up somewhere else.

The best system which I have seen so far, and one that does improve matters considerably, is to divide up the piping system into a number of convenient-sized divisions and by inserting valves at the proper points, so arrange it that any one division can be cut off from the whole system and tested separately by fitting pressure gages and noting the time taken for the pressure to leak away.

The test can only be carried out when the tools are not using air, that is at the end of each working shift, but as that is the only time when the leaks can be repaired it is not a disadvantage.

A typical arrangement of the valves for this purpose is shown in the accompanying sketch, and as will be seen, involves no unreasonable expense either in first cost or in upkeep. Only one pressure gage is necessary, as it can be put on and removed with the pressure on the line by the closing of the valve *B*, shown in the illustration, thus allowing the gage to be transferred to any division that it is desired to test. To make the test, the valve *A* is closed while the full pressure is still on the line and after screwing the pressure gage into place, valve *B* is opened. The branch line under test being now isolated from the main line, the gage will show how long the pressure takes to fall from 80 to 60 lb. and the leaks on the smaller length of piping being tested can be readily located. This test should be repeated on each division until the time that elapses in falling the 20 lb. has reached a set minimum, when another division can be taken in hand.

The method used is first to find which are the most leaky divisions and after they have been brought to a fair state of air tightness, have the mechanic in charge of this work make periodical tests of all the divisions in rotation and keep them all up to the standard determined.

The main advantage of this method is that it gives immediate results as the pipes being tested can be brought down to a length that can be gone over thoroughly, and the leaks located and stopped. The progress made is ascertainable and gives some encouragement to persevere, much more so than when the test is run on a system as a whole where the leaks are so numerous that one becomes discouraged before the results of the work will show.

Almost every system would be much improved if a plan of the piping were made and no new piping installed, except it were first shown on this plan, as it will usually be discovered that the proposed new piping can be simplified by having the plan before one when locating it. The very facility with which air piping can be run, here, there, and everywhere, has tended to make trouble from leaks. A survey of any old system of piping will show, if no plan has been followed, that we soon have a mess of air piping running all over the place, a part of which is as sure to be as leaky as the proverbial sieve. It is very rare to find an old branch removed when its usefulness is ended, although it would certainly pay to cut out all piping not in use.

The making of a plan of existing piping will generally show a lot of pipes that can be eliminated, and so decrease the loss from leakage quite appreciably.

That the attainment of a reasonable freedom from leakage will well repay the expense of getting it need hardly be emphasized, as this leakage involves not only the cost of compressing the air that is allowed to leak away, but also the lowered efficiency of the air tools through low air pressure and the probability of having to purchase larger or more compressors than required.

NEWS SECTION

Program of Industrial Cost Conference

The tentative program of the second national cost conference of the Industrial Cost Association, which will be held at Pittsburgh, Pa., on Nov. 2, 3 and 4, has been announced by the secretary Albert A. Alles, Jr. A comprehensive program covering costs and profits, sales, accounting, inventories and general business conditions has been prepared. It is expected that Secretary of Labor Davis will attend the banquet on the evening of Nov. 3. The program so far arranged is as follows: "Sanitation and Safety," by J. B. Ayres, National Tube Co.; "Costs and Profits of Welfare, Sanitation and Safety," by Major William Hogg, National Tube Co.; "Responsibility of the Comptroller or Accountant in Times of Business Depression," by F. S. Willett, Dodge Manufacturing Co.; "What the Sales Manager Should Have From the Accounting Department," by S. B. Taylor, S.K.F. Industries, Inc.; "How Can a Cost System, Although Efficient, Demoralize an Organization," by J. M. Howell, General Electric Co.; "Inventories — Methods of Completing the Physical Count," by E. C. Grimley.

At the banquet the speakers will be as follows: "Looking Into the Future," by Newcomb Carlton, Western Union Telegraph Co.; "Federal Taxation," by Sanford Robinson of New York, N. Y.

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Dr. King Re-Appointed Cuban Consul at Atlanta

The Cuban government has again appointed Dr. Guy King as Cuban consul in Atlanta, this being his ninth successive year in that capacity. Since Dr. King became the Cuban consul in Atlanta export trade between that city and the island has developed to more than $1,000,000 per year. Most of Atlanta's export trade with Cuba includes machinery and mill supplies, machine tools and equipment, railroad supplies and equipment, and metal products of various kinds.

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Automobiles in Samoa

Vice Consul Quincy F. Robins, at Apia, writes that there are probably 125 automobiles and trucks in Western Samoa, the majority being small cars. The mileage of tires is very low on account of bad roads and the destructive climate.

Ordnance Dept. Proves Efficient at Aberdeen Tests

Ordnance officers believe that the recent elaborate tests at the Aberdeen Proving Ground gave them an opportunity to prove that their engineering is sound and that the Department is doing efficient, forward looking work. So far as the mechanical features of the test were concerned, the rating was close to 100 per cent. This is held to be the more remarkable since work is based on a 1.2 factor of safety.

The exacting tests to which the two new 16-in. guns were subjected failed to develop any mechanical imperfections of moment. This applies to the 16-in. gun on a Barbette carriage as well as to the one on a disappearing carriage. The tests emphasized the advantages of the Barbette type of carriage. This is due largely to the absolute necessity of a high angle of elevation for long ranges.

ONLY ONE DEFECT

The only mechanical difficulty which developed was with the throttling bars in the hydraulic cylinders which control recoil. It is admitted that there must be some improvement in the design of these parts. Another weak point was in the elevating screws. To prevent excessive breakage of these parts, hydraulic cylinders have been placed at the base of the elevating arms. It was stated that this device is in need of some perfecting.

The mechanical engineers have been somewhat apprehensive of trouble with the drop-blocks on the Barbette carriage because of the multiplicity of threads which complicated the method of obturation.

There was not a single failure in any test to which the mechanical features of bombs were subjected.

One of the striking demonstrations of the test was the performance of the mobile 8-in. gun. It was shown that this very heavy piece of artillery can be moved with a speed sufficient to keep up with the army at any time. While it is admitted that there is still much to be desired in the way of mechanical improvements of track laying vehicles, it was shown that high speed can be maintained with much less power than formerly was required and that the track mechanism possesses sufficient length of life to make it thoroughly practicable. It also was shown that much has been done to reduce the noise on vehicles of this type, an important factor in wartime operations.

Metal Trades in Conference at Dallas

The western division of the Southern Metal Trades Association held an important meeting at Dallas, Tex., Oct. 12 to 14, in conjunction with a meeting at the same time of the Texas Industrial Congress. J. H. Dore, of the Houston Car Wheel and Machine Co., Houston, Tex., first vice-president of the association, presided. An address on the progress of the open shop in the foundries and shops of the South was delivered by L. J. Black, of Beaumont, Tex. W. C. Trout, of the Lufkin Foundry and Machine Co., Lufkin, Tex., vice-president of the association for Texas, spoke on "How Present Wage Scales Effect Business and How They May Be Equalized." The association's foundry cost system was explained by Mr. Dore and W. E. Dunn, Jr., of Atlanta, secretary of the S. M. T. A. This system is for machine shops and foundries.

Subjects discussed in open forum included freight rates in their relation to the metal trades industries of the South, the adjustment of wage scales in railroad shops, and whether or not effort should be made to secure pig iron contracts that are not all one-sided.

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Pierce-Arrow Sales Approach Normal

Production and sales activities of the Pierce-Arrow Motor Car Co. of Buffalo, N. Y., which have been accelerating gradually during the last three months, have reached a schedule which is rapidly approaching normal. As a result, the factory is running full time with a force of 4,230 workers. There is every prospect, according to company officials, that this force will be maintained, if not increased, during the next six months.

"Insofar as the automobile industry reflects general conditions throughout the country, our situation indicates a decided improvement in business," said Colonel Charles Clifton, chairman of the board of directors of the company.

"The unfilled orders we have on hand will keep the plant operating at its regular output until Dec. 1.

"These orders are not the result of a sudden or freakish flare-up of business. They represent a healthy, day-by-day increase, which shows no sign of letting up. Indeed we are confident that Jan. 1, 1922, will find the company with sufficient orders to operate from sixty to ninety days ahead, which is the basis on which we plan in normal times."

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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The possibility of a railway strike has overshadowed other happenings of the week to such an extent that nearly all the market news must be discussed in the light of the strike's connection with it. The securities markets during the week have been merely barometers of opinion, reflecting by their fluctuations what people think as to the likelihood of a walkout and its effect.

It is therefore encouraging to note that the quick recovery from the early decline in stock prices supports the conclusion which one must reach after an independent survey of the probabilities; namely, that the folly of such a strike and the certainty of its defeat are so apparent even to the labor leaders that their threat will never be made effective. Nevertheless it is reported that in commodities such as textiles, whose distribution would receive a serious check from such a catastrophe, purchasers have shown a hesitation which has brought back the era of hand to mouth buying and temporarily curtailed market activity.

It is more profitable to realize that the effects of such a strike on business would be minimized by its probable incompleteness and short duration than it is to debate whether it will occur. Potentially its capacity to disrupt the nation's economic life borders on the infinite, but practically there are many reasons why it would soon collapse, including the almost certain refusal of the less important unions to join the brotherhoods, the announced intention of the Government to run mail trains, the determination of the railroad executives to "have it out" and their preparedness for a struggle, the almost universal condemnation which the threat has received from public opinion, and the earnest efforts at compromise which are being made as this is written. As a business factor I think that the markets have gaged it accurately—a cause for hesitation only where hesitation can involve no loss.

It is becoming increasingly evident that the stock market cannot long be held down by pointing to wreckage which has drifted ashore from the past and is all but cleared from the stream. Oil shares responded promptly last week to the steadily increasing strength of the petroleum market and to the fifth advance in a month in Pennsylvania crude. New financing has been well taken and bonds are firm. Improved earning prospects are reported from nearly all the leading industrial corporations and since most bankers are predicting that money will become still easier as the crop movement nears completion the beginnings of a primary bull market will probably be in evidence when the weight of the strike is lifted.

The Federal Reserve System's reserve ratio of 70.3 per cent is much the highest of the year and both rediscount and reserve note circulation are the lowest since the armistice. Talk of another cut in rediscount rates is persistent. The gain in gold holdings of the system reaches the astonishing total of $44,000,000, and the efforts of other nations to refill their money bags at our treasure house are redoubling. Peru, Chile, Argentina, Cuba and Mexico are all active candidates for loans in this market and in the case of Cuba the announcement of a $50,000,000 credit is to be momentarily expected. Otherwise efforts to help our foreign trade are still unproductive and reports of the outlook ahead of it still lugubriously stress the demoralization of the exchanges and the alleged truth that Europe is consuming only 30 per cent of the goods she used in pre-war days. But the fact is that despite the difficulties in the way of buying the rest of the world must have goods and we are doing a much larger volume of overseas business, mainly in foods and raw materials, than those who fail to take proper account of the price decline believe. Out of twenty articles listed among our September exports seventeen, and the most important ones, were shipped abroad in much greater quantity than in September a year ago, and the total volume was roughly equal to August.

AMERICAN OPTIMISM

Under such circumstances it is not surprising that we are still prosperous despite foreign troubles. There is a grain of truth in the pratings of those who say we cannot expect complete recovery until we recognize the government of Mexico and until the Central Powers and Russia are again drawn into the world's organization, nevertheless for cripples we are hopping into our automobiles and Pullmans and walking into the dining rooms of expensive hotels with amazing celerity.

The state of the world abroad advanced more than it receded during the week. The betterment of British Indian export trade has actually drawn, for the first time in many months, an export shipment of gold from this country to India, normally a great absorber of the world's gold. Silver made a new high for the current movement of 73⅝ cents, connoting better times for Far Eastern trade. Sterling exchange has crossed $3.95 for the first time in five months and other Western European currencies have been strong, while even the mark recovered to 68 cents per hundred from its low of 52½. In New York the feeling seems to be gaining ground that the mark has passed its low point, and South America is buying actively, but as it is already irredeemable and the financial difficulties of the German government are already so obviously insurmountable that it is on the point of falling, I am inclined to think that the printing presses will continue to augment the supply for some time to come. Last week they added more than a quarter of a billion to the circulation. The frantic rush to get rid of marks continues throughout Germany and no thoughtful person dares predict when it will end.

Ratification of the peace treaties with the Central Powers is probably the best thing that could have been done under the circumstances and negotiations of commercial treaties providing for exchange of consular officers will follow. In Mexico the settlement of the oil tax controversy and the rise in the price of silver has greatly stimulated business, and oil exports in September were not far below the record. In Great Britain Lloyd George's proposal to stimulate trade by guaranteeing interest on loans has heartened business and even in Russia a "boom" is reported to have followed the practical establishment of free domestic trade.

In this country sentiment is still cheerful, though the fall in wheat and the possibility that it will drop to a dollar is a cause of anxiety because of the impairment of the farmer's purchasing power. The decline offers interesting proof of the futility of the Emergency Tariff to help the farmer, yet the House has passed a bill extending its life until Feb. 1. Coffee, sugar and cotton are also lower and it is not to be expected that the public will support speculative markets until Congress shows more readiness and ability to deal with the problems confronting business. The decline in the cost of living and wage reductions seem to be going hand in hand but the maintenance of high rents, and even the increase in many places, is justly discontenting labor and constitutes a principal obstacle to orderly readjustment. Building is remarkably active for this season and the materials markets are busy. The iron and steel trade is holding its gains but copper interest has waned again. Shoe manufacturers are working near their normal rate and an autumn survey of the tire industry indicates a strikingly improved inventory position. Crude rubber is higher. Mail order houses are doing a better and bigger business.

One result of the depression of the past year is the enormous amount of study which has been given to business problems. Industrial engineers and economists have added so extensively to their knowledge of the causes of these cyclical reactions that they generally concede the possibility of preventing them, or at least mitigating their severity. I have long contended that their causes are human and therefore eradicable and that our fatalistic habit of accepting instead of challenging them is largely responsible for their existence. If others reach this same conclusion in their own way this may be, as I hope, the last time we have to crawl out of such a bog of depression.

National Machine Tool Builders Meet

Annual Meeting in New York Very Well Attended—Statistics and Economic Questions Principal Topics of Discussion—General Outlook Better

The Annual Meeting of the National Machine Tool Builders' Association was held at the Hotel Astor in New York City on Oct. 18, 19 and 20. The dull times seemed to have no effect on the attendance, which was larger than usual. The meeting opened Tuesday morning with the announcement of the convention committees by President August H. Tuechter.

Officers Elected by National Machine Tool Builders' Association

AUGUST H. TUECHTER, President; E. J. KEARNEY, 1st vice-president; C. WOOD WALTER, 2nd vice-president; H. W. DUNBAR, Secretary. (We regret that we are unable to present a likeness of Winslow Blanchard, who was elected treasurer.)

The next order of business was the president's report which was received by the members with close attention. Mr. Tuechter told of the hard times through which the industry is passing and said that the association figures showed that the depression was the worst since 1893, and in proportion to the capacity of the plants the worst ever experienced. Mr. Tuechter then read extracts from the addresses of the various presidents of the association from 1904 up until 1920 and traced through the tenor of the remarks made by each, the rise and fall of the business cycle curve of the machine-tool industry. The president wound up this section of his report with a strong plea for better co-operation on the part of the members in supplying the production and other statistics needed by the general manager to prepare the barometric charts showing industrial trends.

The general manager's office had prepared several charts to illustrate the points made by Mr. Tuechter.

Mr. Tuechter then referred to the report of the Federated American Engineering Societies' Committee on "Elimination of Waste in Industry" and told of the part played by the association and some of the members in securing some of the necessary data for the report. He called attention to the fact that the committee found a high percentage of waste chargeable to the inefficiencies of management and urged the members to give close attention to their own affairs to remedy this situation if they found it existing in their own plants. Mr. Tuechter then went back into the recent history of the association and told of the reasons for the decision to retain a paid executive to handle the association matters and went into some detail as to the budget and means of paying for the services of the secretary and the gathering of the desired statistics. He next pointed out the value of machine-tool figures to other industries, inasmuch as a falling off in orders for machine tools had practically always indicated an industrial depression. As a consequence, complete machine-tool figures would form an excellent barometer to indicate coming downward movements in the general business curve. These could well be exchanged for figures from some of the other industries which occupied the opposite position, that is, whose figures indicated in advance coming rises in the business curve.

ERNEST F. DUBRUL
General Manager

The matter of standardization of machine-tool parts was then taken up and an account of the activities of the standards committee was given. For several reasons, notable among which was the desire of the machine-tool section of the American Society of Mechanical Engineers for co-operation, this committee had held in abeyance most of its plans until the engineers were ready to go ahead. Mr. Tuechter recommended a general committee on standardization to act for the association and special committees to act for the various groups. He gave unstinted praise for the work done by the general manager of the association, Ernest F. DuBrul, and also paid his compliments to the ex-presidents, members of the executive committee, the members of the manager's staff, etc. He concluded his address with some remarks about the probable future of the machine-tool industry and touched on the problem of its vastly increased capacity, the number of second-hand tools on the market, and the desirability of a better knowledge of costs on which to base fair selling prices.

An abstract of the treasurer's report was presented by Winslow S. Blanchard.

The next order of business was the general manager's report by E. F. DuBrul, who gave it as his opinion that the association had in the past been a great power for the stimulation of good fellowship and confidence among the members and that its activities along these lines should be maintained. At the same time there are many legitimate activities of trade associations which have hardly been touched upon and they should be given attention if the association is to serve its full purpose. The trade association is strictly a business proposition and properly conducted can be made to pay well for the time and effort put into it by the various members.

Mr. DuBrul went on to say that matters are in such a serious condition now that this is no time to potter around. On the contrary, the hardest kind of thinking along economic lines is necessary if the machine-tool manufacturers are to get over their present troubles. He also made a strong plea for better co-operation from the members in supplying the data for statistics and charts on production, costs, etc., and said that while present figures were better than none they were hopelessly incomplete and should be largely increased. He pointed out that an excellent barometer would be possible at a very small cost when all the members were ready to give their full co-operation in supplying the figures to his office. He concluded his report with suggestions that a subject worthy of studying was the relative value of cheap and expensive machines as indicating trends. He said that the few figures in the possession of the association indicated that small tool sales dropped off after those of larger tools, and picked up sooner on the other side of the curve, so that large tool sales could be used as an indicator of depression and small tool sales for evidences of revival.

The afternoon session of the first day was given over to addresses and discussion. The Hon. Charles L. Underhill, Congressman from Massachusetts, spoke in favor of a sales tax. He stated that the excess profits tax has been found to be a failure both in England and in the United States, including reference to the amount of effort required by business concerns to make out proper tax returns.

BUSINESS CYCLES

The subject of business cycles was admirably discussed by Professor David F. Jordan of New York University. He dealt with the causes for the fluctuations in business conditions, considering the subject under six major classifications — production, marketing, labor, business profits, exchange transactions and finance. Agricultural production has the greatest effect on business conditions, but is a factor which cannot be regulated, principally because it depends upon climatic conditions.

When attempting to prognosticate conditions, it is necessary to take into consideration all of the factors entering into the case, and to determine just which ones are the causes and which the effects. It was Professor Jordan's opinion that the period of liquidation is not yet finished, although recovery will be rapid, and during the coming winter we should witness a marked revival of business.

C. L. Cameron, of Gould & Eberhardt, and Ernest F. DuBrul engaged in a discussion on the subject, "What Things Should Machine Tool Builders Do and What Should They Avoid at Various Stages of the Cycle?"

Mr. Cameron divided the business cycle into four phases: Prosperity, liquidation, readjustment and improvement. He advised a continued effort to determine the causes of depression and showed that one of the difficulties encountered by the machine-tool builders in their attempts to look ahead is the fact that many of their sales are arranged on long time deliveries. He gave it as his opinion that business in general is on the increase, is, in fact, entering the phase of "improvement," but that machine-tool builders are to experience further liquidation.

DUBRUL'S ANALYSIS

Mr. DuBrul chose to divide the business cycle into six phases: Depression, revival, prosperity, boom, crisis and liquidation. In general, he advised that a careful watch be kept on the relation of production and shipment. He stated that the fore-handed man will, during a period of depression, or at any rate during the latter part of it, stock up just as far as justified by demand, will repair, redesign, systematize, improve his personnel and conduct missionary work.

The revival phase was considered to be a period during which stock should be accumulated. It was suggested that in order to take advantage of the prosperity phase prices should be more sensitive to conditions than they now are. Orders should not be taken during this phase at low prices for long delivery. Liquidation should be begun, but at increased price. The speaker advised that during the boom phase, it is unwise to build a new plant or to book orders too far ahead. It is advisable to sail close to the wind, keeping open the chance to curtail production, to watch out for cancellation, and to pay off debts.

Government Cuts Ordinary Expenses in September

Ordinary expenditures of the Government fell off by almost $25,000,000 during September, as compared with August, according to the monthly statement issued on Oct. 18 by the Treasury, while payments on the public debt increased by more than $800,000,000.

During September ordinary expenditures totaled $266,523,392, as against $291,157,847 in August, while public debt disbursements aggregated $1,173,842,743, compared with $237,519,233 in the previous month. Redemption of certificates of indebtedness amounting to $1,051,903,950 accounted for the bulk of the public debt disbursements.

The crisis phase represents the time during which production must be restricted to the point where it is following demand on down. High wages should not be maintained. Over-stocking must be guarded against. The phase of liquidation represents the time when it is necessary to sell and when a close watch upon price is equally necessary. The foregoing statements, of course, refer to normal times and it was admitted that prediction is now very difficult on account of the questionable influence of war machines.

Wednesday was devoted to committee meetings, as well as to group meetings for manufacturers of different types of machine tools. At these meetings points relating to the development of the particular line of the industry involved were given consideration, and the idea of developing a statistical service in each line was discussed.

RASTALL ON EXPORTS

Thursday morning opened with an executive session. The first address was given by W. H. Rastall, chief of the Industrial Machinery Division, United States Department of Commerce, his subject being "The Orient as a Machine Tool Market." The growth of the Asiatic trade in machine tools is indeed surprising. In 1910 our exports of machinery to Asia amounted to only $100,000, in 1915, $500,000, but in 1919, $8,000,000, while 1921 will probably be about $6,000,000. Mr. Rastall stated that the development of Asia will be of more importance from the machine-tool standpoint than that of Latin America. At the present time, about 25 per cent of the total export of American machine tools goes to Asia. India is now being industrialized, providing there a great opening for American machine tools. It was Mr. Rastall's opinion that there would be a great future for American machine tools in the Orient if we would use intelligent salesmanship, and endeavor to give real service to the buyer in the East.

H. L. Flather, treasurer, Flather & Co., Inc., discussed the possibility of utilizing machine-tool plants during slack times. He stated that the company which he represented had tried many make-shifts during times of depression in the machine-tool industry, but he believed that most of the ventures into fields foreign to those normally occupied were unprofitable in the end. He believed that a concern should not attempt to make temporarily a product differing very much from its standard product.

The possibilities of reduction in the cost of machine tools in 1922 was the subject of a talk by E. M. Brotherhood, vice-president, Manning, Maxwell & Moore, Inc. Mr. Brotherhood stated that it was practically impossible to forecast the future in this respect, and that at best only a guess could be made. However, many machine tools are being now actually sold below cost, and it is hardly possible that a normal basis will be reached in 1922.

FOREIGN CREDITS

The afternoon session was opened by J. E. Andress, secretary, Barnes Drill Co., his subject being the granting of long-term credit with proper guarantees or insurance in foreign trade. He stated that since some foreign countries are at present extending credit for 120 to 180 days, the American manufacturer must take some steps to meet the situation. He believed that it was not properly a government function to itself handle this matter, although governmental foreign credit insurance has been used in Europe for some time. A co-operative plan for credit responsibility has been developing in this country, and is working satisfactorily as a private enterprise.

AMERICANS POOR MERCHANTS

J. H. Drury, treasurer, Union Twist Drill Co., who has recently returned from a visit to Europe, told of conditions there as related to the machine-tool industry. His opening statement was: "You Americans are all right as manufacturers, but very poor merchants." Due to the fact that so many cheap German machine tools are now flooding the European market, the status of the American machine tool abroad is being greatly injured. Mr. Drury asked that great consideration be given by American manufacturers to their foreign representatives, so as to aid them in every way possible to weather this crisis.

It was decided to hold the next Spring Convention at Atlantic City.

The officers elected were as follows: President, August H. Teuchter, president, Cincinnati Bickford Tool Co.; first vice-president, E. J. Kearney, president, Kearney and Trecker Corporation; second vice-president, C. Wood Walter, vice-president and secretary, Cincinnati Milling Machine Co.; treasurer, Winslow Blanchard, president, Blanchard Machine Co.; secretary, H. W. Dunbar, sales manager, the Norton Company. Ernest F. DuBrul will continue as general manager of the association.

Fall Meeting of Machine-Tool Section of National Supply and Machinery Dealers' Association

The Machine Tool Section of the National Supply and Machinery Dealers' Association held its fall meeting at the Hotel Astor, New York City, on Wednesday, Oct. 19. The meeting was opened by the chairman, L. H. Swind, of the Swind Machinery Co., Philadelphia, Pa., whose address dealt broadly with conditions in the industry and with the work of the association.

Mr. Swind stated that close co-operation was necessary between the buyers and sellers of machine tools at this time, because of the fact that as a rule the buyers do not have the cash resources necessary. Credits must be extended in some manner, so as to alleviate the conditions. Mr. Swind said that the problem of selling machine tools has been greatly complicated by the presence of so many rebuilt and second-hand machine tools on the market. Since it is necessary that these tools be absorbed, he advocated an appraisal plan, so that the true value of the tools could be determined and guaranteed to the customer. Considerable attention was given by Mr. Swind to the subject of taxation of machine-tool dealers.

Mr. Swind stated that it was a matter of common knowledge to the industry that the present and immediate future did not offer any great amount of encouragement. It was his belief that for the resumption of business we must look to the railroads to take the initiative. In closing, Mr. Swind stated that the present time offers a great opportunity for the development of real salesmanship in machine-tool fields.

August H. Tuechter, president of the National Machine Tool Builders' Association, spoke on the need of close co-operation between the machine-tool builder and the machine-tool dealer. He stated that the dealer is in this case not the market of the builder, but rather the channel to the market. Since he considered that the dealer represented merely an extension of the sales force of the builder, dealings should be characterized by all the honesty and frankness possible.

M. A. Viall, Brown & Sharpe Manufacturing Company, as he himself stated, was both optimistic and pessimistic in his viewpoint. He spoke on the economic conditions in the machine-tool business at present. He has faith in the future of the industry, because of the fact that its market continually changes, having been kept busy in the past successively by the sewing machine, the bicycle, the automobile and the electrical industries.

E. J. Kearney, Kearney & Trecker Corporation, gave it as his opinion that there is no need at present for making special concessions to educational institutions supported by taxation, when selling them machine tools for use in industrial training.

Percy M. Brotherhood, first vice-president of Manning, Maxwell & Moore, Inc., in his address stated that it was necessary that a certain percentage of a dealer's resources should be kept liquid in order to constructively finance sales promotion during periods of low business, although the amount would vary in each particular case.

H. K. Mitchell, president of the Harron, Rickard & McCone Co., San Francisco, Cal., brought a very optimistic message from the Pacific Coast. He stated that the business there seems to be about 60 per cent of the 1920 business, most of it being done with small concerns.

The afternoon session was devoted to the consideration of many questions vital to dealers in machine tools. The effect of the presence of so many old and second-hand machines on the market was discussed at considerable length. The price of second-hand machinery was stated to be about the same as the price of new machinery in 1914. Many of the machines on the market at this time are coming from export dealers, and from the government stores, and are new, or practically so; but in order that the tools may be unloaded, they are often sold at the price of second-hand machines.

The section decided to co-operate as far as possible with all national organizations touching its field, particularly the National Machine Tool Builders' Association. The question of advance information on machine tool prices was given attention, and although very desirable from the dealers' standpoint, was considered to be difficult of attainment.

Progress of the Hearing on Ladd Metric Bill

After listening to a large number of witnesses, who favor Senator Ladd's bill proposing the compulsory adoption of the metric system as a single standard of weights and measures after ten years, Senator McNary, of Oregon, who is conducting the hearings, expressses himself as being convinced that the principle of the metric system is right, but states that he doubts the advisability of forcing it upon the people by law. From the excerpts of testimony and comment which follow, an idea may be obtained of the character of the hearing.

In the course of his testimony before the committee, Dr. William J. Schieffelin, a chemist of New York, said: "It was in Munich that I became entirely accustomed to the use of the metric system, although, of course, in the laboratory at Columbia we used it. In Munich everyone used it. I lived there a year and a half and when I came back to the United States I was really shocked to find the complication and the delay not only in business but in ordinary life that this present lack of system entails upon us. It is a greater handicap than any of us appreciate."

Senator Jones at one point in the hearing said: "Personally I am convinced that it would be better for this country if we had the metric system. What I would like to know is how we could bring it into existence without making too abrupt a change."

Extracts from the testimony of Elwood Haynes, president of the Haynes Automobile Co., of Kokomo, Indiana, are as follows: "There is no reason why we cannot take a lathe, for example, and turn to the metric system size whenever we are disposed to do it. We do not have to throw away all of the machinery. That is true of a large number of machines. Jigs and taps, for instance wear out anyhow and have to be bushed or something done to keep them standardized. Nearly all research work is done in the metric system. Our industries are dependent upon the research work of our scientists. They work in the metric system because it is simple, more logical and can be handled with much greater facility. When the scientist is called on to make any investigation, he makes it in the metric system. Then he is obliged to transform his figures into the common system which is a laborious and cumbersome process.

"I favor very decidedly the adoption of the metric system. I think this bill is quite practical. Of course, I should want to give the matter some study before I gave an opinion of it."

During the testimony of Arthur B. Smith, chief research engineer of the Automatic Electric Co., Chicago, Ill., the following colloquy took place between Senator McNary, chairman of the Committee, and Mr. Smith:

Senator McNary: "As a practical question, do you think the Government should impose this system upon the people by statutory enactment, setting an arbitrary date, or should it be brought about through a gradual approach, being taught in the schools to the young and being adopted by those who believe in the system?"

Mr. Smith: "I do not know that I am in a position to express myself on that. Our plan is that we are going to go ahead ourselves. It will make it easier for us. It will be of assistance to us and to every other manufacturer who wants to progress, if the rest of the country comes with us."

Senator McNary: "Do you think legislation of this kind is important and is it needed?"

Mr. Smith: "I think the change to the metric system is very greatly needed."

Senator McNary: "Can that be brought about gradually by teaching it in the schools or should be it forced upon the public?"

Mr. Smith: "We have had a lot of other things forced on us and I am inclined to think that inasmuch as we are law abiding citizens, we will all fall in line and obey it."

Senator McNary: "I appreciate that, but it is not at all an answer to my question."

Mr. Smith: "I believe if we leave it to individual initiative, the thing will drag out unduly. I believe we will have to have legislation."

Senator McNary: "Do you think that people who are not engaged in your line of work, people such as the wage earner, the salaried employee, the farmer, would gain anything by the adoption of this method and would yield to it readily and willingly?"

Mr. Smith: "They will gain by it and will yield to it readily."

Senator McNary: "Engineers are a different proposition. Of what advantage is it to the farmer out in North Dakota or to a fruit grower?"

Mr. Smith: "As to the farmer, I am not sufficiently informed. As to the storekeeper and other trades people and ordinary homekeeper, they will benefit greatly by it."

Senator McNary: "I am wondering, as a practical proposition, if the next generation would not accept it better than having it forced by arbitrary legislation upon those people who are out of school."

GROUP PHOTOGRAPH OF DELEGATES AT ROCHESTER MEETING
(The report of this meeting was published

Afterthoughts of the Unemployment Conference

Lack of Fundamentals of Business Economics—Coal Strike Probabilities—Hoover's Closing Remarks

Information laid before the Unemployment Conference indicates that social unrest in the United States is much more widespread than has been realized generally. The men who thus interpret the data, gathered systematically from all parts of the country, are not those who trot out the bogey of Bolshevism. The prevalence of discontent is so widespread that the leaders in the conference agree that fundamental improvement of our social and economic system must begin at once. The fact that there are 4,000,000 men out of employment at this time is referred to as a disgrace of the first order and an outward indication of the need for inaugurating more intelligent economic policies. The recrudescence of coal control bills in Congress is pointed to as an indication of the times.

U. S. IS INDIVIDUALISTIC

In that connection it is known that some of the leading figures in the conference cannot disguise their disgust with the frequent demagogic charge that capitalism is the dominant factor in the United States. They point out that the United States is the outstanding example of all history of an individualistic country. Individualism and equality of opportunity are so emphasized that capital really comes in for little public concern. There seems to be no doubt that business as a whole suffers materially because the public is not considerate enough of capital. A fact not fully realized is that the United States is practically the only country in the world in which there is no stratification of classes. In the countries of Europe those in the upper stratum stick there through generations regardless of individual worth. The more meritorious are blocked from displacing the unworthy. Only the most superficial knowledge of social relationships in the United States is necessary to know that class stratification as it exists in Europe could not be transplanted here.

The Unemployment Conference has brought out with particular clearness the great lack of fundamental knowledge necessary to the intelligent conduct of business. Even in dealing with the immediate object of the conference, the whole opportunity of its being helpful has been jeopardized by the lack of real statistics as to unemployment. By a process of elimination, more than anything else, the conference finally established that the unemployed certainly are not in excess of 4,000,000 revealing that business for months has had to withstand the shock and lack of confidence engendered by seemingly authoritative reports of 5,000,000 or more being out of employment.

The Unemployment Conference has not been carried away by the tendency toward centralization. The burden of the solution of the problem of unemployment has been thrown upon the communities. The Federal Government can help but the conference will do all in its power to see to it that Governors of states and Mayors of cities do not pass on unpleasant responsibilities to the Federal Government. State and community officials are being pushed into action and aroused to the necessity of carrying the country through the winter without suffering.

THE CONTROL OF LABOR

The conference necessarily brought up some discussion of employer and employee relationships. Among the thoughts brought forcibly to the attention of the employers was the one that the control of labor by its less intelligent element must be avoided. Particularly favorable mention was made of shop councils. It is stated that there has not been a strike in an industry where shop councils have been established. If they have no benefit other than freeing labor of brutal and unjust foremen, the plan is worth while, it is contended.

From the information available at the Department of Commerce and at the Unemployment Conference, it may be judged that the coal industry is in desperate straits. The importance of coal to all industries makes the attitude of the United Mine Workers of the greatest public interest. It has been revealed during the last few days that efforts have been made by Government officials to insure the country against a coal strike next spring. Since a threatened strike slows down business and has a general upsetting influence months in advance of the possible time of the strike, an effort was made to get the bituminous coal operators and the United Mine Workers to agree in advance to arbitrate any differences that might arise in the Spring. The operators after some hemming and hawing agreed but the representatives of the mine workers not only decline to agree to any such proposal, but tied themselves into a bow knot by voting at Indianapolis to consider no such proposition until February.

PROBABILITIES OF A COAL STRIKE

Many have discounted the probabilities of a coal strike, but the Unemployment Conference was told that the situation is a very serious one. It is made the more serious by the low level of consumers' stocks. The railroads owe more than $100,000,000 for coal already burned. Due to the failure of Congress to pass the funding bill, the railroads are in no position to buy coal to store. Instead of having fifteen days' supply on hand, they should have three months' supply. The members of the conference were urged to use their influence to convince the people that it is a wise public which will lay in three months' supply of coal at this time. At any rate notice has been served on all consumers and the full responsibility of any coal shortage this winter has been placed squarely on their shoulders.

In the discussion of the coal situation, it was a generally held opinion that it is vicious to attempt to build up a daily wage large enough to cover the idle time. If reserves were sequestered in the season of demand to be used to provide for the period of unemployment, there is a feeling that efforts to increase the number of working days would have more encouragement. The plan of laying aside 10 per cent or

)F AMERICAN GEAR MANUFACTURERS' ASSOCIATION, OCT. 13, 14 AND 15
n the Oct. 20 issue of *American Machinist.*)

ome other proportion of earnings for ardtimes was described as being simly composite providence.

The work of the conference will be arried on by a standing committee which has power to reconvene the whole ody if an emergency arises.

In closing the conference Mr. Hoover aid:

"We have, indeed, a great crisis, and he purpose of this conference has been o find a plan by which we can get hrough this next winter into seas less ough; into areas of greater economic rosperity; into times when our labor vill have been re-absorbed into indusry. You have laid out a plan. The lan has been willingly accepted by a arge section of the country, and you ave erected the machinery to pursue hat work, and we will see if we cannot et through this crisis without calling n the funds in the public purse for upport and subsistence of our unemloyed. Whether we can succeed in that vill depend greatly upon the co-ordilation and co-operation that we can gure from industries and civic bodies f the United States. That this is a roblem for voluntary organization is onsonant with American spirit and merican institutions. If we cannot seure its solution in that direction, we hall have made a distinct step backvard in the progress of this country. t is, therefore, vital that you who reurn for a term to your own sections of he United States should insist, in seaon and out of season, that this is a roblem that rests upon the voluntary nd neighborly action of the American eople.

"To me the successful consummation f the conference marks a milestone in e progress of social thought. Aside rom the pressure of the war, I believe hat this is the only conference held in Vashington under the auspices of the overnment where the ultra extreme in ocial thought have been brought toether, and where the conference has ome through for actual constructive esults, and parts in good will. We ave found it possible to agree upon very major issue; to agree upon the mergency measures that are required the social background of those meares, and to agree upon the great principles that must be met if we are to have a recuperation of employment and industry. We may have disagreement as to detail. It would be impossible to bring together 60 persons of strength of mind capable of sitting in a conference of this kind without having such minor disagreement. This, however, is the outstanding thing that this conference has proved, that it is possible to bring together 60 people representing every particular avenue of thought in the United States, and have them sit down together and come to a common agreement upon a subject that vitally affects each and every one of them.

"There has been a definite spirit in this conference that, in itself, is an encouragement to every one in the United States. That is that while we have been here dealing with problems of railways, of shops, and of farms, and of instruments of commerce and industry, there has been in the back ground of every person's mind the fact that we were dealing, not with mechanical things, but that we were dealing with the problems of men, women and children.

"There has been in this conference the dominating thought that the better control of economic forces was in fact simply the better comfort of our country."

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Engineers Consider Financing

On Oct. 19 the New York Sections of the A. S. M. E., A. I. E. E., A. S. C. E. and A. I. M. E. met jointly in the Engineering Societies Building. Arthur B. Leach of A. B. Leach & Co., New York, said that it is necessary for us to utilize to their fullest extent the industrial installations that now exist, before we attempt to finance new undertakings. Money for development work goes where it has the best chance of making a profit, but since many of our industries cannot now hope for this, there must necessarily be but small extension of them.

That the engineer is generally a failure as a financial manager was stated by Philip Cabot, of White, Weld & Co., Boston. He said that the engineer is an executor rather than a planner, and ordinarily cannot direct an organization.

Dodd Urges Standardization of Quality and Variety

Part of the tremendous waste in distribution in this country can be eliminated by standardization of the quality, quantity and variety of products, Alvin E. Dodd, manager of the Domestic Distribution Department of the Chamber of Commerce of the United States, told the National Association of Purchasing Agents at the annual meeting just held at Indianapolis.

SCIENTIFIC GRADING

According to Mr. Dodd, the work of the purchasing agents would be simplified if commodities were more scientifically "graded." In unnumbered instances, he said, there is no standard at all to which a purchase may be related.

More and more the purchasing agents have come to rely upon a certain house as the criterion for everything in its line. Its product established the grade of all others of a like kind. It may be belting or rope or chain, or hardware or shirts or awnings. Sometimes the price is a little more, but the purchasing agent knows before the goods are shipped exactly what he is going to get. And it is this confidence on the part of their customers which allows manufacturers to keep their works going when their competitors are shut down tight.

Surprisingly little has been accomplished in the accurate grading of organic products; and indeed surprisingly few attempts have been made toward this very desirable purpose.

A CRYING NEED

With minerals as with other natural products the case is entirely different. You can buy steel and iron quite definitely, from structural members to watch springs based upon chemical formulas and heat-treatments. Petroleum and its derivatives are thoroughly described by gravity and flash test specifications. The mysteries of lubricants and abrasives are expressed in such simple terms that their purchase involves little if any risk. To extend these facts to other articles of manufacture constitutes a crying need for every one engaged in the purchase of supplies

Business Conditions in England

BY OUR LONDON CORRESPONDENT

One way and another the really serious character of the domestic position of Great Britain is being recognized. Councils and committees are being called and formed with a view to devising remedies for the prevailing unemployment—where some improvement may be visible—the slackening in trade generally and the heavy decline in the public revenue. The last, however, has a way of recovering itself, so that too much need not be made of the deficit shown in the returns for the first half of the current fiscal year. This deficit is more than 41 million pounds, comparing with a surplus exceeding 77 million pounds last year in the same period. In fact, of the total decline of revenue of 200 millions estimated for on the full year ending about the beginning of April next, a drop of 163 millions has already been recorded.

WAYS AND MEANS OF TAXATION

The floating debt has been increased by 45 millions with signs of taking "power to add to the number." The chief failures are apparently from the excess profits duty which has yielded say 27 millions, the corporation profits tax which has so far produced about 6 millions, and the sale of war stores. In the prevailing circumstances it is hardly probable that these items will show real recovery during the next six months. On the other hand the income tax has exceeded the proportionate estimate, showing in fact an increase approaching 14 million pounds as compared with the same period last year. Much depends on the taxing authorities. If they attempt a squeeze they can usually produce more than the estimate; there are always arrears to be recovered. The difficulty of meeting these demands is increased at a time like this, the tax being based on the profits of the previous year when the returns are naturally higher. Customs show a decline, but this is more than balanced by the increase in excise, suggesting that the sums spent on drink are still rising. Thus, while from a taxation point of view income is declining, expenditure is increasing, and a committee has been sitting for the purpose of finding ways and means of reducing the figure considerably, so that, it is hoped, the public expenditure next year will be less than that of the current year by 130 millions.

PRICES AND FINANCE

Meanwhile prices continue to show a tendency to decline, and the cost of living figures, at 120 per cent above prewar rates, are only one point beyond the minimum reached two or three months ago. Pressure of public opinion has had its effect on retailers; so too has foreign competition in certain materials and the decline in demand due to the unfortunate decision of the government to scrap the building program. "The ring round the house" has for a year or more been the subject of agitation by one of the London newspapers, but now that there is no assured market the Light Castings Association has had to reduce prices, and still lower prices are quoted by a few firms outside that ring. It has been stated that the profits being made today on some housing materials exceed the pre-war selling price, the selling profits of a merchant in one case being one-and-a-half times this price. After 13 years, the Cast Iron Pipe Association has broken down. Similarly in regard to coal, for various reasons the demand has fallen away, the extraordinary weather—the temperature of days in October has been several degrees higher than for any day in the whole of 1920—continuing to enable the householder to postpone his orders, with the result that, two days after stating it was impossible, London coal merchants—mainly by the threatened break away of one of the members of the ring—actually issued lists of reduced prices, and showed signs of further weaking. Wholesale prices generally are about 80 per cent above pre-war prices, with retail prices increased by 120 per cent.

BURDENSOME WAR DEBTS

Export credit schemes appear, without much effect, in every morning paper. Lectures on public economy are delivered by every chief waster. Much is regularly parroted by every little business man on the stabilization of exchanges; it is one of the favorite remedies for the prevailing depression in overseas trading. Whether the process suggested is practicable is distinctly a moot point. In any case it is an entirely artificial proceeding, and the world is anxious to get back to natural operations. American aid in the rehabilitation of credit is thought very desirable. What is weighing on all countries, and particularly on the countries with any reputation, would seem to be the load of debt incurred during the conduct of the war. If these debts could be removed the possibilities of buying and selling would be enormously enhanced, and people are not wanting in Great Britain who are ready to contend that cancellation or remission all round is the only remedy, that it would be as much to the advantage of the creditor as of the debtor country. As far as can be seen at present the debt can only be paid in goods and the restrictions and handicaps which most countries—Great Britain taking a hand in the game—are placing on imports simply render the situation more difficult. Certainly the load of debt in Great Britain, if only indirectly, is responsible for want of enterprise. It means heavy taxation to provide interest on, to say nothing of redemption of, debt and thus robs industry of much capital that might be risked and even capital needed for mere replacement of plant.

EUROPE IS POOR

The fact should be recognized that as the result of the war the world, or Europe at least, is very definitely poorer. The food production of the world is apparently somewhere about 20 per cent lower than it was pre-war, and the loss of lives and of material need not be mentioned. Yet it is no unusual thing to meet the assertion that this country or that country, having gained territory, is richer as the result of the war. In detail the statements may appear true, though the inference that the world is better off is mistaken. What is gain to one country is loss to another, and the fact that France or Italy or Great Britain increased their possessions in no sense adds to the sum total of markets available.

SHIPBUILDING AND REPAIR

Announcement has been made that Harland & Wolff are preparing to build and equip a ship-reparing works near the Royal Albert Docks on the Thames. Shipbuilding is not mentioned and there is consequently nothing in the present announcement to compensate for the loss by London some years ago of this work and of the engineering work which accompanied it. Apart from Yarrows and the closing of the Thames Iron Works, which will be within the memory of most people interested, one need not be very old to recall the names of Penn, Rennie, Maudslay, not to mention Samuda, Miller and Ravenhill, Russell and so on. To return to Harland & Wolff, new slips, workshops, foundry, etc., will be set up and equipped and machine-tool firms have already been endeavoring to get interested. It is understood that the firm will undertake the whole of the repair work called for by the Port of London Authority.

MACHINE-TOOL INDUSTRY

The decline continues, where it is possible, in the machine-tool industry, and the government is being severely criticised on account of the further projected series of sales of surplus war stock. The Manchester district still remains most fortunate. Several firms here continue for the present on full time, though firms have shut down, and in one well-known case the only order obtained during the last six months was valued at £900. Motor car repair work is being undertaken. Or again, a firm may have enough work on hand to keep the machine-tool side active till the end of the year, while the small tool shops are almost bare. Similarly there will be no difficulty in finding a machine shop running, if that is the right word, solely on stock. Here again may be noted the fact that it is the maker of special tools rather than the manufacturer in quantities who finds some work to do. For example, whatever may be the case in their other departments, the machine-tool shops of Holroyds at Milnrow are running a full week; but the settled policy of this firm is to undertake nothing except special tools, and it is the textile machinery people mainly who are responsible for the firm's relative good fortune.

DECREASED PROFITS

The report of the Leeds firm of Joshua Buckton & Co., makers of heavier machine tools, testing machinery, etc., confirms the general reading of the situation, for the profits shown are only £13,763, this including an unspecified amount by way of refund of excess profits duty. The dividend therefore proposed is 2¾ per cent per annum. The balance sheet includes a loan of £48,344 from bankers, secured on debentures, and the outlook as regards orders is frankly described as very unsatisfactory. An amalgamation of interests of some note in the machine-tool world is the union of Fairbairn, Lawson, Combe Barbour, Ltd., of Leeds, Belfast and Lille, with the Scottish firms of Urquhart Lindsay & Co., and Robinson & Orchar, Ltd.

The report of Guest, Keen & Nettlefold is certainly more encouraging than some showings, for the net profit on the year's working of £810,101 is only about £50,000 less than that of last year. The 10 per cent free of tax dividend paid cannot be compared fairly with the usual distribution of 15 per cent. Owing to changes in capitalization, bonus shares to a considerable extent have been distributed out of reserves. Here again the company has been extending its interests by acquiring controls, not only of the Wolverhampton metal firm of Bayliss, Jones & Bayliss, Ltd., but also in coal mining and coal distributing companies. On the other hand, the Steel Company of Scotland shows a net profit for the year of £105,874 against more than £246,000 the previous year, the dividend being 7½ per cent, less tax.

AUTOMOTIVES FALL FLAT

Coventry is described as feeling the full effects of the slump but hope springs eternal in the human breast and the motor car industry is now looking forward to the November shows to be held in London. Some firms who had, according to the ballot, arranged to exhibit at the White City, W., find that space is available at Olympia, W., the explanation being that the financial stress has proved too heavy for at least a few organizations. The light car trade has pretty well gone; the home trade has, due to the season, fallen flat, and export shows no improvement. The report of the Rover Co., Coventry, for the year ending with July last must in the circumstances be regarded as satisfactory, for the profits shown on the year's work, namely, £102,320, are not £7,000 less than those of the previous year. The dividend of 10 per cent was this time paid less income tax instead of free of tax, mainly on account of the increase of £350,000 in the ordinary share capital. A bonus distribution in 1919 doubled the shares. The company had a special war contingency fund amounting on the last showing to £50,000. This has been utilized in part to write down stocks and also to provide for cost of converting the Birmingham works for the production of 8-hp. cars.

At the last meeting of the London Iron and Steel Exchange, buyers held off in view of further reduction in prices. A wage reduction of 108 points on the standard of steel workers in the South Wales district has been effected, due to the sliding scale system; wages are based on prices during three months and are now 64½ points above standard. It is further reported that against keen German competition, a Scottish firm secured an order for machinery valued at £70,000 for Rangoon, and further, that numbers of inquiries are being received from South Africa and Australia; here however the long credits called for act somewhat as a handicap.

Business Items

The Black & Decker Manufacturing Co., Baltimore, Md., builders of portable electric tools, has declared a dividend on outstanding preferred stock for the third quarter this year amounting to 2 per cent, or 8 per cent per annum.

The new foundry building of the Gilbert & Barker Manufacturing Co., West Springfield, Mass., which is practically completed, enables the company to add 200 to its working force. The increase will be gradual.

A dinner was given on Oct. 13 at the Engineers Club Boston, to their business associates by William B. McSkimmon and J. Henry Drury. Executives of the Union Twist Drill Co., S. W. Card Manufacturing Co., Butterfield & Co., New England Drawn Steel Co., O. S. Walker Co., Vitrified Wheel Co., Goldmark Knitting Co., and the State Street Trust Co. were present. Mr. McSkimmon was toastmaster and everyone spent a most enjoyable evening.

Fire of unknown origin entirely destroyed the foundry and shops of the Bowie Stove Foundry at Rome, Ga., recently, causing a total loss estimated at about $100,000. The plant had been in operation more than 30 years.

The Lovejoy Tool Co., Inc., manufacturer of metal cutting tools, of Springfield, Vt., has announced a 25 per cent reduction from list price on high-speed steel inserted-cutters for Lovejoy holders. The reduction became effective on Oct. 10.

J. R. McWane, president for some years of the American Cast Iron Pipe Co., of Birmingham, Ala., has resigned his position effective Jan. 1, 1922, to become president of the McWane Pipe Co., another corporation recently formed by Mr. McWane and associates. He will retain his financial interest in the American company and remain a director. The new corporation will manufacture a patent joint for high pressure pipe and also will make 2- and 3-in. pipe to be used with this joint. A plant has been leased in North Birmingham that will be used as shops for the time being.

The United States District Court, sitting at Canandaigua, N. Y., has appointed M. H. Anderson receiver of the Davis Machine Tool Co., of Rochester, N. Y. The assets of the company are placed at $1,130,000 and the liabilities at $283,300. Mr. Anderson is authorized to continue the business or to liquidate it, as he may be directed by the court. The Davis company was organized and incorporated in 1915 with a capital stock of $750,000. John M. Fitzgerald is president.

An order for locomotives has just been placed with the American Locomotive Co. by the Chicago, Rock Island & Pacific for 14 heavy Mikado type engines. The American Locomotive Co. announces it has also recently secured the following orders: Chilian State Railways, 20 broad gage Mikado type engines; Mississippi Central, two Mikado type engines, and La Crosse & Southeastern, one 10-wheeler.

The Hydraulic Steel Co., Cleveland, Ohio, reports for the year ended June 30, 1921, a deficit from operations of $383,901 and a loss from inventory adjustments of $1,500,000, making the total deficit for the year $1,883,901, compared with a net income of $1,020,182 for the previous year. President Foster declares that the business of the company shows improvement and that operations are now being conducted at a profit. In July the volume of business was $247,000, August $440,000 and September $480,000. The October business is expected to reach $550,000.

Directors of the Electric Alloy Steel Co., Youngstown, Ohio, have recommended the authorization of $750,000 convertible cumulative preferred stock, an issue of $500,000 is contemplated and it is understood that the approval of the stockholders is virtually assured. Informal subscriptions for half of the issue have already been made by interests within the company. Proceeds of the new stock are required for working capital. President L. J. Campbell reports that the company's business is improving.

The Chicago Belting Co., of Chicago, Ill., has filed a notice of an increase in capital stock of its Oregon branch from $375,000 to $500,000.

The Lincoln Machine Co., of Pawtucket, R. I., has recently increased its capital stock from $50,000 to $100,000.

A foundry and machine shop is to be established in the near future at La Grange, Ga., by the Duke Boltless Rail Joint Co., a corporation recently formed in that city with $25,000 capital. The incorporators were G. W. Duke, J. T. Thomasson and J. C. Thomas. In addition to manufacturing a boltless rail joint, for which it owns the patents, the company will make other castings and manufacture various steel and iron products.

The Dusenberg Automobile and Motors Co., of Delaware, has applied for incorporation in the State of Indiana. The new organization has a capital stock of $5,000,000, and will manufacture and sell automobiles and parts at Indianapolis.

The Arrow-Light Co., of Springfield, Mass., has been incorporated. Capital stock is $30,000. Officers are Gurdon W. Gordon, president; T. M. Marezul, treasurer.

The Martin Motor Co., of Springfield, Mass., has been organized in that city. Charles J. Glidden is president. The new company will manufacture small automobiles to be built of aluminum and duralumin.

The Modern Die and Tool Co., at Indianapolis, Ind., has been incorporated with a capital stock of $75,000. The company manufactures bearings and tools. Incorporators are W. L. Sandage, Harold W. James and Roger G. Wolcott.

The Indiana Watkins Manufacturing Co. has been organized at Indianapolis with a capital stock of $15,000, for the purpose of manufacturing bearings for automobiles. Organizers are E. A. Watkins, G. H. Oburn and R. W. Schneider.

The Grand Rapids Metal Products Co. has been organized at Grand Rapids, Mich., to manufacture furniture, refrigerator, phonograph and automobile hardware, specialties, etc., as well as to job several kindred lines of well-known manufacturers. The complete plating plant of the Miller Plating Co. has been taken over. John C. Miller for seventeen years with the Wolverine Brass Co., is president; E. R. Freeman is vice-president, and A. W. Honecker is secretary and treasurer.

Immediate errection of a new forge shop 50 x 250 ft., to cost $100,000, and the erection of a large pattern shop, was announced this week by directors of the Alliance Machine Co., Alliance, Ohio. Their own employees will be used in constructing the new buildings. General plant improvements also are contemplated.

The International Westinghouse Electric Co., the Baldwin Locomotive Works, the Pressed Steel Car Co. and the Anaconda Copper Mining Co. have secured a contract to electrify the Chilean State Railroad between Santiago, Los Andes, Valparaiso and Buenos Aires. It is predicted that all the railroads of Chile will be electrified eventually.

The Builder's Steel Co. has been organized at Hartford, Conn., to manufacture iron and steel products. Incorporators are Samuel Rome, Abram Ozia and Harry Ogens.

The plant of the Precision Engineering Co., at Jamestown, N. Y., was totally destroyed by fire on Oct. 4. A quantity of machinery, tools and equipment was rendered useless.

The Frank Miller Co. has been incorporated at Trenton, N. J., to deal in steel, iron and metals. Capital stock is given as $250,000. Directors are S. Lewis, Jacob Vine and R. Miller.

The Arctic Pump Manufacturing Co. has been organized at Spokane, Wash., to make and sell an engine cooling device for Ford cars. Capital stock is $100,000. Directors are G. B. Kemp, R. S. McClintock and H. L. Kemp.

The Bush Manufacturing Co., Hartford, Conn., manufacturer of automobile, truck and airplane radiators, has purchased the plant of the Ellison Construction Co., in Hartford. Due to the expansion of business, more room was required for working facilities.

Personals

George L. Sawyer, formerly sales manager of material handling machinery for the Barber-Greene Company, Aurora, Ill., has been appointed to represent the Universal Crane Co., of Elyria, Ohio, in the New York field. His offices are at the Allied Machinery Center, 141 Center St., New York City.

John J. Eagan, of Atlanta, has been chosen to succeed J. R. McWane as president of the American Cast Iron Pipe Co., Birmingham, Ala. Mr. Eagan is also chairman of the board of directors.

Mayor James E. Higgins, of Chicopee, Mass., has recently sold out his interests in the Higgins & Company, brass foundry, Holyoke, Mass. to his partner Frank Williams. Mr. Higgins has been identified with the business for the past 35 years.

J. M. Lloyd has resigned as superintendent of Lowellville, Ohio, plant of the Sharon Steel Hoop Co. at Sharon, Pa.

E. H. Warner, well-known in the machinery world through his long connection with the Cowdrey, Fitchburg Machine, Fairbanks and other machinery building concerns, has established himself as a direct factory representative for several manufacturers. He is now located at 76 West Alvord St., Springfield, Mass.

H. W. Heinrich, manager of the Latin-American department of the export department of the Yale & Towne Manufacturing Co., of Stamford, Conn., has recently returned from a three months' business trip to Cuba, Santo Domingo and Porto Rico.

G. M. Graham on Nov. 1 will become a vice-president of the Chandler Motor Car Company, in charge of sales, service and advertising. Mr. Graham was formerly a vice-president of the Pierce-Arrow Motor Car Co.

William M. Chamberlin has been appointed as assistant to the vice-president, in charge of sales, of the Maxwell and the Chalmers Motor Sales companies. He will devote his time to developing better merchandising methods.

Lyle W. Orr, general manager of the Modern Tool Co., Erie, Pa., has resigned his position but will retain his interest in the company.

Frank Trabold has resigned as vice-president of J. H. Williams & Co., of Brooklyn, N. Y., which company he has served for twenty years. Mr. Trabold has opened offices at 30 Church St. ,but has not as yet completed his plans for the future.

M. A. Green, for ten years superintendent of branches and agencies of the Crucible Steel Co., of America, has been appointed manager of the tool steel department of John Henry Andrews & Co., Ltd., of Sheffield, England.

Obituary

Robert Lawrence Ahles, forty-three years old, died at Westbury, L. I., on Oct. 17. Mr. Ahles for many years was prominent in the steel industry. He was at the time of his death, president of the Sweet's Steel Co. of Williamsport, Pa., where he resided. He was formerly identified with the Hewitt interests in northern New Jersey, where he operated blast furnaces.

Julius J. D. McNamara, 65 years old, manufacturer of engines, died unexpectedly on Oct. 9 at his residence in Newark, Ohio.

Lorenzo Dow Hawkins, of Stoneham, Mass., died on Oct. 12 in his ninetieth year, as the result of a recent fall. Mr. Hawkins was for many years a manufacturer of elevators and of shoe machinery, as head of the old-time Boston firm of L. D. Hawkins & Co.

Josiah Gibson, treasurer of the Marsh Motor Car Co., Cleveland, Ohio, died on Sept. 28.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A merchant in Italy desires to purchase or secure an agency for the sale of iron and steel, scrap iron and steel. Quotations should be given c.i.f. Genoa or Naples. Reference No. 137.

A firm in Victoria, Australia, which has taken up the manufacture of light tractors and motor trucks, wishes to be placed in communication with firms for the purchase of suitable engines and transmissions. Prices and full particulars are requested. Reference No. 122.

A business man in Spain desires to get into touch with manufacturers and exporters of aëroplanes and motor boats. Catalogs and price lists should be forwarded as soon as possible. Reference No. 128.

A merchant in Norway desires to purchase and secure an agency for the sale of metals and iron and steel. Quotations should be given f. o. b. New York. Reference No. 149.

Local manufacturers of chocolates in a city of Ecuador are planning to extend and improve their factories, and desire to receive catalogs of machinery and apparatus. None of the manufacturers have produced heretofore more than 1,500 pounds daily. Reference No. 161.

The owners of a coal mine in Colombia desire to be placed in touch with American firms for securing an aerial cable for transporting coal, and machinery appropriate for use in briquetting coal in the form used for export purposes. Reference No. 162.

The Commonwealth engineers in South Australia desire to purchase and secure an agency for the sale of stationary engines and irrigation machinery, suitable for agriculture. Quotations should be given f. o. b. New York. Payment, cash against documents. Reference No. 169.

An importer in India desires to purchase large consignments of structural steel, beams, girders, rails, bolts, and nuts. Quotations should be given c. i. f. Indian port. Reference No. 171.

Trade Catalogs

Vertical Shapers. Pratt & Whitney Co., Hartford, Conn. Circular No. 269 illustrating and describing the 6 and 8-in. vertical shapers of this company.

Seybold Automatic Cutter. E. P. Lamson Co., Inc., New York, N. Y. An eight-page catalog devoted to a description of the improved Seybold machine for cutting paper and like materials.

Concrete Bins and Pits for Coal Storage. Portland Cement Association. Pamphlet showing increased use of concrete in building storage bins for coal.

Autovent Fans. Autovent Fan and Blower Co., Chicago, Ill. Eighth edition catalogs, describing the latest types of autovent fans, Uni-blade blowers and exhausters.

Forthcoming Meetings

The annual convention of the Industrial Relations Association, of America, will be held in the Waldorf-Astoria Hotel, New York City, on Nov. 1, 2, 3 and 4.

The National Conference of the Industrial Cost Association will be held at Pittsburgh, Pa., on Nov. 2, 3 and 4.

The third annual convention and exhibition of the American Gas Association will be held in the Congress and Auditorium Hotels, Chicago, Ill., on Nov. 7 to 12.

The twenty-fifth annual convention of the National Founders' Association will be held in the Hotel Astor, New York City, on Nov. 16 and 17.

NEW *and* ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

N. Y., Buffalo—J. Wagner, 192 Villa Ave. —11 or 12 in. machine lathe.

N. Y., New York—Bd. Educ., P. Jones, Supt. of School Supplies, Park Ave. and 59th St., receives bids until Oct. 31 for machine tools, machinery, miscellaneous hand tools and materials, principal items as follows:

One 13 in. swing by 5 ft. bed, loose change gear, Star engine lathe.

One Reed Prentice, 14 in. x 6 ft. engine lathe.

One Hendey, cone type screw cutting engine lathe with equipment.

Four speed lathes, 1 in. x 4 ft.

Forty-eight bench lathes, 32 to 38 in. length, 7 to 9 in swing.

Forty-one engine lathes, 11 in. x 4 ft.

Thirty-six No. 211 lathes with 12 in. swing, 4 ft. bed and 12 with 12 in. swing, 5 ft. bed.

One Washburn, 14 in. sensitive drill.

One Hisey electric drill, 2 speed, Model K. A.

One Barnes, 20 in. upright drill.

One Yankee, 2 speed breast drill

One U. S. sensitive, 14 in. floor drill.

Two Willey electric driven portable drills.

One 14 in. U. S. sensitive drill press.

One 20 in. drill press.

One 24 in. sliding head, drill press.

Five Greenerd arbor presses, No. 2 and one No. 3.

One "Perfection" combination arbor press, 30 tons capacity.

One Fairbanks, 20 in. back geared drill press.

Ten 14 in. sensitive drill presses.

Four 20 in. fixed-head drill presses.

One No. 25 plain milling machine, Bilton or Becker.

One No. 1 Kempsmith universal milling machine.

One Marvel cylinder reboring machine, 2½ in. to 8 in. capacity with equipment.

One back geared 16 in. Hendey shaper.

One 17 in. x 20 in. x 9 ft. planer.

One No. 3 Robertson, 6 in. x 6 in. high speed, power driven hack saw.

One B. & S. No. 1 Universal grinder.

One twist drill grinder (Wilmarth or Norman).

One U. S. ball-bearing bench grinder.

One Hisey grinder.

One 14 in. wet tool grinder.

One 10 in. dry grinder.

One 12 in. speed lathe, 72 in. bed.

One Vertical hollow chisel mortiser, with compound table.

Forty-eight Wells manual training lathes.

One single surface planer.

One 3 roller cylinder press, 28 x 41 in. bed with equipment (Babcock-Optimus).

Specifications may be obtained by writing the Bd. Educ.

Pa., Phila.—F. Pettit, 809 Master St.—several machines for ornamental iron works.

Pa., Phila.—W. H. Robinson, 1823 Ludlow St.—metal stamping and electro plating machinery.

Pa., Phila.—School Dist., 19 and Chestnut Sts., W. Dick, Supt. of Supplies—bids will be received until Nov. 3, for lathes, drills, etc.

Ga., Columbus—T. Houston Mfg. Co., 30th St., manufacturers of Machinery—

Key-seating machine for outside work with shafts for keys up to ¾ in.

Baker machine or equivalent for inside key seating up to ¾ in.

One 36 in. lathe, about 10 ft. bed, large face plate, extra compound rest, 4 jaw chuck, prefer brass bearing in head stock (used).

Ill., Chicago—Accessories Mfg. Co., 2311 North Crawford Ave.—one 20 ton screw press.

Ind., East Chicago—The Union Iron Products Co., 148th St., manufacturer of metal culverts—rotary ring and circular shear, 14 gage capacity.

Mich., Detroit — Zang-Marvin Co., 130 Cadillac Sq.—one No. 7 Burke miller, No. 3 Barber Coleman gear hobber, and one 8 in. chain pull, counter shafts.

O., Columbus—The Capitol Motor Car Co., 32 South 4th St., C. D. Beck, Service Mgr. —2 or 3 air compressors and drills, 1 lathe and other equipment.

Wis., Columbus—The Columbia Auto Repair & Paint Co., F. Menke, Purch. Agt.—repair machinery and automatic paint applying brushes.

Wis., Madison—The Purcell Wischau Co., 219 East Washington Ave.—lathes, presses (1 and 2 ton), etc.

Wis., Milwaukee—F. J. Hanson, 463 Lenox St.—one lathe for auto repair shop.

Wis., Milwaukee—E. C. Kahn, 4129 Highland Blvd., (machinist)—drill presses.

Que., Montreal — J. Buckley Co., St. Nicholas Bldg., St. Nicholas Ave.—one 48 in. roll turning lathe.

N. Y., Lewiston — The Riverview Upholstering Co.—feather renovating machine.

Pa., Phila.—Co.-Ed Knitting Mills, 1542 Frankford Ave., B. M. Cohn, Pres.-general machinery for the manufacture of neckwear, scarfs and novelties.

Ala., Anniston—The Union Fdry. Co.—jointer, belt driven, 12 to 20 in. blade (good condition).

Fla., St. Petersburg—The Marine Ways Mch. Co., Inc., K. Grable—automatic machine for making pipe nipples from ⅛ in. to 1½ in.

S. C., Columbia—The Halo Co., E. M. Lowman, Secy.—small temporary outfit for manufacture of syrup.

Va., Roanoke — The Harris Hardwood Co., Inc., manufacturers of hardwood flooring, etc., G. L. Wade, Mgr.—planing mill machinery hardwood floorer, gang rip circular resaw, swing cut-off, file room equipment, etc.

Ill., Chicago—W. S. Mole, 2821 Prairie Ave.—complete line of machinery for the manufacture of gas mantels.

Ill., Marengo—The Bd. Educ.,—manual training equipment for proposed high school.

Ill., McHenry—The Bd. Educ., c/o O. G. Treadway, Supt. — manual training equipment for proposed high school.

Mich., Roseville — The White Eagle Furniture Co., Fraser and Michigan Aves. —belt sander, swing saw, all steel veneer press (used).

O., Cincinnati — The Greaves Machine Tool Co., 2420 Spring Grove Ave., W. Greaves, Secy. and Treas.—one gear tooth rounding machine.

Wis., Beaver Dam—Ruland & Price—refrigerating and butter-making machinery.

Wis., Cumberland—Cumberland Creamery Assn.—refrigerating machinery and belt driven butter-making machinery, including separators and churns.

Wis., Kaukauna—The Valley Pulp Co.—beaters, etc. for proposed mill.

Wis., Milwaukee—N. Leonard, 801 24th Ave.—one woodworking lathe with motor.

Wis., Milwaukee—Luick Ice Cream Co., Ogden Ave. and Jackson St.—special ice cream making machinery.

Wis., Owen—W. F. Weaver, (millworker) —rip saws.

Wis., Racine—Hansen & Nielser, 1622 Grange Ave., R. C. Hansen, Purch. Agt.—wood working machinery.

Ark., Texarkana—Williams Mchy. Co., P. O. Box 356.—saw mill equipment, grist mills, farm machinery, gasoline engines, etc.

Mo., Independence—Good Mom Products Co., C. A. Birdsall, Pres.—paper package machinery.

Mo., Kansas City — The Western Rock Salt Co., 514 New York Life Bldg.—hydraulic jack, 40 ton capacity.

Tex., Weslaco—A. K. Mattingly, P. O. Box 96—machinery for canning plant.

Ont., Dresden—Lawrence & Wakefield—flour mill machinery and equipment.

Ont., Preston—E. B. Salyerds—machinery for making hockey sticks and wood specialties.

Metal Working Shops

NEW ENGLAND STATES

Conn., South Norwalk — The Norwalk Lock Co., Marshall St., has awarded the contract for the construction of a 1 story, 50 x 100 ft. factory. Estimated cost, $30,000.

Conn., Waterbury—G. W. Russell is having plans prepared for the construction of a 1 story, 60 x 135 ft. garage on Cottage Pl. J. S. LaDow, 51 Leavenworth St., Archt.

Conn., Waterbury—H. Weyand Co., 16 Jefferson St., has awarded the contract for the construction of a 3 story, 82 x 110 ft. plant on Judd St., for the manufacture of sheet metal skylights.

Mass., Boston—Meisel Press Mfg. Co., 944 Dorchester Ave., will soon award the contract for the construction of a 1 story, 300 x 400 ft. machine shop near Locust St. Estimated cost, $300,000. McNaughton & Cleverdon, 19 Congress St., Archts. Noted May 26.

The Weekly Price Guide

This Week's Market

Pittsburgh mill prices on steel plates have been quoted at $1.60@$1.65 for small tonnages; but business has been done as low as $1.50@$1.55 per 100 lb. Structural shapes are quoted at $1.50@$1.65 as against last week's price of $1.60@$1.75 per 100 lb. Bars are quoted at $1.50 with small tonnages selling at $1.60@$1.65 per 100 lb. Mill shipments, New York, of structural steel shapes and plates are quoted at $1.98@$2.13; bars at $1.88@$2.03 per 100 lb.

Wrought-iron pipe discounts, since the Pittsburgh basing card of Sept. 16, have increased an even 5 per cent on all sizes from ¾ to 12 in., both black and galvanized.

Electrolytic copper is quoted, to the consumer in New York warehouses, at 13¾c., as against 13⅝c. and tin at 28¾c. as compared with 27½c. per lb. previously.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$24.50
Northern Basic	22.52
Southern Ohio No. 2	23.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	30.26
BIRMINGHAM	
No. 2 Foundry	20.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	22.75
Virginia No. 2	28.74
Basic	20.75
Grey Forge	21.75
CHICAGO	
No. 2 Foundry local	22.70
No. 2 Foundry, Southern, sil 2.25@2.75	26.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	22.96
Basic	21.96
Bessemer	21.96

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50	3.28	3.10	3.38
No. 12	2.60	3.33	3.15	3.43
No. 14	2.70	3.38	3.20	3.48
No. 16	2.80	3.48	3.30	3.58
Black				
Nos. 17 and 21.	2.85	4.05	3.55	3.95
Nos. 22 and 24.	2.90	4.10	3.60	4.00
Nos. 25 and 26.	2.95	4.15	3.65	4.05
No. 28	3.00	4.25	3.75	4.15
Galvanized				
Nos. 10 and 11.	3.00	4.25	3.75	4.15
Nos. 12 and 14.	3.10	4.35	3.85	4.25
Nos. 17 and 21.	3.40	4.65	4.15	4.55
Nos. 22 and 24.	3.55	4.80	4.30	4.70
No. 26	3.70	4.95	4.55	4.85
No. 28	4.00	5.25	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of Sept. 16, 1921:

Steel			Iron		
Inches	Black	Galv.	Inches	Black	Galv.
BUTT WELD					
1 to 3	68½	56	¾ to 1½	44½	29½
LAP WELD					
2	61½	49	2	39½	25½
2½ to 6	65½	53	2¼ to 4	42½	29½
7 to 8	62½	49	4½ to 6	42½	29½
9 to 12	62½	49	7 to 12	40½	27½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66½	55	1 to 1½	44½	30½
2 to 3	68½	56			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59½	48	2	40½	27½
2½ to 4	63½	52	2½ to 4	43½	31½
4½ to 6	62½	51	4½ to 6	42½	30½
7 to 8	58½	45	7 to 8	35½	23½
9 to 12	52½	39	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded.	60%	46%	60½%	47½%	68½%	56%
3½ to 6 in. steel lap welded.	51%	37%	58½%	44½%	65½%	53%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (heavy)	5.00	6.00	*3.78
Spring steel (light)	6.00	6.00	†8.50
Coppered Bessemer rods (base)	8.00	8.00	*6.03
Hoop steel	3.88	3.29	3.48
Cold rolled strip steel	7.50	8.25	6.75
Floor plates	4.85	....	5.23
Cold finished shafting or screw	3.88	3.50	4.00
Cold finished flats, squares.	4.38	4.00	4.50
Structural shapes (base)	2.88	2.74	2.88
Soft steel bars (base)	2.78	2.64	2.78
Soft steel bar shapes (base)	2.78	2.64	2.78
Soft steel bands (base).	3.43	....	....
Tank plates (base)	2.88	2.92½	2.88
Bar iron (2.15@2.25)	2.78	3.52	2.78
Drill rod (from list)	55@60%	55%	50%

Electric welding wire .... New York $\frac{3}{32}$, 8½c. per lb.; ⅛, 7.15c.; $\frac{5}{32}$ to ¼, 6.75c. Swedish iron sells at 9c. per lb. in Chicago. *Price to dealers. †Carriage spring steel.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	13.75
Tin, 5-ton lots, New York	28.75
Lead (up to carlots), St. Louis, 4.60; New York	5.00
Zinc (up to carlots), St. Louis, 4.97½; New York	5.37½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.00	25.00	20.00
Antimony (Chinese), ton spot	5.50	6.00	6.50
Copper sheets, base	20.75	21.50	20.50
Copper wire (carlots)	16.50	16.50	15.50
Copper bars (ton lots)	19.00	23.00	18.00
Copper tubing (100-lb. lots)	20.50	23.00	20.50
Brass sheets (100-lb. lots)	16.25	16.00	16.25
Brass tubing (100-lb. lots)	18.00	18.00	18.00
Brass rods (1,000-lb. lots)	14.25	16.00	14.25
Zinc sheets (casks), (8% dis. carlots)	11.00	11.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	....	....
Nickel (electrolytic), Bayonne, N. J.	44.00	....	....
Solder (½ and ½), (case lots)	19.50	23.50	17.50
Babbitt metal (best grade)	70.00	39.00	32.00
Babbitt metal (commercial)	30.00	13.50	8.00

—Shop Materials and Supplies

MONEL METAL—Base price in cents per lb., f.o.b. Bayonne, N.J.:

Shot	35.00	Hot rolled machined rods (base)	53.00
Blocks	35.00	Hot rolled rods (base)	42.00
Ingots	38.00	Cold drawn rods (base)	56.00
Sheet bars	40.00	Hot rolled sheets (base)	55.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.50	10.25
Copper, heavy, and wire	9.50	10.50	9.50
Copper, light, and bottoms	8.00	8.00	8.25
Lead, heavy	4.00	3.75	3.75
Lead, tea	3.00	2.75	3.00
Brass, heavy	6.50	6.00	8.00
Brass, light	5.00	4.00	4.75
No. 1 yellow brass turnings	5.25	4.50	5.25
Zinc	3.00	2.00	2.75

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

			New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:					
IC,	20x28,	112 sheets	21.50	......	....
IX,	20x28,	112 sheets	24.00	......	....
IXX,	20x28,	56 sheets	13.75	......	....
IXXX,	20x28,	56 sheets	15.50	......	....
IXXXX,	20x28,	56 sheets	17.00	......	....
'A" Charcoal Allaways Grade:					
IC,	20x28,	112 sheets	18.50	......	....
IX,	20x28,	112 sheets	21.50	......	....
IXX,	20x28,	56 sheets	12.25	......	....
IXXX,	20x28,	56 sheets	14.00	......	....
IXXXX,	20x28,	56 sheets	15.75	......	....

Coke Plates, Bright

		New York	Cleveland	Chicago
Prime, 20x28 in.:			(56 sheets)	
80-lb,	112 sheets	13.60	......	....
90-lb.,	112 sheets	13.80	......	....
100-lb.,	112 sheets	14.00	6.50	....
IC,	112 sheets	14.30	6.65	....
IX,	112 sheets	16.30	......	....
IXX,	56 sheets	9.15	......	....
IXXX,	56 sheets	10.15	......	....
IXXXX,	56 sheets	11.15	......	....

Terne Plate

		New York	Cleveland	Chicago
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.50	6.25	6.25
IC,	14x20	7.75	6.50	6.50

SHOP SUPPLIES

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	—50%	−60%	—60–5%
1⅛ and 1¼x3 in. up to 12 in.	—40%	60–10–10%	—55%
With cold punched sq. nuts	—30%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	—40%	....	....
Up to 1-in. diameter, with cold punched hex. nuts (plus std. extra of 10%)	—30%	....	.....
Button head bolts, with hex. nuts	—20%	$3.90 base	.....
Hex. head and hex. nut bolts	—20%	....	.....
Lag screws, coach screws	—50–10%	....	.....
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	50–10–10%	50–5%
Bolt ends, with hot pressed nuts	—50%	....	.....
Tap bolts, hex. heads	—20%	....	.....
Semi-finished nuts, all sizes	—70%	75%	75%
Case-hardened nuts	—60%	....	.....
Washers, cast iron, ½ in., per 100 lb.	$5.00	$5.50 off	$4.50
Washers, cast iron, ⅝ in. and larger, per 100 lb.	4.25	3.75 off	4.50
Washers, round plate, off list per 100 lb.	3.00	....	.....
Nuts, hot pressed, sq. Off list	2.00	3.00	3.00
Nuts, hot pressed, hex. Off list	2.00	3.00	3.00
Nuts, cold punched, sq. Off list	1.50	3.00	3.00
Nuts, cold punched, hex. Off list	1.50	3.00	3.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	50-10%	60-10-10%	-60-10%
Rivets, tinned	−50-10%	60-10-10%	4½c. per lb. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb.	$3.70	3.50	3.68
Cone heads, ditto	3.80	3.60	3.78
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb.	0.25	....	....
⅞ in. diameter *EXTRA*	0.15	....	....
½ in. diameter *EXTRA*	0.50	....	....
1 in. long, and shorter *EXTRA*	0.50	....	....
Longer than 5 in. *EXTRA*	0.25	....	....
Less than 200 lb. *EXTRA*	0.50	....	....
Countersunk heads *EXTRA*	0.35	....	....
Copper rivets	50–10%	40–10%	40%
Copper burs	25–10%	15%	20%

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb.	.055@.09	.09	.10
Wiping cloths per M., 13¼x13¼	....	55.00	55.00
Wiping cloths per M., 13¼x20½	....	65.00	65.00
Sal soda, 100 lbs	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb.	2.55	3.25	2.75
Linseed oil, per gal., 5 bbl. lots	.73	.80	.81
White lead, dry or in oil	100 lb. kegs.		New York, 12.25
Red lead, dry	100 lb. kegs.		New York, 12.25
Red lead, in oil	100 lb. kegs.		New York, 13.75
Fire clay, per 75 lb. bag		.80	.80
Coke, prompt furnace, Connellsville	per ton		$3.35@3.50
Coke, prompt foundry, Connellsville	per ton		4.25@4.75

R. I., Woonsocket—The Regina Auto Sales Co., Front St., has awarded the contract for the construction of a 2 story, 60 x 80 ft. garage, etc., on Front. Estimated cost, $40,000.

MIDDLE ATLANTIC STATES

Pa., Philadelphia—T. Clark, 2728 North 2d St., has awarded the contract for the construction of a 1 story, 30 x 60 ft. addition to his machine shop at 2732 North 2d St. Estimated cost, $5,000.

Pa., Philadelphia — J. E. Fieldstein, Archt., 901 Walnut St., will receive bids until Nov. 1 for the construction of a 3 story, 89 x 100 ft. garage and service station on Broad St. and Bainbridge Ave., for the Walton Auto Supplies, Inc. D. Perry, Treas. and Mgr.

Pa., Philadelphia—C. K. Guerard, 6422 Oak Ave., has awarded the contract for the construction of a 1 story addition to his machine shop at 1510 Vine St. Estimated cost, $5,000.

Pa., Philadelphia—Ivins Tube Wks. is building a 1 story, rolling mill on Oak Lane, Coventry and Chestnut Sts., for the manufacture of steel tubes. Estimated cost $250,000.

Pa., Philadelphia—F. Pettit, 809 Master St., has awarded the contract for the construction of a 2 story, 99 x 108 ft. manufacturing plant for the manufacture of ornamental iron works, at 809 Master St. Estimated cost, $15,000.

Pa., Pittsburgh—The Cunningham Sales Co., 510 Liberty St., has awarded the contract for the construction of a 2 story, 85 x 100 ft. garage and sales building. Estimated cost, $100,000. Noted Sept. 8.

Pa., Pittsburgh—The Standard Underground Cable Co., Westinghouse Bldg., has awarded the contract for the construction of an addition to its plant between 16th and 17th Sts. Estimated cost, $500,000.

SOUTHERN STATES

W. Va., Point Pleasant—The Auto-Motor Corp., Charleston, W. Va., will open bids about Nov. 15 for the construction of a 4 story factory, consisting of 3 units, here. Estimated cost, $250,000. L. C. Pritchard, Genl. Mgr.

MIDDLE WEST STATES

Ill., Aurora—F. J. Fidler, 16 North La Salle St., plans to construct a 1 story garage. Estimated cost, $40,000. Architect not selected.

Ill., Centralia—J. Longenfeld is having plans prepared for the construction of a 2 story, 80 x 106 ft. garage. Estimated cost, $40,000. Architect's name withheld.

Ill., Chicago — S. Porcaro, 2544 West Superior St., has awarded the contract for the construction of a 2 story, 72 x 120 ft. addition to his garage at 2435 Division St. Estimated cost, $40,000.

Ill., East St. Louis—C. O. McCasland, 810 Chestnut St., St. Louis, Mo., is having plans prepared for the construction of a 1 story, 70 x 120 ft. garage on 10th and Illinois Aves., here. Estimated cost, $55,000. Architect's name withheld.

Ill., Harvard — Cowen & Obert, Crystal Lake, are having plans prepared for the construction of a 1 story, 82 x 90 ft. garage, here. Estimated cost, $40,000. M. A. Stafford, Harvard, Archt.

Ill., Harvard — The Manley Motor Co., c/o B. Manley, is having plans prepared for the construction of a 1 story, 68 x 113 ft. garage. Estimated cost, $40,000. M. A. Stafford, Harvard, Archt.

Ill., Joliet—The Pub. Service Co. is having plans prepared for the construction of a 1 story, 60 x 100 ft. garage. Estimated cost, $40,000. H. Von Holst, 72 West Adams St., Chicago, Archt.

Ill., Pekin—The Conaghan Motor Co., is having plans prepared for the construction of a 1 story garage. Estimated cost, $200,000. J. Zimmer, 217 Court St., Archt.

Ill., Woodstock—The Cross Mfg. Co., c/o E. Wittenburg, Amer. Natl. Bank, plans to construct a 2 story factory for the manufacture of auto shock absorbers. Estimated cost, $35,000. Architect not selected.

O., Cleveland—W. N. Goodman, 1327 East Blvd.,has awarded the contract for the construction of a 1 story, 47 x 97 ft. garage and repair shop on East 14th St. and Webster Ave. Estimated cost, $40,000.

O., Cleveland—P. R. Morren Fdry., 4260 East 98th St., has had plans prepared for the construction of a 1 story, 40 x 102 ft. and 16 x 70 ft. foundry and pattern shop at 10010 Dunlap Ave. Estimated cost, $40,000. Private plans.

O., Cleveland—Richmond Bros., 1600 East 55th St., have had plans prepared for the construction of a 1 story 66 x 90 ft. garage at 1600 East 55th St. Estimated cost, $40,000. Christian, Schwartzenberg, & Gaeda, 1900 Euclid Ave., Archts.

O., Cleveland—The Simon Sign Co., 1729 East 12th St., has awarded the contract for the construction of a 2 story, 43 x 120 ft. factory on East 19th St. and Caton Court. Estimated cost, $40,000.

Wis., Madison—The Purcell Wischau Co., 219 East Washington Ave., is receiving bids for the construction of a 2 story, 117 x 132 ft. garage on West Gilman St. Estimated cost, $125,000. Private plans.

Wis., Milwaukee—The West Side Garage, 2310 Lisbon Ave., will receive bids until Oct. 30 for the construction of a 2 story, 96 x 120 ft. garage and storage plant on Lisbon Ave. Estimated cost between $50,000 and $60,000. Private plans.

WEST OF THE MISSISSIPPI

Mo., Carthage — The Carthage Superior Spring Bed Mfg. Co. plans to construct a 2 story factory. Estimated cost, $40,000. Architect not selected.

Mo., Leeds—The Kansas City Spiral Pipe Co., c/o E. J. Gordan, Secy., Dwight Bldg., Kansas City, is having plans prepared for the construction of a 1 story, 60 x 300 ft. factory. Estimated cost, $50,000. Architect's name withheld.

Mo., St. Louis—The Chester Iron & Fdry. Co., c/o A. J. Schaelieh, Pres., 7800 Vulcan St., is having plans prepared for the construction of a 1 story, 45 x 117 ft. cast iron foundry. Estimated cost, $40,000. L. Haeger, 3844 Utah St., Archt.

Mo., St. Joseph—The Grant Motor Co., 9th and Felix Sts., is having plans prepared for the construction of a 1 story, 120 x 140 ft. garage on 10th and Francis Sts. Estimated cost, $55,000. Architect's name withheld.

Mo., St. Louis—B. Gustavson, 1538 Tower Grove, is having plans prepared for the construction of a 1 story, 41 x 175 ft. garage. Estimated cost, $45,000. Wedmeyer & Nelson, Wainwright Bldg., Archts.

Mo., St. Louis—The St. Louis & San Francisco Ry., Frisco Bldg., has awarded the contract for the construction of a 1 story, 40 x 130 ft. machine shop at 3865 Cheateau St. Estimated cost, $55,000. Noted Oct. 6.

Mont., Bozeman—The Bd of Trustees University of Montana, State Capitol, Helena, will receive bids until Dec. 20 for the construction of an engineering building and shops, at the College of Agriculture and Mechanic Arts, here. Estimated cost, $350,000. F. Wilson, Bozeman, Archt.

WESTERN STATES

Cal., Sacramento—The State Hy. Comn., will soon award the contract for the construction of a maintenance shop on 34th and R Sts. Estimated cost, $76,900.

CANADA

Que., Montreal—The Kennedy Taxi Co., Cathcart St., has awarded the contract for the construction of a 2 story, 56 x 110 ft. garage. Estimated cost, $40,000.

General Manufacturing

MIDDLE ATLANTIC STATES

D. C., Washington—The Knickerbocker Ice Co., 1480 Bway., will soon award the contract for the construction of an ice plant. Estimated cost, $250,000. Private plans.

N. Y., Buffalo—The Amer. Grain & Feed Corp., 303 Chamber of Commerce, is having plans prepared for the construction of a flour mill, feed mill, warehouse, etc. Estimated cost, $400,000. L. R. Veatch, 428 Pratt St., Engr.

Pa., Braddock—B. Markovitz Baking Co., 1019 Talbot Ave., has awarded the contract for the construction of a 3 story, 7 x 75 ft. bakery on Talbot Ave. Noted Sept. 22.

Pa., Philadelphia — T. Bernstein & Sons, Inc., 1401 North 3d St., have awarded the contract for the construction of a 4 story, 58 x 60 ft. woodworking factory. Estimated cost, $48,000.

Pa., Philadelphia—Co.-Ed Knitting Mills, 1542 Frankford Ave., has awarded the contract for the construction of a 2 story 47 x 110 ft. factory on 5th and Courtland Sts. Estimated cost, $26,000.

Pa., Philadelphia—The La France Mills have awarded the contract for the construction of a 3 story, 50 x 61 x 72 ft. knitting mill at 4423 Frankford Ave. Estimated cost, $25,000.

Pa., Philadelphia — Mayer Baking Co., 60th and Naudain Sts., has awarded the contract for the construction of a 3 story, 93 x 115 ft. bakery on 55th St. and Thompson Ave. Estimated cost, $15,000.

Pa., Pittsburgh—Kingan & Co., 1121 Penn Ave., has awarded the contract for the construction of a 4 story, 48 x 100 ft. meat storage plant and warehouse on Penn Ave. Estimated cost, $100,000.

Pa., Pittsburgh—The North Pole Ice Co., 1218 West Carson St., has awarded the contract for the construction of a 7 story, 160 x 192 ft. ice storage plant on Carson St. Estimated cost, $400,000. Noted Sept. 8.

Pa., Pottstown—The Hydro United Tire Co. has awarded the contract for the construction of a 2 story, 134 x 170 ft. auto tire manufacturing plant. Estimated cost, $100,000.

MIDDLE WEST STATES

Ill., Peoria — The Capitol Laundry Co., c/o N. Madigan, Secy., 108 South Madison St., is having plans prepared for the construction of a 2 story, 50 x 150 ft. laundry. Estimated cost, $50,000. H. B. Dox, Lehmann Bldg., Archt.

O., West Park—The F. & S. Paint and Varnish Co., Elmwood Rd., has awarded the contract for the construction of a 3 story, 50 x 70 ft. factory. Estimated cost, $50,000.

Wis., Kaukauna—The Valley Pulp Co., is having plans prepared for the construction of a pulp mill with 30 ton capacity. O'Keefe & Orbison, College Ave., Appleton, Archts. and Engrs.

Wis., Milwaukee—Luick Ice Cream Co., Ogden Ave. and Jackson St., has awarded the contract for the construction of a 5 story, 60 x 60 ft. factory on Ogden Ave. Estimated cost, $75,000.

Wis., Neenah—The Dairymen's Storage Co., c/o H. Krumrey, Plymouth, plans to construct a 3 story, 40 x 60 ft. cold storage plant here. Estimated cost, $45,000. Architect not selected.

Wis., Rib Lake—The Rib Lake Chair and Manufacturing Co. plans to build a 2 story, 60 x 85 ft. chair factory on Main St. Estimated cost, $35,000. Architect not selected.

Wis., Waupun—The Paramount Knitting Co. has awarded the contract for the construction of a 2 story, 52 x 180 ft. addition to its factory. Estimated cost, $30,000.

WEST OF THE MISSISSIPPI

Mo., Kansas City—The Artzcraft Broom Co., 1423 Kansas Ave., has awarded the contract for the construction of a 2 story, 65 x 127 ft. factory on 14th and Kansas Aves. Estimated cost, $75,000. Noted Oct. 20.

Mo., St. Louis—The Sieloff Packing Co., c/o E. Sieloff, Pres., 4339 Natl. Bridge Rd., has awarded the contract for the construction of a 2 story, 120 x 120 ft. cooling cellar on Sacramento and Newstead Sts. Estimated cost, $75,000.

CANADA

Ont., Preston—E. B. Salyerds plans to rebuild his wood specialty plant which was recently destroyed by fire. Estimated cost, $50,000.

B. C., Prince Rupert—Prince Rupert Pulp & Paper Co., 602 Pacific Bldg., Vancouver, plans to construct first unit of pulp mill. here, to have 40 ton daily capacity. Estimated cost, $1,000,000. Engineer not selected.

American Machinist

Volume 55 NEW YORK, NOVEMBER 3, 1921 Number 18

Diamond Dies for Wire Drawing

Information on Hitherto Closely Guarded Operations — How Dies Are Lapped and Tested for Size—Automatic Lapping Machines for This Work

BY C. W. BUSICK

THE drilling and polishing of diamond dies is an art which is not generally understood and a wall of secrecy has been thrown around the processes which confine this art to a few craftsmen who will only instruct sons or friends who have their confidence. Even the heads of important wire drawing industries have but little real knowledge of the operations in this department of their works although the cost of their fine wires depends largely upon the service given by the diamond dies through which they are drawn. As the methods used in making and maintaining dies should be of general interest, some details are given herewith.

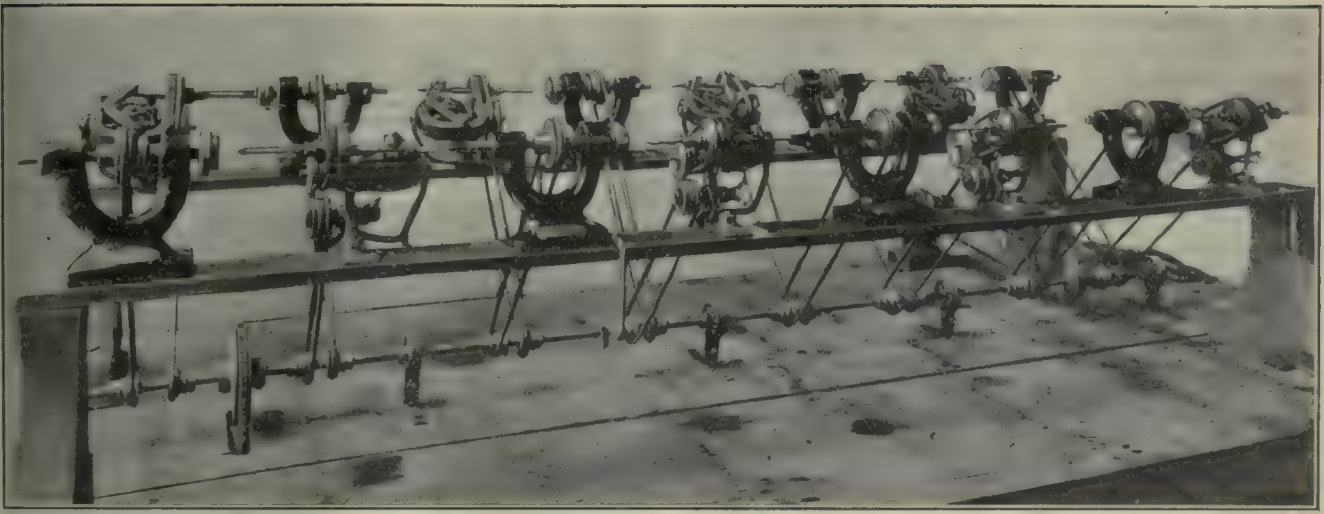


FIG. 2. A BANK OF DIE LAPPING MACHINES

The diamonds used are borts or flat shapes found in the crude state and so thin or of such poor color as to render them useless as gems or jewels. Some of the borts used are chips obtained when cutting the crude diamond into proper shape to be used by jewelers.

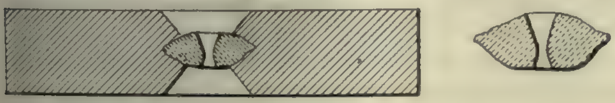


FIG. 1. A SECTION OF DIAMOND DRAWING DIE

These flat shapes are then mounted in a suitable holder to be drilled and polished. Fig. 1 gives an idea of the way the diamond is set in the holder.

The diamond is embedded in the center and the die is placed under a drilling machine driving a blunt bit which revolves in diamond dust. The cutting is done by making "diamond cut diamond," which is doubtless the inspiration for the familiar saying. There is no standard drill for this work but each diamond cutter has his own design specially made for him. These designs are jealously guarded and there is no standardization.

These drilled diamonds must then be polished and shaped, as on this finish depends the quality of the work which the die will do. The proper slope from the sides to the center, the edge through which the wire is drawn and perfect roundness of the opening are all essential to a good die.

Formerly the polishing was done on small machines which depend principally on hand labor to secure the desired results. This left too much to the judgment of the operator, with the result that many of the dies were not true and so could only be used as breaking down or "ripping" dies. Furthermore, after a die has been in use for some time, the opening will become grooved or roughened so as to draw wire out of round and also cause too much breakage.

Such a die must again be polished to exact shape. This requires great care and is expensive especially in the case where each machine must have its individual operator, as the process is slow and the labor cost high.

The quality of the repolished die is largely dependent upon the individual skill of the operator and many imperfect dies are returned to the user. This has led to the invention of the automatic machine illustrated in this article which insures the perfection of the dies after polishing. All manual work in the operation is done away with and a single operator can look after ten to twelve such machines and keep them running.

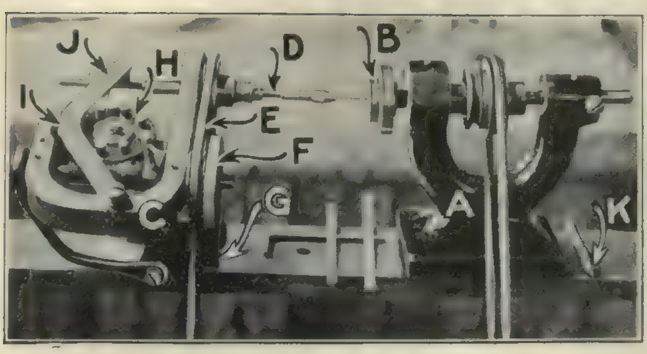


FIG. 3. ONE OF THE MACHINES

As almost all diamond dies break or shatter on one side, the repolishing becomes a matter of lapping out the imperfect hole and rounding the opening to the next larger size so that the die will again draw perfect wire.

If the angles of the approach or throat are not equal, the wire comes in contact with a greater resistance on one side than on the other and the finished product is out of round and flattened. The common method therefore is either to lap the dies by hand or with a lapping bar that works on guides and passes in and out of the die while the die rotates. This method is not mechanical nor is it possible by its use to lap the hole round and at the same time only remove enough material to be able to obtain a perfect radius at the extreme diameter of the hole.

If, for instance, the hole in a die has been pulled out or worn so that it measures 0.0095 in. in one direction and 0.010 in. in the other, it would be 0.0005 in. out of round and must be relapped for the next larger size of wire. As the next size is 0.0102 in., the hole must be enlarged 0.0007 in. in the small dimension and 0.0002 in. in the large one to true it up. In lapping a hole of this size and contour by hand in the ordinary method it is almost an impossibility to obtain a perfect radius or to get it within 0.0001 in. which is considered almost perfection by the average manufacturer. By the use of the lapping machines shown in Figs. 2 and 3, the requirements of some of the best wire manufacturers of high-grade wire can be met and dies can be recut from one size to the next, obtaining a finished product in each case.

It is a well-known fact among machinists that a lapping bar has to pass back and forth through the hole being lapped. In the lapping of diamond dies, however, this does not hold, owing to the fact that the wall of the die is curved and a straight lap would have to go into the hole at an angle and therefore would be under a constant strain, which would cause the lap to drop into the low places in the die. This would have a tendency to cut as much in one place as the other and to keep the hole out of round.

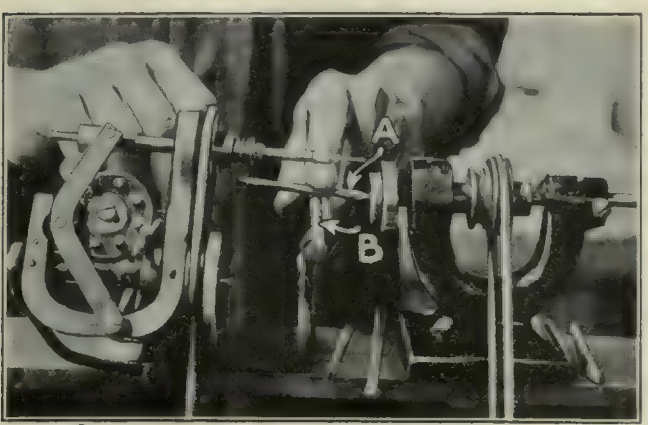


FIG. 4. CENTERING THE DIE

USING NEEDLES FOR LAPS

It has been found that by using the ordinary cambric needle ranging from 0.002 in. to 0.015 in. larger than the hole in the die and running the lapping spindle at an angle of 1½ deg. that a die can be lapped very round and to almost absolute perfection and at the same time dies can be cut or lapped within a margin of from 0.0002 to 0.0003 in. This can hardly be done by hand or with the ordinary polishing machine as any lack of alignment would very quickly cut the lap or needle flat on one side and make it out of round. The only absolute mechanical method is to revolve the lap in one direction and the work in the opposite direction at different speeds and at the same time pass the lap in and out of the hole at about 60 passes per minute making a steady movement so that the lap simply stops and starts back.

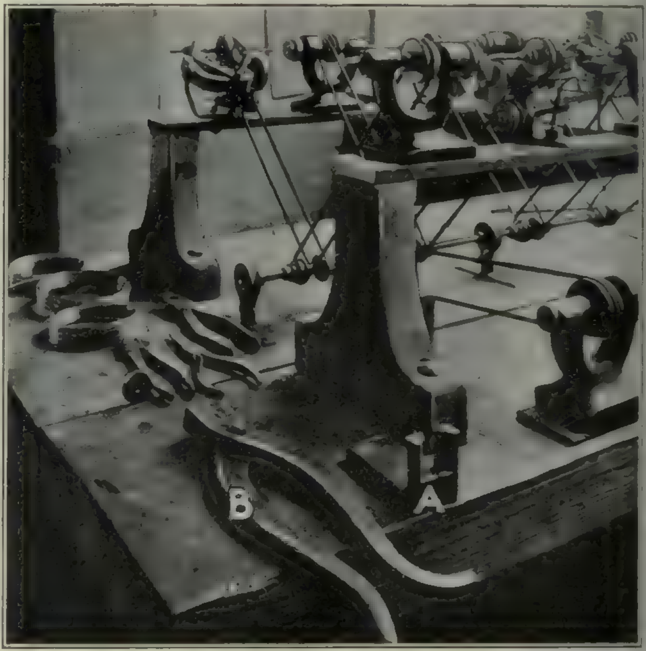
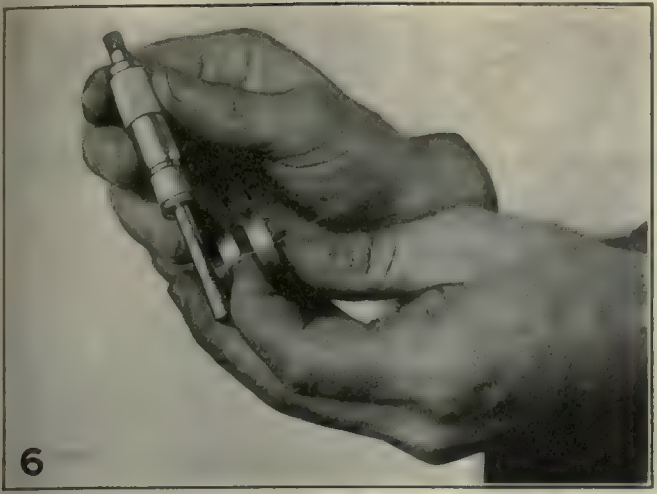


FIG. 5. WHERE THE TEST WIRE IS DRAWN

By this motion the lap cuts a double spiral, one in the opposite direction of the other. The cutting effect is diagonal to both spiral sines and at a right-angle with the hole. With this method it is impossible to cut or leave rings in a die which is very common in the old method and proves to be very unsatisfactory, as the life of the die is apt to be very short and in many cases the die will not draw wire at all. The higher the polish the greater the efficiency and the longer the life of the die. Consequently a greater production is obtained from the die as well as a better quality of wire. It is a common practice to use any die to break down or "rip" as long as it will draw wire, but this is a mistake as a rough, or out-of-round wire, greatly reduces the life of the finishing die and is very apt to give bad results.

A bank of eight automatic lapping machines is shown in Fig. 2 all being driven from a small ball bearing shaft in the center. Each machine consists primarily of the head *A*, Fig. 3, which carries the diamond die at *B* and the lapping head *C* with the spindle at *D*. The spindle is driven by the round belt *E* from the



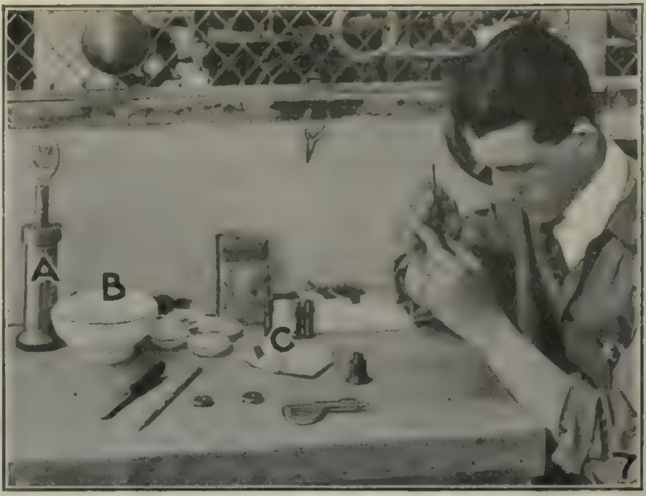


FIG. 6. MEASURING THE WIRE. FIG. 7. WHERE THE DIES ARE EXAMINED

friction wheel *F* which rests on the wheel *G*. The end or in-and-out motion is secured by the pins in the wheel *H*, which is revolved by the worm shown. These pins contact with the roller *I* on the arm *J* and move the spindle endwise at frequent intervals. The lapping material, diamond dust, is applied to the die by a needle, held in a chuck as shown at *K*. In order not to throw off the lapping material the die and spindle must not run too fast, about 600 r.p.m. for the lapping spindle and 1,800 r.p.m. for the die being good practice, as the die and spindle run in opposite directions the total lapping speed is 2,400 r.p.m.

HOW THE WORK IS DONE

In Fig. 4 the operator is locating a die on the face-plate. This is done by holding the pointed end of the rod *A* in the hole of the die while steadying the rod itself on the rest *B*. The die is held with beeswax and is easily centered. It will be noted that the lapping spindle with its cambric needle in place is swung up out of the way. After a die has been lapped so that it appears to be O.K. under the glass, it is tested for diameter by drawing a piece of wire through it. The operator takes a piece of wire, ties it around the forked block *A*, Fig. 5, and breaks it by pulling with the heavy pliers shown at *B*. This reduces the area of the wire at the point of break sufficiently to allow the end to be passed through the die. Then the die is placed behind the forks *A* and the wire pulled through a few inches in order to measure its diameter. The method of measuring is shown in Fig. 6. The die is held between thumb and forefinger of the left hand and the micrometer in the right hand.

A corner of the operation bench is shown in Fig. 7. The diamond crusher is shown at *A* and is a steel tube with a hardened bottom piece and a hardened end on the plunger. After crushing, the diamond dust is floated in either olive oil or gasoline and the grading done by the length of time it takes to settle in the bowl *B*. At *C* is a package of needles to be used for laps while at *D* is a pointed stick of soft wood for cleaning out the die before examining it with the glass as shown. Olive oil is used to carry the diamond dust in lapping.

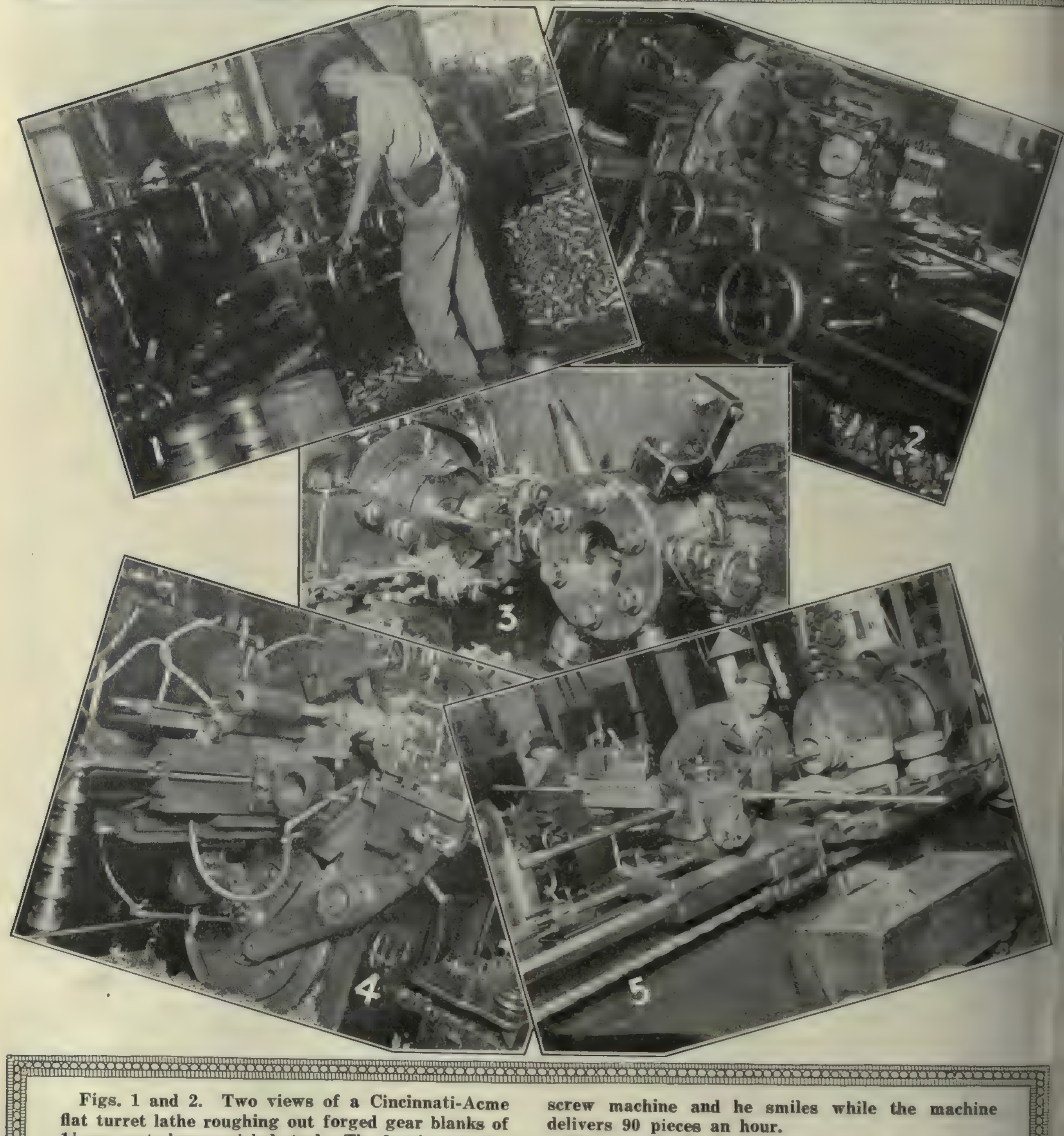
British Developments in Stainless Iron

The extent to which stainless steel has revolutionized the Sheffield cutlery trade is well known, but it is not so generally appreciated, the *London Times Trade Supplement* points out, that stainless iron is of equal importance. Both materials, says the *Times*, were discovered seven or eight years ago. Stainless steel was first manufactured, and soon after it was found that stainless iron could be produced by much the same process, with the exception that a smaller quantity of carbon-free ferrochrome was required.

Stainless iron has been largely used for the production of golf clubs; it has attracted the attention of makers of stove grates and is being used for kitchen ranges, grates, and fenders. An important and useful direction in which the material has been applied is in the fitting of motor cars; it is supplied in sheets for making hoods, and there is in contemplation its greater use for bodies, and since it does not tarnish, for replacing nickel-plated parts. It is made up into a wide variety of kitchen utensils and is used for shop signs and door plates. One British firm is producing the material in wire form, to be made up into door mats, and it is also being used for spring mattresses.

Another important development in contemplation is the use of stainless iron for the furnishing of railway carriages, engines, and rolling stock generally. The proposal is that it should replace brass for door handles, brackets, and many other fittings.

PRODUCTION



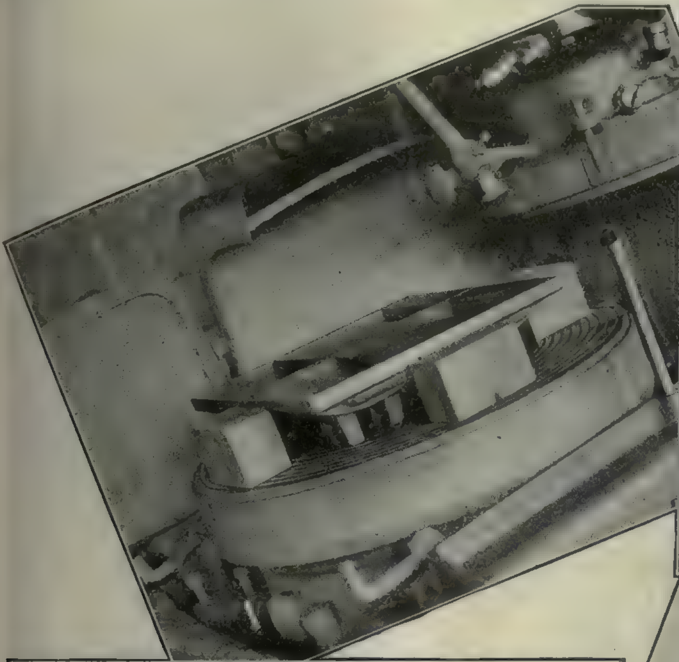
Figs. 1 and 2. Two views of a Cincinnati-Acme flat turret lathe roughing out forged gear blanks of 1½ per cent chrome-nickel steel. The forgings in the rough weigh 275 lb. and after rough machining, 93 lb. The time is 1 hr. and 15 min., and the weight of the metal removed is a little over 2.4 lb. a minute.

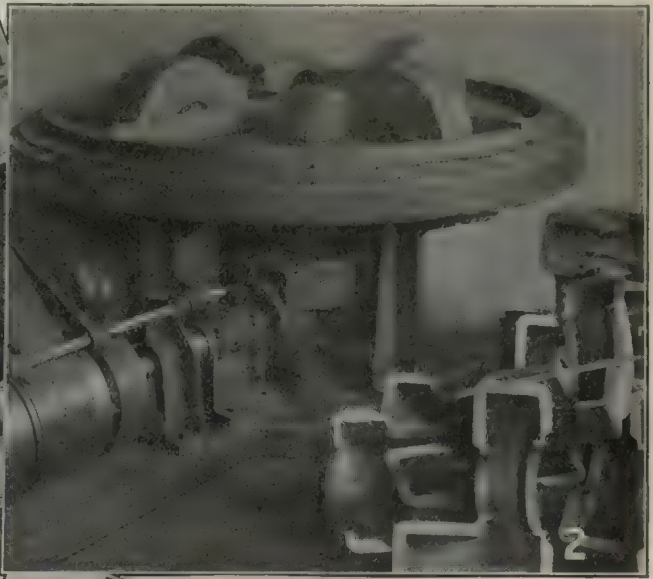
Fig. 3. An order for thousands of duplicate pieces makes a lathe hand feel weary, but turn it over to the operator of this Brown & Sharpe automatic screw machine and he smiles while the machine delivers 90 pieces an hour.

Fig. 4. Blanks for cluster gears are completed from bars of open-hearth steel at the rate of 30 a day in this Gridley automatic. A crackerjack workman might make four or five of these pieces a day in an engine lathe.

Fig. 5. This Gisholt turret lathe is machining 8-in. cast-iron rollers. The production is 25 a day or five times as many as could be turned out by an engine lathe.

IN PICTURES

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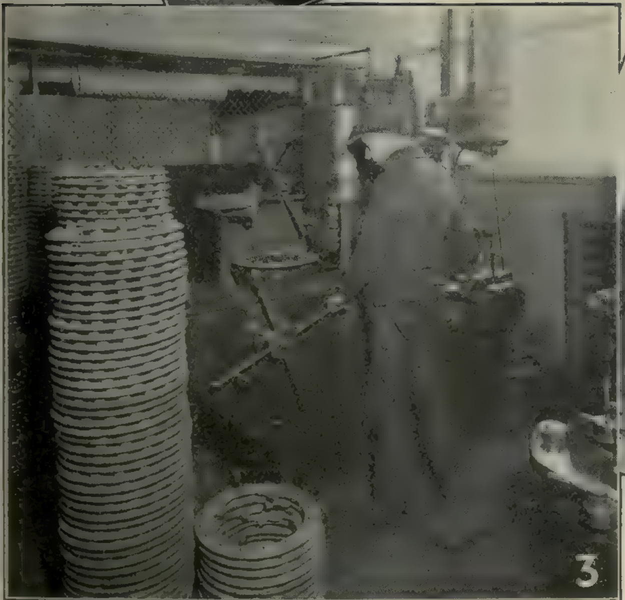
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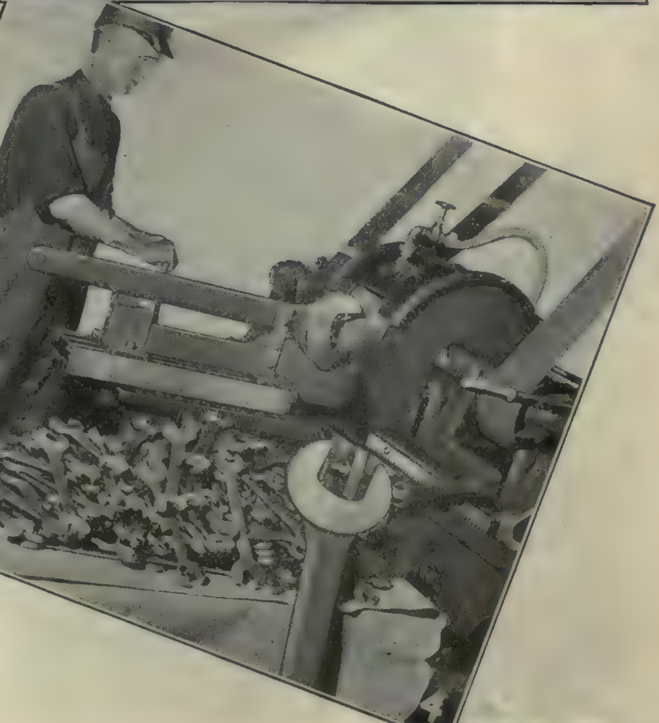
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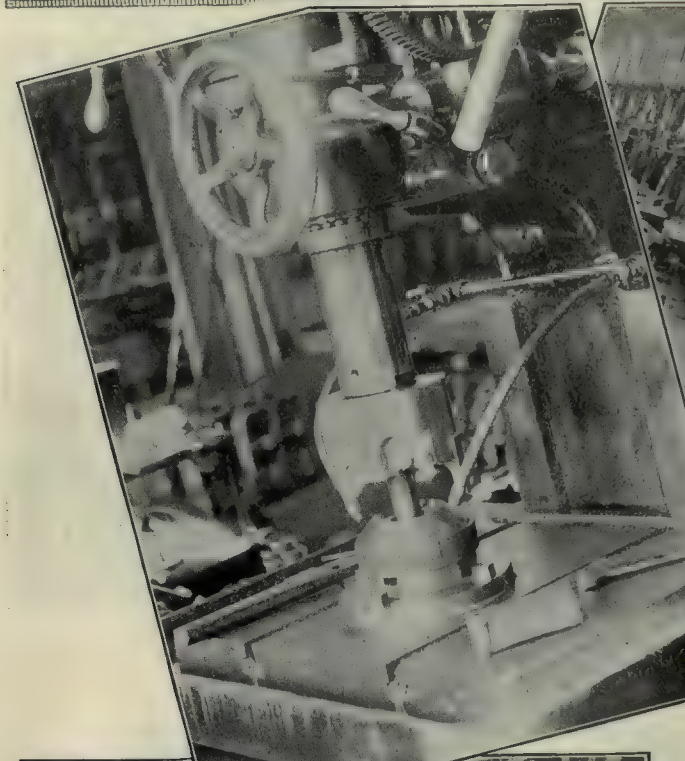
Fig. 1. Four cast-iron slide valves are being ground on this Blanchard vertical surface-grinding machine within limits of ± 0.002 in. A 30-in. magnetic chuck holds the work while $\frac{1}{8}$ in. of stock is removed from each side. Production, 8 pieces an hour.

Fig. 2. Gear cases are being ground from the rough in 4 min. each on this Besly vertical-disk grinding machine. The surfaces must be flat enough to form an oil-tight joint. This operation was formerly done on a planer and required 40 minutes.

Fig. 3. Grinding cast-iron magnet coil supports on a Blanchard vertical surface-grinding machine, within limits of ± 0.0015 in. A magnetic chuck holds the work and the production is 45 pieces an hour.

Fig. 4. Grinding both sides of the head of a large wrench on a Besly wet ring-wheel grinding machine. The weight of the wrench is 9 lb. and the production is 200 an hour. The double end wrenches shown in the foreground are ground at the rate of 600 an hour.

PRODUCTION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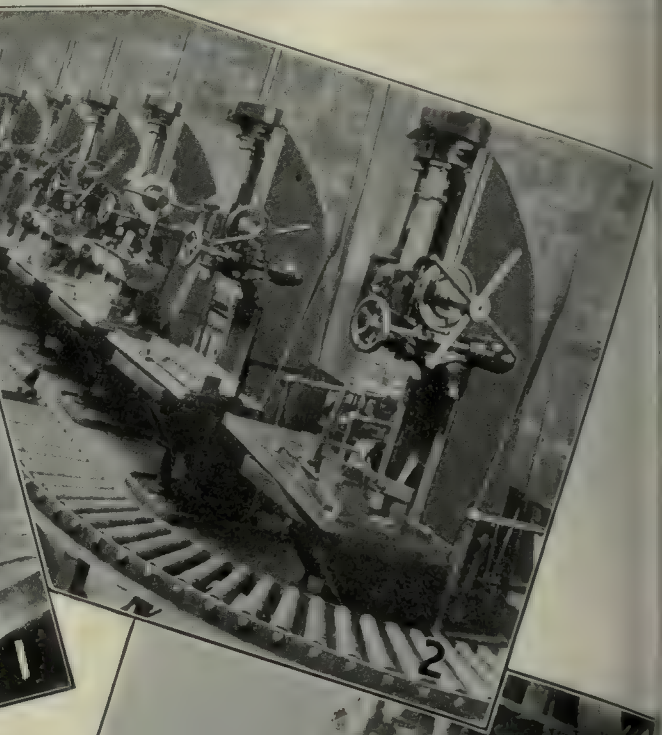
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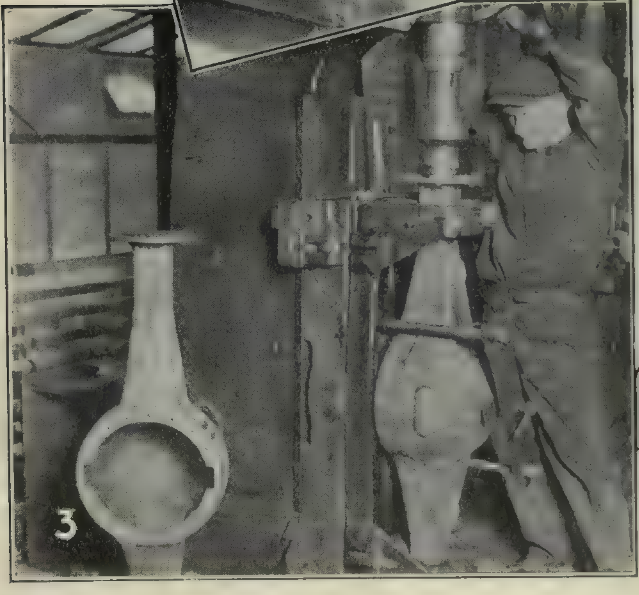
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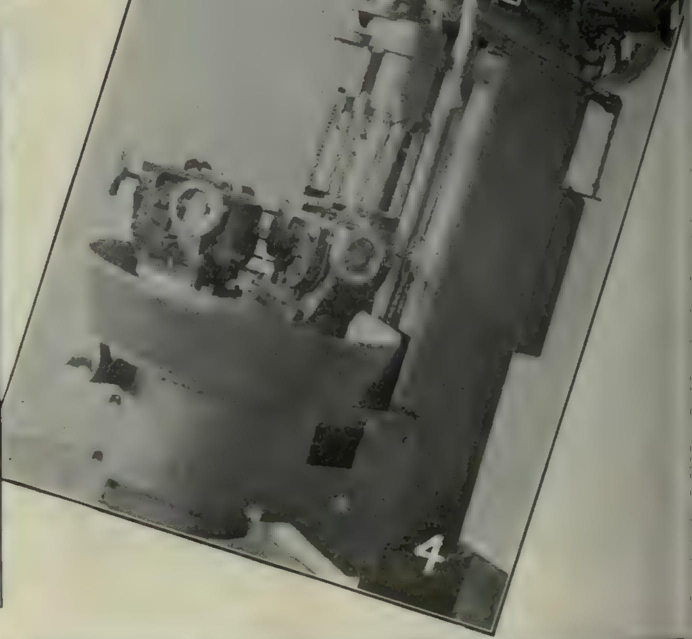
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Fig. 1. The drilling machine is often used for other operations than originally intended. Here a Baker vertical drilling and boring machine is shown at work facing and forming steel bevel-gear blanks at one operation. Accurate depth of feed is secured by a stop collar on the spindle and friction feed-gears that slip when the collar comes in contact with the head of the machine. High production is possible by an unskilled operator.

Fig. 2. Nearly a dozen Baker drilling machines are shown lined up for various operations on automobile motor parts. This line of machines readily fits in with the conveyor system shown and the combination requires but little floor space considering the production possible.

Fig. 3. This Baker vertical drilling and boring machine has been adapted to boring and facing rear axle housings. The table and its elevating mechanism have been removed and an indexing fixture clamped to the column. After one end of the housing has been finished, the fixture will be indexed 180 deg. and the operation repeated on the other end. This installation requires but little floor space.

Fig. 4. Drilling electric motor frames in a Baker automatic drilling machine at the rate of 350 an hour. One fixture is unloaded and reloaded while work in the other fixture is being drilled. The machine is entirely automatic and is in continuous operation except for the time required for the table to index from one station to the other. Such machines increase production from 500 to 600 per cent over single spindle machines.

IN PICTURES

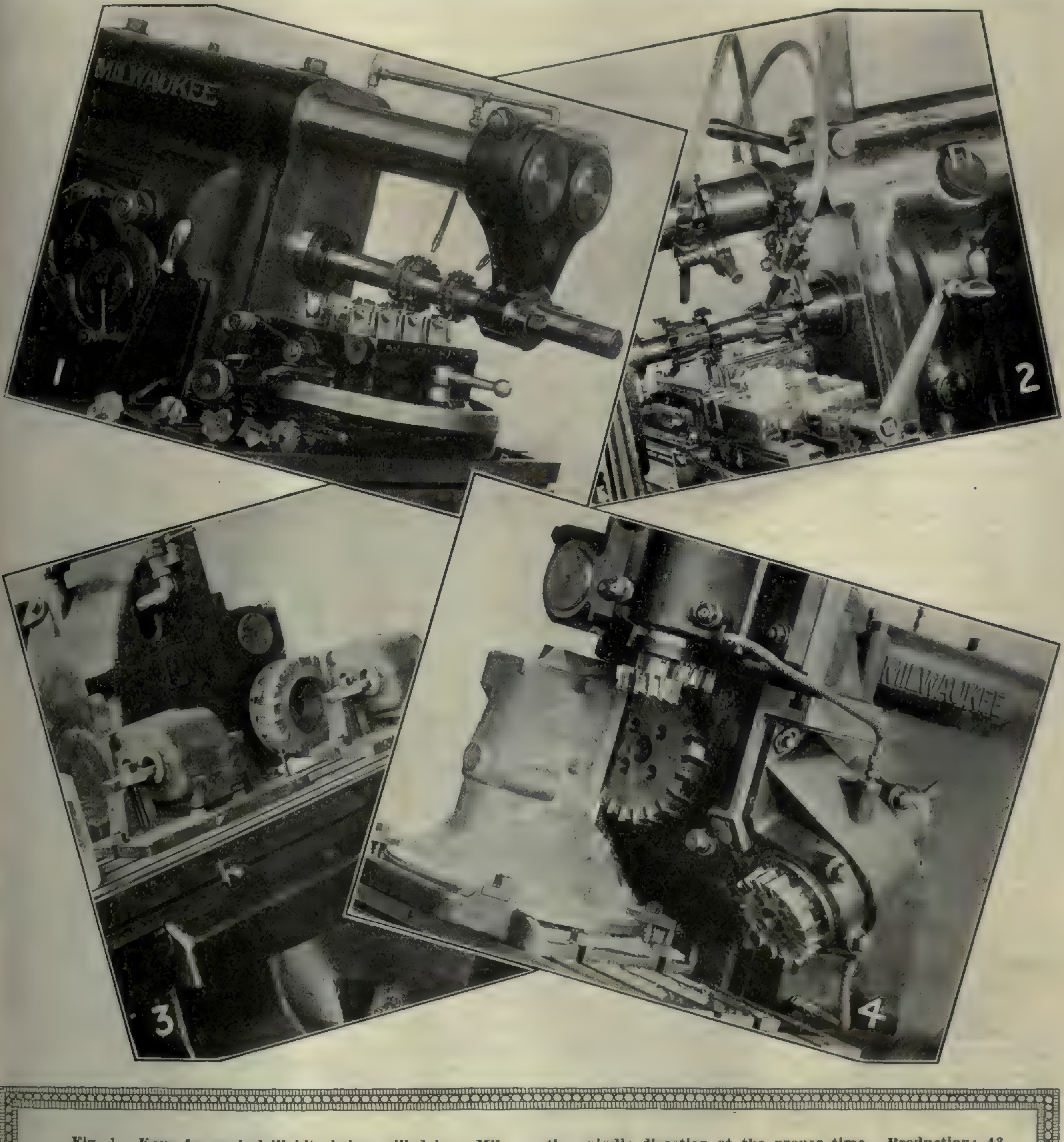


Fig. 1. Keys for rock-drill bits being milled in a Milwaukee manufacturing milling machine in one minute each. The keys are both tapering and undercut. The fixture is inclined to the angle of the undercut and arranged to be indexed 180 deg. Without this set-up three distinct operations would be necessary, increasing the time to 3 or 4 minutes each.

Fig. 2. Here is a Brown & Sharpe automatic milling machine roughing out work in one fixture and finishing it in the other. Changing is done while one operation is under way. Table motions from fast traverse to cutting feed and the reverse are automatic, as is reversing of the spindle direction at the proper time. Production: 43 pieces an hour, an increase of more than 185 per cent over former methods.

Fig. 3. When a machine tool concern takes its own medicine it is pretty good evidence of its faith in its own product. The Kempsmith milling machine here shown is face-milling parts for machines of its make at the rate of 15 pieces an hour; a saving of 45 per cent over former methods. The machine has quick traverse between fixtures.

Fig. 4. This Milwaukee milling machine is taking cuts on four surfaces of a transmission case at once. The floor to floor time is 3 min. each. Taking these cuts singly would involve several operations and handlings and require 15 to 20 minutes.

Automotive Service Methods and Equipment

II. Some of the Tools Used by the New York Telephone Co. for Keeping Its Transportation Units in Repair—Service to Public Dependent Upon Automotive Equipment

BY HOWARD CAMPBELL
Western Editor, *American Machinist*

ONE of the most complete service stations in the world, and probably the one which operates for the greatest good to the greatest number of people, is that conducted by the New York Telephone Co. at Long Island City. Forty years ago the directors of the company spent an entire day deliberating over the purchase of a horse and buggy for service purposes; today the company operates more than a thousand motor cars and trucks, including 670 Fords. The estimated value of the service plant and equipment alone is around $312,000. The amount of gasoline burned up in a year's time is about 1,100,000 gallons, worth $330,000. The tire bill for one year is $160,000, and the cost of repairing the cars is in the neighborhood of $600,000. From which it can be seen that service to the public depends very largely on the brand of service received at the company's own service station.

The result is that every effort is made to keep the transportation units in operation. Not only is the best equipment available purchased, but many tools and labor-saving appliances have been devised by the various foremen. The overhead trolley shown in Fig. 1 has paid for itself many times in the saving of time and labor. The track is jointed to make a complete circuit, and is hung so that the motor can be lifted out of the front end, and the rear end of the truck can be swung clear of the floor at the same time, or the truck can be lifted off the floor bodily, if necessary.

The operator shown in Fig. 2 is using a wheel-lift, by means of which one man can remove a huge truck wheel from a truck, or replace it, as the case may be.

As can be seen, the lift rides on three large casters. The crank *A*, which is made of ¾-in. stock, turns in a bushing, or block, which is held at *B*. The crank is threaded with a 10-pitch thread at *C*, and runs through a swivel block at *D*, which is so held that it can swing up and down to adjust itself to the changing angle of the threaded part of the crank.

A very handy tool for use in a service station or repair shop where a great many automobile chains have to be repaired is shown in Fig. 3. This is known as the Spooks chain machine. It consists of an anvil, a horizontal ram which is operated by foot power, and two heavy springs which keep the ram in position for operation. The drawing, Fig. 4, shows how the ram is shaped. The section *A* is wedge-shaped, as shown, so that when pressure is applied by means of the foot-lever, the wedge will open the link so that a section can be taken out and another one inserted.

To close a link, the loop in the metal is turned so it will be forced together between the anvil and the section *B*. The part *C* prevents the loop from slipping out, and as the ram is ½ in. wide, the surface presented is adequate.

The tools shown in Fig. 5 were all designed and made in the New York Telephone Co.'s plant. At *A* will be seen a wheel bearing cap puller, used mostly on Pierce-Arrow and White trucks. The two outside legs, which are adjustable for distance from center, rest on the outer edge of the hub, while the three inner legs enter through the bearing. The shoulders, or hooks, pull the bearing out when the nut is turned.

At *B* is shown an adjustable puller which can be used in a number and variety of places. The tool shown at *C* is a Pierce-Arrow camshaft puller. The section at *c*, which is a part of the stud, is threaded in the end to screw on to the end of the camshaft, which is also made with a thread on the end. After being attached, the ends of the U-shaped piece are braced against the crankcase, and the nut is turned with a wrench, which pulls the camshaft from its bearings.

At *D* is shown a tool for pulling the clutch from the shaft of a G. M. C. truck. The two legs are hooked back of the clutch and pressure applied by screwing the stud against the end of the clutch shaft. The universal joint flange is removed from the other end of the shaft by means of the tool shown at *E*, which operates in practically the same way.

The large tool at *F* is a Pierce-Arrow spring chair puller. The big collar, which is at the right-hand end in the picture, is locked back of the arms which support the brake shoe. The round disk which is shown wired

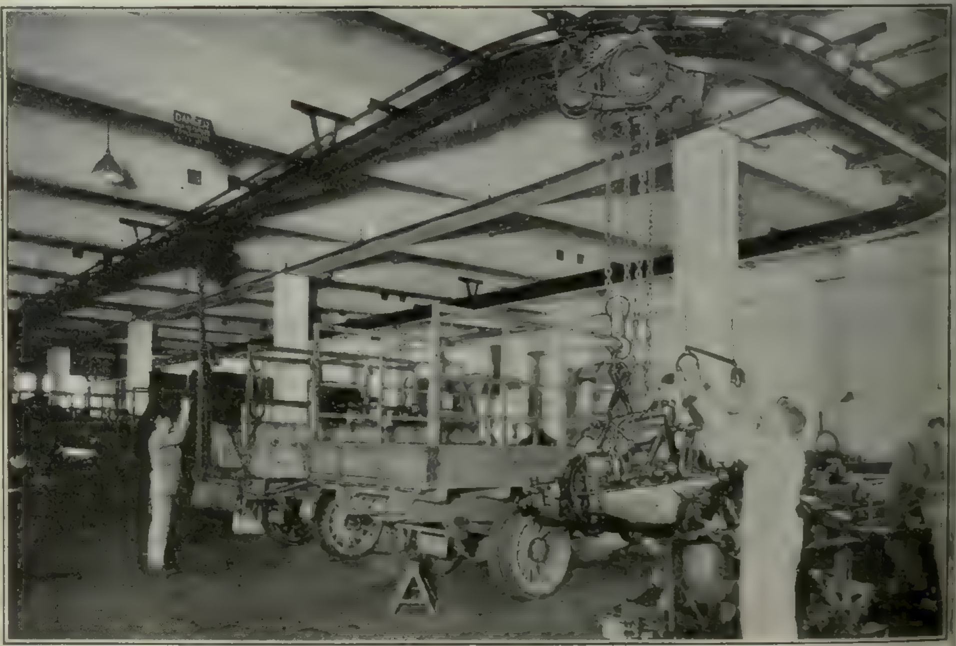


FIG. 1. OVERHEAD TROLLEY FOR LIFTING MOTORS

to the frame is then placed in the end of the shaft and pressure is applied by means of the screw.

The tool shown at *G* is used for removing drive shaft sleeves from Fords. This sleeve, as an automobile mechanic knows, is about 3 in. long, and is made of steel tubing. Careful examination of the cut will reveal a shoulder at *g* which fits over the end of the sleeve when the tool is in position and the hinged part is locked in place. The operation of the tool is obvious.

Another collection of interesting service tools is shown in Fig. 6. At *A* is a Ford clutch drum puller. The Ford clutch drum has four holes drilled in it at the factory, perhaps for the purpose of removing it when necessary. The pins at the ends of the legs fit into two of these holes and pressure is applied on the end of the shaft in the usual manner. A tool for pulling roller bearing cones from their spindles is shown at *B*. The square block at *C* is for the purpose of holding Ford camshaft bearings for hand reaming. These bearings come from the factory with a hole drilled in the side, and this hole is utilized in this instance to prevent the bearing from turning while it is being reamed. The bearing is inserted into the block, the little screw seen in the illustration is screwed into the hole, and the block is placed in a vise. This method of holding the bearing prevents all those troubles which would result from holding the piece between the vise jaws and the application of the necessary pressure to hold the piece and keep it from turning.

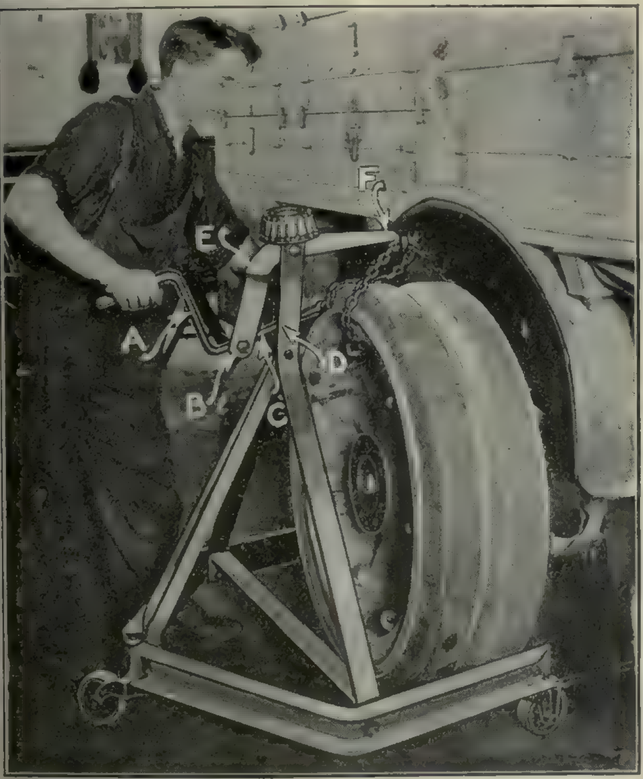


FIG. 2. DEVICE FOR LIFTING OFF WHEELS

The crank shown at *R* is threaded on the opposite end from the handle, the thread being of the same pitch as that on the end of a Ford crankshaft. Thus the crankshaft can be turned while working on the bearings, etc., with a great deal less effort than is usually expended on this simple operation. At *E* is a puller for removing universals from the shafts of White trucks. The holes in the legs fit over the lugs on the universals and pressure is applied at the end of the shaft as usual. A tool for removing ball bearing races from magneto shafts is shown at *F*. The tool consists of a heavy bottom plate and a top plate, held together by two bolts as shown. The top plate is drilled and threaded for the stud which goes through it, and the bottom plate has a hole bored in it which is large enough to slip over the race. This hole is countersunk to receive a split collar. One of these is shown just below the armature. With one of these collars seated in place behind the ball race, pressure is applied against the end of the shaft and the race removed. This tool can be used on various sizes of armatures, by using the corresponding collars, while the tool shown at *G* is applicable to one size only. The tool shown at *G* consists of a bolt, a bushing and a knurled collar. The bushing is made in two halves, both of which are hinged onto the plate which holds the screw. A shoulder is cut in the bottom of the bushing similar to that shown at *g* in Fig. 5. The bushing is placed in position with this shoulder engaging the ball-race, then the knurled collar is slid down to the lower end of the bushing to hold the two halves together. Turning the screw then pulls the ball-race from the shaft.

FIG. 3. SPOOKS CHAIN MACHINES

A PACKING COMPRESSOR

At *H* is shown a transmission rear bearing case packing compressor which is used on a 5-ton Pierce-Arrow truck. The line drawing, Fig. 7, will illustrate the working of this tool. The tool is held in the vise-jaws as shown; the steel washers, felt packing and retainer ring are placed in position in the bearing case. Then the collar *A* is placed in position, the nut *B* is screwed on to the stud and tightened down, compressing the packing

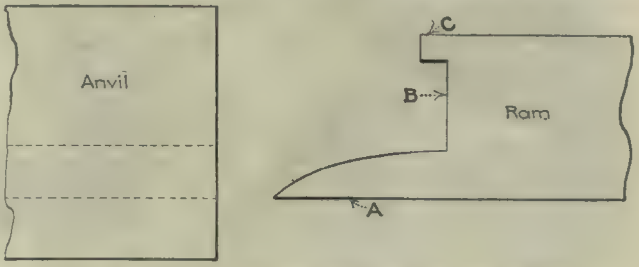


FIG. 4. DETAIL OF SPOOKS CHAIN MACHINES

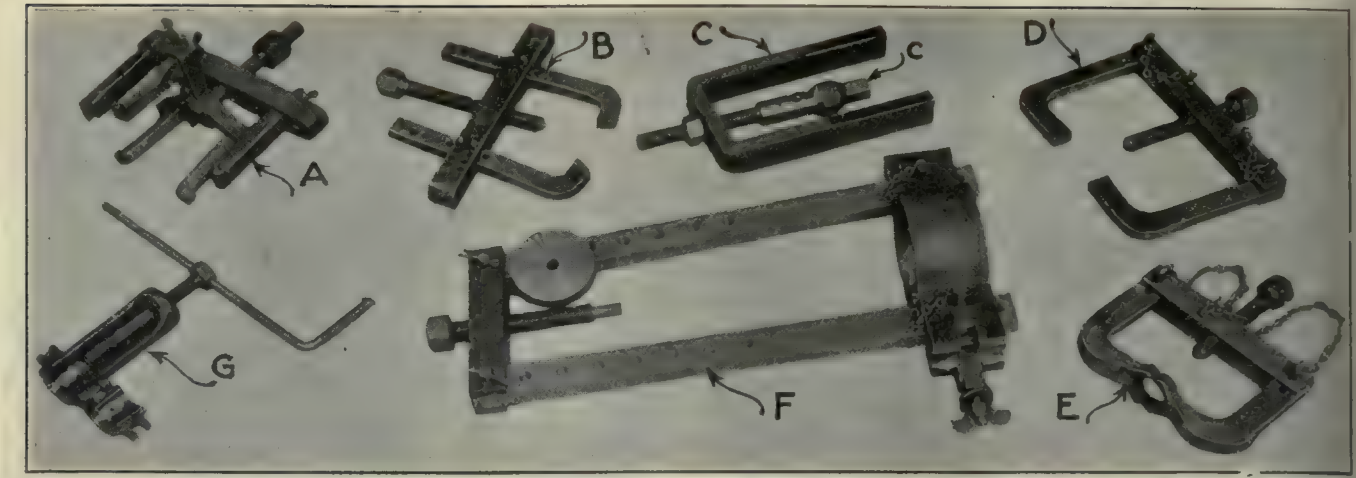


FIG. 5. TOOLS DESIGNED AND MADE IN COMPANY SHOPS

and allowing the retainer ring to slip into its groove.

Returning to Fig. 6, a Ford pinion gear puller, for pulling the pinion gear from the drive-shaft is shown at *I*. The operation of this tool is obvious.

A tool for releasing the clutch disk spring on the GMC truck is shown at *J*. When the clutch is removed from the car, the clutch spring remains compressed until released. To effect this, the tool shown is slipped through the clutch in place of the clutch shaft. Then the nut and collar are put on and screwed down against the cup which is over the end of the spring, compressing the spring still further and releasing the tension on the pin which holds the spring in compression. The removal of the pin then becomes a simple matter.

A hand punch press is shown at *K*, and beside it the piece of work on which it is used. That portion of it extending below what might be termed the table of the machine is gripped in a vise, so that the handle may be worked up and down vertically.

The frame *a* of this machine is cut from a steel block milled out to allow for the handle and for the ram which holds the punch. The ram has a slot milled through the upper part, and is cross-drilled to accommodate a roller *b* which is held by the pin *c*. This roller comes in contact with a cam at the lower end of the handle. Thus when the handle is pulled down, the handle also forces the ram down performing the operation required, which is the punching of slots in brass strips to be used as fins for repairing in radiators.

At *L* is a simple tool for holding a piston ring so that the side of the ring may be polished to remove high-spots, burrs and so forth. The tool is made from the flange end of a Ford crankshaft. It is counter-bored just deep enough to leave about $\frac{1}{32}$ in. of the ring projecting. The tool is held in the hand and the ring rubbed over a piece of emery cloth lying on a face-plate or other smooth block.

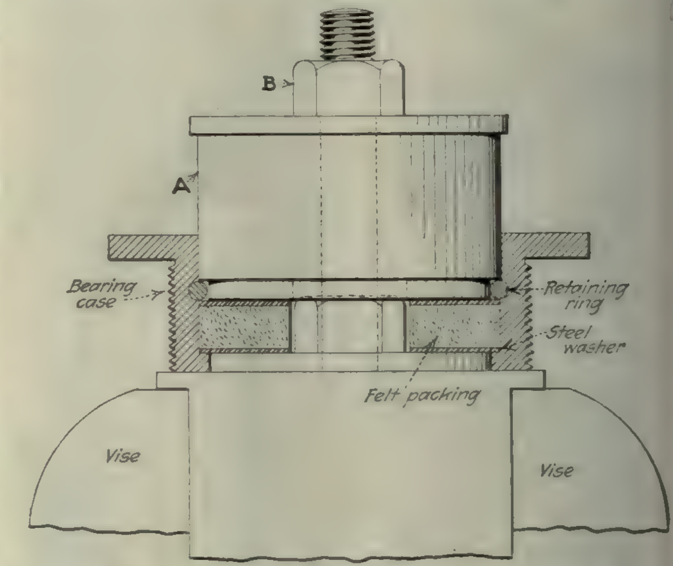


FIG. 7. DETAILS OF PACKING COMPRESSOR

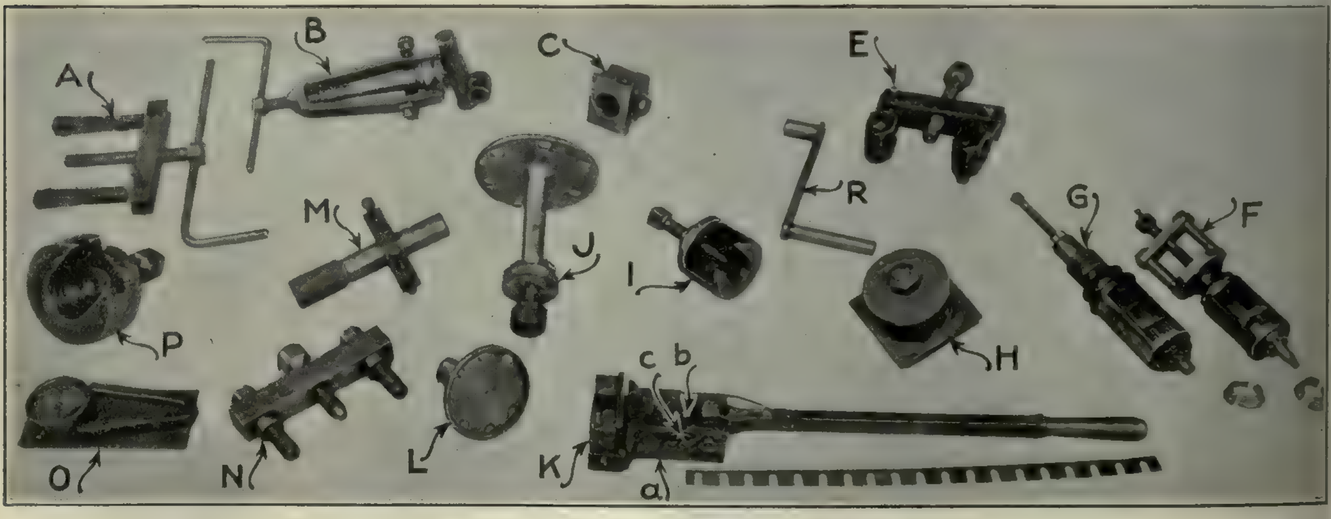


FIG. 6. SOME MORE HOME-MADE TOOLS

The tool shown at *N* is for pulling the flywheel out of White truck motors. These flywheels have two holes in them, into which the two studs shown in this tool can be screwed, pressure being applied by screwing down the bolt in the center.

A unique and interesting tool is shown at *O*. This is a magnet tester made from an old speedometer. The shaft to which the hand is attached runs through a small gear which meshes with a sector in the case. This sector is attached by means of a small coil spring to a piece of sheet metal which is fastened just inside the case on the side nearest the magnet. When the magnet is placed on the block as shown in the photograph, if it is magnetized properly, the piece of sheet metal will be attracted toward that side of the case, pulling the sector with it and revolving the hand. The determination of the amount of magnetism indicated by the figures on the dial is a matter of experience.

A transmission drive gear puller for use on Fords is shown at *P*. The groove in the tool fits over the first one of the three gears on the transmission shaft and operates in the usual manner. After the first gear is removed, the transmission can be easily disassembled.

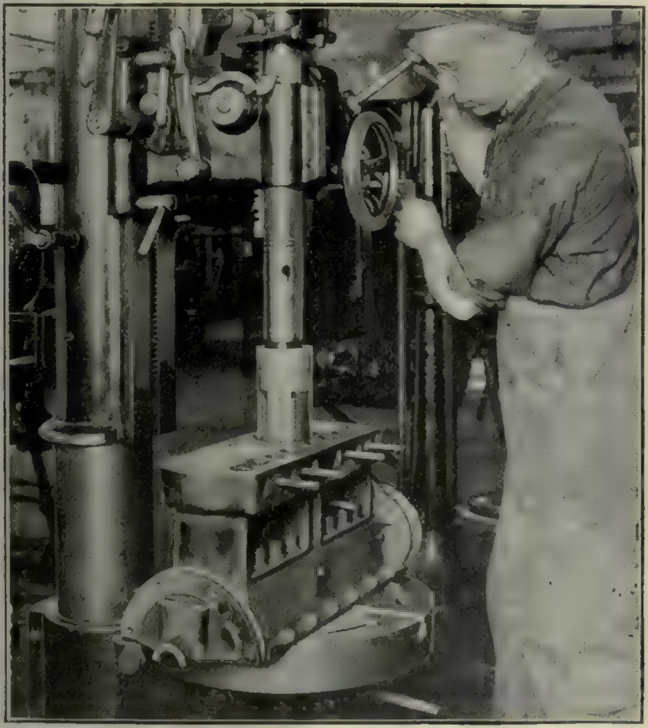


FIG. 8. REBORING CYLINDER BLOCK

The operation shown in Fig. 8 is that of re-boring a cylinder block with an expansion reamer. This reamer, which is made by the Standard Tool Co., of Cleveland, Ohio, can be adjusted to various sizes within certain limitations.

The operation shown in Fig. 9 is that of re-boring the main bearings in a Ford crankcase. The frame *A* is fastened to the crankcase by the bolts and wing nuts *B*. The cutter bar *C* has a tool for each one of the crankcase bearings. When the tool is in position, the larger gears, *D* and *E*, are slipped into mesh with the pinions *F* and *G*. The pinion *F* turns the shaft with it as it revolves, but does not feed the shaft through the work. Pinion *G*, which is of bronze, is cast on a sleeve approximately 3½ in. long. A square thread is cut on the shaft where it passes through this sleeve, a corresponding thread being cut in the inside of the sleeve, so that if the sleeve were held stationary while the shaft was revolved, the shaft would be fed rapidly through the sleeve. In order to reduce the feed to the necessary fineness, the gear *E* and pinion *G* are applied, so that when the gears are in motion, the sleeve is turned in the same direction as the shaft but just enough slower so that the shaft is fed through a little with each revolution. This fine feed gives the necessary finish to the bearing.

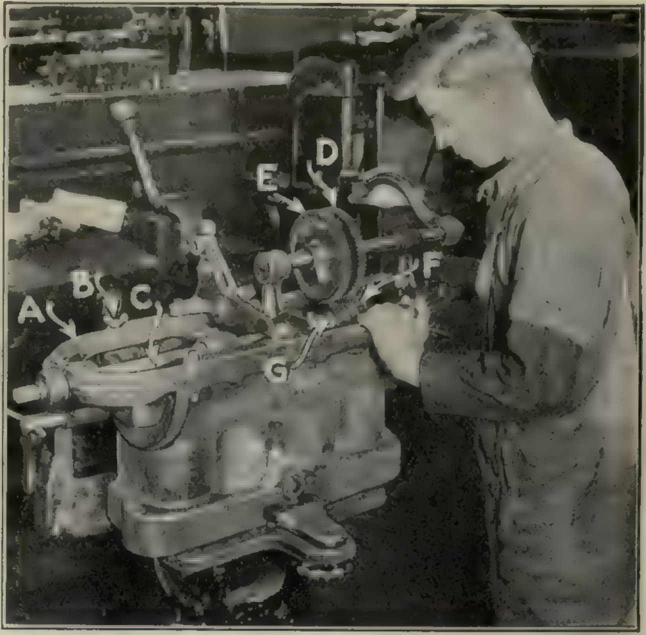


FIG. 9. REBORING FORD CRANKCASE BEARINGS

The operator in Fig. 10 is using a straightening templet to test the straightness of a Ford crankcase (lower half) which has just been welded. The collar at *A* locks the front bearing supports and the two bolts at *B* are screwed into the corresponding holes in the crankcase. Then the two studs at *C* must slip easily into their respective holes; if they do not, the case has to be straightened until they do. When these studs will drop into place, the crankcase will fit into place on the machine very easily.

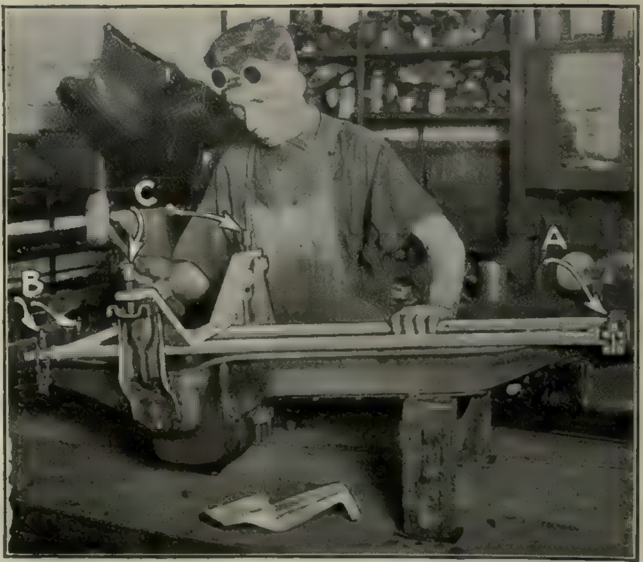


FIG. 10. TESTING FORD CRANKCASE FOR STRAIGHTNESS

Business Tanks and Valves

An Imaginary System of Tanks and Valves to Illustrate the Operation of Business—Economics and the Golden Rule

By Ernest F. DuBrul
General Manager, National Machine Tool Builders' Association

We need a good way to visualize the flow of business through the economic system, in order to understand how it is that a market is subject to periods of glut and activity. Suppose we conceive the system as a series of tanks, one above the other, connected by pipes that have valves to control the flow down through the pipes.

The lowest pipe has the consumer valve. This we can say is regulated by the consumer alone. Nobody above him has any hand on that valve. The consumer himself opens it up or shuts it off, according to his purchasing power. If butter is too high for the purchasing power of a laborer he buys oleo; the family uses less butter; they don't make so many cakes; and so on, so that each consumer takes a little turn on the butter valve.

The tank that is being drained through the consumption valve is the dealer's tank. His valve on the pipe leading into this tank is the "shipment" valve. As he finds that the consumers shut off their valve below him he should know that his own tank will fill up, and if he does not shut off the shipment valve his tank will get too full for its financial underpinning. He will run out of money, and then he will have to try to lower the level in his tank by making lower prices to induce the consumer to open up his consumption valve. At such times these prices will have to be made so low that his excess goods must be sold below their cost to him, and he will be out of pocket.

Many business men do not understand that they must keep a proper balance between their financial resources in ready cash and their stock on hand. If this factor gets out of balance, financial resources are locked up in stock, and to pay bills the dealer has to sell the stock. To sell the stock of goods on a dull market a price must be made that will induce the consumers to open up their "consumption" valve and let more stock flow on through, than the consumer really wants. The dealer's stock tank represents both the wholesaler and retailer, though each one has a tank operating in the same way.

Next above the dealer's level is the manufacturer's level. It has three tanks, the "factory stocks" tank being the one that drains down through "shipments." As the dealer's tank fills up the dealer must shut off shipments, so the manufacturer's tank then begins to fill up more than it should. If his tank gets too full for safety, he tries to force more product down through the "shipment" valve. He offers a lower price, just the same as the dealer did. If the dealer's tank is not too full the manufacturer can perhaps move some of his stock on down at a lower price, but only as long as he can find some dealer whose tank is not full, or in other words, one whose financial strength is not used up. By buying at a lower price the dealer is able to make a lower price to move the stock out down below, and dealers with full tanks have to take a loss on their stock, or else stop business.

The pipe leading into the manufacturer's stock has the "production" valve. When the manufacturer's tank fills up he has to shut off production until the tanks can be drained down, and a balanced flow can be started again.

Unfortunately, very few industries can accurately gage this rate of flow through the "consumption" valve, and very few industries have studied that flow as a whole. The individual dealer or manufacturer knows only what is in his own tank, and what is flowing into it and flowing out of it. He does not know what is in other tanks below him, above him, around him. He does not know the rate of flow out of them, either individually or collectively. He generally can only go blindly on until he finds that he is getting to the point where he is unsafe. Then he shuts off his valve.

Because many men do not know when to shut off their respective valves they get over-stocked, and then to relieve the pressure on their tank they have to put their price pumps to work to try to move the stuff on down, regardless of costs. If the jam is too great they simply burst their part of the system and spill their goods all over the place.

The manufacturer has his inventories, of goods in process, materials, etc. If he has raw material that is saleable on the open market, he can relieve some excess pressure by sacrificing this material. As long as he is solvent, once his goods start down in process they will be moved on down, at some price or other clear through the system to the consumer, but the rate of flow will be different for different kinds of goods.

The topmost tank of the whole system is designated as "unfilled orders." Through the funnel at the top the "new orders" come in. In some lines of business once an order gets into that tank it goes clear on through, unless the man who placed the order becomes insolvent. This is true of the pig-iron business, which is one business that holds buyers to their purchase contracts. In most businesses, however, "orders" are mere "buyers' options"—a sort of condensible "gas."

This unfilled orders tank has a whistle on the top—"cancellations." When the pressure gets too strong on the dealer's tank the excess pressure is blown off through "cancellations" and it makes a loud noise.

The string leading down from the "cancellation" whistle is represented as having a handle for the dealer to grab. In some cases it goes on down to the consumer. But the manufacturer does not have his hand on that cord at all. If he were wise he would have a "shut-off" valve" on the new orders, and he would refuse to take new orders when he finds the pressure in the unfilled orders tank mounting up too high for safety. If all systems were like the pig-iron system, and had eliminated the cancellation whistle it would mean that all the various tanks would get more watching, and the valves more regulating, especially when the consumer begins to shut off his valve. It would make everyone more careful in buying, or he would blow his own tank open.

This would mean healthier and saner business all around. How can one determine the rate of low and the tank levels? Well, trade association statistics, if reasonably complete, can and do do that very thing. Secretary Hoover has the right idea in asking such associations to study their actual conditions. He has well said that "given all the facts, any business problem can be solved." It does no good to have an unsafe quantity of goods in the tank system when the flow through consumption is restricted. Society wants and needs a regular flow and a safe level. It does not want and does not need a glut anywhere or any time. The better the flow is balanced all through each system the more regular will employment be, the more sane will management be, and the safer will investment be. A lot of healthy results will follow in every industry that will gather all the figures monthly, as to the contents of all the tanks and the rate of flow through all the valves, in its own system.

If too little is flowing to supply actual needs, it will be easier to know when and why new plants should be built, and old ones enlarged. If too much is seen to be glutting the tanks at one time, leading to more and more irregular, and less and less profitable operation, capital will be diverted to industries that need it, instead of being invested in industries already overdone.

As years go by and better understanding is had of the actual workings of economic forces, more and more industries are getting to realize the necessity of studying the relation of supply to demand for their own products. Consequently they organize statistical bureaus to gather this information. They gather information as to past years so that the experience of the past will be as much a gage as possible for the future. They gather information for the present demand so as to know the flow and the relative levels in the various tanks. It is true that some of these organizations still seem to have the fallacious idea that somehow they can, by concerted action, regulate the flow.

Society is benefited by close regulation of supply to demand. It is benefited by not having plants built that are actually unnecessary. It is benefited by using the capital that would be thus wasted in providing facilities for producing other goods. But no organization can deliberately regulate that flow any more than any socialist bureaucrat sitting in a government office can do it.

Society must have a free market, one in which every buyer has access to every seller, and vice versa. The freer the market is, the better will competition take care of regulation. Perfectly free competition involves intelligent competition. If every concern were fully informed as to costs of production in its own line, and if every buyer were equally well informed, then prices would be proper for both sellers and buyers. The buyer would expect to pay enough for his goods to cover their costs and the seller's fair profit; and the seller would not expect to get more profit than the buyer ought to pay him to produce the goods under given circumstances. As it is now, the difficulty lies in not enough information being available to either consumers or sellers to enable them to gage the market and to adjust their respective bid and asked prices to actual conditions.

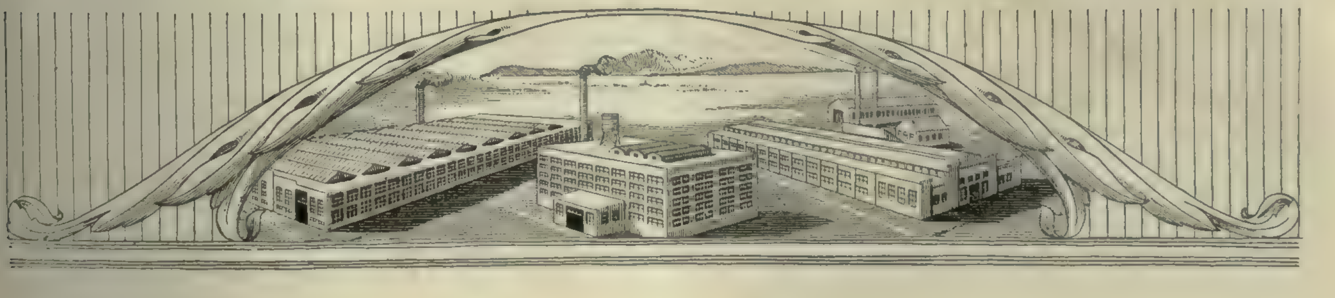
Some concerns set their prices in flush times on a basis of low costs at maximum capacity of their plants, and a small unit profit at that rate of production. The fact is that due to the waves, long time costs actually rest on a basis of considerably less production year in and year out. When that kind of a seller goes out in the market he commits either business murder or business suicide by quoting prices that are lower than the economic level demands. If a price is not realized at such times that will provide a reserve to meet the next depression the concern has to dip into its original capital to tide it over the gap in demand.

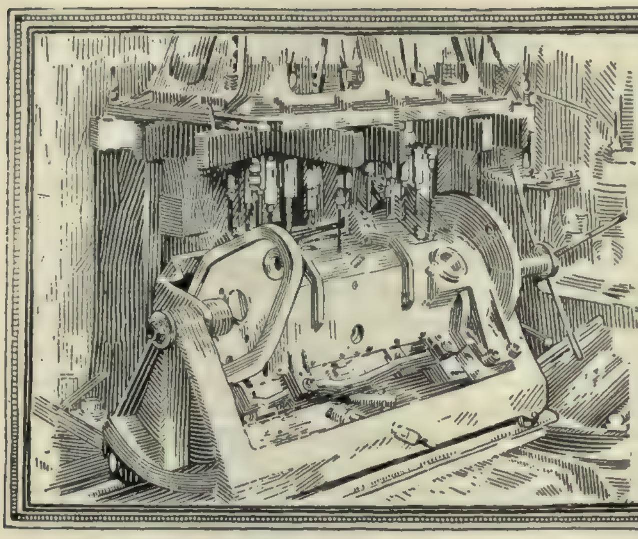
There is nothing in the law that does or should prevent intelligent competition. There is nothing to prevent a man from having full information as to the market that he is attempting to reach. Such information is manifestly for the benefit of society as a whole, and both buyers and sellers should have free access to it. The law does say, and properly, that there should be no artificial restraint of the market. Even if there were no law to condemn artificial restrictions and interferences with competition, such practices are unwise and uneconomic, and such restrictions always carry within themselves the seeds of their own dissolution. Those who try such restraints try to work against economic law, as well as against statute law. This cannot be successful economics because it is unsound economics, and should be abandoned for that reason if for no other. Cut-throat competition is just as uneconomic, and brings its own penalty by compelling the competitor to retaliate in order to preserve his own existence, and the cut-throat loses more than he can possibly gain. Here again, what is perfectly good economics is strictly in accord with the Golden Rule.

Australian Attitude on Motor Cycles

An interesting side light on the attitude of Australian motor-cycle traders is given in a letter from a Sydney firm to a London publisher, an excerpt of which is printed below:

> Our firm are importers of motor cycles only, not handling cars at all; and the position with us is that English motor cycles have become prohibitive in price, and the trade started with America during the war will have to be maintained until such times as the present English prices are cut somewhere in half.
>
> We have landed a few sample English machines—such well-known makes as Matchless, Sunbeam, and Triumph—and find these lines unsalable at landed cost prices.
>
> You will realize under the circumstances that we have no option but to continue our trade with American motor cycles exclusively until such times as landed costs of English goods are enormously decreased.





Tool Engineering

By

Albert A. Dowd and Frank W. Curtis

President and Chief Engineer

Albert A. Dowd Engineering Co., New York City

Turret and Engine Lathe Tooling for Second-Operation Work—Collets, Step Chucks, Chuck Jaws and Adapters—Construction of Fixtures—Soft-Jaw Chucks

WE HAVE discussed in a previous article a number of methods of holding rough work on chucks and fixtures for turret lathe operations. It frequently happens that several operations are necessary on a turret lathe, or it may be that work has been previously machined on some other type of machine tool prior to the turret lathe operation. Under these circumstances, the location of the work for the turret lathe operation must be determined from some of the previously finished surfaces or holes. This article will take up a number of methods of holding work for a second operation locating from some previously finished surface.

There are several conditions which may affect work-holding devices of this kind. The piece may have been machined in circular form, either on the outside or the inside; it may have been drilled and reamed on a drill press; or it may have been milled, or otherwise machined on some other type of machine tool. For the turret lathe operation it is necessary to locate from some of these finished portions in order that finished dimensions may be held accurately to size.

Collets, Step Chucks and Chuck Jaws

We have previously devoted some space to a description of collets, step chucks and chuck jaws, and much of the matter mentioned in connection with these devices can be applied to second-operation work. It is important, however, to observe that collets which are used for work which has been previously machined, are commonly not checked or grooved, but are left smooth and ground out accurately to the size of the work which they are to hold. Care must be taken not to mar the work by using jaws or other holding devices which will tend to rough up the finished surfaces.

The matter of provision for chips and dirt is particularly important in connection with fixtures used for second-operation work. The greatest care should be taken to make all locating surfaces in such a way that they can be easily cleaned, so that the required accuracy will be obtained. Distortion caused by improper clamping, counterbalancing of the fixture in order to make it run without vibration, and projecting clamps or lugs should all be given due consideration; but, as these points have all been mentioned previously, it is unnecessary to go into detail regarding them, except in specific cases which will be hereinafter mentioned.

Application of Adapters

In making up a fixture for use on a turret or engine lathe, it is advisable to avoid, as far as possible, fitting the fixture to the spindle. Spindles are threaded and turned, and any fixture which is to be applied to them must be very carefully bored out and threaded in order to obtain accurate work. If a number of fixtures are to be made up, this extra fitting to the spindle is costly and should be avoided by using some form of adapter of standard pattern, to which the fixture itself can be attached. Fig. 240 shows a simple diagram of a fixture *A*, which is fitted directly to the spindle at *B*. In making up a fixture of this kind, its cost is increased considerably on account of the fitting operation. Furthermore, if any part of it should be broken or injured, it would be necessary to replace the whole fixture and again fit it to the spindle. By the use of an adapter, such as that shown at *C*, the fixture *D* can be located on it at *E* by simply boring out the fixture to fit the flange. It can then be bolted in place with the assurance that it will run true with the spindle.

Another advantage of using an adapter for fixture work is that adjustments can be made in the fastening of the fixture to the adapter, so that it can be trued up if it becomes untrue after a long period of service. When a fixture is made as a unit to screw onto the spindle, it is difficult to make any adjustments after it has once been constructed. If it becomes inaccurate from use it will very likely remain that way, on account of the difficulty of making any changes which will bring it back into shape again. Several forms of adapters were shown in the first article on turret lathe work.

Any factory which uses fixtures of this nature to any extent should consider very carefully the standardization of adapters for the various machines to which fixtures are to be applied. On small-sized fixtures it may be found more convenient to use a center plug in the adapter, or a center hole into which a plug in the fixture can be set, rather than to use a flange such as the one shown. In standardizing a proposition like this, the

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designer should make drawings of the spindles of the various machines used, and try to make the adapters so that they will be generally uniform and without too many sizes of flanges to which fixtures are to be fitted. If flanges are made in only two or three standard sizes, it will be found possible to transfer a fixture from one machine to another when this seems desirable. In the case of a machine breakdown, or in transfering a machine from one department to another, an arrangement of this kind will often be found a great advantage.

CONSTRUCTION OF FIXTURES

In considering the general features of construction of fixtures for turret and engine lathes, attention should be called to a few points of importance. Most fixtures are made of cast iron, although aluminum and steel are used occasionally. The necessity for keeping fixtures of this kind as light as possible, and at the same time attaining the necessary stability and rigidity, must be emphasized. Excessive overhang on the spindle is likely to cause vibration when the cutting tools are applied to the work, although the fixture may run true before the tools are applied. If it becomes necessary to make a very long fixture, or one which extends a considerable distance beyond the spindle end, suitable provision should be made to support it in some way or other, and thus take the strain off the spindle. This point was brought out in the last article with an illustration of a condition similar to that mentioned.

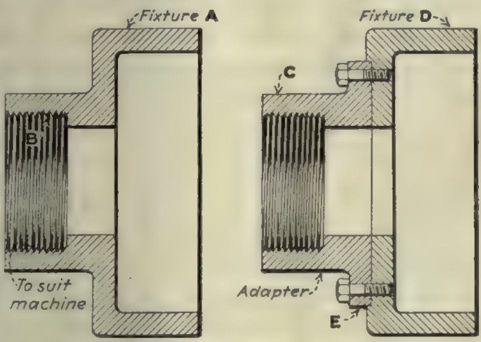

FIG. 240. ADVANTAGE OF USING ADAPTERS

In the making up of fixtures, it is usually better to build up angular surfaces on the fixture rather than to attempt to make a casting with suitable projections on it. An important point is shown in Fig. 241 at *A*, in which an angular pad *B* is made up as a part of the fixture *C*. If this angular portion should be broken, or if it were to be sprung out of true the entire fixture would have to be scrapped. Furthermore, the casting is more difficult to make when in this form, than if a construction like that shown at *D* were to be used. In the latter case, the angular portion is made up as a separate member *E* and fastened to the faceplate. In a like manner, locating pads or surfaces can often be made up separately in the form of steel rings or steel blocks, as may be required, these being fastened to the face of the fixture in order to provide for up-keep in case of injury.

Fixtures which are made to hold an irregular piece of work having considerable weight at one side of the center are frequently counterbalanced, particularly when they are to run at high speed. An example which illustrates the proportioning of a counterbalance is shown at *F*. The work *G* has a heavy portion *H* eccentric to the center hub, and on account of this a counterbalance should be provided, as shown at *K*. In making up this counterbalance, it is usually better to make it up as a separate unit and fasten it to a pad on the fixture, as at *L*. Care must be taken in proportioning it so that it will have more than enough metal to offset the portion of the work which is being balanced; then after it is placed in position with the work on the fixture, it can be drilled out, chipped or faced off so that it balances the work perfectly.

It is possible to make a counter-balance in such a shape that it is adjustable, so that several pieces of the same character can be held on the same fixture, by adjusting the weight. It is well to avoid the use of very heavy masses of metal in fixtures of this kind, and it is better to make provision for stability by means of ribs. It is not good practice, however, to have these ribs project from the fixture so as to cause trouble to the operator and to endanger him. It is frequently possible to cast a narrow rim around the fixture, leaving the outside smooth in order to guard against accidents. If all clamps, bolts and screws are kept below this surface, the fixture will be much better for the operator and present a cleaner and more workmanlike appearance.

USE OF SOFT CHUCK JAWS

Chuck jaws which have not been hardened are often used for second-operation work, being bored out to a diameter such that they will fit the work on some portion which has been previously machined. The method of holding by means of soft jaws cannot be considered as strictly accurate, due to variations which are likely to be found in the chuck itself, and caused by wear on the scroll ring and also on the teeth cut on the jaws where they mesh with the ring. There is also a certain amount of "back lash" in nearly all chucks which are not new, and this matter also may cause slight inaccuracy. Soft jaws are, however, very convenient for certain classes of work and can be used in many cases. It is a matter of judgment regarding the accuracy required when deciding whether to use this method of holding. One of the advantages of soft jaws for second-operation work is the fact that they can be trued up and bored out in position with considerable accuracy. The method used is to hold a piece of cylindrical work in some portion of the jaws which is not to be bored, and grip it tightly by means of the jaws so as to take out any back lash that might otherwise cause trouble. When the jaws are in this position they should be bored to the exact size of the work which they are to hold. After this is done the chuck should not be removed from the spindle center, and no change is to be made in its location with respect to the spindle.

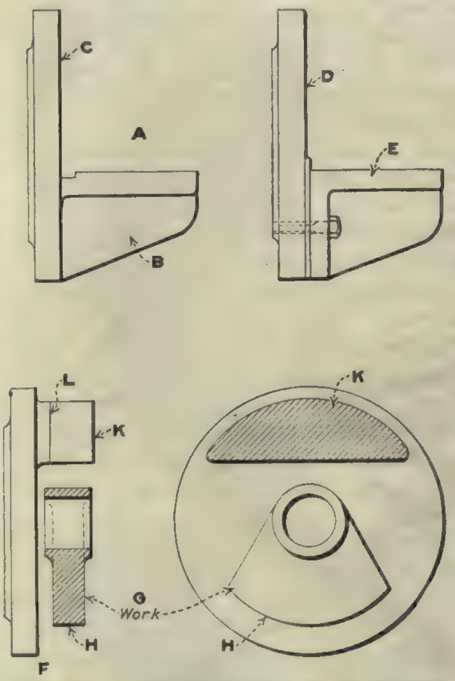

FIG. 241. CONSTRUCTION OF FIXTURES

Soft jaws are used on both two-, three- and four-jaw chucks, but less commonly on the two- and four-jaw variety. They are generally made of cast iron or machine steel, depending on the requirements, and somewhat upon the size of the chuck on which they are used. For a great deal of work, cast iron gives perfectly satisfactory results, although some users prefer machine steel. Jaws are generally made in a form such that they can be attached to the regular jaws of the chuck by means of screws.

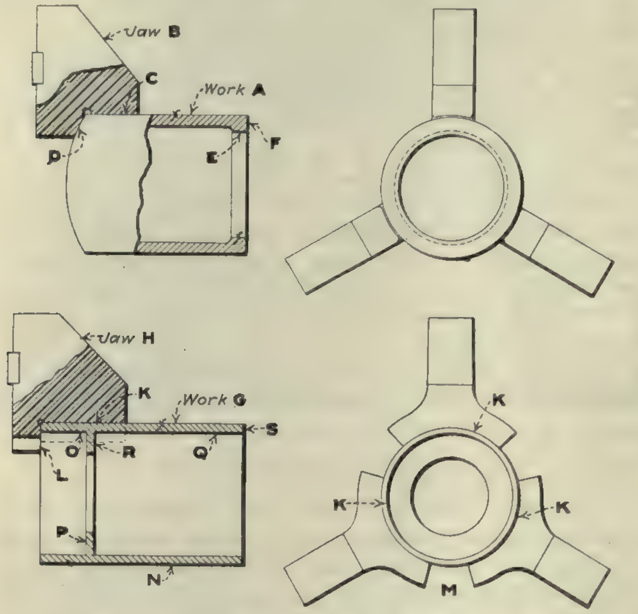

FIG. 242. USE OF SOFT CHUCK JAWS

In the example shown in Fig. 242, the work *A* has been previously machined on the outside and the curved end. Therefore, the jaws will be bored out at *C*, and formed at *D* to act as a seat for the end of the casting. The operation for which the jaws are made is the boring of the portion *E* and facing it at *F*. After this operation, the casting is to be refinished on the outside diameter, and all subsequent operations locate from *E* and *F*. For the condition shown, very satisfactory work can be obtained by this method; and due to the general construction of the casting, there is no possibility of distortion. It is possible to make up jaws of a similar kind but with soft portions inserted, so that replacements can be easily made. This, however, is not commonly done, as the method shown is cheap and generally satisfactory for the majority of cases. When a chuck is to be removed and replaced frequently, as might be the case when small lots are being manufactured, it might be more profitable to use inserted jaws. The designer must be governed by conditions in determining which type to use.

In holding thin work in soft jaws, there is always more or less danger of distortion, as has been previously mentioned. An example of this is shown in the work *G*, which is a thin cast-iron sleeve previously machined at *N*, *O* and *P*. This casting is so thin that it would be distorted if held by a method like that shown for the work *A*. By making jaws of special form with large ends, as shown in the view *M*, a large part of the circumference will be enveloped by the jaws, and thus prevent crushing or forcing the casting out of shape. The jaws *H* are bored out at *K* to the diameter of the work and a seat is provided at *L*. In using these jaws, the surfaces *Q*, *R* and *S* can be easily machined without danger of distortion. This is an example where the large ends of the jaws could be made of separate pieces and fastened to the regular jaws, if it seemed desirable.

Many times there are several methods which can be used for holding a given piece of work, no matter whether it is a first- or second-operation job. Sometimes there is a choice between the methods, both as regards economy and also the accuracy obtained. Fig. 243 shows a piece of work *A*, which has been previously finished at *B*, *C*, *D*, *E*, *F* and *G*. The requirements of the work are that the portion *H* must run concentric with *B* and be square with the flanged portion *C*. In the first method suggested the work is held in soft jaws *K* in a three-jaw chuck. The jaws are bored out so that they fit the portion *B* of the casting. In order to make sure that the flanged portion *C* is square, clamps are provided at *L* directly at the jaws themselves. Provision is made in the clamps so that they can be slid back away from the work when removing and replacing it.

As previously mentioned, there is a possibility of inaccuracies resulting from a method of holding like this. Therefore, it was decided to use a fixture in place of chuck jaws. This fixture is shown at *M*. It is bored out at *N* and threaded to fit the end of the spindle, but it could readily be made so that it could be applied to an adapter. In locating the work, a hardened ring is used at *O* and the work is clamped back against the ring by means of hook bolts at *P*. These are three in number and operate from the back of the faceplate. This construction makes a clean-appearing fixture, and one which has no projections likely to catch on the clothing of the operator. The steel locating ring *O* can be ground to size in place on the machine, and it can be readily replaced in case of inaccuracy.

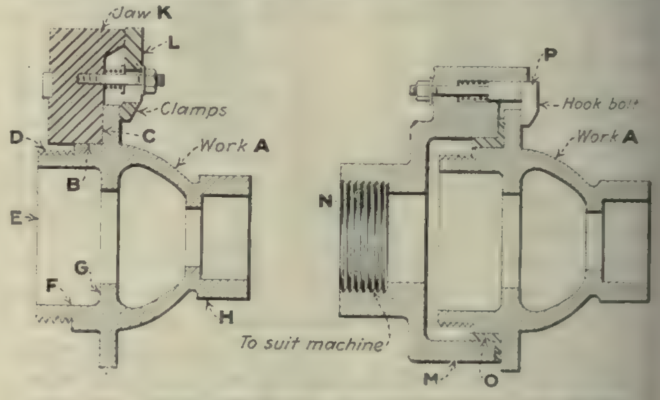

FIG. 243. TWO METHODS OF HOLDING SAME PIECE OF WORK

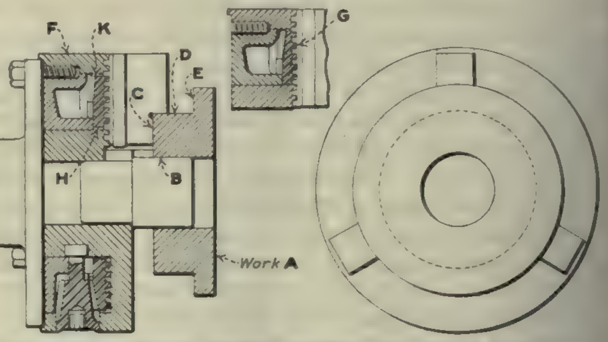

FIG. 244. CHUCK FITTED WITH FLOATING SCROLL

It is sometimes necessary to hold a piece of work for a second operation when it is difficult to grip it securely by means of clamps in a fixture. A case in point is shown in Fig. 244 which illustrates the method that can be used to take care of a condition of this sort. The work *A* has been previously machined in the hole *B* and also at *C*, *D* and *E*. It is necessary to grip the work firmly at *D* and at the same time locate it on a plug at *B*. As there is a possibility of a slight variation in the concentricity of *D* and *B*, it is necessary to make the method of holding at *D* so that it will take care of any variations at this point. By using a standard type of three-jaw geared scroll chuck, such as that shown at *F*, the work can be gripped firmly by making slight changes in the chuck. The scroll ring, shown in detail at *G*, must be taken out of the chuck, bored out at *H* and turned down at *K*, so that these sizes are, respectively, $\frac{1}{32}$ in. over and under their former sizes. This permits the chuck to float slightly, and thus equalize any variations in the casting, and yet at the same time hold it very firmly. This method of holding has been used by the writers in several cases with very satisfactory results.

Organization and Management of the Small Shop

By A. W. Forbes

On page 438 of the *American Machinist*, E. W. Leach under the above title, suggests some methods of planning and controlling production in the small shop. In the last few paragraphs he also suggests some difficulties. However, there is one point in which I think he makes a fundamental error, that is in his assumption that he is to make 300 machines a month.

The distinctive field of the small shop is small quantity production, that is in making articles where the demand is not sufficient for quantity production. Considering the automobile field, it would be folly for a small shop to try to compete with Ford, but a small shop could build special cars to meet the whims of particular customers, as well if not better than Ford.

There are certain things that can be made in large quantities in a small shop, because there is such a small amount of labor on each piece, and when dealing with such practices the methods of the large shop can be used with but little change. The typical small shop practice is making articles one at a time, or at least one lot at a time with but little regard to what kind of work will come next. We are running a small shop making electric motors, but if a man should ask us for a standard motor to run his line shaft we should not think of making it for him. We should refer him to the large manufacturers of motors. On the other hand, if he asked us for a motor to run inside the fire box of his boiler, we would quote on it, probably twice the price of a standard motor, or perhaps a little more. We do make a standard line of motor grinders, but probably half of our work is special in some particular.

I should say that the problems of the typical small shop which the planning should principally consider are:

(1) Flexibility; how can we arrange the work so as to be able to shift the entire force onto a rush order without causing confusion and lack of efficiency; we are not often able to do so, but that is an ideal.

(2) Continuous operation; the small shop demands a higher grade of skill among the ordinary workman than the large shop; it is therefore important to keep the force regularly employed; the item of continuous operation of the machines, that is often discussed, is of less importance than continuous operation of the men; if a shortage of machines occurs it is usually possible to secure the use of one in a neighboring small shop.

(3) Costs; the matter of cost accounting is a simple matter with the large plant using manufacturing methods; if a skilled man is kept for work that only requires one fourth of his time, and is given work for the remainder of his time that could be done by a boy, it is evidently incorrect to charge his wages directly to the job that he is doing; the larger part should be charged to the skilled work on which he spends the smaller part of his time; the small shop has so many irregularities of this sort or other sorts that it mixes up any system.

It was stated above that the small shop requires more skill in the ordinary workman than the large shop. On account of the irregularity of the work it is also true that a higher grade of skill is required in the cost department to obtain accurate costs. But to hire an accountant of greater skill than the large shops is out of the question. The result is that small shop costs are usually based on the judgment of the manager, checked by whatever data he thinks would assist him.

Any intelligent manager knows of plenty of methods that would give him valuable information, but which would cost more than they would save. I am using some forms. I have more in my desk that I expect to use whenever my employees acquire the skill to use them, and I have some that I abandoned when the ones who looked after them left me. I have just resurrected an old card system of giving work to the shop, after three years of non-use. I would have used it all the time if the shop had shown itself able to make use of it.

The determining factor of the small shop is the men who are running it. In the large shop, they may be able to find men who will fit in every given part of a complex system. In the small shop we must fit the system to the men.

Addresses Before Machine Tool Builders

President's Address—General Manager's Report—Jordan on Business Cycles—Flather on Work for Slack Times—Rastall on the Orient—Drury on Conditions in Europe

GOOD addresses featured the twentieth annual convention of the National Machine Tool Builders' Association, held Oct. 18, 19 and 20 at the Hotel Astor, New York, N. Y. On this and the following pages are published in full or abstract the principal papers.

Address by August H. Tuechter, President

In welcoming you to this convention, I do so with the solemn feeling that I am called on to preside at the most important annual meeting the association has yet held. Since last year we have been passing through a period of dullness that is the worst we have had since 1893, and in proportion to the present capacity of the industry is very much worse than any we have ever had. We had four years of false prosperity, due to the war, when our industry was called on to increase its capacity and output far more than we ever dreamed possible. How well it met the call is a record to which we can point with pride.

After the armistice we had a slackening in business which we rather expected, but to our surprise another period of false prosperity began in 1919. However, this did not last long because new orders fell off from January, 1920, and kept slipping down until July, 1921, after which August developed a slight up-turn which however, did not continue during September.

As this depression came on us, I believe that most of us felt that it couldn't last long nor be very bad.

It is sometimes refreshing, and is always valuable, to be able to dig into the past to see if anything that happens now is unusual. Our great statesman, Patrick Henry, said in his speech before the Virginia Convention in 1775, "I have but one lamp by which my feet are guided, and that is the lamp of experience. I know of no way of judging the future but by the past." So it was interesting to go through the records of this association to see what light might be shed on my present uncomfortable position as a machine tool builder and as your president.

To bring it clearly to your mind I will refer to a chart compiled by our general manager from reports of many of our representative members who were good enough to give the information. This bit out of the history of these concerns can be taken, as a fair cross section of this whole industry.

I will read you some extracts from addresses of former presidents at various conventions:

November 1904: Various committee reports indicated that business was not active, and many price reductions had been made. A report was made that the percentage of men employed at that time compared to normal conditions was 61 per cent, and some members reported that they had cut wages 8 and 10 per cent. A table comparing prices of various materials from Jan. 1, 1904, to Nov. 10, 1904, indicated that these had advanced from 3½ to 25 per cent in the face of which machine tools were going down.

May 1906—From Address of Mr. Woodward: We come here leaving our industries, which are teeming with life and loaded with orders, in the hands of trusted people. I may say since last August 1905 there has been a steady growth for the better in the machine tool business. With all the prosperity we have had during the past six months, each member is attending strictly to business, hustling and driving during this time.

Evidently in 1905 business was still dull from the depression that was lowest in December 1903—20 months.

October 16, 1907—From Address of Mr. Woodward: (The big panic came on less than two weeks later.)

Condition of Trade: We have had an era of prosperity, the longest ever witnessed in this country, and this prosperity has been in the extreme to such an extent that we have been overloaded with orders and have strenuously endeavored to execute them. The large and increased amount of business done throughout the United States has necessarily made large demands on capital, and consequently made the interest rate for money high. When money is high the business world commences a gradual curtailment in business, particularly in the manufacturing interests, and this means depression.

Present business conditions in the country seem to me to be peculiar. Our country is in a good condition. In most sections our grain crop is good and brings good prices. There is a demand for more railroads and ships to carry our products. What railroads we have are short of rolling stock and are unable to promptly convey our products, all of which indicate that there is a necessity for more machinery. It seems to me that the amount of money we have in circulation in the United States is insufficient for the large volume of business they handle.

President Woodward, through his long experience, recognized the fact that machine tools were one product in which price had little influence on demand, and commented on this fact.

May 19, 1908—President F. L. Eberhardt:

There has been no time since the organization of our association which has been so important to us as a body as at present. The history of business conditions during the last seven months need not be gone into here except to remark that the least expected sometimes happens. I confidently believe that the worst is past, and with the political horizon cleared, confidence will supplant doubt and normal business conditions return. The manufacturers who are known for their high prices have a great moral, steadying effect on business. They know that their prices, based on true costs, do not bear an unreasonable or unjust profit, especially when one stops to consider the skill required to produce machine tools.

October 20, 1908—President F. L. Eberhardt:

The past year has been making some very peculiar history The various happenings in the financial market, coupled with the political situation has wrought havoc with business for the year. I have always thought that these revulsions of business ought not to be, and by some peculiar control, might be avoided, but the more one thinks about it the more one is forced to the conclusion that they will continue to occur in the future as they have in the past. The peculiar part of it is that, like Jersey lightning, it never strikes twice alike. We are therefore forced to consider basic principles the more carefully and guide our course accordingly. The experience of the past year shows that the profits of busy years must support business during a depression, a fact which the purchasing public must not be allowed to lose sight of.

The depression from which we are emerging started with the larger interests, and it seems to me from observations that can be made, that the clouds are breaking and we will soon look back on the business experience of 1908 as a thing of the past, but don't let's forget the lesson.

May 1909. There were numerous reports of price reductions at the meeting, showing that demand was still low. Touching on the activity in railroad shops, one speaker stated that while there was not wide room for improvement, the increased earnings of the road gave promise of some rapid strides ahead, which it was expected would soon close the gap of idleness left by 1½ years of industrial depression.

October, 1909—Mr. Eberhardt: Six months ago we only believed the trade corner of the business depression had been passed. Today we are sure of it.

May, 1910—Mr. Kearney: It is probable that the machine tool industry was never in such a prosperous condition as it is at this time, and it owes much of its prosperity to the influence of the Association, which brought out an interchange of ideas which has resulted in a broader education for all of us as regards some of the essentials of our business.

October, 1910—President Geier (Only five months later):

Since our last convention in the spring time we have experienced a little change in business conditions, and yet, while we have had a little lull, I hope that you are filled with hope and optimism and that you feel that the future is as bright as the sky is this morning. It is my belief that we are about to enter upon a substantial period of activity. Although we may have a recession here and there, the curve is upward, and I think that this association will be able to educate its members so that we shall always be able to take a long view forward, and when a little depression comes we will not lose heart and be ready to disorganize our business, but rather become philosophic and appreciate that such conditions are simply temporary.

May, 1911. (President Geier had to admit that he made a bad guess.)

We have been going through a period of tribulation. We in our business have been trained to stand trials and tribulations, and the skies certainly are clearer today than they were a short time ago. These periods of quietude should bring to our minds the necessity of most carefuly studying our households, to analyze every department with the purpose of bringing them to a higher state of efficiency, looking toward economies possible to be effected by which we shall be better prepared than ever before for such conditions as we are now passing through.

In October, 1911, the depression was still on, and evidently deeper, because President Geier said:

I am very glad to see this delightful, bright, sunny weather, because there have been a few clouds hovering about our business offices and it is a good thing to get out of the clouds and out of the gloom and go to a place where the sun shines.

When these depressions come upon us we feel that we are stung a little bit, and when there is an unusually vexatious one we feel like complaining a little more than otherwise. But let us not forget the sun is shining and that things are not as bad as they seem to be. Better times are still in store. Let us not become disheartened. I hope this meeting will serve to buoy us up and I hope we will realize that things are not as bad as they seem, but that they might be a good deal worse. Sometimes I think we are apt to be too sensitive and allow things to get on our nerves more than they should.

In May, 1912, the depression was over. At this meeting Mr. Hildreth brought out a chart showing the rise and fall of pig iron prices, which of course correlated closely with the rise and fall of demand and pig iron production. He indicated that the industry must anticipate these periods. It was a very good paper. It only gave the experience of three machine tool builders, because that was all that he could get figures from. The chart was reproduced and printed in the proceedings of the Association, but was "seed that fell by the wayside and was trampled under foot."

October, 1912—President Bullard: The year past has been one of progress. Crop reports and business conditions throughout the world indicate that the prosperous times predicted by my predecessor, Mr. Geier, are upon us.

By October, 1913, business had again begun to go off, since President Viall said, in May, 1914:

As far as business conditions are concerned, many, if not all of us, are working under subnormal conditions, and we are hoping from week to week that there may be a pronounced change for the better. While a hopeful frame of mind does not pay the bills and allow us to employ our full quota of men, it does help us to plan for the future and take those steps that will help not only our own but the general business industry when good times come in. It is to be hoped that none of us, ostrich fashion, will hide our heads, attempting to conceal from ourselves the true state of affairs, but it is to be hoped that when new plans are brought for your consideration that you will consider them with confidence, with the idea that some day our country will be back where it belongs under normal conditions.

October, 1915: President Viall reviewed previous conditions as follows:

Business had begun to go off somewhat at the time of our annual meeting in 1913, and the depression that had set in, not only with our own industry but with all other industries, had begun to deepen. In April, 1914, you will remember that our convention was in a way trying, though we were all endeavoring to see the bright side, and to estimate the time at which our business would take on a color that didn't need rose-colored glasses to give it a proper shade. We all felt that business would revive some time, but when it would revive was a serious question. We were all putting up stock, and many had come to the point where they felt that they could not afford to increase the accumulation of stock goods.

At the October meeting last year (1914) some of us had begun to get very busy, and we were very keen to follow all scents that led toward a discovery of persons holding orders. Few of us at that time had any idea of what was in store for us, many of us were running short-handed, and the occasion had not yet arisen to warrant adding to our forces and in many cases to our hours of operation.

When we met this spring (1915) all our plants were in full swing, crowded in a way that we had never been crowded before, and we were compelled to reject orders that were offered simply because we were not able to take care of customers. We now find ourselves busy. Hardly a section is without distinctly disturbing labor troubles.

Through all these changes, and oftentimes periods of dull business that are more trying for an organization of this character to live through than are periods of prosperity, our membership has held together well.

October, 1916—Mr. Doan: In the United States there has been immense business development during the last two years. Old machinery has been put in shape for working, and new machinery has been built with break-neck speed. New buildings have been erected, and expansion has been the order of the day in the machine tool industry, along with others. Our demand has been due to the numerous calls for machinery and supplies of every kind from Europe. But this Hercules at work will grow weary—will there then be sufficient demand to keep all busy? In the stress of unprecedented prosperity, let us not forget to prepare for other days.

The members of this association are all optimists, but unless we discourage new entrants into the business of those untrained, many of them would easily become pessimists. Let us keep the business sound; let us plan to keep it steady; let us plan to keep it permanent.

I hope that no one feels that I feel pessimistic at all about present business conditions. I don't. In fact, I think that the immediate future, or rather as much as we can reasonably forecast—perhaps the next year—is almost assured. You all know that business conditions change in our industry much more rapidly. We have all seen changes occur from one month to another. Therefore I think it an opportune time when we should look very carefully into the future.

October, 1917—Mr. Doan: This war will end some time. No man knows when, and then the business man with the large plant and large payroll will have some real difficulties to solve, requiring clear vision and courage. A prophet may indulge in predictions based on natural laws and past experience. Without, however, making any attempt at prophecy, I want to direct the attention of this membership to the fact that during the last three years there has been built about the same number of machine tools as would ordinarily be built in ten years. Therefore, I ask you how long it will require the world market to absorb its over-supply, which even now is apparent in some kinds of machine tools? Mind you, I am not predicting—simply calling your attention to a condition with a view to having each manufacturer answer the question as best he can; but I would also like to add the old warning, "The good sailor trims his sails for a squall."

At this same meeting there was also an address by Geo. F. McElwain, of Babson's Statistical Service, explaining the well known Babson charts. During the course of his talk he said:

When the peak of the war period is reached, we are going to start to go down into a period of final depression which will mark the close of the war, which will include all the warring countries and most of the neutrals. This period will take us down into a depression such as we have not known in civilized countries for a great many years.

May, 1918—Mr. Doan: I desire to direct the attention of our members to the fact that in the small sizes of machine tools, the supply is greater than the demand. There is, however, a scarcity of the larger sizes of machine tools, most of which are wanted quickly.

December, 1918—Mr. Doan: The period that we are entering into is perhaps slightly cloudy, at least taking the immediate future, but I feel certain that every cloud has a silver lining, and time passes very quickly, and we will soon pass through this uncharted sea and we will have good business again.

You realize that the war is over, and that the government will not need many of these machine tools. On the other hand, the problem is serious; we have so many, many machine tools in process of construction, so much on order in the way of material, that it begins to be a very serious question.

At the same meeting, Mr. Geier: We surely appreciate the rays of hope and light that have illumined what seemed to many of us a rather dark horizon. There is a surplus of machine tools confronting us to the amount possibly of $200,000,000.

The war made it necessary that the machine tool interests be expanded from three to five times in order to win the war. The machine tool industry did this without a cent of subsidy by the Government; not entirely without profit, but they did not make the money that some people think they made; without Government contracts to any particular extent; without any guarantee contracts. Their personal aim was to give every ounce of energy in building up their business as rapidly as they could at their own expense in order that the war might be brought to a successful conclusion.

Under the direction of Government officials they did this, believing, as all the nation believed, that the war would extend well into 1919. They find themesIves at the present moment going at a tremendous rate, with obligations all down the line, extending over the latter part of 1919. Suddenly, six months at least in advance of any opportunity of taking off their shifts or using the raw material or disposing of the unfinished goods in process, they find tremendous surplus of finished product which may possibly equal twice the probable demand for 1919.

May, 1919—Mr. Newton: The principal thing we as an industry are interested in is the present and immediate future of our business. The present situation is not one that will lead us to become recklessly optimistic. On the contrary, I am fearful of the reverse condition. Many of us were members of the association during the trying times occurring between 1908 and 1914.

In October, 1919, business was thought surprisingly good, because in May, 1920, President Newton said:

At our last convention we were rather surprised that business conditions had held so favorably since the signing of the armistice. We had been promised, and most of us had looked forward to a real depression, at least in our line of industry. Fortunately, things have turned out quite differently. We have experienced, instead of a depression, a most successful and easy selling market.

Today most of us are confronting a shortage of new orders, although we have plenty of unfilled orders on our books. I am looking forward to the resumption of good business conditions in a few months. In other words, if we are to have a business depression it will be of short duration.

October, 1920—President Newton: For the past few months business in general has been on the down grade, attaining greater velocity as the time went on, so that now, even if the brakes were set hard, we cannot expect to stop the downward trend at once. Therefore, let us face the situation as it is and realize that we are face to face with a real depression, and that the orders for machine tools are few and far between.

Most of us know from past experience that the demand, or lack of demand for machine tools is entirely beyond the control of the machine tool builders. The depression which we are now contending with is no new experience for us, and is not a surprise, as we have been expecting it for some time. In 1915 and 1914 we experienced a situation in the machine tool business very similar to the one which we are now passing through. That experience taught us the real value of our association—a value that has never, and can never be too highly rated.

Let us attack this depression as though we thought it would last for some time. Let us conserve our energies, meaning cash, so that if we have cause we shall be able to meet conditions in a businesslike manner, and then we shall be ready to resume our full productive capacity when the demand comes back to us, as it surely will in the not very distant future.

In view of these extracts, though we may without shame be surprised at the depth of this depression, ought we not be ashamed if we feel it to be anything unusual? An industry that has had seven slumps in 21 years ought to have its eyes open, and be ready for one almost any old time.

Now, then, let us not make this same mistake again. We have a thoroughly competent observer on watch (the new general manager of the association) who will warn us of shoals ahead and of clear sailing, of the rise and fall of our business barometer. Let us now do the things necessary to help him correct and revise our barometer. It is ours—for all of us—but some don't know it even exists. Some prefer to sail without it. Some will not help, either through lack of knowledge or fear of damage to their own craft.

As the members know, before his selection as Secretary of Commerce, Herbert Hoover, as chairman of the American Engineering Federation, asked a committee of distinguished engineers to estimate the amount of waste in industry, the object being to call the public's attention to the sources of waste and to arouse industry to the necessity and profit of eliminating waste.

THE PERCENTAGE OF WASTE

Fred J. Miller, former editor of the *American Machinist*, was active in this committee and asked the association's assistance in making some studies of the machine tool industry. This assistance was given, and the investigation seemed to show a probable waste of about 40 to 45 per cent. The report of the committee is very interesting, and it shows that in the machine industry not a large proportion of this waste can be chargeable directly to labor restrictions; therefore, the responsibility for elimination of waste in the machinery business rests largely on the shoulders of management.

There is a very large excess of facilities that are not used to the fullest extent. There is badly planned management. Efficient planning and guidance of production is the duty of management. Better employment service and policies lie within the power of management, and not of the employees.

The old proverb says that a dollar saved is a dollar earned, and I recommend to our members that we ourselves look to every opportunity to save waste in our own shops—wastes of every kind in plants, in time, material, organization, and costs.

Since our Cleveland meeting, Scovell, Wellington & Co. have made cost surveys for a number of our members. The cost work of the association should be continued until the members are all found to be figuring the proper elements of cost. Unless they do so they have a false basis on which to base their prices. The man who does not charge enough into his costs is very prone to make mistakes in his prices, and his cost system should automatically provide for the proper charges. Most of our men can easily get their labor and material, but the burden distribution is the part of cost-keeping that presents the most difficulties, and many people are inclined to neglect it just because it seems too difficult.

Those members who have not yet had the survey made of their plant should do so, and should consult with the accountants as to what parts seem to be deficient in their system to bring it in line with the uniform plan adopted by the Cleveland convention.

NECESSITY OF COST ACCOUNTING

If all of us had used the device of calculating a normal burden, and putting away cash reserves in boom times to carry over depressions, our industry would be in a much healthier position than it now seems to be. Several members have written that they could not spare the money it would cost to attend this convention. Is that not evidence that there is a necessity for some of this cost accounting work?

The most promising, the most necessary activity which the association has undertaken this year is the organization of statistical service for each group of tools for which it is possible to render such service.

We are all familiar with the very great irregularity to which this whole industry is subject, and this excessively high war peak certainly is significant. If the law of action and reaction applies in business as in physics, the industry seems due for a very long reaction to compensate for the excessively lively action that we had during the war.

None of us can judge our wisest course merely from our own experiences with anything like the soundness we could have by pooling our information through a statistical service. Other trade associations find this to be the most valuable service they can render their members, and I personally am fully convinced of that fact. The whole world gains much from the monthly reports of output that the iron industry has published for many years. All industry is closely related, and by proper study and interpretation of conditions, it will be possible to better stabilize industry, to have ready for the consumer all the goods that he needs, and not to have an excess of goods when the consumer is not likely to need them. The lone manufacturer confronted with such a business situation as we have now is groping blindly if guided only by his own knowledge. He is much more subject to losses than if he had full information as to the total current output and sales of his particular product, together with reliable information as to finished stock on hand, the amount in process, and the rate at which this stock is moving out. It is very valuable when these items are compiled, to compare one's own experience with the consolidated figures for the whole group. Each can determine how his own sales compared to those of all other producers as a group, and how far he is justified or not justified in making special sales efforts.

It is of the greatest value at this time for each group to take its shipments for the last twenty years, as some groups have done. We are thus able to form a pretty fair conclusion as to the pre-war trend, and in the light of that, to plan intelligently our policies in the future. This composite curve before you is significant, but is not as valuable as the group curve showing your own products. Then with the monthly reports and charts for each group, the actual flow of business in the group is very well seen, whether it be good or bad. Without it, you can only guess; with it, you can reasonably estimate.

BENEFIT OF CO-OPERATION BETWEEN INDUSTRIES

Our own statistics of this sort can be made of great value to the country because indications are that our own slump in any period of depression precedes a general business slump by some months at least, perhaps by a year. In exchange for this information from us we can hope to secure similar information from other industries whose activity precedes ours on the rise. Then we will know the right time to make stock and to get ready for the prosperity that will occur during the following cycle.

Such co-operation between industries depends on co-operation between individuals in each industry. Such work cannot be done by any individual alone. In such co-operation lie great possibilities of benefit to all members of a group.

A promising innovation in the association's work has begun this year by holding two series of regional meetings. One series, conducted by Mr. Scovell of the Scovell Wellington & Co., discussed our uniform cost plan, and the second, conducted by our general manager, discussed general conditions in the industry. Letters that come into the office commend the work in these meetings in the highest terms.

The work of an association must necessarily be informational—that is, it must gather and spread information. Regional meetings should be a part of our program from now on. At these meetings not only should the heads of the concerns be present, but they could well have present the men known as junior executives, who are in responsible positions, and who gradually grow up to be heads of concerns. The education of such men in the broader aspects of this business can have only a good effect. The principles and the difficulties underlying the development of this industry might well be laid even before the workmen, who are prone to think that the bosses never have any troubles.

There are many possibilities in these regional meetings and they can well be developed.

For many years this association has talked about the possibilities of standardization. The time now has come to stop talking and go to work. The American Society of Mechanical Engineers has taken up a number of subjects that directly concern the machine tool builder, and we shall have to be represented on committees on these subjects.

A recent letter from Sol Einstein, chief engineer of the Cincinnati Milling Machine Co., who is now in Germany, says that the German machine tool builders are very busy with standardization work. I do not need to go into this in detail. You know it is needed, for many reasons, and each committee should seriously and promptly formulate opinions as to what things can be standardized and then go into the work of standardization itself.

The general plan could be to have a general committee of the association which can make recommendations to the Engineering Standards Committee. Each machine group should have a special committee on standardization which would report its findings to our general committee, for transmittal as above mentioned. This is the practice of other organizations. We should take our proper position on these matters. If we do not do this work ourselves as affecting our own interests, we will have no just cause for complaint if some others attempt to do it for us and then do it badly, for lack of understanding of our problems.

We should not let the matter lie as we have heretofore, but we should make this a very vital and active part of our association program. It will finally be a very profitable undertaking, as has been demonstrated with standardization work in other fields.

I consider it necessary that I at this meeting of the association make some reference to the National Association office which has been open in Cincinnati since Jan. 1, 1921. To get the office into shape, properly equipped and running, was naturally the first task which confronted Mr. DuBrul, and with this accomplished he went to work with a vim and vigor which must be seen to be appreciated.

Report by E. F. DuBrul, General Manager

IN THE 20 years of its existence the Machine Tool Builders' Association has done good work, but compared to much younger associations, its activities have been limited. Many activities now successfully pursued by other organizations can well be followed by this association. The necessity of other work beside good fellowship and acquaintance among competitors, has led many trade organizations into much more active work.

The Machine Tool Builders' Association has done extremely well in the matter of cultivating good fellowship and confident knowledge that the word of one's competitor was good. When the association was organized a machine tool price list meant nothing except the salesman's maximum limit; today, in spite of the depression that exists in the business, a machine tool price list means just what it says, in the vast majority of cases. The ethical standard of the machine tool business on that one account is vastly improved over what it was 20 years ago. Such a betterment of ethics would not have been possible without the good fellowship and confidence that this association has brought about among competitors.

The association's co-operative work of the past should not be minimized, but now the conditions are such that unless co-operative work of a much higher type be undertaken in more and newer ways, the association will fail of reaching its highest value to the members, who are paying for its operation.

I have tried to make it plain in bulletins, in the regional meetings, and in the Cleveland Convention, that association work should be regarded by the members as a strictly business proposition. The association will be more and more successful the more the members so consider it. They should weigh its worth to them against the dollars they pay out for it. Unless they do so look upon it, they will not co-operate in the things that they are asked to do. Those who seriously regard the association office as just as much a part of their every-day organization as though the association office were under their own roof, will co-operate to the fullest extent and will be repaid many times over.

The economic upset the world has been going through and the present depression in the machine tool industry, require real service along economic lines. This is no time for puttering with business problems. On the other hand it requires of every man, the deepest thought, and most serious study, if he would keep his own business and his industry in a healthy condition.

With the approval of your executive committee, and its advice and assistance, I have tried to proceed along broad lines of constructive work, just as fast as the members were inclined to follow.

Distributing Information

Co-operation through an association brings results like the multiplication of the loaves and fishes, in so far as ideas are concerned. If one member gets a good idea, but keeps it to himself, it does not multiply. If through the association his idea is spread broadcast, it benefits the whole industry; thereby it reacts and benefits the one who first got the idea. He not only has not lost anything himself, by giving forth this idea, but he has multiplied its value many times when he has given it to 200 other members. If it also induces someone else to give out a good idea, all the 200 then have two new ideas instead of only one man having one idea. You all turn ideas into dollars.

Since January we have sent out sixty-six numbered bulletins and some letters that were not numbered, altogether perhaps ninety general communications addressed to the membership. These covered many different subjects, and some of them seemed rather long. There is always a tendency, when you receive a long communication from an association office, to lay it aside until you get more time to read it, and then to forget it. Every bulletin is not going to be of equal value to every member in the association, because every shop is different. So many important subjects have been cropping up that we questioned whether we might not be sending out too many communications. The president sounded the membership in that regard with a general letter over his own signature. The kind and number of responses received indicated a desire for all the information possible that looked in any way helpful, and proved that the members would rather be their own censors, preferring to get too much rather than lose by not receiving enough material of special benefit to them.

It is to be desired that every member will take these communications in the spirit in which they are sent: that is, the spirit of helpfulness.

If any communications have appeared to be a bit strong please understand that it is because this industry has reached a very serious stage as a result of post-war reaction and because some men are doing things that are futile, useless, and disastrous.

It is not in a spirit of carping that I may put out a bulletin that sounds rather sharp. It is with the idea of strongly calling attention to situations that have become very plain to me, as I have had the opportunity to survey the whole field, but which are not so plain to a manufacturer who does not have the same opportunity to picture the industry as a whole.

The member who gets a bulletin that strikes him as too strong should first frankly consider whether or not the bulletin touches on his own conditions. If it does, he should then consider if it would not be well to eliminate the condition that the bulletin is pointing out and that the condition may demand strong medicine, and not a homeopathic pill. If he finds after careful analysis that the bulletin does not in any way bear on his own business, let him, in charity both for the manager and the members who do benefit by it, realize that it was sent out for the purpose of helping some others, and was not intended to rub anyone's feelings the wrong way.

STATISTICAL WORK FOR THE VARIOUS GROUPS

It is well demonstrated by many trade associations that the most valuable service that can be rendered is to gather and distribute statistics of production, shipments, stocks, and sales. Without information of this sort, each manufacturer must simply grope blindly in the dark, making the wildest kind of guesses as to conditions that he must meet. The poorer his information of a general situation, the worse his guess is likely to be.

Every man wants to know and should know whether he is getting a fair share of what business is going at any time. He can tell this only if he knows the total volume in his line being sold in a month. If he knows that the present state of demand is only fifty machines a month, and if he knows that he is getting his share of that limited demand, he will not be tempted to do things that compel his competitors to enter cut-throat fights for business. But if he is ignorant of the true facts he is pretty sure to do something that will work against his own pocketbook and every one else's, including the consumer's.

In no other way can he know, except by joining with his competitors in compiling a composite report of the conditions. When he has that report he can then set his own conditions alongside not only of the condition of the group as a whole, but of his competitors as a whole with himself excluded.

To develop that sort of information for each group, we are organizing monthly statistical services by groups, of orders, cancellations, production, shipments, factory stocks and dealers' stocks. The shaper, radial drill and upright drill groups have already put this regular service into operation. We wish each group to consider this at the group meetings tomorrow, and hope all will get in line so that they, too, will have the benefit of better information as to their own markets.

Some groups have a picture of their past from which they can guide their future because they have gathered statistics of shipments for the last twenty years. While these are far from complete, they are fairly typical.

One reporting group found that of certain sizes of machines the factory and dealers' stock is sufficient to supply demand, at the current rate, for something like thirty-six months. Can any man think that to be a healthy condition? Remember that those stocks were accumulated at high costs, and now have to be liquidated in the face of much lower replacement costs. The difference in cost went to the workers and the material men, but it will never come back into the bank accounts of the men who accumulated those stocks in over-anticipation of their demand. If they had had this sort of service in the last two years they would have real money in good, select investments bearing high rates of interest and increasing in value. Instead, they have it tied up in stock that not only earns no interest, but costs interest to carry, and besides creates loss and demoralization, as overstocking always will do in every industry.

An illustrative flow chart is presented to show the form these group charts are going to take, one for each size of machines a group chooses to report on. A manufacturer should be glad to join with every competitor in the compilation of figures of this sort, because it gives him a much better guide for his policy than he could have in running by mere guesswork, as he must do without such information.

Charts of this kind show the trend of the forces of demand and supply at work every month. Every group can use statistics of this sort, the details and the method of compilation being arranged according to the needs of the group.

Is it not plain that when an industry as a whole provides far more production capacity than the demand of its customers justifies, that industry is not going to pay a reasonable rate of return on the investment so made? True, some individuals in a group might generally be able to earn a fair return on their own capital, but when demoralization of price occurs, because of blind guessing on the operation of economic forces, even sound, well managed concerns cannot hope to make the earnings that their efforts and capital at risk really justify, and knowing it will be able to keep their own business in sound condition. Naturally, if all, or a great majority are doing the right thing, the industry as a whole will be healthy; but if a majority are doing the wrong thing, all will suffer.

THE BAROMETER

The barometer chart figures that we have been issuing every month are very far from being as satisfactory as they can be made. As I have said at the group meetings, a feather thrown into the air will indicate the wind's direction better than nothing at all, but it would hardly serve the weather bureau, to measure and record wind velocity and direction accurately enough to predict the general course of the weather.

From various curves drawn to show shipments of the past twenty years of different sizes of various tools, we can now say that this industry can construct a first-class barometer for itself, if it wants to. This can be done, and at slight cost, but it will require co-operation by the members. Such a barometer can and should be made for each group if the group statistics are better organized and better appreciated. In addition, a general barometer can and should be constructed for the industry as a whole and it can be done very easily.

A grave defect of our present barometer is its basis of dollar values taken on the high prices prevailing in the first quarter of 1920. Another defect is that it is an average of percentages that have no common base. About half of our membership are contributing their figures to this barometer and I should like to see their faithfulness better rewarded as it can be, if the contributing members will assist.

Since our Cleveland Convention, even perhaps before, our member, Mr. Oesterlein, made a suggestion that I believe will greatly improve the general barometer. That suggestion is, that each member report unit orders received each month, giving the number of machines ordered and cancelled, and the balance of unfilled orders, report blank being arranged to show the value of machines sold in classes according to a scale of values to be decided upon.

It is fairly evident that the lighter machines are most sensitive to rising demand because they do not require buyers to make much cash outlay and such types naturally are the greatest in numbers sold every month. We have no sufficient evidence on which to base a fair presumption that as the lighter machines precede the heavier ones in activity on a rising market, the heavier ones show a slump coming long before the lighter ones do. Therefore the interests of builders of heavy and light machines are mutual in pooling information as to the course of the general market from month to month.

As a basis of discussion, it is suggested that reports be taken, as follows:

(*a*)	Machines sold to the customer at	300.00	or less	
(*b*)	Machines sold to the customer at	300.00	up to	800.00
(*c*)	Machines sold to the customer at	800.00	up to	1,500.00
(*d*)	Machines sold to the customer at	1,500.00	up to	2,500.00
(*e*)	Machines sold to the customer at	2,500.00	up to	4,000.00
(*f*)	Machines sold to the customer at	4,000.00	up to	6,000.00
(*g*)	Machines sold to the customer at	6,000.00	up to	10,000.00
(*h*)	Machines sold to the customer over	10,000.00		

Curves of each of these classes would clearly show the trend of business. Low interest rates precede activity in pig-iron production, with which we now know the machine tool demand to be closely correlated. With such curves we will then be in a fair position to forecast the movement of machine-tool demand. If we find the small machines becoming active, we can send out to the whole industry the glad tidings that the clouds are breaking. We know that long before a general boom is at its height interest rates go up, and the heavy types of tools fall off in demand, for very well known reasons. When we find this to be showing up, we can hoist a storm signal for the industry, so that all can reef sail.

If the members will take the very little trouble required to make the reports the association can easily give all a fine service, at a cost that is negligible compared to the benefit.

I strongly recommend that some action be taken along this line, the change to be effective beginning with January next. This would give the members time to get their records in such shape as to enable them to report on whatever basis is adopted.

I have shown our results to other workers along these lines and they give our industry credit for being able to forecast coming depressions with remarkable accuracy quite a time in advance of most others. Exchange with other industries that forecast an advance will be to our benefit. It only remains for us to perfect our own statistical service. I am confident that an industry which did so much to help win the World War, will not fail in rendering the large service to itself that this work will render when fully operating.

What Can Be Made in Idle Machine-Tool Plants During Times of Slack Demand for Regular Products

By H. L. Flather
Treasurer, Flather & Co., Inc., Nashua, N. H.

PROBABLY no one thing causes machine-tool manufacturers more concern than the problem of keeping their factories busy during slack times. It seems presumptious on my part to attempt to be the Moses who can lead you other machine-tool builders into the promised land and show you how your factories, which are now more or less idle, may be put into profitable operation, when I have never been able to do it with our own.

Some thirty-five or forty years ago, when I was a boy I spent an occasional vacation with an uncle on a farm. Now while this uncle was one of those men whom children love to visit, he was not what others would call successful, especially in his line of work. In fact, he had all he could do to make a living. However, regardless of his faults, he possessed one faculty or talent, and that was the ability to see and point out the mistakes of his fellow farmers. He could show, theoretically at least, their every fault, and also how if they would only follow his advice they could not help but be successful. Some of my friends who knew me best have at times intimated that I resemble my uncle in some respects.

If any of you here came with the expectation of my being able to tell you of a plan that will change an idle shop into a busy one, I am afraid you will be disappointed. After careful thought I have concluded that about all I can do is to copy my uncle and point out the faults and mistakes, as they appear to me, of what has been done in the past, not only by our company, but by some others with whom I have been more or less acquainted, hoping that by taking the negative side something may develop in the discussion which is to follow that will be of real benefit to the machine tool manufacturers in times like the present.

My first experience with a business depression came in 1893 and I haven't missed once since. I also feel more or less acquainted with the depression of the seventies through hearing it talked over and discussed by the founders of our company. On account of the many hardships endured and the ways and means used to keep our company in existence, the panic of the seventies was ever a live topic in our family, and although there were only about six lathe manufacturers at that time, the problem of how to keep alive was just as serious then, possibly more so, than it is today. The same difficulties existed then as now, so there is in reality nothing new to face, except to find a better way of overcoming them, and it is regarding these that I have theories of what we manufacturers should and should not do. You will notice I say theories, because after having been actively engaged in making machine tools for over thirty years, I only *know* two things, the rest is all theory. The two things referred to, are, first that in dull times it is next to impossible to make money, and second you can make a tremendous loss unless the greatest care and foresight are exercised.

Speaking for my own company, I can say that in the past we have done about everything to keep the wheels moving. Some years ago, our company purchased from a manufacturer located in a small city some distance away, a single purpose machine and I was sent there to learn to operate it. Not knowing anything about the hotel accommodations, inquiry was made of a friend who traveled that territory as to which was the best one, and he replied, "There are six, but whichever one you go to, you will wish you had gone to another," and it is the same way with dull times—whatever we do we wish we had done something else. We have run on short time with practically a full crew, we have run full time with a reduced crew, and we have shut down entirely. We have built up stock when we wished we had not and we have kept our money in the bank when we wished we had it in stock.

We have made an endless number of mechanical contrivances, including the first type of bicycle, familiarly known as the "bone-shaker," have made many patented articles, including flat-irons, horse shoes, even jack-knives with a blade for every conceivable use, designed many original machines for special purposes and also built them from designs furnished us; but I think without exception that in the long run each venture was a mistake and money loser. In all such cases a great deal of time and energy must necessarily be consumed which can not be accounted for in preparing to manufacture something greatly dissimilar to one's regular line, and unless the manufacturer is exceptionally fortunate in having executives of unusual ability, the probabilities are that many of the ways first tried to produce the new product will not be successful, necessitating starting over again, at least once, if not more times. If it were possible to use the same energy and ability in improving one's regular line, the financial benefit would be much greater.

Many manufacturers take on special machinery and sometimes this works out to advantage, other times not. I will cite two examples, one which was a success, and the other a failure. For a successful example I have in mind a manufacturer who commenced years ago to make special machinery used in a food industry and due to a combination of unusual circumstances had made a success of this business. First, owing to a universal and constantly increasing market for this particular food, the demand for this special machinery is practically constant, and second, to being located where he has no competition. In this one case the side line has outgrown the original. The tail has wagged the dog. On the other hand, I know of instances where the building of special machinery has lost to manufacturers business in their regular line, because the machines have not come up to the customer's expectations and regardless of the fact that he was not at fault the machine-tool builder was held responsible. It is needless to add that in such cases the manufacturer would never again receive from such customers consideration in the placing of future business, either for standard or special machines.

My unsuccessful example is that of a machine-tool builder who by hard work had established for himself a fairly good name for his particular line when one of these depression cycles swept over the country. Not being any too strong financially, it was necessary for him to keep his shop in operation if possible. A plausible inventor happened along at this time and the shop owner was persuaded to undertake to manufacture a machine which, according to the inventor, would revolutionize a certain industry. As is usual in nine out of every ten of these cases, the machine turned out to be fundamentally wrong in design and became a failure. Nevertheless the builder was blamed by the inventor, payment was withheld and a long law suit resulted. Eventually the machine-tool builder won the law suit but it practically cost him his business. During the time the law suit was on he had to neglect his regular line. Meanwhile normal conditions returned in the machine-tool business and he was unprepared to take care of his agents and customers and by the time he was, they had gone elsewhere. Further, when he came to the actual manufacture of the special machine he found that his regular machinists were not adapted to the new work and he had to hire some that were, and by the same token, when he returned to making his regular line he had to change once more, and his old men having found positions elsewhere, it was with great difficulty that a new set of competent men was secured. The final result was that although the machine-tool builder recovered the cost of the special machines, the amount did not offset his loss in other directions and he became financially embarrassed and forced to liquidate.

In considering these two cases the critic may say that success or failure was simply a matter of foresight and business sagacity, but I do not think that is the correct answer, because I happen to know that in the case of the successful manufacturer the special machinery was taken on simply to tide over during a slack time and the future expansion was not in any way due to ability or foresightedness. In the case of the manufacturer who failed I also happen to know that he did not depend on his own judgment but sought the advice of others. The consensus of opinion of them all was that the invention apparently had great possibilities and if it made good there was a fortune in it. Some may even reason that it is best to distribute your eggs among many baskets, but personally I agree with Mark Twain, who said, "Put all your eggs in one basket, but watch that basket." If you once decide to make machine tools, stick to them.

My own conclusion is that doing work foreign to one's regular line is unprofitable. There is, however, one exception which I wish to make and that is the taking on of comparatively simple work, requiring little or no supervision, at a fixed rate per hour. This enables a manufacturer to keep his organization together and cuts down the overhead. The fly in the ointment in this proposition is to first obtain the business. In dull times there is very little of it to be had anyway and what there is, is generally given to contract or job shops which make a specialty of doing this work both in good times and bad. Still our firm has always been able to secure some and in thinking the matter over, I recall that most of this kind of outside work has been confined to planing. Such being the case, I would suggest that our members look into this and see if they cannot develop something locally, especially those who have unusual planer equipment, such as exceptionally long or wide planers. Because of our firm happening to have an extra wide planer we were able recently to secure on an hourly basis some work right in our own city that amounted to about two thousand dollars.

Every depression occurring in my generation has been brought about by a different cause, over-speculation, politics and the World War all playing their part; and no two depressions have come about from the same cause, so that the lessons we learn from one cannot be applied to another. If the present depression were caused by the same conditions as the one of 1893, or if the next one will be the result of another war, I am sure we could apply to advantage the knowledge gained in the past, but as each depression was the result of entirely different causes, the lesson we learned in '93 is of very little value now.

You may think that I am straying from my subject, and perhaps I am, but the point I am trying to bring out is what we should do with idle shops in dull times depends a great deal on the cause of dull times. For example, if world conditions today were similar to those existing in '94 and '95, I should advocate running our plant to capacity and stocking, if necessary, all the machines we could make. On the other hand, if there should be another World War and I am unfortunate enough to be alive at that time, I should commence to curtail with the first rumors of peace and not stock a single machine.

As I said earlier in this paper, my actual knowledge of what can be made to advantage in a machine-tool shop during slack times is very limited, my experience having grown only a crop of theories. I do think, however, that if you take on outside work or special machinery, it is much better to confine the new work as closely as possible to the line in which you are already engaged. Sometimes, even what seems like a small change from the regulator, will cause a lot of trouble, as perhaps the following illustration will show:

During a semi-slack period some years ago a firm in a nearby city placed its order with us for what seemed to be nothing more than an ordinary lathe with a turret on the ways and another on the carriage, it being thought by all that a machine of this kind would handle a certain part to perfection. After the machine itself was made the job of tooling it up and testing it out was given to me. Of all the deceitful things which I ever encountered, that piece of work was the limit. I worked on the job for months until I fairly hated the very sight of it. Finally we hit upon a new scheme for tooling the work up and by hard work I finished the tools the night before I left on a vacation, sure in my own mind that they would be a success. Upon my return, almost the first words my father said were, "Son, I am glad you are back, those last tools didn't work and the machine is waiting for you to try something else." Eventually, after we had spent in experimenting several times the original price, the machine was accepted and we charged the loss up to experience. Having expounded my theories regarding what shouldn't be done in slack times, possibly you are wondering if I have any theory as to what should be. I have one, but I hesitate to tell it, as it may be thought idealistic and visionary. However, I realize that if it is, there is no better time or place to submit it for criticism.

SUCCESSFUL SHOP OPERATION

To operate a shop successfully in dull times you must be able to do so in good times. That statement may sound like pure nonsense at first, but before passing judgment let's analyze it for a moment. What constitutes successful operation? Does the mere ability to secure orders sufficient to make a profit when business is good constitute successful operation? I claim that that is only partial success. We all know without my going into the whys and wherefores that the machine-tool business can be operated at full capacity only at certain periods or intervals of more or less duration. That every so often we are confronted with a cycle of depression, caused by conditions beyond our control. That in spite of our being a fundamental industry, the one in fact, on which the world today is dependent, as it is on no other, yet it is also a fact that what profits there are, are made only during good times, and to make ends meet at others it is necessary to resort to extreme measures.

My theory is that the price at which machine tools are sold when there is a market should be sufficient to return a profit great enough to pay a reasonable dividend annually, good times and bad, on the capital invested, and in addition take care of the ordinary expenses during dull times. Hence my idea of operating a shop successfully in good times is to see that we obtain that price, and if we do, we shan't have to worry so much about the dull times.

The Business Cycle

By DAVID M. JORDAN
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I AM not here to try to tell you it is possible to foresee what is going to happen in the business world. It cannot be done except relatively speaking, but it can be done to a certain extent. We have to get down to fundamentals to see how business swings and why it swings. We have known for about 100 years that business conditions more or less move in cycles. Business swings around the cycle from depression to recovery; from recovery to prosperity; from prosperity to liquidation, and back to depression again.

I want to follow the cycle around with you for a few moments. We will start with production. Production and distribution are the biggest things in business, and production is first. Production may be divided into two classes, agricultural and industrial. In that way I will say that everything which is not agricultural production falls under the classification of industrial. Distribution, or marketing, depends largely on production. I think it is folly to study statistics of marketing because marketing shows the effect, not the causes. All through this matter of prognostication of the future, differentiate between cause and effect. If we want to look ahead we have to figure the causes, and the effects will take care of themselves. We have four conditions—commodity prices; foreign trade; the railroad companies, transportation companies, carloadings and idle cars; and then retail sales—four divisions of marketing.

The third classification is labor. We study labor under three or four heads: First, wages; second, controversy; third, immigration. The fourth division we call business profits, meaning by that the earning records of corporations. Then there are business failures; of course, they are just the opposite of business profits. The commercial failures are merely a phase of business profits, so we have the corporate earnings and commercial failures.

Next, we have new security issues, because the volume of new securities being offered reflects more or less how conditions are as far as business profits are concerned.

Fifth, we have exchange transactions; in other words, those transactions which take place on the commodity exchanges, on the stock exchanges, and on the foreign exchanges.

The sixth division we call finance. Under finance we have bank clearings, bank statements, interest rates, gold movements between countries and operations of the United States Treasury Department.

AGRICULTURAL PRODUCTION EXTREMELY IMPORTANT

The greatest thing in business today—the cause which has more effect than any other single cause upon fluctuation in business—is agricultural production. The thing that governs agricultural production will be the climatic conditions of the country, and who could pretend to foretell climatic conditions?

As far as the business cycle is concerned, you cannot tell from current agricultural production if we are in depression or prosperity. In other words, you find that the business cycle goes on regardless of agricultural production because the farmer is looking ahead and planning for his next crop, and at that time conditions may be entirely different. Industrial production, however, is at its last ebb in times of depression. We know it must be so because there is one thing that is making depression. In industrial production we have a peculiar phase of it called new construction or new building. New building does not work out just the same as other industrial construction, because at the stages of prosperity, when prices are high, new building is postponed. When prices are going to be lower, six months or a year from now, at that time we will build, so one of the features of a period of depression, is, there is a tendency for new building to increase before other industrial production increases.

In the case of marketing we have first, prices. Now prices are low. That alone should be conducive to an increase in business. Now, what effect has price upon business? Do prices make business? Not always. Within the last year we had cotton at 42 cents, and we have seen cotton at 11 cents. Was it easier to sell cotton at 42 cents or 11 cents? At 42 cents. In other words, it is not the prices that determines whether you get the business or not. It is the trend of prices.

FOREIGN TRADE, LABOR, IMMIGRATION, EXCHANGES

Foreign trade is a big subject just now, of course; as a phase of marketing it has to be treated differently than in the case of the ordinary business cycle, because of the unusual conditions existing abroad. But in the periods of depression, ordinarily speaking, exports tend to increase and imports tend to decline. Why? Simply because when prices are low here there is a foreign demand. Why are exports not increasing now? It is on account of the monetary situation in Europe.

So far as labor is concerned, wages are low in a period of depression. It is relative. They are lower than they are when times are good, but there is this feature about it—the wages of labor tend to increase after the backward swing. Wages tend upward before labor conditions start to improve, which is a peculiar feature. There is a tendency to put wages down to bed rock, because expenses have been increasing during the preceding periods, and business has been falling off during the preceding period of liquidation. Wages get abnormally low. They get to the point where the worker cannot survive, and the employers have to increase the rates despite the fact that business does not justify it, and when they are doing that they are helping themselves, but they do not realize it. They say it is an added expenditure, and the profit is small. But with that increase to labor it does not need much to get business swinging back toward normal again, and that little increase which labor gets is one of the things which helps to bring it back.

As for immigration, it is no longer a factor in predetermining business conditions because of the new law in this country.

Then business profits: First earnings of corporations. Earnings are low. Where business is poor commercial failures are numerous. They are more numerous at this stage than they are in the stage of liquidation following a period of prosperity. In the stage of liquidation commercial failures increase, but they are large. They are small in number, but large in volume; large in dollars in the period of depression.

Next, exchanges. Here is the place I think you can profit very wisely if you are looking ahead on commodity exchange. Watch the prices on spring and winter wheat. Do not pay any attention to future prices. Watch the spot prices. The future price will say how conditions will be in six months from now. The future prices of all commodities are always fixed by the spot prices. Watch the basic price of such commodities as cotton, wheat, corn and pig iron. You get advance information there if you can get it any place, because the cleverest minds are looking ahead in the business world on the commodity exchanges. If the commodity exchange be low the prices will be low, but when they start to improve on the commodity exchange then you can expect improvement through the rest of the business structure. As far as the stock exchange is concerned, it provides a barometer of business only so far as the industrial stocks are concerned, the stocks of companies which handle raw materials particularly. I do not think that railroad stocks are a good barometer.

The average price of a selected list of industrials will give you a good barometer, and in times of depression especially good, because whenever there is an improvement in the stock exchange it will be decided by general business conditions as a general rule.

Now, as far as finance is concerned in a period of depression, first we have bank clearing. Let me tell you not to pay any attention to bank clearings so far as the future is concerned. In the first place, they are not a cause, for you know when you sell goods you bill them at thirty to ninety days. I do not know what the terms are in your line, but when bank clearings reflect the volume of business they reflect the volume of business that was, and not that is. The bank statements, however, are an excellent criterion. Every Friday morning the Federal Rererve Bank issues a statement of the condition of its combined Federal Reserve Banks. When business is poor bank statements are good.

With regard to the gold movements, I can eliminate international gold movements because they do not mean so much these days. There is a gold embargo although you may not know it, all over the world at the present time. Gold can not leave any country in the world at the present time, except the United States. Therefore, international movements of gold have not the same significance that they used to have. We gained about $500,000,000 or $600,000,000 in the last six months. Where did it come from? It is the new gold from Transvaal. There is a free market for gold in London at the present time, only on the new production of the Transvaal, so that the gold we have, has been sent us at the expense of not a single European nation for the past two years. I do not think there is any European nation, with the exception of Germany, that has not more gold than it ever had. France has over a million dollars in gold in the Bank of France. The Bank of England has ever $600,000,000, the largest stock it ever had. The gold we have gained has not been at the expense of foreign countries. It has been the new gold which has come into the world in the meantime.

DEMAND AND SUPPLY

Now we swing to the period recovery. As I told you, it is very difficult to say when depression ends and recovery begins. The cause of the business cycle can be expressed very simply. It is simply the maladjustment between supply and demand. I say a whole lot when I say maladjustment between supply and demand. In the period of prosperity production is overdone. In the period of depression production is underdone, and sooner or later the demand is going to get ahead of the supply. If for no other reason than that production is underdone, it is psychological that when profits are large production is increased; when profits are small or minus production is curtailed. At some point it develops that there is a shortage. There is a demand for this commodity, and the supply is not sufficient. The increase in business helps one industry here and another industry there. As the result of that the improvement spreads all through the business world.

If you are going to produce a certain thing you have to take into consideration limitations. First, if you are a farmer you have to take into account climatic conditions. Second, if you are an industrial man, as all of you here are, you have to take into consideration other conditions, because if you are going to borrow the money at a profitable rate you have to take into consideration transportation conditions as they are going to exist.

You have to take into consideration other things, such as output and capacity. You have to predetermine what interest rates will be. You cannot do it accurately, but the success you are going to have will be determined by the extent to which you study your position, so as a result the demand and the supply will very rarely equal each other. It would be a miracle if they did. Therefore, we get a maladjustment between demand and supply. The great difficulty in your line, as in any other, is the fact that you center too much in your own line. You study your own condition. In industrial production you have to study conditions all through the business world.

The Orient As a Machine-Tool Market

By W. H. Rastall
Chief of Industrial Machinery Division
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IT IS a great pleasure indeed to have the opportunity to come and speak before you. Your invitation has implied an interest in foreign trade, and the activities of the Bureau of Foreign and Domestic commerce, as you know, are largely connected with foreign trade.

I have had the good fortune to know your Secretary for some years, and he has had some occasion to know of various trips I have made abroad. In a small way I have tried to co-operate with him in his business, and now, having been made one of the employees of the Bureau of Foreign and Domestic Commerce, it will be a great pleasure to help you in your business at any time the opportunity offers.

Those of your members with whom I have conversed have indicated that business conditions in your industry are most emphatically abnormal, and probably your minds have been concentrated very closely on your domestic problems. What I intend to say this morning is largely with the idea that you shall not concentrate your minds so closely on the domestic problem that you will forget opportunities in your foreign field.

If you have been watching the statistics closely, there will be very little that is new in what I have to say; but the conditions of your industry have been so abnormal that it has seemed possible that you would be interested in noticing not only the volume of your foreign business, but the most peculiar changes that are developing in the currents of that trade.

In the beginning, I want to take you way back to refresh your minds with regard to the conditions as they existed before we knew there was to be a war. The nature of your industry is such that war and munitions and machine tools are so closely allied that you gentlemen have borne the brunt of one of the largest manufacturing problems connected with the world war; and you felt this pressure, as you well know, long before the United States saw fit to declare war.

The statistics gathered by the American Government, covering the export of machine tools are not altogether satisfactory, because in their present form they do not allow us to segregate the different classes of equipment, and in speaking to a gathering of this sort, I cannot speak of lathes and the customs returns would not allow me to speak of milling machines, and I have thought it best to give you the figures based on the entire classification of metal-working machinery. That covers four items as usually presented in the customs figures, namely: Lathes, other machine tools, sharpening and grinding machinery, other metal-working machinery.

PRE-WAR GROWTH OF FOREIGN BUSINESS

If you will take those four classifications or others that correspond to them and trace back to the year 1909, your total export business was $3,600,000 for the year.

I wonder if you realize the extent to which your foreign business was growing in the pre-war days: $3,600,000.00 in 1909; $6,000,000.00 in 1910; $9,600,000.00 in 1911; $12,100,000.00 in 1912; $16,000,000.00 in 1913.

I want to congratulate you on that showing. Those were the days of peace, the days when you were forced to face the competition of the whole world in the markets of the world. That increase was something like 440 per cent in five years.

From what has appeared in the newspapers, technical magazines and others, you see, you hear, you read a great deal about foreign competition—what the British can do, what the Germans can do, what the Japanese can do, or the Chinese.

Frankly, from what I have been able to see, this affair of foreign competition seems to be greatly overrated.

It has been my good fortune to spend nine years in selling machinery in Asia, and I have wandered over that continent quite a little, and if you will permit this personal statement, from all I could see, your products are so distinctive that really it is almost incorrect to say that you have foreign competition.

The fundamentals of the designs of your tools are based on the well-known American ways, which lead toward standardized production, special equipment, and in some instances single purpose tools, and it is not necessary for me to call to your attention the fact that European manufacturers and Asiatic manufacturers design from a radically different basis; and in so far as it is safe to make a general statement of this kind, their products are standardized tools in the sense that they are designed for general service. They are the tools that can be adapted to a great variety of purposes. But coming back again to these figures I read to you a minute ago, I want to give you the corresponding figures as representing the foreign trade of Great Britain during the same period.

You will remember that I gave you the figures that in 1909 you started with $3,600,000, and by 1913, this had expanded to $16,000,000.

The British exports in 1909 were $3,700,000; in 1910, $3,500,000—less than your own; in 1911, $3,700,000; in 1912, $4,500,000; in 1913, $4,900,000.

In other words, they had been able to increase their business about one-third during the same pre-war years that you had succeeded in expanding your business 440 per cent.

If you take the corresponding figures with regard to German exports, these statistics are a little confusing, because the returns of the German customs include under "machine tools" a great many articles that you would not so classify.

Those who know the German language better than I, tell me that to the German mind machine tools includes anything in the way of wood-working machinery, stone-cutting machinery, or that great variety of equipment that will be immediately clear to you when this distinction is made.

Using the German basis, their 1910 figures—I was not able to get the 1909 figures—their 1910 figures start in at $12,368,000; 1911, $12,323,000; 1912, $15,300,000; 1913, $19,500,000.

So that the increase during those same years was roughly, from $12,000,000, to $19,000,000.

Now, those of you who are familiar with the foreign trade of machine tools understand perfectly well that Germany as a factor in the world's trade in machine tools is not on a par with either Great Britain or the United States.

For that reason I hope that you will disregard the size of the business as indicated by these returns, and will consider only the ratio of increase.

GROWTH OF FOREIGN BUSINESS SINCE 1913

The figures given stop at 1913. You well know that immediately after that, we had the war. German business was wiped out; British interests suffered; and your own trade was expanded enormously; but for your guidance it will be interesting to read these figures: (It is a very pleasing story and you will all enjoy it hugely.)

In 1914 you exported $14,000,000; in 1915, $28,000,000; in 1916, $61,000,000; in 1917, $85,000,000. (Mind you, this started from $3,600,000 in 1909.) 1917 was $85,000,000; 1918, $58,000,000; 1919, $58,000,000; 1920, $44,000,000.

Estimating for 1921 on the basis of the returns for the first eight months of the year, it looks like you would have exported, for 1921, $20,000,000 worth of tools.

That is a great come-down from 1917-1918, and you have all felt it; but have you realized the way in which it compares with 1909 with $3,600,000, and the other years?

The significant part of this whole statement is that your present export business is substantially on the level of 1915. It is far ahead of anything you knew in the years before that, and it represents at least 500 per cent of the business you did in, say 1909.

A very difficult situation arises when you try to analyze these returns, to study out the future prospects, to plan the way in which you should develop or maintain your export organization, in view of the tremendous changes that are taking place in your business; and yet it seems that this is the really important thing on which you would have your minds at this time.

In all the years to which we have referred so far, by far the heaviest of these shipments have been sent to Europe.

Returning again to these figures: 1910, 81 per cent of your shipments went to Europe; in 1913, 76 per cent; in 1915, 89 per cent; in 1918, 74 per cent.

I understand you have another speaker to dwell upon this European situation. I do not care to go into it too greatly in detail, but you will notice that there is a very marked shrinkage: In 1918, as I said, 74 per cent; in 1919, 69 per cent; in 1920, 57 per cent.

So although Europe as a customer for machine tools is the most important you have, and always has been, and although the changing conditions in Europe which will be described to you by another, have caused a tremendous shrinkage in not only the dollar value, but in the percentage, Europe is a market which must not be neglected.

The character of the tools that you ship there are your own specialties. They are of types that are scarcely produced in Europe, and they are certainly of the types in which you have a minimum of competition, if you have any real competition at all.

FOREIGN MARKETS OTHER THAN EUROPEAN

There is a temptation for you to overlook the other machine-tool markets of the world. Probably your foreign sales managers divide the whole globe up into those territories which would be covered by a traveler, if he were sent abroad. Each organization would handle the problem a little differently from all other organizations, but it seems safe to say that if you send a traveler to Asia, he would cover the territory from Yokohama to Bombay. If you sent travelers to Europe, possibly Europe could be considered as a whole. Possibly you would send several travelers to cover that territory. If you sent travelers to Austrilia, probably they would cover Australia and also New Zealand. If you sent travelers to Africa, the whole continent would be more or less a single unit, but if you sent travelers to Latin America, I understand that Mexico and Central America would constitute one unit, the Carribean Islands and the Carribean countries a second group, and the main continent of South America would constitute a third group. As business stood before 1914, each of these three groups was very important, relatively speaking, and to a certain extent each group absorbed a quantity of machinery that would compare more or less with the total that would be absorbed by Asia; but there have been very great changes; Asia is developing in a way that few of us will recognize unless we have been giving the subject very close attention.

In 1910 all of the countries of Asia absorbed only $156,000 worth of your machine tools; in 1913 this had grown to $200,000; in 1915, to $500,000; in 1918, to $5,900,000; in 1919, to $8,800,000; in 1920, to $7,400,000.

In spite of all that you have seen in Europe, in spite of the tremendous expansion induced there by war conditions, the ratio of expansion in Asia has been more rapid, and in recent years and in recent months it has been more practically sustained. The indications are that for 1921 the exports of metal-working machinery to Asia will be about $6,000,000. In other words, 1921 so far as Asia is concerned will probably be a better market for your product than the year 1918.

Now, in comparison with these volumes, the present total of, we will say, $6,000,000, the Australian group in 1910 was $153,000, and in 1921 has expanded to $1,100,000, and the Latin-American group, comprising all three of those districts that we mentioned a few moments ago, increased from $476,000, in 1910 to $4,000,000, in 1920.

It seems that the significance of this tremendous development in the absorption of metal-working machinery in Asia is of great importance. Asia has absorbed more machinery of the kind you produced in the last three years than she could have absorbed in a century had she gone on at the rate at which they imported such tools in pre-war days.

Asia is a continent that is densely populated, and from the days when your early voyagers first went to those countries, it has been the dream of the missionary, it has been the dream of the merchant, the politician—of every one interested—it has been their hope and ambition that Asia should be modernized; and some of our writers have come to refer to Asia as the "Unchanging East" and some times we gather the impression that here in this country we feel that the East is unchanging.

For this reason it seems necessary to emphasize to you that Asia is changing, and it will be a mistake if in developing your sales policies you feel that China is as she always has been, that India is unchanging, that because of the caste system and the thousand other obstacles, your trade will not develop.

Something connected with the war, I cannot tell you what it is, but something has agitated Asia. You all know the Japanese market very well. It is scarcely necessary to dwell upon it. For a great many years Japan has been absorbing very important quantities of machinery. We have all marvelled to a greater or less degree at the extent of their development, their rejuvenation, and the way they have absorbed Western practices, but it has been felt that Japan was a little different than the rest of the continent; and then again we looked long and earnestly at China. In some way China has found her way into the hearts of the American people, and I find among our business men a feeling that China deserves attention, while Japan perhaps does not.

It will interest you to know that during recent years, and speaking again in round numbers, Japan has absorbed roughly 50 per cent of the machinery that you have shipped to Asia.

China, on the other hand, in spite of her large area, in spite of her tremendous population and resources, has absorbed only about 15 per cent; but both of these markets of Japan and China are comparatively well known to the American manufacturer.

The markets of British India, the markets of the Dutch East Indies are not so well known to you. In order that we may understand this situation a little better, I have a few more figures here. It will interest you to know that of the metal-working machinery shipped abroad by the United States in recent years, in 1910 Asia absorbed only 3 per cent; in 1913 Asia absorbed only 1 per cent; in 1915 Asia absorbed 2 per cent; in 1918, when this mysterious influence connected with the war had been at work, this percentage was increased to 11 per cent; in 1919, 15 per cent; in 1920, 17 per cent.

And the indications are that for 1921 Asia will absorb 25 per cent of your exports.

Now, when you come to contrast conditions as they exist in Europe and conditions as they exist in Latin-America with conditions as they exist in Asia, you find some most startling differences.

Latin-America, comparatively speaking, is unpopulated; Asia is densely populated. The resources of Latin-America are possibly unexplored, but at any rate, so far as we know now, they seem to be limited. The mineral wealth of Asia is enormous.

Europe has her problems. You know well the nature of the resources of Europe, and the extent to which industrial development has been advanced, but I wish to emphasize that Asia is now developing very very rapidly in any industrial way, and probably the most significant of all the countries there is British India.

In the days before the war it seemed safe to say that British policy was to keep India as an agricultural country, a producer of raw materials, and if she had mineral wealth, to take that mineral wealth as raw material, carry it to Europe, manufacture it in the United Kingdom and let these two elements of the British Empire work for each other and produce a coordinated Empire.

Something has changed that policy, and now in British India you will find that the Government of India—all of those having political authority—the financial interests whether they be the native Indian interests or the British interests, and the financial interests of London, the man in the street of London, the man of the street in India, in fact everybody that is concerned with controlling the destinies of the Indian Empire—have decided on a policy that India shall be industrialized.

That statement should be brought home to you with all of the emphasis and significance that it is possible to put into it, because the subject is being approached in a perfectly scientific way, an effort is being made to establish the key industries here and there throughout the Indian Empire; the Government of India will turn to our employers and say, "You make railway cars"—"You make air brakes"—"You make enamel iron ware"—"You make aluminum utensils"—and so on through a long list of industries.

The natural resources of the country are being studied. They told me, while I was in India, that it was possible to produce pig iron there and lay it down in San Francisco at a competitive cost. They have developed a very large steel plant, largely under the guidance of American engineers, known as the Totta Steel Co., and the Totta Steel Co. has been demonsrated, they tell me, to be a great success. Imitating the Totta Steel Co., they have now started three other large enterprises, and it is planned to build in the neighborhood of the Totta Steel Co. and those other iron foundries, shops to produce machinery, shops to produce railway cars, railway equipment; India will roll her own rolls in the near future and will roll her own structural iron.

It is impossible to say how far and how rapidly this development can grow, but you may take it as a definite certainty that India is to be industrialized, in the largest sense of that word, as rapidly and as effectively as British and Indian interests can accomplish it.

Bearing these conditions in mind, I want to read you some figures regarding American exports of machinery to India, and by machinery I mean the metal-working machinery of the same classifications that we have discussed so far.

In 1910 your shipments there were $45,000; in 1913, $43,000; in 1915, $23,000; in 1918, $1,251,000; in 1919, $900,000; in 1920, $1,374,000.

This last figure represents roughly 18½ per cent of all the machinery that you exported to Asia.

As you remember, China takes about 15 per cent; Japan about 50 per cent.

Now, the question arises and is frequently asked me as to where the money comes from to promote these industries. India for decades has been known as the "sinking hole" for capital. Any silver, any gold, shipped into India never comes out. It is the custom of the country for the people to hoard, and the hoardings in some instances are buried in large sums, and those of the common people, the man in the street, are frequently in the form of jewelry carried or worn by his wife or wives. Frequently they have plenty.

One of the native states of India—and by the native states, you understand I mean those territories in which the local government is not British—the state of Hydrobad, the largest of these states, is about the size of Indiana. It has a population of about thirteen million people. Its ruler, the Nyzam, is an absolute despot and in his despotism he is guaranteed by the British Government that this realm shall be for him and his line in perpetuity, and this guarantee is made by the British government as a reward for loyalty at the time of the Indian mutiny back in about 1856; but the Nyzam is of the old type we used to read about in our books. He has the power of life and death over all his subjects, theoretically. The British exercise a certain restraint. He has 300 wives. He has all of the things that are usually taken by an Asiatic potentate, and in a conversation with the director of the Nyzam's Mint, he told me that the Nyzam has a hoard of 500 tons of silver—and this was in the days during the war when exchange in India worried the authorities, and conditions became so acute that our own Government was approached for help, and we sent out, as you know, 300,000,000 silver dollars, and during all this time the British government was not able to secure or control one pound of the Nyzam's hoard.

I was considerably impressed with this discovery, and turning my way to another of the native states, Baroda, in conversation with one of the officials of the Baroda government, I mentioned the matter. This official, a native Indian, well trained, an Oxford graduate, smiled amiably: "Well," he said, "You should go to Kotch, the Rajah of Kotch has his cellars full of gold." I did not go to the Rajah of Kotch but I wanted to.

However, in Calcutta in the months between September, 1919, and January, 1920, there was a tremendous industrial boom, and it was possible to float a corporation for almost any enterprise that you can imagine, and the aggregate of these flotations ran into the tens or hundreds of millions in a very short time. They do things on a large scale in India.

The sugar industry is one of their particular problems. India makes more sugar cane, that is, India has a larger acreage devoted to cane than any other country in the world, and yet India is a very important importer of sugar, bringing most of her supplies from Java.

Now, you will easily understand that when the authorities controlling the destinies of India are studying the problem of industrializing the country, they would first of all wish to overcome a difficulty of that kind, and the sugar problem has been passed on to a committee for special investigation.

Cane is grown in every province in the country. It is grown in a very primitive way. The extraction methods are very unsatisfactory. As a business problem it is a very large, difficult and serious one, but they have made up their minds that they want to develop this industry on modern lines. They want to get modern machinery, and instead of importing this machinery they wish to manufacture it in their country, and the committee having this matter in hand definitely set about organizing a corporation with a capital of 50,000,000 rupees in order to manufacture this machinery. Now, 50,000,000 rupees is somewhere between sixteen and twenty-five million dollars, depending upon the exchange rate you use, and taking figures that have been in force during recent months.

Regardless of whether this corporation is a $16,000,000 corporation or a $25,000,000 corporation, it is certainly the sort of an enterprise in which you would have a very great interest.

In establishing this industry, they want to get in contact with sugar engineers in either Europe or America to guide the new enterprise, to make sure that their engineering methods will be correct, and that the enterprise once moving will be a genuine success.

Wherever you go in India you will find that the American expert has a very good reputation. Time after time large enterprises there have been put into the hands of Europeans, British or German or what-not, and in a great many instances, or several instances any way, these enterprises have failed, following which those in control have brought in American engineers, and I do not know of a single instance in which the American engineers have failed to make a thorough success in India, even though they are taking over properties where others had failed.

It will interest you therefore to do what you can to encourage American experts to go out to that part of the world. I say India, but the same principle applies to all of these Oriental countries.

AMERICAN ENGINEERING METHODS SUPERIOR

There is a difference between American engineering methods and European engineering methods, a difference between American ideas in design and the European ideas. A European railway is nothing like an American railway. The fundamentals on which we work are altogether different. Traffic is heavy.

Now, in these Asiatic countries of large area and great population it is perfectly clear to you, I think, without much study, that their railway problems will at least approximate our own.

It is safe to say that the whole railway problem of England or France, probably also Germany, is less than the railway problem of our State of Illinois, and when you get European engineers in these countries that are destined to develop tremendously, it is obvious to you, I think, that the railways they lay down will be indequate in a reasonably short time.

To my mind it is very unfortunate that so many of the railways of China have been installed on European lines, and if you wish a concrete example, if you want to remove this from the discussion of what might be called the theory of things, and make it perfectly practical, you have only to examine conditions as they exist in India. For many years the factories in the neighborhood of Calcutta and elsewhere have struggled with their coal supplies and frequently have had to operate part time for no other reason. At the same time, at the pit-mouths in the mining regions there was plenty of coal, but the railways were inadequate. The fuel could not be transported. It is not merely a matter of locomotives and cars, but it goes into the very fundamentals of the whole design of the equipment.

The switching facilities are inadequate. The signalling facilities are not right.

You will make no mistake if when opportunity affords you will get American engineers, provided they are our best engineers, into these countries.

The problems that confront these pioneers are the greatest that are to be found anywhere so far as I know. They will tax the resources of our best men, and if you have the opportunity to send men abroad, by all means send the best that you can find, but if you will get these men abroad, the reaction will be entirely to your satisfaction, because they think in an American way. Their ideas of design are the ideas that you have developed as your industry has grown from year to year, and will correspond to the same development known in other branches of American engineering.

Now, as an index of the way in which India has been growing, I would like to read you a few more figures. Taking the average for the five years ending 1913 and 1914, that is to say, ending March 31, 1914, India imported $21,000,000 worth of machinery and metal work; that includes all classifications of machinery, locomotives and everything else. In the five-year period ending March 31, 1919, this importation was $20,000,000—in other words, substantially the same.

But during this period the United States increased its participation in a very marked way.

In 1913 the United States supplied about 3 per cent of this 20,000,000 rupees; in 1918 the American participation had advanced to roughly 25 per cent. Recent figures are not available to show whether that is being sustained or not, but if it is not being sustained it is purely a matter of salesmanship, and this raises the question as to what you should do in connection with your foreign trade.

How To Sell Machinery in Asia

One of the first questions that will be asked is, how to sell machinery in Asia, and fortunately it is very easy to give a definite answer.

One hundred per cent of the machinery sold in Asia is sold through the merchant there, the import merchant. That corresponds more or less closely to the export merchant as you know him here.

There might be some opportunity to discuss that, but there are no exceptions. The only way to sell machinery is through these merchants.

It is the duty of the Department of Commerce to try to assist you in developing your foreign business, and it will give us great pleasure to co-operate as fully and as heartily as we can.

Now, we have in Washington reasonably complete lists of all of the machinery dealers in every important city of the world. If you wish to get this information write to us or come and see us. It will be very much better if you can come to see us, because we would be disposed to turn over to you all of the information we have in our files regarding any and all of these merchants. If we attempt to handle the matter by mail, it seems that the best we can do is to send you a list, but if you can come to Washington we can probably tell you the name of every firm for which a given dealer is agent. We can give you an idea of his bent, that is to say, whether he specializes on mining machinery or textile machinery or machine-shop equipment. We can give you an idea as to whether his prejudices are such that he will refuse to handle American machinery, or, on the other hand, whether he is disposed to take an interest in your products. It is a very large subject.

I had the pleasure a few days ago of discussing this matter with one of your members. The conversation ran on for six hours, and this member of yours was kind enough to say he hoped we would meet again soon.

Frankly, the Department of Commerce can help you, and if you can take the time to come personally or to send a representative to Washington, we are at your service and you can decide for yourself just how much of this time you will devote to the subject.

Referring again to the matter of the business of India, we discovered in the papers a few days ago a very interesting item covering the amount of money floated in the London market for new capital issues, and it gave a certain value as representing investments being made in industries and so on in the United Kingdom, and another item as covering the investments in other parts of the British Empire, and another item covering the investments made in foreign countries; and in this connection it gave the figures for British investments in London for industries to be established in India and Ceylon for the six months ending June, 1920.

London invested one million and a half pounds sterling. For the six months ending December, 1920, this had expanded to three million five hundred thousand pounds sterling. For the six months ending June, 1921, it had expanded to fourteen million six hundred thousand pounds sterling. If you take a pound at $4.00, which is more or less correct, it represented floating $56,000,000 in securities on the London market, 5,000 miles away from British India, in a six-months' period.

It will not be necessary to enlarge upon this subject and call to your attention the present condition of the London money market and the fact that London has expanded from a million and a half to fourteen million and a half in a 12-months' period. This will give you some little index of the interest that British capital is taking in the industrialization of India.

Unfortunately it has been necessary to stress India in these remarks, but I hope you will not construe this to mean that you will neglect any of these other countries.

The Dutch East Indies are another colony representing another European country and I wish you knew a little more about the Dutch East Indies, because I know that Americans as a whole do not know this country well.

If you were to place the Western end of Sumatra on Seattle and draw maps to corresponding scale the Eastern end of the Archipelago would stretch a good long distance out into the Atlantic Ocean.

The Island of Java is substantially as long as the distance from Chicago to New York. It is not a very wide island. It is mountainous. It has about 30 volcanoes. Agriculturally it looks more or less like an impossible country, and yet it is populated by 39,000,000 people. It is cultivated very carefully. The principal industry there is probably sugar. On the Island of Java there are 200 sugar controls, having an average capacity of possible 500 tons of cane a day each. A plant of that kind would represent an investment of not less than a million dollars. So that the sugar industry in Java would represent an investment of very much over $200,000,000. A substantial amount of this is in the machinery used for crushing the cane and turning the juices into sugar.

In addition to this there is the rubber industry, the mining industry. The Dutch Eeast Indies are probably one of the greatest tin producers in the world.

Time prevents enlarging upon this subject, but you will find that the Dutch East Indies have absorbed also very large quantities of our machinery.

Starting in in 1910 with a negligible figure of $4,000.00 it expanded by 1920 to $326,000; 1919 was a little better $614,000 in machine tools.

There are quite a number of important Dutch merchant firms right here in the City of New York that are in a position to sell your goods in those territories, and they have on their staffs in Java and the other Isles of the Dutch East Indies a good corps of well-trained engineers, usually men with European training, and they have come to appreciate the qualities of the American tools and they like them.

Frankly, I believe that you would get better representation in those territories if it were possible to put your interests in the hands of Americans, because there is this difference between an American design and European design which has been mentioned, but if you cannot attain the ideal, if you cannot send your best man to Java, it is a very wise policy to do the next best thing, and I would suggest that you give very careful attention to these Dutch firms and see if you will not be able to establish relations with them that will result in business that will be very much to your advantage.

While in Batavia, going through one of the warehouses, maintained by one of these Dutch merchants, he was showing me his large stocks. He had a very fine stock, and he showed me a large number of American tools, and all of a sudden I said, "What is that?"—and this very nice Dutch merchant immediately apologized. He said, "I am very sorry; we are not going to do that again." And looking at it a little closer, I saw it was a Japanese copy of an American lathe.

This question of competition is one in which it is easy to say something as a general statement that can be contradicted in a particular instance and yet our limitations here are such that it seems to me necessary to confine ourselves to these general statements. Frankly, you have no Japanese competition. The difficulties of manufacturing lathes or other machine tools in Japan are tremendous. It is not easy to get the iron that is wanted. There is some question as to whether their cupola men understand well how to mix iron so that it will be suitable for various purposes.

Going through a Chinese shop in TIEN-TSIN, I saw a very nice looking milling machine, probably a perfect copy of the type that you know very well; and looking at it from a little distance it seemed to be a very nice tool, but close inspection revealed the fact that there had not been a single surface on that milling machine that had been ground or scraped.

Obviously there is no competition in that class of machinery, so that the problem in these different countries narrows itself down to that of selling a quality product at a comparatively high price.

If a Chinese manufacturer produces a milling machine using indifferent mixtures in the castings and declining to grind it on any of its surfaces, unquestionably he can produce it cheaply—and that is about the only thing that can be said in favor of it.

So that in organizing your sales campaigns abroad I would strongly emphasize that you take such measures as may be necessary to fortify your campaign with real salesmanship. Give your representatives there—whether they be Japanese or Americans or British or Dutch or whichever they might be—full information to show the superior qualities of your equipment, and this sales campaign should be supported with a reasonable amount of intelligent advertising, and by advertising I do not refer to newspaper or periodical advertising, but I mean almost anything that can be done to support your salesman, and probably the best results can be secured from a well-handled mailing list.

This is the sort of subject that could be continued indefinitely. I must not take too much of your time, but as I said before, if the Bureau of Foreign and Domestic Commerce can be of any assistance to you in handling any of these problems, we are very anxious to do what we can.

Conditions in Europe

BY J. H. DRURY

Treasurer, Union Twist Drill Co.

"YOU Americans are all right as manufacturers, but you are damned poor merchants." This is a statement, gentlemen, that was told and handed to me 25 years ago by one of the then leading German importers of machinery. The reason for making that statement was that at that time there was a tremendous development in Germany, and consequently a tremendous demand for American machine tools.

Of course, I repudiated that statement, but he said in explanation: "One of your manufacturers came over here. He made a certain tool. He wanted me to take the agency, and I asked him the price. He showed photographs and blueprints, and the price was perhaps satisfactory, but I said to this man: 'What is your capacity?' He told me. 'Well, now you can increase that capacity?' 'Yes.' 'All right. You go back to the hotel and figure on your utmost capacity, come back here and give me a price,' which he did. I contracted with him for his entire output. Of course, in time I did not want his output, but where the American manufacturer at that time showed he was not a good merchant, was that he was willing to give his entire production to one market, and that was foreign trade; he made no provision for his domestic market."

Well, gentlemen, many of you at that time made connections with foreign agents, and those connections have proved valuable, have proved loyal.

About a few years later than this time that I speak of, as you all know, or most of the gentlemen that are my age would know, as there are only a few here, there was a lull in the demand for American tools in Germany, and as the result of that lull many of the importers of American tools saw fit to encourage the manufacture of copies of American tools in Germany.

They were very good as copies, with the exception that they did not possess the quality, and except in a very few instances, the German tools are still good copies, but they lack the quality.

Now, that fact has become known throughout the continent of Europe; so that for many years, perhaps previous to the war, the Germans even with their lower priced tools found it difficult to successfully compete with the American tools; and since that time, and today, the conditions are different.

With the high prices of American tools and the low prices of German tools, I want to say to you gentlemen that they are simply flooding the continental markets of Europe; they have stopped the production of machinery in Norway and Sweden because of this. The Germans are getting into the markets of Italy, France, England, Belgium, and the new creation of states in Southeastern Europe. These loyal dealers that many of you gentlemen have, and you know them, are up against it. They say: "We are confronted with this German competition; we appeal to our American clients or manufacturers. We have no assistance from them."

You have heard that the foreign dealers require financial assistance. You have read in the papers where some returning banker or some gentleman rushes into print with the statement that Americans must finance Europe. The United States must finance Europe.

I do not know perhaps just what that referred to; but I will give you the statement of some of the leading importers of tools in Europe: "They say we require no financial help. All we ask is to have the American manufacturer fix a price, based on, for instance, in francs, of so many francs to the dollar, and arrange for the payments on that basis, so that we will know where we are. We do not expect the American manufacturers to meet the German competition, but we do want a little leeway."

I have heard many of these agents, and I felt sorry for them. They said they could get no assistance, could not even get a decent reply; could not get any encouragement. Now then, the point I want to make is this: You gentlemen, most of you, have got a lot of foreign business. You have got agents, and it never cost you a dollar. These foreign agents came here and solicited your lines. Perhaps the machinery business is the one business for which it cost less to create this market in Europe than any other, for the reason that I spoke of a while ago, that the Germans first saw the possibilities of American tools and they were followed by the French and others who came here soliciting agencies and getting them.

Now then, what you must do is to make a study of foreign conditions. We all make a great deal of studies of new designs, new fixtures, and new methods. We have scientific treatments of various projects; but how far do you go into the detail statistics that you alone can get in connection with this foreign trade? Do you study it? I wonder if you do. I wonder if you simply take the reports that come in to you, that the German mark is at such a price, and it is useless to attempt to compete, also the franc is so low we can not do anything with that.

If you are not going to do something, you are going to jeopardize your foreign trade. If you let it go; it is going to cost you some real money to get it back when you are looking for it. What I hope is this, and I hope you will do it, and that is to take this matter up seriously with your foreign representatives, and show a disposition to work with them; show that it is simply a partnership affair, that you are willing to help them; that you are willing to spend some money to help them. It won't take an awful lot, because this condition will not continue very much longer.

Three weeks ago I was in Frankfort, Germany, and some of my friends told me of a strike that was going to occur on the following Tuesday. I was there on Saturday. The strike was not among the workmen, it was among the clerks, the draftsmen, or the engineers as they called them, and it was for an increase in pay. Twenty-five manufacturers were bound together in the association. They considered this question of more pay. Three voted in favor of it. One of them told me: "It is a shame. We have got to pay these men more money. The cost of living in Germany is increasing every day; consequently, we must pay some attention to it."

I have not yet heard the result of this strike, but I saw in Italy, three days before, discount sheets sent out by German manufacturers in connection with tools, in which the discounts were changed. They were raised 800 per cent.

Now, that does not mean very much. For instance, when you see a chuck made by a manufacturing company of Connecticut which sells in Italy for $28—when you see a copy of it which looks just like it, made in Germany, and sold for $3.70, you wonder how they can do it, or if they stole the material, and somebody threw in the labor.

But this has got to change. So do not get worried about those things, because their costs will go up and continue to go up; but I will say once more, that I hope you will give this serious attention and take this matter up at once.

Those of you who have loyal foreign agents, show them that you are loyal to them; show them that you are trying to help them over this period, and perhaps it will be over by three or four years; and if you do this now, your business, four or five years hence will be in a splendid condition.

And, just remember at this time, if you had a fair foreign trade today, the conditions in every one of your shops would be much better than they are.

Now, then, a man will tell me we do not want labor to go back where it was in 1914. Gentlemen, it does not make any difference if you pay a man 25c. an hour or 50c. an hour if he can buy just as much for the 25c. as he can for the 50c., but it does make a lot of difference in your sales.

Now, then, you have got to take the bull by the horns, and you have got to get your costs down. You have got to get your selling prices down.

Formula for Strength of Rope

How strong is a rope? At the Bureau of Standards laboratories in the Department of Commerce, tests have been made that have resulted in answering that question with a formula.

For three-strand regular lay manila rope from ½ to 4½ in. in diameter, the following computation will give the breaking load of the rope:

The average breaking load in pounds equals 5,000 multiplied by the diameter of the rope in inches, multiplied by the diameter of the rope increased by one.

This will give, of course, the average maximum weight that the rope will hold, but the working load or the load that a contractor or safe-hauler may apply with proper safety and precaution would be considerably less than the load given by the formula.

EDITORIALS

Progress of the National Machine Tool Builders' Association

IN ANOTHER part of the paper will be found abstracts from several of the addresses made before the recent annual meeting of the National Machine Tool Builders' Association. They are worth reading even if you are not connected with the machine-tool building industry, for the problems of the makers of machine tools are much the same as those of the users.

As was to be expected, this year's meeting was more concerned with the present industrial depression than with more technical matters, for the fact cannot be ignored that the industry as a whole has been struggling through the worst period of its existence. President Tuechter's admirable report brings out this point very clearly. The one redeeming feature of the situation is the interest of the members in the valuable statistical work just started by the general manager of the association. Had the figures on total production been available over a period of years it is most unlikely that many of the serious economic mistakes, by reason of which the industry is now suffering, would ever have been made.

In the past, as pointed out in several of the addresses, this association has been very successful in cultivating good-fellowship and mutual confidence among the members, a praiseworthy activity but one which has had but little effect outside the industry. In the future, however, if the promise of the sound economic and statistical program laid out by the officers is fulfilled, the benefits will accrue not only to the owners of machine tool plants but to their men and to the country as a whole.

A business run on unsound lines is a menace to the whole commercial structure for its mistakes involve others and its losses are seldom confined to its owners. The economically sound organization, on the other hand, is not only successful itself but contributes to the success of those who have dealings with it.

Can We Afford Not to Disarm?

MANY people are skeptical as to what a disarmament conference can accomplish; some are in doubt as to the need for disarmament. Every taxpayer is painfully aware of the cost of past and future wars, but has come to look upon this expense item as an inescapable insurance premium for protection against aggression.

Thoughtful men, however, are watching the steeply ascending curve of armament costs all over the world and are wondering where it is to stop. If it keeps on rising at the present rate much longer, there will be no money left for peaceful needs—then what?

As we see it there must be a sharp limitation of this race in the immediate future. The world cannot afford to continue the contest and it is consequently well that the representatives of the more powerful nations gather together next week in Washington to see what can be done about it.

If concrete reasons for the gathering of such a conference are wanted, one has only to glance through the following London dispatch to the daily press:

> Tonight the chancelleries of the continent are gravely perturbed at the attempted Hapsburg restoration and the first symptoms of war fever are apparent.
>
> Tonight Lord Curzon's department got word that Karl has arrived at Budapest.
>
> It is commonly believed that England is on the verge of resumption of war with Ireland. Germany is plunged into a great political crisis because of the resignation of the Wirth Cabinet.
>
> In France, Communism is raising its head. In Portugal, Cabinet members have been assassinated by reactionaries. Bulgarian War Minister Dimitroff was shot dead yesterday.
>
> In Spain, the throne of King Alfonso is tottering, while his army attempts to retrieve the Moroccan disaster.
>
> Italy may well be convulsed as a result of the subterranean support alleged to have been given by her Foreign Minister to the return of Emperor Karl to Budapest.
>
> Reports credit Jugo-Slavia, Czecho-Slovakia and Rumania with making preparations to expel Karl.
>
> The war alarms extend even beyond Europe. Tonight London learned that an ugly situation has arisen in the Far East, due to China sending a note to Japan which is tantamount to an ultimatum regarding Shantung. The terms of China's last reply to Japan include:
>
> "The Japanese claims which it is desired to negotiate are highly objectionable and never have been recognized. It is only proper that the entire Japanese army should now be immediately evacuated."

Certainly not a very pleasant picture from any point of view. But leaving out for a moment the moral and humanitarian aspects of the problem, bear in mind that most of the countries involved are deeply in our debt and that some of them are practically bankrupt. Our security is none too good as it is, but it will be worse than worthless if more fighting is to take place.

Can we afford to let this go on any longer? Can we afford not to disarm and to see to it that everyone else does likewise?

Two National Ailments Which Seem About to Be Mended

THE first two recommendations of the President's Unemployment Conference looking toward a permanent cure for the unemployment evil, have to do with the reduction of railroad rates and with the speeding up of the deliberations on the tax bill. The news of the day indicates that the recommendations along these lines are being followed, for we heard a few days ago that rates on hay and grain had been reduced and that other reductions were to follow.

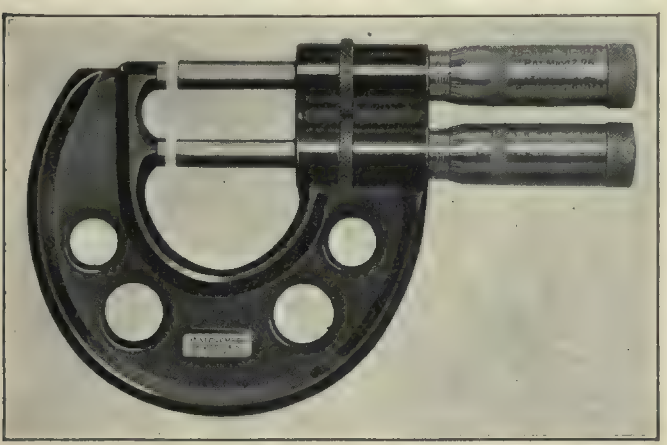
On top of this comes the move of the republican Senators to force continuous sessions of the Senate until the tax bill is passed. As we have remarked before, the tax bill leaves much to be desired as a model revenue act but under present conditions a poor act is better than none.

The Unemployment Conference had no power to enforce its recommendations, but it must be a source of satisfaction to the members that two of their suggestions are receiving such immediate attention from the constituted authority in both the administrative and legislative branches.

Shop Equipment News

Slocomb Snap-Gage Micrometer

The illustration shows a measuring instrument that has recently been brought out by the J. T. Slocomb Co., Providence, R. I. This tool is in reality a micrometer with two measuring screws, each of which can be locked in any desired position, giving the instrument a wide range of measurement and adaptability. The tool is at present made in only one size, having a measuring range of one inch. In this way a single instrument can take the place of many snap gages in places where it may not be desirable to tie up capital in a large number of snap gages which are not in constant use.



SLOCOMB SNAP-GAGE MICROMETER

When used as a snap gage, the screws are set to the desired high and low limits respectively. This setting can be done either by reading the micrometer screws themelves, by standard measuring blocks, or by samples which are known to be right. In this way a single instrument may be used for a large variety of sizes within the range.

When used in the machining of work, it may be advantageous to set and lock the lower or "no-go" screw only. The upper screw is set at or above the high limit, and can readily be used as a micrometer to ascertain how much stock is to be removed. Used in this way, the micrometer takes the place of a special fixed gage with an indicator on the high limit, as is sometimes used.

The micrometer is particularly useful for inspection work. The lower screw may be locked at the rejection point for minimum diameter, and the upper screw used to measure the large diameter, when it is advisable. It is especially applicable to inspecting wire, rods and sheets. The frame is of forged steel. The same accuracy is maintained as in the other micrometers made by the firm.

Cleveland "Mezzo-Steel" Twist Drills

The Cleveland Twist Drill Co., Cleveland, Ohio, announces a line of twist drills made from a special steel and said to possess some very unusual qualities, particularly regarding life in service. The steel has the qualities ascribed only as the result of a special heat-treatment. The steel properly heat-treated is said to make it possible to obtain a performance much better than that of carbon steel, in fact, midway between carbon and high-speed steel, and to effect a very marked economy in drilling costs. The trade name for tools made from this steel is "Mezzo," meaning midway between carbon and high-speed steel.

Tests of performance as compared to carbon drills are shown in the accompanying table, compiled from tests run on the maker's own product. These results are particularly interesting in view of the fact that the full efficiency of high-speed steel tools is obtained only in machinery of great rigidity and power, which is at the same time capable of high speeds. As many shops are not equipped with machinery of this character, they consequently use high-speed drills under disadvantageous conditions. Moreover, they break many high-speed drills, because the drill press is lacking in rigidity. Such conditions and the comparative drilling costs often force shops to abandon high-speed in favor of carbon steel tools.

It is evident that a saving in drilling expense can be made, in such cases, as well as maximum production obtained, by the use of a drill which can be purchased at a moderate price and which will run at speeds and feeds considerably above those possible with carbon drills, and still stand up to the work. Mezzo drills are said to fulfill these requirements, and to have proved to be efficient and economical tools when working under the conditions for which they are intended. They are particularly well adapted for drilling cast iron at greater speeds and feeds than can be used for carbon drills. In machine steels and the softer alloy steels, these drills perform at much higher rates of speed and feed than carbon-steel tools. They are not however, suitable for extremely hard materials.

TEST OF MEZZO AND CARBON DRILLS

Size Drill, In.	Material Drilled	R.P.M.	Feed per Rev., In.	Speed, Ft. per Min.	—In. Drilled— Mezzo	Carbon
⅝	3-in. C.I.	356	0.032	60	60 *	5
⅝	4-in. M.S.	356	0.024	60	32 *	⅛
¾	4-in. M.S.	294	0.024	58	10½	¼
¾	4-in. M.S.	225	0.020	50	32¼	½
¾	3-in. C.I.	294	0.020	58	30 *	1
11/16	4-in. M.S.	225	0.024	55	8	¾
11/16	4-in. M.S.	225	0.017	55	7	2
11/16	3-in. C.I.	294	0.032	75	30 *	2½
1	4-in. M.S.	225	0.015	60	21	1½
1	3-in. C.I.	225	0.020	60	25	1
1¼	4-in. M.S.	180	0.016	59	24	4
1⅜	4-in. M.S.	144	0.020	51	12	1½
1⅜	4-in. M.S.	144	0.032	61	30 *	2¾
2	4-in. M.S.	106	0.015	55	32 *	3⅛

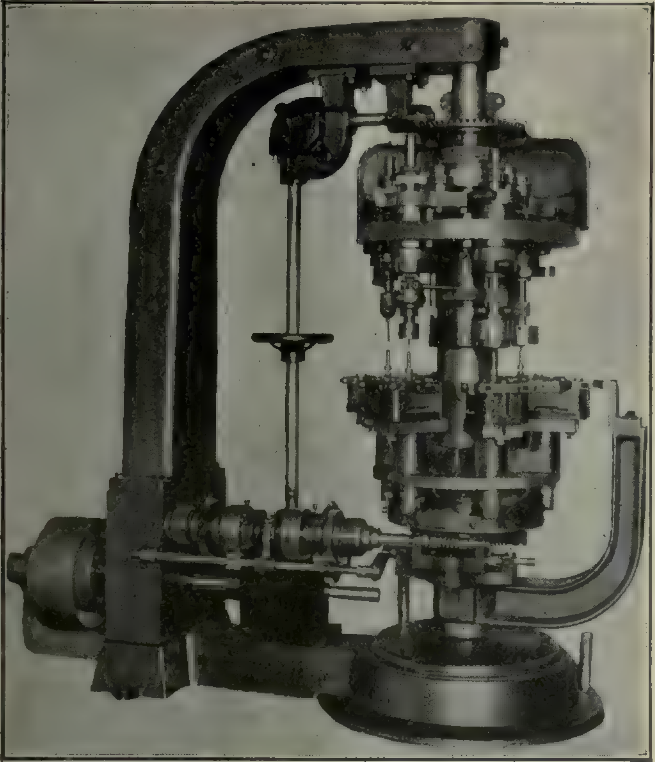
NOTE—3-in. C.I. means a cast-iron billet 3 in. thick.
4-in. M.S. means a machinery-steel billet 4 in. thick.
* Means test stopped with drill still in good condition.

An inherent advantage of the Mezzo drill is said to be its greater ability than carbon steel to withstand softening under heat. Heating the cutting edge of a Mezzo drill to even a dark blue color does not draw its temper, but the tool is said to work at its best efficiency at this temperature. As shown by the table, these drills should be used at approximately double the feeds and speeds at which carbon drills under average conditions work satisfactorily. The drills have a special blue-black, rust-resisting finish. At present they cannot be furnished smaller than 3/16 or larger than 2 inches.

"Jackson" Vertical Automatic Chucking Machine

In the accompanying illustration is shown a type of the "Jackson" vertical, automatic chucking machine recently placed on the market by the Vertomatic Manufacturing Co., Third & Buttonwood Sts., Reading, Pa. The machine is intended for the rapid and automatic performing of machining operations on small parts such as required for plumbing, electrical and gas fittings, and for automobile work. Drilling, reaming, tapping, milling, facing and similar operations can be performed on the same piece, it being necessary for the operator only to feed the machine. The machine is heavily but compactly made, so that a high production can be obtained with a small amount of floor space. It is ordinarily driven by belt. The illustration shows one-half of the cover which guards the gears removed.

The machine is made in three types. The Type A machine is intended chiefly for work requiring a series of operations on the same piece, these operations being from three to five in number and performed at either the same or at different points on the work. On work requiring only two operations, two chucks can be fed at each indexing. In this machine there are six work-holding chucks, and five active spindles above them. Each spindle carries a particular type of tool adapted to the work that it performs.



"JACKSON" AUTOMATIC CHUCKING MACHINE

At the front station the operator places a piece of work in the fixture which is at that point. The fixture then revolves about the vertical axis of the machine, and the work is automatically clamped in place. Under the first spindle, the first machining operation is performed, and then the work fixture indexes another portion of a revolution and a second machining operation is performed. By the time the piece has made one complete revolution, it has received the entire number of operations and is automatically ejected. Since all of the chucks hold work, and each spindle operates at each indexing of the table, one finished piece is ejected with each indexing.

The speed of the spindles can be varied by means of the gearing. The spindles do not feed to the work, but feeding cams located under the chucks cause the chucks to move upward independently of each other at the desired speed and to the required height for the operation being done. When the operation is completed, the cams allow the chucks to drop down, and the chuck turret is then indexed to the next working position and locked while the operation is being performed.

The Type B machine is intended for work requiring two or three operations. It has four double chucks and three pairs of spindles, so that the operator places two pieces into each chuck every time it indexes. The work in three chucks is machined during the time the operator is replacing the work in the idle chuck at the loading station, and two finished pieces are ejected at each indexing of the turret.

The Type C machine is for jobs requiring a single operation only, or two operations combined in one tool, such as facing and tapping. The machine has no clutch nor indexing mechanism, and each spindle is mated to a certain chuck and operates on this chuck only. The chuck turret and the spindle turret are locked in position and rotate constantly in one direction at the desired speed. The work is placed in the chuck at the loading station, and as soon as it passes on, a single continuous cam raises the chuck toward the tool, and the machining operation is performed while the turret is rotating. Thus, in five of the six chucks the work is being performed at the same time.

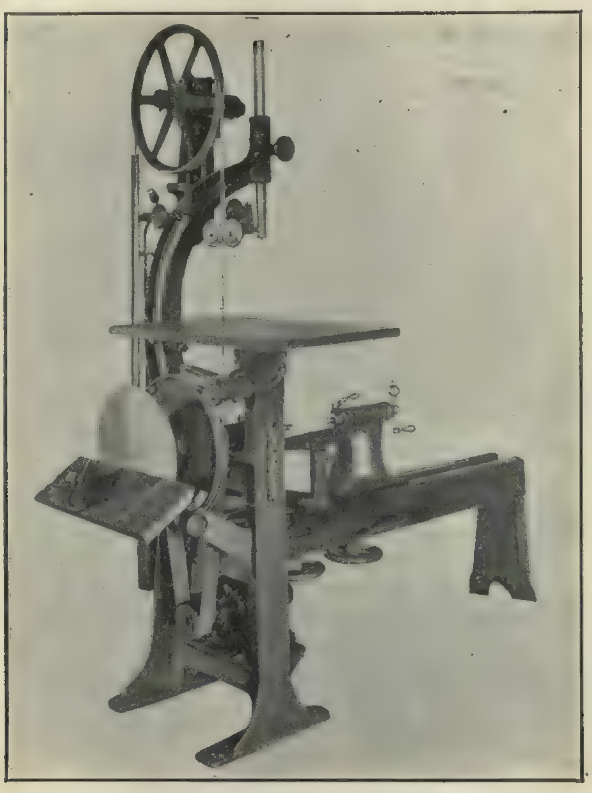
The vital parts of the machine are made of hardened and ground tool steel. Change gears are furnished to permit of a range of speeds and feeds. The working parts are guarded.

Paddock Three-Way-Table Band Sawing Machine

The Paddock Tool Co., 320 Ridge Bldg., Kansas City, Mo., has placed on the market a band sawing machine for wood-working use, the principal features of the machine being the facts that the table can be tilted in any one of three directions, and that a three-wheel ball bearing guide is employed for the saw. The frame of the machine is a T-section casting, providing means for locating the motor at its base. The table can be tilted 45 deg. to the front, 45 deg. to the right side or 35 deg. to the left side, being locked in any desired position by means of a double-jaw clamp. It is placed 45 in. above the floor. It is said that the 20-in. saw will take a cut under the saw guide 16½ in. deep. In this machine, the speed of the bandwheels is 600 r.p.m., although the motor speed employed is 1,800. The band wheels run on double-row ball bearings, large oil pools being provided for lubrication.

A G.E., a.c. motor is mounted on the base of the frame, and belted to the pulley on the lower wheelshaft. Tightening of the belt is effected by removing shims from under the base of the motor. The bandwheels are provided with rubber tires.

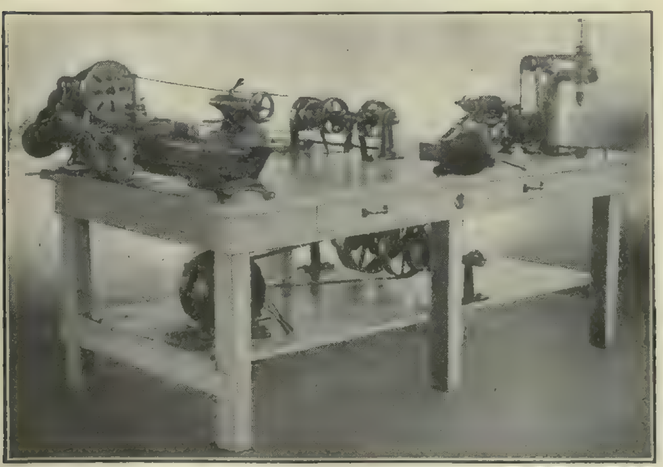
The machine can be furnished with a number of attachments, such as shown in the accompanying illustration. On the front of the frame is placed a 15-in. sanding disk having a tilting table. On the back of the frame is an 18-in. wood-turning lathe having cone pulleys, so as to give speeds of 300, 600 and 1,200 r.p.m. to the spindle. A wooden lathe frame carrying a tailstock is provided. A 35 x 6-in. sanding roll can be placed in the lathe, so as to make it adaptable for surface sanding. If desired, an abrasive wheel can be mounted on one of the shafts, so as to provide a grinder. The machine is thus applicable to a wide range of woodworking operations. It is made in four sizes, the bandwheels being 20, 25, 30 and 36 in. in diameter, respectively.



PADDOCK TILTING-TABLE BANDSAW

Myers No. 2 Combination Work Bench

The Myers Machine Tool Corporation, Columbia, Pa., has recently placed on the market the combination work bench shown in the accompanying illustration. The outfit is intended for use in such places as automobile repair shops and hotels, and for mechanics who have need for a small installation. It is especially adapted to the use of those requiring a small lathe and hack-saw, being a larger unit than the one described on page 34 of the *American Machinist*.



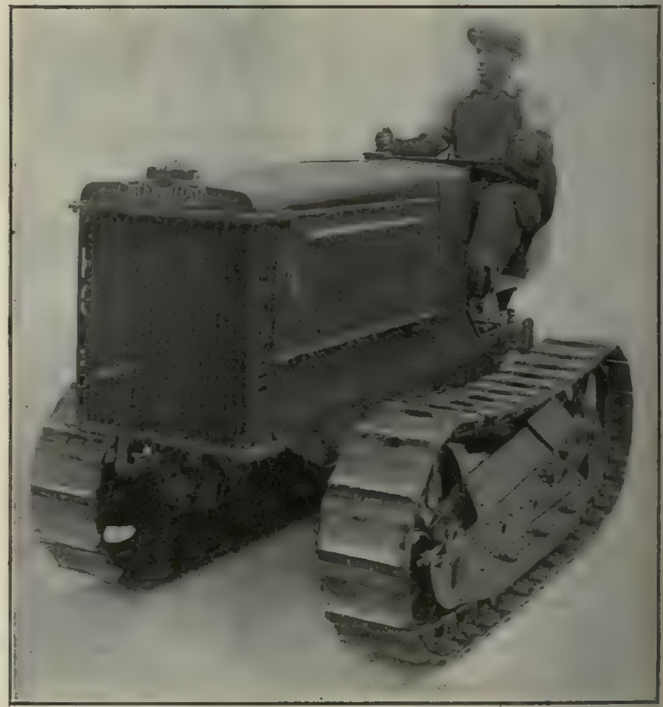
MYERS NO. 2 COMBINATION WORK BENCH

The machines are mounted on a table 45 in. wide x 84 in. long x 32 in. high. Two drawers are provided for holding small tools. On the shelf of the table is mounted a motor that drives all of the apparatus through the countershaft, also placed on the shelf. Either a.c. or d.c. current of 110 or 220 volts can be used, the motor operating at 1,750 r.p.m. and giving ½ hp. The lathe has a swing of 10 in. and a working length of 45 in. It is provided with change gears, power cross feed, compound rest, back gear and three-step cone pulley.

A 10-in. sensitive bench drill, having a small table and a ⅜-in. chuck, is mounted at the other end of the table. A 10-in. grinder head carrying an abrasive wheel and a muslin polishing wheel is also provided. A 3½-in. machinist's vise having hardened steel jaws, is mounted at the front of the bench. All of the machines are made by the concern. The lathe is driven by means of an open belt from the countershaft above the table, but the other machines are driven direct from the lower countershaft.

Holt T-35 Caterpillar Tractor

The Holt Manufacturing Co., Inc., Stockton, Cal., has recently brought out the small caterpillar tractor shown in the accompanying illustration. The machine is known as the Model T-35, and is intended for general use, both on the farm and in industry. It is said to be easily and economically operated, and to be similar in general details to the type of tractor previously made by the concern.



HOLT T-35 CATERPILLAR TRACTOR

The tractor consists of three main units, the motor, the transmission, and the trucks and tracks, each unit being entirely self-contained. A four-cylinder motor is used, the bore being 4-in. and the stroke 5½-in. It runs at a speed of 1,000 r.p.m., and develops 28 hp.

A chrome-vanadium steel crank-shaft 2¼ in. in diameter is employed, and large bearing are provided. The valves are placed in the heads of the cylinders, and an overhead camshaft is employed. The governor is mounted directly in the camshaft driving gear. The motor is lubricated by pressure, an oil pump being provided. A tubular, finned radiator is employed.

A multiple-disk dry-plate clutch is used and a clutch brake is provided. The transmission provides three speeds forward and one reverse, all gears being made of heat-treated chrome-nickel steel. The mainshaft of the transmission is equipped with heavy-duty Hyatt roller bearings at the rear and with double-row New Departure ball bearings at the front. Side clutches are provided, so that either one of the trucks can be disengaged from the motor. In this way, the machine can be turned, a brake being placed on the housing of each side clutch, so that quick turning can be performed. The mechanism of the final drive is entirely enclosed, so as to prevent dirt from getting into the gears, which run in oil.

The truck frames are made of heavy pressed steel. The wheels are made of cast iron, with chilled rims, and run on heavy-duty Hyatt roller bearings. The front idler is made of steel and is carried on two roller bearings. The track is 10 in. wide, the link and the shoe being made in one piece of carbon steel. The lubrication of the truck wheels and idlers is accomplished by means of Alemite grease plugs. A spring-cushioned seat is provided for the operator, the controls being conveniently arranged. A power pulley 10 in. in diameter and having a 6½-in. face is provided for driving a belt. The machine is 103 in. in length overall, 48 in. wide, and 52 in. in height to the top of the hood.

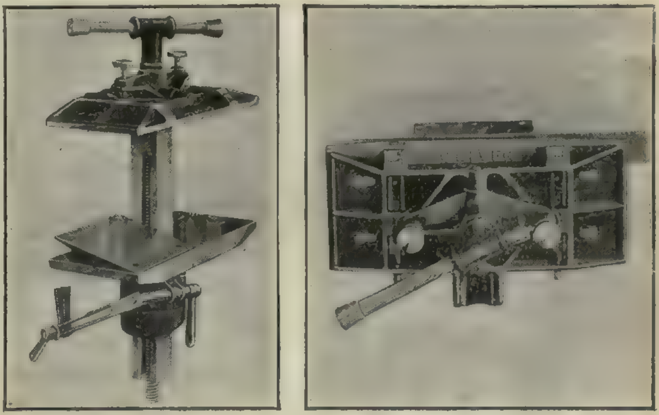
Oliver Universal Woodworkers' Vise

The Oliver Machinery Co., Grand Rapids, Mich., has recently placed on the market its No. 1 universal vise for the use of patternmakers and woodworkers. The device is capable of operation in many different positions, and is adaptable to a wide range of work. On the right of the accompanying illustration it is shown in its natural position, for clamping work in the usual way. However, two small dogs in the top of each jaw can be raised, if desired, so as to form stops for the holding of circular or irregular-shaped work that does not fit down into the vise proper.

Besides holding parallel-sided pieces, the jaws can be set by means of thumbscrews so as to clamp at an angle, this being particularly desirable with wedge-shaped work. The jaws can be turned about the axis of the screw, and used to hold work in any position desired, whether at right-angles or at only a slight angle to the natural position. When swung through one right-angle, the vise is well adapted for holding work above the bench level. When swung through one-half turn, the small steel-faced jaws on the side of the main jaws come into position for the holding of metal parts. This is particularly useful for working on metal patterns.

In addition to the vertical plane, the jaws can also be placed in a horizontal plane, as shown by the view on the left of the illustration. If desired, the jaws can be set to clamp work at an angle, in the manner stated before. In addition, the small detachable angle jaw shown lying on the lower jaw is for use in holding small, irregular-shaped pieces.

The jaws are 18 in. long by 7¼ in. wide, and the vise has an opening of 16 in. It is stated that the entire construction is very rigid, and that great holding power is provided no matter at what angle or in what position the vise be placed. The screw used is 1⅛ in. in diameter and has a buttress thread. The vise weighs, when boxed, 85 lb., the contents of the box being 2 cubic feet.



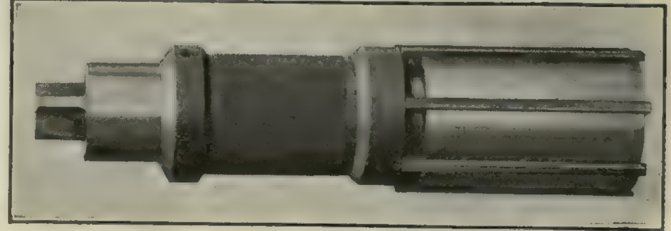
OLIVER NO. 1 UNIVERSAL VISE

Ransome Parallel Expansion Reamer

The accompanying illustration shows a reamer for the refinishing of the bores of automotive engine cylinders, and recently placed on the market by H. A. Hopkins & Co., Inc., 247 LaPorte Ave., South Bend. Ind. The reamer can be used without removing the cylinder blocks from the chassis, and is ordinarily driven by hand. A ratchet wrench can be furnished to fit on the shank of the reamer, so that the device can be turned even where there is only scant clearance. In order that the tool can be counterbalanced, so that the proper feed can be given to it, a hook and a swivel are fastened to the wrench, enabling the connection of a rope so arranged as to hold a counterweight.

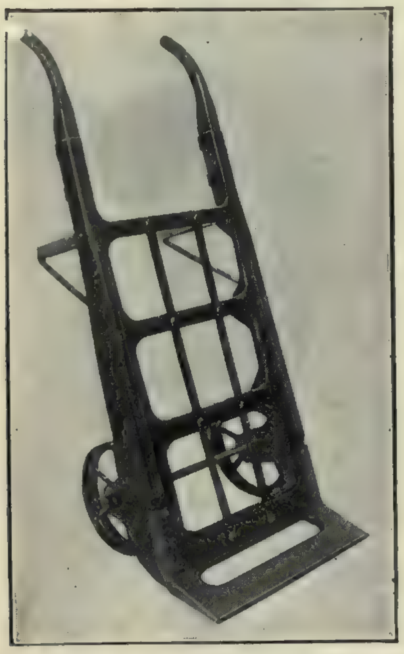
The reamer consists of three units, the body, the nut and the blades. The blades are secured in the body by means of flanges running in T-shaped slots. A very long nut is employed. A micrometer dial is provided, so that it is possible to set the blades with an accuracy of 0.001 in. The blade ends are fitted into the nut and rest solidly against the nut and the body, so that they have a firm bearing and give a uniform expansion when the nut is turned.

Ordinarily, the lower ends of the blades are ground without clearance slightly smaller than the cutting edges, so that they serve as a pilot to assist in the entering of the reamer. After the pilot ends have been placed in the bore, the reamer can be adjusted for size. The cutting is done by means of the sharp corner at the lower end of the cutting edge, so that the metal is removed by a boring rather than by a scraping action. The reamer is made in five sizes, the total range of adjustment being from 2¾ to 4 in.



RANSOME EXPANSION REAMER

Sharon "Bluenose" Hand Truck



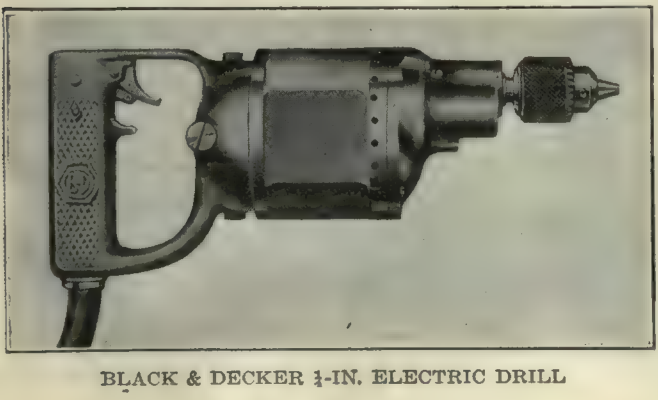
SHARON "BLUENOSE" HAND TRUCK

The illustration shows a type of heavy-duty hand truck for general warehouse and industrial use that has recently been brought out by the Sharon Pressed Steel Co., Sharon, Pa. The principal feature of this truck is the fact that it is constructed entirely of pressed-steel parts, with the exception of the wheels, axle and handles. The main frame is made in one piece of ⅛-in. steel. The crossbars are made straight for general use, but can be depressed for the carrying of barrels. The wheel lugs are a part of the frame and have a ½-in. bead on each side. This construction prevents the tendency of the wheel lugs to buckle when the truck is heavily loaded. The nose of the truck, which gives it the trade name of "Bluenose," is a steel stamping made from one piece of ¼-in. steel, and well reinforced by the large flanges on the corners.

The footing is composed of steel stampings. The handles are ordinarily of bent oak, but can be furnished straight if desired. The trucks are equipped with malleable-iron wheels, and either plain or roller bearings can be furnished. The truck is made in two sizes, the lengths overall being, respectively, 54 and 64½ in.; the heights, 10½ and 13 in.; the widths at the nose, 18½ and 23½ in.; the wheel diameters, 9 and 12 in.; and the weights, 65 and 120 pounds.

Black & Decker Light ¼-Inch Portable Electric Drill

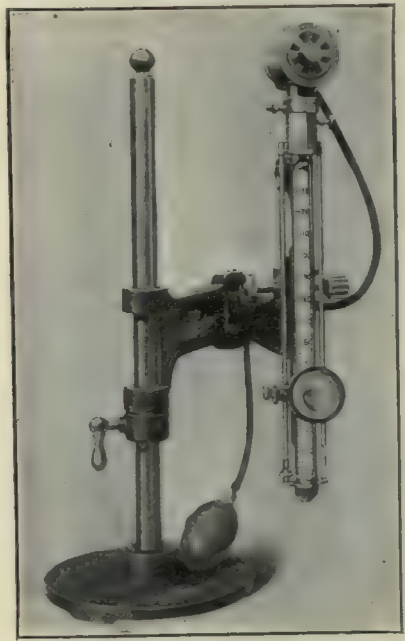
The Black & Decker Manufacturing Co., Baltimore, Md., announces a light-weight portable electric drill, shown in the illustration, for drilling metal or wood, the capacity in steel being ¼ in. The drill has an aluminum-alloy housing, and weighs only 5 lb. It has double reduction gearing, giving a no-load speed of 1,600 r.p.m. It is similar in all respects to the other drills made by the concern, having stub-tooth gears of heat-treated chrome-nickel steel, running in a grease-tight gear box. All bearings are removable and renewable. The drill is equipped with a pistol grip and trigger switch, with the switch mechanism in the handle. It is adapted to close-corner work, the drill spindle being arranged so that it is possible to drill within about an inch of any obstruction.



BLACK & DECKER ¼-IN. ELECTRIC DRILL

The parts are easily accessible. The brushes can be renewed from the outside of the case. By removing four screws, the commutator, switch mechanism, field leads and cord terminals may be entirely exposed. The commutator end bearing is carried in a spider integral with the motor case, holding the armature in alignment and permitting the removal of the cover plate while the tool is running. The rubber-covered cable is clamped in the handle, so that strains on the cable have no tendency to pull the terminals loose from the switch. The tool is supplied complete with a three-jaw chuck, flexible cord and attachment plug.

Changes in Shore Model-C Scleroscope



SHORE MODEL-C1 SCLEROSCOPE

The Shore Instrument and Manufacturing Co., Jamaica, N. Y., has recently made some changes in the design of its Model-C scleroscope, the new model, designated as Model-C1, being shown in the accompanying illustration. The maker claims that the refinements made so increase the flexibility of the operating mechanism that the instrument will give more uniform service, even though the adjustments are comparatively approximate, and the working conditions, including the skill of the operator, less favorable. Among the features to which attention is called are the fine screen covering the openings in the housing above the scale, to prevent dust from entering the operating mechanism; and the replacing of the leather operating piston by one made of tungsten steel. The former rigid adjustment of the hammer-hook mechanism has been replaced by a flexible adjustment, which should greatly prolong the life of the glass tube; and the hammer-hooks have been provided with shock shoulders, which prevent breakage or disalignment of these parts. In addition, more perfect glass tubing is being employed.

The refinements are said to so perfect the instrument that it may be easily and accurately operated, under all conditions and speeds. It is adaptable to the use of the laboratory man, as well as to be the precision manufacturer on quantity production.

NEWS SECTION

Engineers to Become Men of Affairs, Says Dean Cooley

During his first visit to the headquarters of the Federated American Engineering Societies since his election to the presidency of the organization, Dean Cooley announced his conclusion that the most necessary thing to do first is to tune up the existing machine so that it may be in the best working order to accomplish the multiplicity of tasks that are before it. Engineers are foremost, he said, in the actual service rendered to the public, but the amount of public service they are capable of rendering can be increased immensely if the Federation can co-ordinate and direct the vast energies of the nation's engineers. The public already has been sold the idea of the federation. Dean Cooley believes, but he thinks much education and hard work will be required before the federation can be sold to the engineers themselves.

There is scarcely a limit to what engineers can do if they will really work to a common end. Even if they were to limit themselves to efforts to stabilize industries and to eliminate waste, they could perform a national service of first magnitude and indirectly benefit themselves immeasurably, he believes. Only a little progress along these lines would have to be made before unemployment among engineers would disappear, in his estimation.

Dean Cooley points out that it is well understood why engineers, as a whole, have so few collective accomplishments to which they can point. It goes back to the schools, he says, where there is failure to give the engineer a well-rounded education. As a result, he stays within the narrow boundaries of his specialty. With the example of the spirit and point of view of such engineers as Herbert Hoover, Dean Cooley believes there is going to be a general breaking away from the meshes of technicality and that engineers are going to utilize the ability they already possess as economists and businessmen and become men of affairs.

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Air Service to Hawaii

That an inter-island airplane mail and passenger service may become a reality in the Hawaiian Islands was indicated by a letter received recently by the Honolulu Chamber of Commerce from C. A. Webb, of San Francisco, who asked for particulars regarding the possibility of establishing an aerial line between the islands.

Franklin Institute Awards

The Franklin Institute, Philadelphia, Pa., acting through its committee on science and the arts, awarded on Oct. 19, its Elliott Cresson gold medal to Dr. Byron E. Eldred, of New York, for his development of the low expansion leading-in wire for incandescent electric lamps. At the same meeting, the institute awarded to Alfred O. Tate, of Cranston, R. I., its Howard N. Potts gold medal for electrolytic process of waterproofing textile fabrics.

After these medals had been presented by Coleman Sellers, Jr., vice-president of the institute, Ralph Modjeski, chief engineer of the Delaware Bridge Commission, delivered a lecture. His subject was "The Delaware River Bridge Between Philadelphia and Camden."

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Gov. Allen to Address Engineering Societies

A public meeting under the auspices of the New York sections of the four national engineering societies on the subject of the St. Lawrence ship canal and power project will be held in New York City on Monday, Nov. 14. W. L. Saunders is chairman of the committee; this is one of a series of joint meetings arranged by the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers and the American Institute of Electrical Engineers.

Governor Henry J. Allen of Kansas will be one of the speakers. Dr. R. S. MacElwee, former director of the Bureau of Foreign and Domestic Commerce, now director of the School of Foreign Service, Georgetown, University, Washington, D. C., will also speak.

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Build New Shops on Ashes of Old

Work has been started on tearing down the old buildings at the American Car and Foundry Co., at Terre Haute, Ind., which were partially destroyed by fire some time ago. When the old buildings have been wrecked and taken away work will begin on the construction of the new buildings, according to the announcement made by E. D. Buick, district manager. The new buildings will house the machine and blacksmith shops.

No attempt will be made to re-open the car shops until the building has been completed. However, a number of men were given employment in tearing down the buildings and more will be employed in building the new shops.

Machinery at Indianapolis Exposition

The Indianapolis Industrial Exposition which was held in that city from Oct. 10 to 15, was one of the most successful, from the manufacturers' standpoint, ever conducted under one roof. The affair was conducted by the Indianapolis Chamber of Commerce. It was arranged by O. B. Iles, chairman of the Manufacturers' Committee of the chamber, under the direction of Charles F. Coffin, president of the chamber.

Machine-tool builders and dealers were prominent among the exhibitors, machinery being one of the most important industries of the city.

Some of the machinery builders and dealers who exhibited were: Huetter Machine and Tool Co., International Machine Tool Co., Eastern Machine Works, Marschke Manufacturing Co., Millholland Machine Co., Pearson-Scott Co., Rice Manufacturing Co., Stevenson Gear Co., Vonnegut Machinery Co., J. D. Adams & Co., Allison Engineering Co., Climax Machinery Co., The Electric Machine Co., Fairbanks, Morse Co., E. C. Haupt Co., Hetherington & Berner, Indiana Air Pump Co., Mansfield Engineering Co., Meier Electric and Machine Co., C. & G. Potts Co., Shoaf Cutter Co., and the Universal Paper Co.

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Education Discussed at Dayton

The Trade and Industrial Section of the Ohio State Teachers Association has just closed its annual conference, held this year at Dayton, Ohio. The meeting was held in the schoolhouse of the National Cash Register Co., and at the invitation of John H. Patterson, president of the company. About 100 men and women attended.

Eminent speakers addressed the meeting, the subjects all bearing on industrial trade apprenticeship, vocational education and soldier rehabilitation. A comprehensive account of the conference is contained in the vocational bulletin of the Woodward Technical High School, at Dayton, and edited by Lawrence Parker.

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Meeting Postponed

It has been announced that the semi-annual meeting of the American Iron and Steel Institute, which was to have been held in the Hotel Commodore, New York, on Oct. 28, has been postponed until Nov. 18. It is understood that the delay is due to the fact that Marshal Foch, of France, who is to be the guest of honor, would not have reached this country in time.

A. S. M. E. Plans Big Meeting in December

Elimination of industrial waste will be stressed at the annual meeting of the American Society of Mechanical Engineers, to be held in New York City Dec. 5 to 9. The report of the Committee on Elimination of Waste in Industry of the American Engineering Council will provide the basis for the discussion, which will emphasize the engineering phases of the waste problem. The A. S. M. E., in arranging its annual meeting program, follows the recommendations of the committee that each technical society give intensive treatment to the report.

The leading session will point out the necessity for waste elimination and develop essential principles of standardization and stabilization. The professional sections will consider in technical fashion the steps that can readily be taken more effectively to utilize our national resources. The management division of the society will announce the names of the speakers for the leading session in the near future.

The tentative program shows an intimate relation between the leading session and the technical sessions of the professional division. The Aeronautic Division, Ordnance and Forest Products Divisions have not entirely completed their lists of speakers. The Aeronautic Division contemplates a discussion of the economic possibilities of commercial aviation and two technical papers on the materials used in airplane construction, one of these, on cables, will be given by R. R. Moore. The Ordnance Division will present a paper by Colonel J. W. Joyes, chief of the technical staff of the Ordnance Department, in which avoidable wastes in ordnance manufacture will be pointed out. The Forest Products Division will demonstrate how several lumber manufacturers have successfully reduced waste in the various processes involved in the conversion of the log into forest products. The experience of the Southern and West coast districts will be related and the need for still further reduction in wastes will be emphasized.

The limitations of the Engineering Societies Building makes it exceedingly difficult to hold more than three simultaneous sessions. Accordingly, the council has this year granted permission to extend the meeting for five days, and the leading session will be called to order at two o'clock on Monday afternoon, Dec. 5. As a further step to properly utilize every available moment, morning sessions will begin promptly at half-past nine. It is believed that this will reduce the necessity for adjourned sessions.

Two sessions on education will be held, one under the auspices of the Committee on Education and Training in the Industries, which will present a program pointing out the great needs for education in the industries. Dean R. L. Sackett, of the Pennsylvania State College, will present in one of the papers a resumé of the status of industrial education throughout the country. The second paper, by D. C. Buell, of the Railway Education Bureau, Omaha, Neb., will relate the steps taken by the railroads of the country for the training of their men. It is earnestly hoped that this program will bring out discussion that will enable the committee to plan a constructive program for future industrial training.

The second session on education will be a joint meeting with the Society for the Promotion of Engineering Education. Prof. Dugald C. Jackson is in charge of the program, which will give an opportunity for mechanical engineers to discuss with teachers the requirements of an adequate technical school training in mechanical engineering.

A new and important development in annual meeting projects will be launched at the coming convention. The Committee on Relations with Colleges has charge of a session at which the papers will be prepared and presented by students. Discussion will be limited to students and the meeting will be conducted by students.

The honorary memberships which have been granted to Henry R. Towne and Nathaniel G. Herreshof will be formally bestowed on Tuesday evening, following the address of President Carman.

The business meeting has been scheduled for Wednesday, Dec. 7. The entire day will be given over to the discussion of the policies of the society and especially of the new constitution.

A more elaborate program than last year has been planned for this meeting. In addition to the presidential reception, which will be held Tuesday evening there will be a ladies' tea and dance on Wednesday afternoon, an informal get-together dinner for the membership on Wednesday evening, and a dinner dance on Thursday evening. Friday evening will be devoted to college reunions and the following institutions are planning events: Cornell University, University of Illinois, Lehigh University, Massachusetts Institute of Technology, University of Michigan, New York University, Pennsylvania State College, Polytechnic Institute of Brooklyn, Purdue University, Rensselaer Polytechnic Institue, Stevens Institute of Technology, Worcester Polytechnic Institute and Yale University. The ladies' tea will be served Wednesday, Dec. 7, half-past three on the fifth floor of the Engineering Societies Building. The place for the informal get-together dinner on Wednesday evening has not been chosen. An informal program will be given during the smoker which will follow the dinner. The dinner dance will be held at the Hotel Astor. On Thursday a luncheon is planned for members of Sigma Xi honorary scientific society.

Excursions will lead to points of technical interest about New York. Arrangements are being made to provide special railroad rates for members attending the meeting.

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Motor Show in India

The Motor Trade Association of Calcutta will hold an automobile exhibition in Calcutta from Dec. 19 to 24 of the current year. In view of the fact that the Prince of Wales is due to arrive in Calcutta on Dec. 24, there is a possibility that the exhibition may continue until the 31st. Present arrangements call for the erection of 45 buildings especially suited for exhibition purpose, electric lighted and with tile roof. If the demand for space warrants, additional buildings will be erected. P. H. Moseley is Vice-Consul at Calcutta.

Safety Code for Elevators Prepared by A. S. M. E.

After five years of effort, and with the co-operation of the industrial boards and other organizations and individuals in many states, the Committee on the Protection of Industrial Workers of the American Society of Mechanical Engineers has completed the preparation of a Safety Code for Elevators. This code, representing another striking phase of the society's professional endeavor on a nationwide scale, is analogous to the A. S. M. E. Boiler Code, and, like it, was developed for the purpose of incorporation into law by the state legislatures.

California, Texas, Ohio, Maryland and Massachusetts are among the states, it is announced at the national headquarters of the society, that are now considering the code as the basis for legislative enactment. The work of the committee has attracted universal interest, and confidence is felt that the undoubted need for the code as well as the thoroughness with which it was formulated will result in speedy and substantial progress in this field.

The committee consisted of John W. Upp, chairman; Magnus W. Alexander, Carl B. Auel, William P. Eales, Carl M. Hansen, John Price Jackson, Byron Cummings, Melville W. Mix, William A. Viall, and Herbert L. Whittemore. Aiding in the preparation of the code, which governs the construction, operation and maintenance of dumbwaiters and escalators, were representatives of the U. S. Bureau of Standards, Elevator Manufacturers Association of the U. S., Elevator Manufacturers Association of N. Y., casualty and fire insurance companies, American Institute of Architects, various related engineering societies, elevator specialty manufacturers and independent engineers. Prof. Clifford B. LePage of Stevens Institute is secretary of the committee.

During the five years in which the Safety Code for Elevators has been developed, the industrial boards or commissions of many states have kept in constant touch with its development. Notable among these are California, Michigan, Ohio, Maryland, Massachusetts, Pennsylvania and New York. Early in the development of the code the Bureau of Standards voluntarily discontinued the work which it had begun on a Safety Code for Elevators and co-operated completely with the work of the committee.

The A. S. M. E. through its Elevator Code, is again brought to the attention of the engineering profession and the public as the agency through which a series of standards are being created. Most of these standards have been very generally adopted by American industries, notably the American Standard Pipe Thread, now available as a publication of the American Engineering Standards Committee, and standards for pipe flanges and fittings. The society's safety codes, particularly the Boiler Code, have been recognized by various state legislatures as the basis for laws safeguarding human life and promoting humanitarian progress.

The Elevator Code comprises seven parts: Hoistway construction for passenger and freight elevators and for dumbwaiters, power passenger elevators, power freight elevators, hand elevators and hand invalid lifts, dumbwaiters, escalators, operating rules.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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There will be no railroad strike. The labor leaders are to be congratulated upon their good judgment. The stock market, which was singularly complacent while the strike threatened, advanced sharply when its abandonment was announced and there are many who believe that a real boom is incipient. In the oil and industrial share department many sharp advances have already been recorded and the railway stocks, which have been held back by the strike talk, should now attract attention.

Meantime traffic has been quickened by the fear that transportation would be interrupted by the strike and both car loadings and net earnings continue to show increases. Freight rates are, moreover, gradually coming down. Transcontinental rates and the rate on iron ore were reduced some weeks ago and last week a reduction of from 10 to 17½ per cent in the rates on grain and feed in the Western territory was ordered. There is an intimation that a reduction in lumber rates will be shortly made, for even the railway managers are coming to realize that a cut in the cost of carrying both passengers and freight would greatly stimulate business.

Trade reports are generally optimistic in tone. Revillon, the New York furrier, says that "it is almost impossible to fill orders." The President of the American Radiator Co. claims that they are doing the largest business in their history. The United States Chamber of Commerce announces a decided improvement in the industrial situation generally. In a speech at Atlantic City Charles M. Schwab prophesies the greatest boom in American history. Many similar statements from all over the country could be quoted did space permit. The Harriman Bank asserts that not more than one million persons are now unemployed and the *New York World* of last Monday published twelve columns of "Help Wanted—Female," and seventeen columns of "Help Wanted—Male" advertisements. The other papers also carry an unusually large number of help wanted advertisements.

In the West some reduction of purchasing power is expected as a result of the decline in grain, but when I was in Chicago last week the merchants that I saw there told me their trade was surprisingly good. In the South the feeling is distinctly cheerful and in the textile industry there as well as in New England there is practically no unemployment.

Cotton has become comparatively static at between 18 and 20 cents. Around this level the minds of buyers and sellers seem to have met. The dry goods market is gradually adjusting itself to the advance in the raw material and while there is no boom the offtake is about equal to the production. The demand for woolen goods is excellent and higher prices for raw wool have been paid at the auction sales recently held in London, Australia and New Zealand.

Rubber is rather firmer and increased activity in the factories of the Akron district is reported. A better demand for leather is also to be noticed. The production of crude oil is gradually increasing. The bituminous coal production for October promises to be the largest of the year. There is a better demand at a slight advance in price.

An increase in building activity in many sections is also reported. Steel rails have been reduced $7 to $40 a ton and the best authorities agree with R. H. Sweetser of the Southern Ohio Association in believing that a real revival of the steel industry only awaits the expected reduction in freight rates.

The cheerfulness to be inferred from the foregoing has not been seriously affected by the expectation that there will be much illness in the country during the coming winter now that real beer and wine are procurable on a doctor's prescription.

Like the eel that got used to skinning, the business community is becoming somewhat indurated to the procrastination of the Senate over the tax bill and as almost anything is better than the present uncertainty there are many who are commencing to hope that the revision of taxes may be delayed until after the election of 1922. The tariff bill seems to be entirely moribund. The weekly Federal Reserve statement shows a gain of 13½ millions in the gold held and a reserve ratio of 70.8, the highest since September, 1917. Money is daily becoming cheaper and further reductions in Federal Reserve rediscount rates are generally expected.

The quoted rate on commercial paper is 5½ per cent but this can probably be shaded by borrowers of undoubted credit. Two hundred million treasury certificates offered at 4¼ per cent for those maturing April 1, 1922, and 4½ for those due Sept. 15, 1922, have been enormously oversubscribed. The bond market is firm and new issues aggregating nearly $100,000,000 were easily absorbed during the week.

As the notables from the Orient and Europe arrive to attend the Disarmament Congress hope of an agreement that will really make war a remote possibility is revived, despite a dispatch from London announcing that 5 per cent was charged and paid at Lloyds to insure against war between the United States and Japan before Dec. 31, 1922. Another policy written at Lloyds last week has attracted international attention. It insures against transfer of any part of the British West Indies to the United States in payment or part payment of England's debt to our Government on or before Dec. 31, 1922. For this indemnity 15 per cent was paid and the rate would indicate that it is not impossible that the Bahamas, Bermuda, Jamaica and Nassau may soon come under the American flag.

In continental Europe conditions seem to grow more chaotic. German marks could be bought in New York last Thursday at 55 cents per 100. Some cigar stores are giving 50 marks instead of trading stamps with each box of cigars sold. The demand from this source will not, however, go very far in providing a market for the 88 billion marks now outstanding and as their worthlessness becomes understood in Germany their demonetization will be certain. Just what will happen then no one can say, nor is it known whether the reparation payment due November 1st will be met. There are rumors that a postponement has been agreed to by the Reparation Commission pending the arrangement for a German loan which the Rothschilds are said to be considering.

De Valera is still talking, but is gradually making himself ridiculous even in the eyes of his fellow Sinn Feiners and it is unlikely that he can prevent a settlement of the Irish problem at the London conference. It is to be hoped that nothing will occur to keep Lloyd George from coming to Washington.

The Prince of Wales has started for India, where the religious and social unrest seems to be extending. It is hoped his advent may allay it. Lenine admits that individualism is reascendent in Russia and that trade is in consequence reviving. Mr. Lamont of the Morgan firm has returned from Mexico but is silent as to the results of his trip. Inability to agree upon terms for the reajustment of the Mexican debt is inferred but this inference may be wrong. Bankers do not always take the public into their confidence.

The situation in Cuba is improving as the sugar is being sold. An American loan of from five to fifty million dollars is persistently talked of. The smaller amount is said to be arranged for.

Dollar securities are now being dealt in on the London Stock Exchange. The dollar is gradually becoming the money that continental shop keepers prefer and it may be that it will in time become the financial esperanto of the world and so provide a medium in which many of the economic problems that now trouble Europe may be resolved. Meantime growing supremacy of the dollar, plus the inexhaustible resources of the country to which it is indigenous, seem likely to insure our prosperity despite the perplexities of the old world and the clouds which are discernible over seas. It is even thinkable that the centripetal attraction of the dollar may compel a union for the preservation of the world's peace and if this is possible we should miss no opportunity so to use the power that it gives us.

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McGraw Heads Publishers

James H. McGraw, president of the McGraw-Hill Co., Inc., was elected president of the Associated Business Papers, Inc., at the annual convention just held in Chicago.

Latvia's Railroads and Their Requirements

By V. Leitis
Riga, Latvia

Latvia and Esthonia are the new small republics on the Baltic Sea, formerly being a part of Russia. Almost all of the important countries, excepting the United States of America, have recognized them *de jure* and they were recently accepted into the League of Nations as full members. By this last event they are recognized as nations which have a stable government, with sound political and economic organization.

Soviet Russia tried to establish her communistic order there, but the Letts and Esthonians developed strong resistance and cleared their boundaries of the bolshevist invasion. Soviet Russia then recognized their rights to independence, made adequate peace treaties, and there is no ground to assume that she will break these treaties in the future. Russia uses both these countries as transit mediums for her import and export goods, and no doubt Latvia and Esthcnia are able to keep the necessary harbors and railroads in better condition than Soviet Russia could do it.

Of greatest importance to Russia are the Latvian harbors and railroads. Russia's total commerce in 1912 in the Baltic Sea was:

Port Petrograd	$180,046,000
Port Riga, Libau and Vindow (present ports of Latvia	261,881,000
Port Reval (Esthonia)	51,332,000
Total	$493,259,000

Thus 53 per cent of the whole of Russia's Baltic Sea trade went through the present Latvian port.

The present Russian trade is small; but the time will arrive when it will have grown to large proportions, and then the Latvian harbors and railroads will be obliged to work up to pre-war capacity if the new republic of Latvia wishes to keep her independence. It is necessary that Russia have comparatively free outlet to the Baltic Sea, and so long as the republics of Latvia and Esthonia will satisfactorily play the rôle of transit mediums, it is possible that there will be peace between them and Russia. If, on the contrary, Russia tries to sieze the Baltic ports and railroads then Latvia and Esthonia would perhaps loose their independence. Besides such a probability the income from Russian transit forms a considerable part of Latvia's budget, and Latvia is keenly interested in raising the capacity of her railroads and harbors to the highest possible degree.

During the war, Latvia suffered greatly from German and Russian invasion. The Germans seized all they found and sent it to Germany, and the Russians in order to prevent the Germans from such acquisitions, sent all they could find to Russia. Thus almost all the factories in Latvia were evacuated. Although by the peace treaty Russia is compelled to return all the machinery taken from Latvian factories, it is difficult to find, assemble and ship this equipment. Most machines in Russia are broken and worn-out and it would not pay to re-ship them. Formerly in Latvian cities hundreds of thousands were engaged in industry, today there are possibly only ten thousand. As the wages and costs of living in Latvia are comparatively low, some foreign capitalists are prepared to open factories there, using the empty buildings.

The railroads, of course, suffered heavy; some bridges were blown up, locomotives and cars driven away and the railroad buildings destroyed by fire. By the peace treaties, Russia and Germany agree to return a part of the cars and locomotives, but this worn out equipment is not able to serve the heavy traffic which is to be expected in the future.

At present, Latvia is short 501 locomotives and 11,800 cars. As mentioned before, the local factories are closed, their equipment is lost or worn out, and there remains nothing to do but buy all necessary cars and locomotives from foreign countries. Some have already been ordered from the United States. American locomotive and car works should be more interested in the Latvian railroads.

Financially Sound

The question of payments should be investigated separately. But the financial status of Latvia is sound. Although the exchange of the Latvian rouble is low (370 roubles today equals one dollar in American money), but the printed money does not exceed one thousand roubles per inhabitant. The amount of gold in reserve is not small, but the debt in foreign countries is not big and there are negotiations with foreign capitalists to open—together with the Latvian government—an emission bank. The export of forest products, flax and the customs from Russian transit comprise a steady and substantial income.

In order to understand the actual conditions of the Latvian railroads we must use some detailed figures. The Latvian railroad tracks have four different gages: (1) The Russian, 1525-mm. gage, 1,135 klm. long; (2) the standard, 1435mm. gage, 749 klm long; (3) the narrow, 750mm. gage, 267.7 klm. long; (4) the smallest, 600mm. gage, 567.3 klm. long; this makes a total of 2,809 klm of rail lines.

The standard gage tracks connect with Germany, the Russian with Russia, and the two smaller gage lines serve the interior of the country. The chief task of all these railroads is to take care of the enormous Russian trade.

About 50 per cent of the locomotives in the Latvian railroads are unfit for use, most of them being over 50 years old. As to the condition of the cars, they are mostly worn out and in need of repairs. In pre-war time the Russian railroads had an average of 38 locomotives and 87 freight cars on every kilometer of road. These figures are taken from the estimations of the Ministry of Communication. The desirable type of locomotive should have a wheel diameter of 145 mm. and weigh 70.5 tons full weight, with 14,000 kg. pulling power. The Latvian intends to invite foreign capital to participate in re-establishing the railroad repair shops at Dvinsk, where formerly 1,700 laborers were employed. This shop was cleaned out by the Russians but the spacious buildings are still in good conditon. Russia is sending her locomotives and cars to Latvia for repairs, and these shops could be developed and put on a paying basis with the aid of foreign capital.

Switzerland as a Market for American Goods

American manufacturers and exporters are overlooking an important field for business development in Switzerland, says American Trade Commissioner H. Lawrence Groves in a special survey of the markets of that country published last week by the Bureau of Foreign and Domestic Commerce of the Department of Commerce.

In his report, published as a convenient handbook of Switzerland, the commissioner calls special attention to the increased importance of that country as a financial and a commercial center. He says that Switzerland, located in the heart of Europe, is essentially an industrial nation, almost entirely lacking in raw materials. Consequently, its many industries are dependent on foreign countries for supplies of raw materials as well as for many semi-manufactured and finished products. In his opinion, the supplying of these commodities is of sufficient importance to merit much more intensive consideration than heretofore accorded on the part of our exporters.

The report is devoted to Switzerland, exclusively. It reviews the country's industries, finances, natural resources, markets, etc. Conspicuous facts in its foreign trade are mentioned specifically. There is also information about advertising, credit and transportation agencies, and other similar trade factors.

The complete report is known as "Special Agents Series No. 210—Switzerland—A Commercial and Industrial Handbook." Copies can be purchased at 40 cents each from the Superintendent of Documents, Government Printing Office, Washington, D. C., and from the district and co-operative offices of the Bureau of Foreign and Domestic Commerce.

To Build Two-Ton Truck

The Hampden Motor Truck Corporation has been organized with $1,000,000 capital to engage in the manufacture of two-ton trucks. A site of eight acres has been purchased in Willimansett, Chicopee, Mass., and a contract will be awarded within a few days for a one-story brick factory with a frontage of 633 ft. on the Boston & Maine tracks, and comprising about two acres of floor space. It is purposed to build only one model of truck, with selling price around $2,000, and to be ready for production by next spring. In the meanwhile several cars will be built in time for exhibition at the January shows.

It is the aim of the company to eliminate surplus costs all along the line. The truck, though not built primarily for speed, will be of somewhat lighter design than is usual for a vehicle of that capacity. Concentration on one model is expected to be a further element of economy, and distribution will be simplified by selling direct through established dealers. A number of original ideas in construction are planned.

The corporation is composed entirely of Holyoke men, with these officers: President, R. D. Bloom; vice-president, John F. Lynch; treasurer, Ernest S. Steele; directors, R. L. Davenport, John H. Woods, C. H. Collins, F. G. Burnham and C. P. Lyman.

Industries of South Resuming Full Capacity

Virtually all lines of business and industry in the Southern field have experienced steady improvement since the early part of October, while the unemployment situation is better than it has been in several months, due to the increase in operations at many of the industrial plants. It is generally believed that production as a whole will have attained normal by the early part of 1922.

Building operations got started rather late in the Southeast, but construction activity is making excellent progress in many sections. Conditions in this regard are especially good in Atlanta and Birmingham, where new records are being established this year in home building.

The lumber industry of the section is in better condition than it has been in more than two years. The demand for Southern pine has reached a point where it is in excess of production at the southeastern mills, and the hardwood market has also experienced a considerable increase in demand the past three or four weeks. Preparations are being made by many of the larger manufacturers to reopen their mills, most of which have been idle for many months, while those now operating are steadily increasing their capacity. The manufacturers are moving with caution, however, waiting definite settlement of the railroad trouble.

Textile conditions are also on the upward trend and mills of the section are increasing capacity from week to week. Many are now running full force, several operating both day and night schedules.

In Alabama and Tennessee steel fabricating plants are adding steadily to their working forces and experiencing a better demand than in more than a year. The improvement in this regard has been steady for the past two months.

SOME BRIGHT SPOTS

The big steel plant of the American Brake Shoe and Foundry Co., at Chattanooga, Tenn., is running at 100 per cent capacity, while the brake-shoe department is going at 50 per cent. Operations at the plant have been increased as a whole about 25 per cent the past few weeks. At the plant of the United States Cast Iron Pipe Co., also at Chattanooga, operations were resumed in mid-October after nine and a half months of idleness. Other foundries and shops in Chattanooga and throughout Tennessee, most of which have been closed down since last autumn, are preparing to start up again either before the end of this year or early in 1922. Pipe making plants and shops in Tennessee and Alabama are enjoying excellent business, many operating at full capacity. The Iron City Pipe and Fittings Co., of Birmingham, Ala., also went on a full time schedule in October.

Operations have been resumed at the iron mines of the Telford Mining Co., at Shackelton, Ga., with orders enough on hand to insure steady operation for more than a year. The mines have been closed down for the past eighteen months.

A new electric steel furnace being constructed at Cordele, Ga., by the Williamson-Harris Machine Co., as an addition to the foundry and shops, will be completed and ready to make steel castings within the next few weeks.

There are now twelve furnaces in active operation in Alabama, compared with five that were running on Aug. 1. Several resumed during October.

Announcement has been made by officials of the Lock Joint Pipe Co., of New York, that a $50,000 factory will be constructed in Atlanta to serve the southeastern territory. This company makes re-inforced concrete pipe, and now has twelve factories in Canada and the United States.

Automotive Boom in Michigan

It is reported that the Continental Motor Corporation at Muskegon, Mich., has closed a contract to supply Durant Motors, Inc., with $12,000,000 worth of motors, which will add at least 2,000 employees to the plant in that city.

Calls were sent out on Oct. 25 for the return to work of 500 employees of the Oakland Motor Car Co. at the Pontiac, Mich., plant.

Attacking the Machine Age

(From the *Toledo Blade*)

Following one Butler of lively imagination, another wag attacked the Machine Age, which is our time and generation. He has written a five dollar book on the text that machinery is an abomination, its products all evil, its developments highly damaging to the human race.

The conditions of life, he says, are adjusted to the machine, and not the machine to life. A point that might be disputed. The machine, he declares, replaces brains. If it replaces anything, we would say, it is physical drudgery. He proceeds to say that man is the slave of the machine. We are particularly ready to admit that to be true at the moment the alarm clock goes off.

Such a thesis would carry much weight if any country, any section or any community which is barren of machinery, could be pointed out as happier, more intelligent, more kindly, more tolerant, more productive of superior humanity, than countries and districts in which life depends upon machinery. There is no country, no section or community, thus wanting in mechanical equipment which has any advantage as a living place over any place encumbered of machinery. The districts which in the United States have the least machinery are those in which such societies as the Ku Klux Klan most actively flourish. In these same districts there is economic stagnation. There is the poverty which weighs upon the soul. There is a higher percentage of imbeciles than elsewhere. There is insanitation, suspicion, hatred, physical and moral woe of the ugliest.

The best cure we know of for one who is pessimistic about the Machine Age is a visit to some of our machineless districts. We commend the excursion particularly to women who are fascinated by the writings of iconoclasts who get five dollars for their books. They will find that the lot of the woman in these simple spots is first that of the breeder, then that of the drudge. Neither as the one nor as the other does she accomplish anything very satisfactory.

Hearings Continue on Metric Bill —Proponents Heard

Hearings on the metric system bill were resumed on Oct. 24. The subcommittee of the Senate will continue to hear witnesses who favor the adoption of the metric system. Witnesses who favor the retention of the English system and who as a consequence are opposed to the bill introduced by Senator Ladd, will be heard after the metric system advocates have made their initial presentation.

Henry D. Hubbard, secretary of the Bureau of Standards since 1901, appeared in behalf of the legislation. Among other things he said: "The time has gone when we are content to include under weights and measures merely the pound, the yard and the bushel. We now measure light, heat, electricity, refrigeration, steampower, ventilation and all the countless properties of materials. The far reaches of measurement have extended into fields a thousand times more difficult than the mere measuring of the volume of a particle of grain or the measurement of a length of fabric."

Mr. Hubbard then took up the history and a technical description of the metric system. After he had proceeded for sometime, Senator McNary, the chairman of the committee, interrupted to say: "I want to keep the record down to the consideration of this bill. This is all interesting but it has no purpose in this hearing. If you care to supply for the record a statement of historical phases of the system, you may do so, but it is discouraging that we cannot keep near the purposes and aims of this bill and discuss its feasibility and practicability. A technical or historical discussion does not help us to an understanding of the problem that is before the committee."

PRESENT SYSTEM INADEQUATE

In reply Mr. Hubbard said: "Our present system is inadequate. It does not begin to meet and cannot hope to meet the needs of scientific work. That was recognized years ago. The present system has been found as exhibited by the typical case of the bushel, to be of appalling complexity, and with respect to the ton, introducing the most diverse and confusing misunderstandings."

A RECORD BREAKING PROFESSOR

E. B. Bingham, professor of chemistry at Lafayette College, and chief chemist Malitor of Carl E. Schmidt & Co. appeared in favor of the bill. Chairman McNary asked Prof. Bingham how long it would take the average man to familiarize himself with the metric system. Prof. Bingham's estimate was half an hour. This led Senator McNary to say. "You hold the record for educational results." Mr. Malitor declared that the system is a requisite in the development of foreign trade. Senator McNary stated that he had heard of many essentials to the acquisition of foreign trade, but that this was the first time he had heard that this expansion is dependent upon the introduction of the metric system.

Since so many of the witnesses in favor of the bill have been chemists, Senator McNary has expressed the hope that representatives of other activities will be brought forward to testify.

Safety Council Elects Vice-Presidents

The executive committee of the National Safety Council at its first meeting following the Tenth Annual Safety Congress, held recently in Boston, elected the following vice-presidents for the coming year: David S. Beyer, Boston, vice-president for service to members; B. F. Tillson, Franklin, N. J., vice-president for industrial safety; F. A. Davidson, New York, vice-president for sectional activities; C. B. Scott, Chicago, vice-president for local councils; David Van Schaack, Hartford, Conn., vice-president for public safety; W. E. Worth, Chicago, secretary and treasurer.

W. H. Cameron, formerly secretary-treasurer of the National Workmen's Compensation Service Bureau, New York, was elected executive secretary of the council. Mr. Cameron, who on Nov. 1 will assume charge of the headquarters of the National Safety Council at Chicago, returns to a post which he held from 1912 to 1919. Sidney J. Williams was re-elected chief engineer of the council. C. W. Price, formerly general manager, will assist the National Safety Council as a special consultant in public safety.

The executive committee approved the organization of a Drop Forge Section and a Petroleum Section.

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A Brief Statement from Canada

Special Correspondence

Things are very much unsettled just prior to the Dominion election to be held on Dec. 7. With the revision of the tariff as the big issue, and farmers all over the country clamoring for a lower tariff, manufacturers are necessarily going a little slow until they know what is going to happen. This situation, in addition to somewhat depressed business conditions generally, has a tendency to hold up all construction work, especially factory building. We are hoping things will get straightened away by spring.

Business Items

The Engineering Society of Western Massachusetts had its October meeting at the Strathmore Paper Company's Woronoco mill, on Oct. 23, with 90 members in attendance. George E. Williamson, president of the society and chief engineer for the company, accompanied by mill executives, showed the party through the plant, which affords an excellent example of the most advanced type of machinery for the manufacture of fine quality writing paper. The hydro-electric power plant and steam turbine run by fuel oil were interesting features. Later there was a motion picture exhibition showing the processes of making paper at the mill and other films of interest to engineers and manufacturers.

The Instant Freezer Corporation, Springfield, Mass., incorporated last May, has closed a contract with the Victor Saw Manufacturing Co., of the same city, to produce 25 freezing machines a month. Work under this contract will being at once. The freezer is designed to be used on soda counters. It is of metal construction and has two five-gallon receptacles for cream. Operating power is furnished by an electric motor of ¼ hp. The corporation intends to increase its capitalization from $25,000 to $500,000. Officers are: President, Paul Werder; vice-president, Wallace McHolt; secretary, George Drabble; treasurer, Harold Kittenger.

The Newburyport Metal Stamping Co. has been incorporated at Newburyport, Mass., to manufacture metal stampings and tools. W. F. Runnells, N. Russell and W. G. Fisher are among the directors.

The Lovejoy Manufacturing Co. has been organized at Brookline, Mass., to make automobile accessories. Incorporators are R M. Lovejoy, O. E. Leighton and H. B Shepard.

Incorporation of the Carter Motor Car Co., with a capitalization of $2,000,000, has been announced at Washington, D. C. The company was incorporated under the laws of South Dakota by L. L. Stephens, Frank L. Carter and A. Gary Carter. Buildings formerly occupied by the Washington Motor Car Co., at Hyattsville, Md., have been taken over for a factory. The advance notices issued by the incorporators state that a small car will be marketed at an attractive price. The car will be equipped with easy riding comfort springs, the patent for which is controlled by the incorporators.

The New England Tire and Rubber Co., South Holyoke, Mass., starts production this week in its new factory and purposes to attain an output of 300 tires and tubes daily within two months. Capacity of the factory is 1,000 tires and 1,500 tubes daily. Factory branches have been established, in New York, Newark, Washington and Boston.

The Henshaw Motor Co. has been organized at Boston, Mass., and incorporated for $600,000. Automobiles, parts and accessories will be made.

The Sun Machinery Co., has bought the building at 28 Mechanic St., Newark, N. J., and will move its office and display room to that address. A warehouse has been procured on Green St. The removal from 103 Commerce St., Newark, was made necessary on account of the tearing down of the building by the City of Newark to make room for a new market. P. J. McManus and William Tunic are the proprietors.

The Burroughs Machinery Corporation, Newark, N. J., builder of hydraulic machinery, has acquired all of the patents, drawings, patterns and machinery of the Charles Burroughs Company. The concern is now operating at 246 N. 10th St., Newark, N. J.

The Collins Motor Car Co., has been incorporated at Boston, Mass. Capital stock, $100,000. Directors are J. T. Collins, A. V. Hiscox and H. L. Legg.

The Cyclone Fence Co., Ltd., of Canada, has secured a Dominion charter and will be a branch plant of the Cyclone Fence Co., of Waukegan, Ill.

The Adams Axle Co., Findlay, Ohio, has been awarded the contract to make all the axles and brake bands for the Durant Automobile Co.

The Oberlin Machinery Co., Oberlin, Ohio, has been incorporated with $30,000 capital. H. W. Ingersoll, J. C. Smith, F. E. Stetson and B. A. Smith are directors

The Crane Co., manufacturer of valves and like supplies, has purchased the plant of the Glenmore Lubricant Co., at Lima, Ohio, and will open a branch factory as soon as alterations are made.

The Crandall-Johnson Co., of Stamford, Conn., has recently been organized and incorporated with a capital stock of $100,000 to engage in repairing and dealing in machinery, engines, etc. The incorporators are Arthur I. Crandall, Stamford, Conn.; M. Johnson, of New Canaan, Conn.; and A. M. Rossberg, of New York City.

Machine-Tool Exports Decline in September

Exports of metal-working machinery continue to decrease. The value of all exports of this class of machinery fell to $626,186 in September. This is less than one-fifth of the value of the exports in September, 1920, and is about one-eight of the monthly rate maintained in 1919.

The only favorable deduction that can be made from the September figures is that exports increased to Argentina and to Brazil, but the volume of business done with those countries was small. The detailed figures, which are those of the Bureau of Foreign and Domestic Commerce, follows:

	September, 1920	September, 1921
Metal-working machinery:		
Lathes	$50,781	$65,093
Other machine tools	1,176,175	218,339
Sharpening and grinding machines	333,844	65,886
All other	1,190,343	276,868
Total metal-working machinery	3,207,143	626,186
Exported to:		
Belgium	188,100	14,523
France	452,936	99,742
Italy	120,958	8,481
Netherlands	....	13,302
Norway	7,860	1,206
Spain	24,684	5,400
Sweden	33,038	1,389
United Kingdom	649,017	101,646
Canada	419,964	51,028
Mexico	37,350	34,822
Cuba	86,350	18,094
Argentina	....	9,821
Brazil	25,454	47,112
Chile	5,971	3,251
China	309,062	11,004
British India	83,249	11,366
Dutch E. Indies	....	16,202
Japan	290,742	83,980
Australia	84,563	10,518
Other countries	387,545	83,299
Imports	September, 1920	September, 1921
Machine tools	$12,703	$2,805

The Hardinge Company, 120 Broadway, New York, has acquired the pulverized fuel department of the Quigley Furnace Specialties Co., Inc., also of New York. The Hardinge concern will continue the policies and methods of the Quigley Co. in the production of fuel systems. The Quigley Co. will now devote its entire forces to the development of refractory specialties.

The Readio Company, Springfield, Mass., has been incorporated to manufacture and deal in vehicles, engines, general machinery and merchandise, and has bought a site in that city for the erection of an automobile repair shop. The principal stockholder is George U. Readio and the officers are: President, Edwin C. Spear; treasurer, Frederick J. Hillman.

It is reported that the H. B. Smith Co., manufacturers of radiators and boilers, Westfield, Mass., is rushed with orders, and has converted a large storeroom into a molding room and has hired additional molders, bringing its payroll to the highest point in its history. The company is exporting to the Orient.

The Rhode Island Crucible Steel Co., Inc., of Providence, R. I., has recently been incorporated with a capital stock of $100,000, to engage in the general foundry business. The incorporators are Carl A. Hagstom, Carl W. Sverker, A. B. Benson and George C. Hagstrom.

The Ashley Motor Sales Co., has been organized and incorporated in New York to manufacture and sell machinery. C. S. Ashley, W. J. Llewellyn and R. W. Ashley are mentioned as directors.

The Insulation and Specialty Corporation of America has been organized at Wilmington, Del., with P. C. Hennig as president. The new company is engaged in the manufacture of "Fibre Granite," an insulating material said to be more efficient and quicker to produce than any other on the market. The company's offices are now at 5154 Dupont Building.

A certificate of incorporation has been issued to the American Chain Shops, Inc., of Holyoke, with a capital stock of $25,000. Samuel Garlitz is president of the company.

A voluntary petition in bankruptcy was filed Saturday, Oct. 15, at Birmingham, Ala., by the Birmingham Steel Corporation, liabilities being listed at $262,529 and assets at $235,000. The assets include mainly real estate, buildings and machinery. According to H. L. Brittain, president of the corporation, the shipping board is the principal creditor. He stated that efforts will be made to adjust the matter immediately in order that operations at the plant may be carried on.

Construction work has begun on the main building of the Agricola Pipe Shop, at Gadsden, Ala., the previous structure having been entirely destroyed by a recent fire at a loss of about $125,000. Only the main building was destroyed, the machine shops and the pattern shops escaping damage.

Loss estimated at about $40,000 was caused recently when fire originating in the oil tank section destroyed the new plant of the National Forge Co., at Anniston, Ala. The plant was established only this year.

Personals

D. McCall White has resigned as associate vice-president of the La Fayette Motors Co., Indianapolis, Ind. No successor will be appointed.

M. H. Roberts, chief engineer of the Franklin Railway Supply Co., Inc., New York, is chairman of a board of engineers recently appointed by Director H. Foster Bain of the Bureau of Mines to study the production of helium in Texas. Prof. W. L. DeBaufre of the University of Nebraska is also serving on this board.

Frank L. Rowland, assistant treasurer and office manager of the Gilbert & Barker Manufacturing Co., West Springfield, Mass., is conducting a course of twelve lessons in office management under the auspices of the Massachusetts State Department of University Extension.

Leonard W. Kearns, prominent in the leather belting industry, has affiliated himself with the sales organization of the Chicago Belting Co., Chicago, Ill. Mr. Kearns has been active in the leather belting business for twenty-one years. He has specialized in the belting requirements of saw mills, steel mills, wood-working plants, flour mills and machine shops and is a practical belting engineer.

Edward F. Smith, for many years president of the Greenfield Machine Co., Greenfield, Mass., until that concern was merged in the Greenfield Tap & Die Corporation, has resigned his position with the corporation and is on a vacation in the West.

Ralph M. Barstow, general sales manager for the Greenfield Tap & Die Corporation, Greenfield, Mass., has been appointed lecturer on salesmanship for the State Department of University Extension. He is also the author of a course of study on the subject, to be used in the university extension work.

Henry Atwater, secretary-treasurer of the Columbia Nut and Bolt Co., of Bridgeport, Conn., was nominated last week by the Democratic party to run on that ticket for Mayor of Bridgeport at the election in November.

Sol Mooney, has recently been chosen secretary of the Atlas Iron Works, Inc., of Bridgeport, Conn.

John L. Taylor, salesman for L. F. Seyfert's Sons, Inc., Philadelphia, Pa., has resigned and established himself as a dealer in machinery at 6315 Torresdale Ave., Philadelphia.

L. J. Hoy, for several years a salesman with the Eastern Machinery and Equipment Co., Philadelphia, has resigned his position to take charge of the used machinery department of the Sherrit & Stover Co., 2006-8 Market St., Philadelphia.

Frank S. Mills has sold his interest in the Ware Foundry Co., Ware, Mass., of which he was superintendent up to Jan. 1 of this year.

Floyd W. Parsons, formerly editor of *Coal Age*, and for the past two years in charge of the "Everybody's Business" department of the *Saturday Evening Post*, has become editorial director of the *Gas Age-Record*.

W. D. Shambrook, formerly of the firm of W. D. Shambrook & Co., Hamilton, Ont, has been appointed president of Duro Aluminum Ltd., of that city.

Alan A. Wood, for a number of years connected in an engineering and sales capacity with the Providence plant of the Builders Iron Foundry and the Diamond Machine Co., associated companies, is now sales manager of the Philadelphia district, having an office at 419 Widener Bldg., Philadelphia.

J. Philips Bird has resigned as general manager and assistant treasurer of the National Association of Manufacturers. It is said he will engage in private enterprise in the East.

Charles E. Stone, a pioneer in the motor truck engineering field is sponsoring a new association known as the "Society of Motor Transport Engineers." Mr. Stone was one of the founders of the Motor Truck Manufacturers Association in 1907, and the Motor Truck Association of America in 1910.

Frederick A. Gotier, formerly with the Buick and Cole organiations, has been selected to represent the new Bradford Motor Corporation, distributer of the Studebaker cars in Albany, N. Y.

Col. Currie, president of the Imperial Steel and Wire Mills at Collingwood, Ontario, Canada, states that the plant which has been closed for some time will resume operations shortly.

Archibald Wright, for 27 years with the Clare Bros. Foundry, at Preston, Ontario, Canada, has been appointed factory inspector by the Provincial Government.

Col. Robert Starke, of Starke-Seybold Co., Montreal, Canada, has been appointed to the board of directors of Argonaut-Gold, Ltd.

W. Q. Sigsbee has been appointed manager of the Canadian branch factory of Ace Chain, Ltd., to be located at Hamilton, Ontario. The firm is affiliated with the Ace Chain Corporation of New York.

A. Schoen, of Detroit, Mich. manager of the Honolulu Irons Works, has been appointed a director of the Peninsular Sugar Co., which will erect a new $1,250,000 refinery at Petrolea, Ontario. F. H. Hubbard, of Ottawa, Ohio, manager of the Ohio Sugar Co., has been appointed vice-president.

C. J. Morrison, for the past two and a half years executive assistant to the president of the Atlas Tack Corporation, Fairhaven, Mass., has resigned.

Dean J. DeButts has resigned as manager of the Dallas, Tex. office of F. W. Freeborn Engineering Corporation, to accept an interest in the Knapp-Ritzmer Co., Inc., construction engineers, with headquarters in New York.

Preston M. Smith has recently been appointed general sales manager of the Manthey-Zorn Laboratories Co., Cleveland, Ohio.

G. Edward Barnhart is now vice-president and consulting engineer of the Barnhart Aircraft Inc., Pasadena, Cal.

Yozo Tamura, representing the South Manchuria Railway, has arrived in this country to place orders for several millions dollars worth of American machinery, rails and rolling stock for delivery in the next few years. His headquarters are at New York.

M. H. Christopherson, for a number of years general works manager for the Otis Elevator Co., in charge of the Ordnance Works, Chicago, is now New York State Deputy Industrial Commissioner located at 124 E. 28th St., New York. He still retains a connection with the Otis Company as consulting engineer.

C. V. Davis, formerly in charge of the publicity department of the McClary Manufacturing Co., London. Ontario, Canada, has been appointed district sales manager for the Solex Co., Ltd., with headquarters at Winnipeg.

Obituary

Alexander S. Purdy, aged 62, president and founder of the firm of Purdy-Mansell, Ltd., Toronto, Canada. plumbing and steamfitting supplies, is dead at London, Canada.

E. W. B. Snider, president of the Anthes Foundry Co., Toronto, Canada, and prominently connected with the Waterloo Maunfacturing Co., of Waterloo, died at his home at Kitchener, Ontario. He was one of the pioneer workers for hydro-power development in Canada.

Winthrop G. Bushnell, fifty-seven years old, a director of the Delaware Aircraft Co., and a prominent manufacturer in New England, died in New Haven, Conn., on Oct. 23. His father, Cornelius Bushnell, financed the building of the "Monitor" during the Civil War.

Robert L. Ahles, president of the Sweets Steel Co., of Wiliamsport, Pa., died at his home in Westbury, Long Island, N. Y. He was at one time associated with the Hewitt interests in the operation of blast furnaces in New Jersey.

Col. Spencer Borden, for many years associated with Thomas A. Edison, and a well known manufacturer of mechanical and electrical devices, died at his home at Woodstock, Vt., on Oct. 17. He was 72 years old.

John M. W. Jordan, who has been connected with the R. Hoe Printing Press Co. for forty years, died on Oct. 20 at the Swedish Hospital in Brooklyn, following an operation. He was 60 years old. He was in charge of stereotyping machinery production at the Hoe plant.

John Wittman, age 65, president of the Atlas Brass Foundry, Columbus, Ohio, died on Oct. 17 at Worthington, Ohio. He had been ill for two years.

David Hall Reddie, sales manager for Smith & Wesson, revolver manufacturers, Springfield, Mass., died from an attack of apoplexy Oct. 13. He was stricken in the factory. He was 54 years old and had been a resident of Springfield for eight years. For many years he was a buyer for the Biddle Hardware Co. of Philadelphia.

Book Reviews

The Aircraft Handbook. By Fred H. Colvin, editor, ***American Machinist*, and** Henry F. Colvin, member, Franklin Institute. Second edition, revised and enlarged, 415 pages, with many diagrams, charts and illustrations. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York City. Price $4.00.

This is the second edition, under a slightly changed title, of the "Aircraft Mechanics' Handbook," brought out by Fred H. Colvin during the war. The present volume represents a thorough revision of the original text which suffered somewhat from the haste necessary to publish it in time to be of service to our air program during the war.

New sections have been introduced dealing with the subjects of instruments, international air laws and landing fields. The other topics covered include simple airplane theory, materials of construction, rigging theory and practice, the airplane engine with detailed information regarding leading American makes, engine trouble-shooting, military equipment and S. A. E. standards. A few useful tables and a glossary of aeronautic terms will be found at the end of the book.

Mechanism. By Robert McArdle Keown; B. S.; engineer, Industrial Commission of Wisconsin; formerly associate professor of machine design, University of Wisconsin. Second edition, 173 pages, 172 illustrations, 6 x 9 in. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y.

The volume is intended as a textbook on mechanism for use in both the classroom and the drafting room. It covers the subject briefly, simply and clearly. The subject matter is very well arranged, to enable the ready grasping of it by students. The chapters are broken up into numbered sections. Definitions and rules are printed in italics, to call attention to their importance. Illustrations are freely used. At the end of each chapter problems are given, some being for classroom and some for drafting room use.

The book can be recommended as giving a thorough and yet brief treatment of the subject of Mechanism. Its scope is well shown by the chapter headings, which are as follows: Motions and Velocities; Instantaneous Centers, Kinematic Chains; Solution of Relative Linear Velocities by Centro Method; Velocity Diagrams; Parallel and Straight-Line Motion Mechanisms; Cams; Gearing; Bevel Gears, Worm and Worm Wheel; Gear Trains; Belting; and Intermittent Motions.

A. S. T. M. Standards. The 1921 edition of the triennial volume issued by the American Society for Testing Materials is a book of eight hundred and ninety 6 x 9-in. pages, giving standard specifications for practically all materials commonly used by the various branches of the engineering profession, and describing methods and apparatus for inspecting and testing many of them. To the busy engineer who wants his materials to meet definite requirements, yet has little time in which to work out an elaborate specification sheet to cover each case, the book is invaluable. It is published by the American Society for Testing Materials at 1315 Spruce St., Philadelphia, Pa. The price in cloth binding is $10.

Pamphlets Received

Industrial Indianapolis: A souvenir pamphlet of the Indianapolis Industrial Exposition, held in that city Oct. 10 to 15, 1921. It contains a comprehensive review of facts and figures concerning "Made in Indianapolis" products and the business and industrial life of the city. It is issued by the Associated Employers of Indianapolis, Inc., 1406 Merchants Bank Bldg.

Direction By Two Ears: Research narrative No. 18 issued by Engineering Foundation, 29 West 39th St., New York City. A brief description of a device perfected by American scientists during the war, for use in ships bottoms as a means of detecting the approach of submarines. The pamphlet was prepared from data furnished by Col. R. A. Millikan, of the California Institute of Technology, who was a member of the Anti-Submarine Board of the U. S. Navy.

Trade Catalogs

Hill Clutch Equipment. Hill Clutch Co., Cleveland, Ohio. Circular No. 17, describing a system of Hill clutches as used in the plant of the American Cotton Oil Co., at Memphis, Tenn.

Yarway Valves. Yarnall-Waring Co., Philadelphia, Pa. Small pamphlet No. DT—1601, describing the new Yarwin double-tightening valves for use on acid lines, soot blowers, locomotive and pneumatic service.

Standard Fuel Oil Engine (horizontal type). The Hadfield-Penfield Steel Co., Bucyrus, Ohio. Catalog, 24 pages, 9 x 11 in., describing the horizontal type Diesel fuel oil engine built in three sizes, 50, 75 and 100 hp. Illustrations of complete engines, as well as individual parts, are included.

Swages and Shapers. Machinery Company of America, Big Rapids, Mich. Catalog No. 33 describing a line of automatic and hand operated swages and shapers for band, circular, gang and frame saws.

Kinite. Kinite Co., Milwaukee, Wis. A twenty-four page, 3½ x 6½-in. catalog. No. 2034. Describing and illustrating the use of this alloy, of steel for shear blades, redrawing tools, blanking dies, embossing and forming dies, broaches, etc.

Standard Fuel Oil Engines (vertical type). The Hadfield-Penfield Steel Co., Bucyrus, Ohio. Describing and illustrating a Diesel type oil engine, manufactured under the Blanchard patents. The engine is built in two cylinder sizes, 50 and 125 hp. per cylinder and in from two to six cylinder units.

Modern Cutting and Grinding. Oakley Chemical Co., 22 Thames St., New York, N. Y. Booklet No. 1042, 4½ x 6½-in. A study and analysis of information on cutting and grinding methods. It deals with practical methods of applying scientific knowledge to every-day shop problems. Tables of cutting speeds, standard measurements, etc., are included.

Brown Pyrometer. Brown Instrument Co., Philadelphia, Pa. A four-page circular, 8 x 10½ in., describing, with illustrations, the latest type of high resistance pyrometer, with improvements consisting of automatic cold junction compensation and means of zero adjustment.

"Shelby" Steel Tubing. National Tube Co., Pittsburgh, Pa. Bulletin No. 17-B, describing the mechanical uses of "Shelby" seamless steel tubing. The booklet is replete with halftones and cross-sectional drawings of various sizes and shapes of tubing.

Chain Furnace and Oven Doors. E. J. Codd Co., Baltimore, Md. Circular describing the new chain furnace and oven doors which are used on metallurgical, glass and chemical furnaces. These screens are said to "keep the heat in and the cold out."

Pratt & Whitney Gages. Pratt & Whitney Co., Hartford, Conn. Catalog describing a line of P. & W. products including precision gages, mikechecks and toolmaker's flats.

"ABC" Fans. American Blower Co. Detroit, Mich. Catalog No. 23, Series 10, devoted to a description of "ABC" ai washing and cooling fans and systems fo use in factories, schools, stores and homes

Starters for small A-C Motors. Cutler-Hammer Manufacturing Co., Milwaukee Wis. Circular No. 2038 describing the ne a-c automatic starters with mercury typ overload relays. The theory of the mercur interlock is given and a curve included t show how tripping depends on time an the percentage of overloading.

Forthcoming Meetings

The third annual convention and exhibition of the American Gas Association wi be held in the Congress and Auditoriu Hotels, Chicago, Ill., on Nov. 7 to 12.

The twenty-fifth annual convention c the National Founders' Association will t held in the Hotel Astor, New York Cit on Nov. 16 and 17.

The annual meeting of the America Society of Mechanical Engineers will t held in the Engineering Societies Buildin New York City, on Dec. 5 to 9.

NEW *and* ENLARGED SHOPS

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Conn., Hartford—J. Jacobsen, 1074 Broad St.—equipment for garage and auto repair shop.

N. J., Newark—Kreuter & Co., Inc., 571 18th Ave. (manufacturer of tools)—

One 12-ft. Sprague electric hoist, 220 volt.

One double disc wet grinder to take 16-in. ring wheel.

N. Y., Brooklyn — Machine Appliance Corp. 351 Jay St.—one compound rest, screw cutting lathe.

N. Y., New York—Mitsui & Co., 65 Bway.—one Barnes 24-in. self oiling all geared drill press.

La., New Orleans—The Rialto Auto Shop, 1836 Constantinople St.—P. Christophe, Prop.—auto shop equipment including Hacksaw and Hacksaw blades, wire cutters, machine pliers, soldering irons, welding outfit, etc. (new and used).

Ill., McHenry—J. Pint (wagon maker)—several 30 in. square shears and one 8 ft. steel brake.

O., Cleveland—The Royal Brass Co., 1418 East 43rd St.—small punch press, (new or used).

O., Ravenna—J. F. Beyers Machine Co.—one 4-ft. radial drill.

Wis., Eagle River — J. B. Cook — lathes, forges, presses, etc., for proposed machine and forge shop.

Wis., Glenwood City—The Glenwood City Auto Co., J. P. Johnson, Purch. Agt—repair machinery, including drill press.

Wis., Hurley—L. Santi—auto repair machinery.

Wis., Madison—T. Roster & Co., 440 Clemens St.—machinery, including lathes, presses, etc. for proposed machine shop.

Wis., Milwaukee—J. Kost, 339 Clinton St. (tool maker)—one bench lathe.

Wis., Oshkosh—Fonte & Slater Co., 118 Main St.,—presses, air compressors, etc. for proposed garage on Main St.

Wis., South Beloit (Beloit P. O.)—P. F. Mork, 94 State St.—drill press for garage.

Ark., Gravette—T. A. Wisdom—machine shop equipment including lathes, drills, forges, etc. for proposed shop on Main St.

N. J., Camden—The Harbor Committee, Room 11, City Hall—one 3-ton traveling crane, gantry, cantilever, electric; two double-drum portable electric winches; one 4-wheel electric tractor including 8 trailer trucks.

N. Y., Buffalo—The Buffalo Litholite Co., Main and Amherst Sts., G. Hipp, Purch. Agt.—iron planer, bed travel about 8 ft. for planing stone.

N. Y., New York—Eschmann & Loede, 239 Center St.—engine turning machine for watch case work, to make markings, etc. on back of watches.

Pa., Philadelphia—The Baldwin Locomotive Co., Broad and Springgarden Sts., W. A. Russel, Purch. Agt.—traveling derrick, 50 ton capacity

N. C., Glen Alpine—J. D. Pitts (woodworker), H. P. Pitts, Purch. Agt.—one combination ceiling and flooring machine, weight about 6,000 lb., about 6 x 24 without feeding out roll, to match and dress as thin as ⅜ in. and dress 4 sides 14 in. wide (must be in excellent condition).

Va., Richmond—J. G. Skelton, Railway & Power Bldg., manufacturer of machinery—six 36-in. gage, 11 x 16 in. cyl. Vulcan or Porter saddle-tank locomotives and two 30-ton standard gauge saddle tank locomotives with A.S.M.E. boilers.

Ill., Chicago—The Garden City Plating & Mfg. Co., 1434 South Talman Ave.—one ball burnishing barrel.

Ill., Chicago—E. H. Stafford Mfg. Co., 218 South Wabash Ave., (manufacturer of furniture), E. H. Stafford, Pur. Agt.—power veneer press.

O., Canton—The Continental Clay Co., Zinninger Bldg.—$200,000 worth equipment including full line of sewer pipe machinery, plunger presses, drying pans, crushers, etc. for proposed plant in East Canton.

Wis., Beaver Dam—Price & Ruland Co.—power machinery, boilers, etc., for dairy products plant.

Wis., Eagle River—V. Krefl Mfg. Co.—power machinery for proposed 3-story auto accessory factory.

Wis., Luck—G. Grinen—blacksmith shop equipment.

Wis., Milwaukee—J. Auchtfer, 1062 11th St.—vulcanizer and gasoline pumps for proposed garage on Oakland Ave.

Wis., Milwaukee—W. A. Bowers Heating Co., 484 Market St., W. A. Bowers, Purch. Agt.—one 8 ft. tinners brake

Wis., Wagner—E. J. Wagner—belt driven machinery for making cheese.

Kan., Coffeyville—The Bd. Educ., c/o H. E. Martin, Pres.—manual training equipment for proposed 2-story junior high school

Minn., Minneapolis—The Bd. Educ., 305 City Hall, K. E. Alexander, City Purch. Agt.—$25,000 worth equipment for manual training depts. and school shops.

Tex., Mexia—The Texas Mexia Refining Co., Telephone Exch. Bldg., O. H. Foster, Pres. — complete refinery equipment for 3,000 barrel refinery (wants terms; suggests $5,000 cash and balance in monthly payments).

Ont., Petrolea—The Peninsular Sugar Co. F. H. Hubbard, mgr. of Ohio Sugar Co., Ottawa, Ohio, Pres.—equipment and machinery for proposed sugar refinery.

H. I., Honolulu—Loves Biscuit & Bread Co.—baking and conveying machinery for proposed biscuit factory.

Metal Working Shops

NEW ENGLAND STATES

Conn., Hartford—J. Jacobsen, 1074 Broad St., is having plans prepared for the construction of a 1½-story, 80 x 145 ft. garage and repair shop on Broad St. Berenson & Moses, 1026 Main St., Archts.

MIDDLE ATLANTIC STATES

Pa., Economy (Ambridge P. O.)—The Wyckoff Drawn Steel Co. will build a 1 story, 60 x 240 ft. addition to its factory.

Pa., New Brighton—The Standard Mfg. Co., Bessemer Bldg., Pittsburgh, has awarded the contract for the construction of a 1 story, 144 x 180 ft. foundry.

Pa., New Brighton—C. C. and E. P. Townsend Co. has awarded the contract for the construction of a 3 story, 124 x 128 ft. wire mill, warehouse and factory.

Pa., Pittsburgh — Arburthrust Stevenson Co., Penn. Ave., has awarded the contract for the construction of a 1 story 75 x 210 ft. garage on Bidwell St. Estimated cost, $75,000.

Pa., Pittsburgh — McLean & McGuiness, manufacturers of wagon supplies, have awarded the contract for the construction of a 5 story, 40 x 100 ft. factory at 142 Libery Ave. Estimated cost, $45,000.

MIDDLE WEST STATES

Ill., Belvidere—The Belvidere Heating Co., c/o J. Meyers, is having plans prepared for the construction of a 2 story factory. Estimated cost, $55,000. Architect's name withheld.

Ill., Chicago—P. Gerhardt, Archt., 64 West Randolph St., is receiving bids for the construction of a 2-story, 80 x 230 ft. auto service and sales station, at 5725-31 Bway., for Kelley & McLin.

Ill., Chicago—The Hannifin Mfg. Co., 621 South Kolmar Ave., manufacturer of special machinery, is having plans prepared for the construction of a 2-story, 90 x 160 ft. factory on Knox and Wellington Sts. Estimated cost, $200,000. Architect not announced.

Ill., Chicago—R. Munizzo, 2904 South Wells St., has awarded the contract for the construction of a 1-story, 110 x 125-ft. garage on 31st St. and Princeton Ave. Estimated cost, $40,000.

Ill., East St. Louis—C. O. McCasland, 810 Chestnut St., St. Louis, Mo, has awarded the contract for the construction of a 1-story, 70 x 120-ft garage on 10th and Illinois Aves. Estimated cost, $55,000. Noted Oct. 27.

Ill., Elgin—The Elgin Watch Co., c/o C. H. Hulbird, Pres., 10 South Wabash Ave., Chicago, is having plans prepared for the construction of a 4-story, 30 x 374-ft. watch factory, 3-story 40 x 432-ft. dormitory and 3-story 100 x 150-ft administration building. Estimated cost $1,000,000. Postle & Fischer, 140 South Dearborn St., Chicago, Archts.

Ill., Evanston—C. F. Thumm, 2313 Lincoln St., Chicago, has awarded the contract for the construction of a 1 story, 171 x 200 ft. garage. Estimated cost, $85,000.

Ill., Harvard—Cowen & Obert, Crystal Lake, will build a 1-story, 82 x 90-ft. garage here. Estimated cost, $40,000.

Ill., Joliet—The Public Service Co. has awarded the contract for the construction of a 1-story, 60 x 100-ft. garage. Estimated cost, $40,000. Noted Oct. 27.

Ill., Wheaton—F. E. Wheaton & Sons are having plans prepared for the construction of a 1 story, 66 x 101 ft. garage. Estimated cost, $55,000. L. M. Mitchell, 138 North La Salle St., Chicago, Archt.

The Weekly Price Guide

This Week's Market

Structural steel shapes, plates and bars are quoted at the Pittsburgh mills at $1.50@$1.65 per 100 lb. No change has occurred in the price of steel shapes during the week but plates and bars show a tendency to adhere to $1.50@$1.65 as against last week's price of $1.60@$1.65 per 100 lb. Weaker mill prices have not as yet been reflected in the warehouse quotations. Mill shipments, New York, of shapes and plates are quoted at $1.88@$2.03; bars at $1.80@$1.88 per 100 lb.

Electrolytic copper is quoted in the New York warehouses at 13⅝c. as against 13¾c. and tin at 28½c. as against 28¾c. per lb. Long terne plate has advanced slightly in Chicago. Lineseed oil has dropped 1c. in New York and 5c. per gal. (5 bbl. lots) in Chicago.

We are quoting this week for the first time prices on cutting and lubricating oils, belting and various forms of abrasive materials. These quotations are to the machine shops in quantities customarily used.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$24.50
Northern Basic	22.52
Southern Ohio No. 2	23.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	30.26
BIRMINGHAM	
No. 2 Foundry	20.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	22.75
Virginia No. 2	28.74
Basic	20.75
Grey Forge	21.75
CHICAGO	
No. 2 Foundry local	22.70
No. 2 Foundry, Southern, sil 2.25@2.75	26.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	22.96
Basic	21.96
Bessemer	21.96

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50	3.28	3.10	3.38
No. 12	2.55	3.33	3.15	3.45
No. 14	2.60	3.38	3.20	3.48
No. 16	2.80	3.48	3.30	3.58
Black				
Nos. 17 and 21.	2.85	4.05	3.55	3.95
Nos. 22 and 24.	2.90	4.10	3.60	4.00
Nos. 25 and 26.	2.95	4.15	3.65	4.05
No. 28	3.00	4.25	3.75	4.15
Galvanized				
Nos. 10 and 11.	3.00	4.25	3.75	4.15
Nos. 12 and 14.	3.10	4.35	3.85	4.25
Nos. 17 and 21.	3.40	4.65	4.15	4.55
Nos. 22 and 24.	3.55	4.80	4.30	4.70
No. 26	3.70	4.95	4.55	4.85
No. 28	4.00	5.25	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of Sept. 16, 1921:

Steel Inches	Steel Black	Steel Galv.	Iron Inches	Iron Black	Iron Galv.
BUTT WELD					
1 to 3	68½	56	¾ to 1½	44½	29½
LAP WELD					
2	61½	49	2	39½	25½
2½ to 6	65½	53	2¼ to 4	42½	29½
7 to 8	62½	49	4½ to 6	42½	29½
9 to 12	62½	49	7 to 12	40½	27½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66½	55	1 to 1½	44½	30½
2 to 3	68½	56			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59½	48	2	40½	27½
2½ to 4	63½	52	2½ to 4	43½	31½
4½ to 6	62½	51	4½ to 6	42½	30½
7 to 8	58½	45	7 to 8	35½	23½
9 to 12	52½	39	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	60%	46%	60½%	47½%	60%	46%
3½ to 6 in. steel lap welded	51%	37%	58½%	44½%	57%	43%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	5.00	6.00	*3.78
Spring steel (light) (base)	6.00	6.00	*2.93
Coppered Bessemer rods (base)	8.00	8.00	*6.03
Hoop steel	3.88	3.29	3.48
Cold rolled strip steel	7.50	8.25	6.75
Floor plates	4.85	....	5.23
Cold finished shafting or screw	3.88	3.50	3.83
Cold finished flats, squares	4.38	4.00	4.35
Structural shapes (base)	2.88	2.74	2.88
Soft steel bars (base)	2.78	2.64	2.78
Soft steel bar shapes (base)	2.78	2.64	2.78
Soft steel bands (base)	3.43	....	3.48
Tank plates (base)	2.88	2.92½	2.88
Bar iron (2.15@2.25)	2.78	3.52	2.78
Drill rod (from list)	55@60%	55%	50%

Electric welding wire .... New York $\frac{3}{32}$, 8½c. per lb.; ⅛, 7.15c.; $\frac{5}{32}$ to ¼, 6.75c. Swedish iron sells at 9c. per lb. in Chicago. *Pric to dealers.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	13.62
Tin, 5-ton lots, New York	28.50
Lead (up to carlots), St. Louis, 4.60; New York	5.00
Zinc (up to carlots), St. Louis, 4.97½; New York	5.37

	New York	Cleveland	Chicag
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.00	20.00	20.00
Antimony (Chinese), ton spot	5.50	6.50	6.00
Copper sheets, base	20.75	21.50	22.50
Copper wire (carlots)	16.50	16.50	15.75
Copper bars (ton lots)	19.00	23.00	19.00
Copper tubing (100-lb. lots)	20.50	23.00	22.50
Brass sheets (100-lb. lots)	16.25	17.00	18.25
Brass tubing (100-lb. lots)	18.00	19.00	20.0
Brass rods (1,000-lb. lots)	14.25	16.00	15.2
Zinc sheets (casks), (8% dis. carlots)	11.00	11.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ½), (case lots)	19.50	23.50	18.0
Babbitt metal (best grade)	70.00	39.00	34.0
Babbitt metal (commercial)	30.00	13.50	8.0

—Shop Materials and Supplies

MONEL METAL—Base price in cents per lb., f.o.b. Bayonne, N.J.:

Shot	35.00	Hot rolled machined rods (base)	53.00
Blocks	35.00	Hot rolled rods (base)	42.00
Ingots	38.00	Cold drawn rods (base)	56.00
Sheet bars	40.00	Hot rolled sheets (base)	55.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grades "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.50	10.25
Copper, heavy, and wire	9.50	10.50	9.50
Copper, light, and bottoms	8.00	8.00	8.25
Lead, heavy	4.00	3.75	3.75
Lead, tea	3.00	2.75	3.00
Brass, heavy	6.50	6.00	8.00
Brass, light	5.00	4.00	4.75
No. 1 yellow brass turnings	5.25	4.50	5.25
Zinc	3.00	2.00	2.75

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

	New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:			
IC, 20x28, 112 sheets	21.50	......	....
IX, 20x28, 112 sheets	24.00	......	....
"A" Charcoal Allaways Grade:			
IC, 20x28, 112 sheets	18.50	......	....
IX, 20x28, 112 sheets	21.50	......	....
Coke Plates, Bright			
Prime, 20x28 in.:		(56 sheets)	
100-lb., 112 sheets	14.00	6.50	7.25
IC, 112 sheets	14.30	6.65	7.40
Terne Plate			
Small lots, 8-lb. Coating:			
100-lb., 14x20	7.50	6.25	7.25
IC, 14x20	7.75	6.50	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb.	.055@.09	.09	.10
Wiping cloths per M., $13\frac{1}{4}$x$13\frac{1}{4}$	....	55.00	55.00
Wiping cloths per M., $13\frac{1}{4}$x$20\frac{1}{2}$	....	65.00	65.00
Sal soda, 100 lbs	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb.	2.55	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.72	.80	.72
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 75 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville	per ton	$3.25@3.50	
Coke, prompt foundry, Connellsville	per ton	4.25@4.75	

SHOP SUPPLIES

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	—50%	—60%	60%
$1\frac{1}{8}$ and $1\frac{1}{4}$x3 in. up to 12 in.	—40%	60–10–10%	—55%
With cold punched sq. nuts	—30%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	—40%	....	$3.25 off
Button head bolts, with hex. nuts	—20%	$3.90 base	.....
Hex. head and hex. nut bolts	—20%	....	.....
Lag screws, coach screws	—50–10%	....	60%
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	50–10–10%	50–5%
Bolt ends, with hot pressed nuts	—50%	....	55%
Tap bolts, hex. heads	—20%	....	.....
Semi-finished nuts all sizes	—70%	75%	80%
Case-hardened nuts	—60%	....	.....
Washers, cast iron, ½ in., per 100 lb.	$5.00	$5.50 off	$4.50
Washers, cast iron, ⅝ in. per 100 lb.	4.25	3.75 off	4.50
Washers, round plate, off list per 100 lb.	3.00	.... off	4.50
Nuts, hot pressed, sq. Off list	2.00	3.00	3.25
Nuts, hot pressed, hex. Off list	2.00	3.00	3.25
Nuts, cold punched, sq. Off list	1.50	3.00	3.25
Nuts, cold punched, hex. Off list	1.50	3.00	3.25
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	50-10%	60-10-10%	–60-10%
Rivets, tinned	–50-10%	60-10-10%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb.	$3.70	3.50	3.68
Cone heads, ditto	3.80	3.60	3.78
$1\frac{1}{8}$ to $1\frac{7}{8}$-in. long, all diameters, *EXTRA* per 100 lb.	0.25	....	0.15
⅞ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	....	428 base
Copper rivets	50–10%	40–10%	50–10%
Copper burs	25–10%	15%	10%
Lard oil, pure, (50 gal. bbl.) per gal.	0.95	......	.....
Lard cutting oil (50 gal. bbl.) per gal.	0.60	......	.....
Machine oil, lubricating, per gal.	0 35	......	.....
Belting—Present discounts from list in fair quantities (½ doz. rolls)			
Leather:			
Light grade	50–5%	.....	8 in. standard
Medium grade	45%	.....	50–5%
Heavy grade	40%	.....	.....
Rubber and duck:			
First grade	50–10%	....	Standard
Second grade	60–5%	......	60–5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	$9.00 less 20-10-5%	....	20–10%
Emery paper	11.00 less 20%	.....	–20%
Emery cloth	32.75 less 10%	.....	–10%
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	$4.50 net	....	list+10%
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	$1.65 less 20%	.....	–10%
Cloth	$3.55 less 10%	.....	–10%

O., Cleveland — Richmond Bros. have awarded the contract for the construction of a 1 story, 66 x 90 ft. garage at 1600 East 55th St. Estimated cost, $40,000. Noted. Oct. 27.

O., Cleveland — J. M. Sands, Sweeney Ave. (manufacturer of water heaters), has had plans prepared for the construction of a 1 story, 37 x 100 ft. forge shop at 10300 Harvard Ave. Estimated cost, $40,000. Private plans.

O., Cleveland—Sobul & Elder; 416 Guardian Bldg., have awarded the contract for the construction of a 1 story, 100 x 100 ft. garage at 2719 East 55th St. Estimated cost, $50,000. Noted Oct. 6.

O., Cleveland—G. A. Vyse, 8816 Harkness Rd., has had plans prepared for the construction of a 2 story, 34 x 64 ft. garage at 8816 Harkness Rd. Estimated cost, $40,000. Private plans.

O., Findlay—The Glenwood Motor Car Co., c/o B. J. Cline, East 71st St. and Euclid Ave., is receiving bids for the construction of a 1 story, 100 x 700 ft. auto factory. Estimated cost, $250,000. Private plans.

O., Dayton—W. D. Huber, 209 North Main St, plans to construct a 3-story, 120 x 200-ft. garage and business building on West 4th St. Estimated cost, $175,000. Architect not selected.

Wis., Drummond—The Drummond Garage Co. has awarded the contract for the construction of a 2 story, 60 x 60 ft. garage and repair shop on Main St. Estimated cost, $42,000.

Wis., Eagle River—J. B. Cook is receiving bids for the construction of a 1-story, 50 x 50-ft. machine and forge shop. Estimated cost, $45,000. Private plans.

Wis., Eagle River—V. Krefl Mfg. Co. has awarded the contract for the construction of a 3-story, 60 x 85-ft. factory on Main St., for the manufacture of auto accessories. Estimated cost, $50,000.

Wis., Hingham—Eernisse & Co. is having plans prepared for the construction of a 2-story, 60 x 110-ft. garage. Estimated cost, $40,000. Private plans.

Wis., Madison—T. Roster & Co., 440 Clemens St., has awarded the contract for the construction of a 1-story, 50 x 60-ft. machine shop. Estimated cost, $40,000.

Wis., Milwaukee—J. Auchter, 1062 11th St., has awarded the contract for the construction of a 1-story, 90 x 122-ft. garage on Oakland Ave. Estimated cost, $40,000.

Wis., Milwaukee—S. Bodner, 546 4th St., has awarded the contract for the construction of a 1-story, 62 x 154-ft. garage on 4th St. Estimated cost, $40,000.

Wis., Milwaukee — H. and R. Larsen, Columbia Ave., have awarded the contract for the construction of a 1 story, 40 x 120 ft. garage on Fond du Lac Ave. Estimated cost, $40,000.

Wis., Milwaukee—J. Wellaeger Co., 417 Wells St., has awarded the contract for the construction of a 4 story, 90 x 120 ft. garage on Grand Ave. Estimated cost, $100,000. Noted Oct. 6.

Wis., Oshkosh—Fonte & Slater Co., 118 Main St., has awarded the contract for the construction of a 1-story, 61 x 87-ft. garage on Main St. Estimated cost, $45,000.

WEST OF THE MISSISSIPPI

Ark., Gravette—T. A. Wisdom plans to build a 1 story, foundry and machine shop on Main St. Estimated cost, $40,000. Architect not selected.

Kan., Council Groves—E. A. Roberts is having plans prepared for the construction of a 2-story, 50 x 87-ft. garage. Estimated cost, $45,000. C. W. Squires, Emporia, Archt.

Kan., Lawrence—The University of Kansas, c/o J. A. Kimball, Bus. Mgr., Topeka, has awarded the contract for the construction of a 2-story, 53 x 110-ft. electric laboratory. Estimated cost, $40,000.

Kan., Wichita—The Wichita Visible Pump Co., c/o E. P. Hayes, 701 Gilbert St., will build a 2-story factory for the manufacture of pumps. Estimated cost, $50,000. Noted Aug. 1.

Minn., Minneapolis—J. Cohen, 2015 Irving Ave., S., has awarded the contract for the construction of a 1-story, 132 x 158-ft. garage and store building on Nicollet Ave. and 14th St. Estimated cost, $60,000.

Minn., Minneapolis—The Murphy Transfer & Storage Co., Inc., 309 3rd Ave., N., plans to construct a 2-story, 70 x 160-ft. garage and office building on 4th St. and 9th Ave. Estimated cost, $40,000. Architest not selected.

Mo., Monett—The Missouri Holding Co., c/o J. Nelson, Secy., Broadway Hotel Bldg., plans to construct a 1 story factory on Main St. for the manufacture of dehydration machines. Estimated cost, $50,000. Architect not selected.

Mo., St. Joseph—The Grant Motor Co., 9th and Felix Sts., has awarded the contract for the construction of a 1-story, 120 x 140-ft. garage on 10th and Francis Sts. Estimated cost, $55,000. Noted Oct. 27.

Mo., St. Louis—The Chester Iron & Fdry. Co., 7800 Vulcan St., has awarded the contract for the construction of a 1-story, 45 x 117-ft. foundry. Estimated cost, $40,000. Noted Oct. 27.

Mo., St. Louis—J. E. Dougherty, 127 Blow Ave., is having plans prepared for the construction of a 2-story, 50 x 117-ft. garage on 39th St. and McRee Ave. Estimated cost, $45,000. Architects name withheld.

Mo., St. Louis—B. Gustavson will build a 1 story, 41 x 175 ft. garage at 1538 Tower Grove Ave. Estimated cost, $45,000. Noted Oct. 27.

Mo., St. Louis—The White Co., c/o W. C. Capen, Mgr., 3442 Lindell St, is having plans prepared for the construction of a 1-story service station on Leclede and Vanderventer Sts. Estimated cost, $75,000. P. J. Bradshaw, International Life Bldg., Archt.

Tex., Houston—The Missouri, Kansas & Texas R. R. Co., c/o E. L. Martin, Commerce and Market Sts., Dallas, has awarded the contract for the construction of a 1 story, 50 x 130 ft. machine shop here. Estimated cost, $35,000.

CANADA

Ont., Brockville—E. F. Phillips Electrical Wks., Ltd., DeGaspe St., Montreal, Que., manufacturer of copper electric wire and cable, plans to build main plant here to cost between $2,500,000 and $3,000,000. The company will commence work on first unit of plant (a rolling mill) within 4 months.

General Manufacturing

NEW ENGLAND STATES

Mass., Cambridge—J. W. Greer, 139 Main St., has awarded the contract for the construction of a 1-story, 63 x 80 ft. candy factory on Windsor St. Estimated cost, $25,000.

Mass., Springfield—The Springfield Ice Co., 47 Dwight St., has awarded the contract for the construction of a 1-story, 100 x 147-ft. ice plant.

R. I., Pawtucket—The Fisk Drug Co., 200 Main St., has awarded the contract for the construction of a 2-story, 60 x 90-ft. drug manufacturing plant on Main and Nashau Sts. Estimated cost, $40,000.

MIDDLE ATLANTIC STATES

Md., Frostburg—The Big Savage Brick Co., 40 West Union St., is having plans prepared for the construction of a brick plant. Estimated cost, $85,000. Private plans.

N. J., Trenton—The Acme Sanitary Pottery Co., May St., has awarded the contract for the construction of a 1- and 2-story pottery on May St. Estimated cost, $80,000.

Pa., Clarion—The Berney Bond Glass Co. has awarded the contract for the construction of a 1 story, 70 x 180 ft. glass factory. Estimated cost, $90,000.

Pa., Philadelphia—E. T. Biddle, c/o H. Biddle, 207 South 9th St., has awarded the contract for the construction of a 1-story, 22 x 139-ft. printing plant at 518 Locust St. Estimated cost, $15,000.

Pa., Pittsburgh—The Air Reduction Co., 342 Madison Ave., New York City, has awarded the contract for the construction of a 2-story acetylene plant on Ridge Ave., here. Estimated cost, $250,000. Noted Sept. 22.

SOUTHERN STATES

Fla., Vero—The Redstone Lumber & Supply Co. plans to rebuild its lumber mill which was destroyed by fire. Estimated cost, $26,000. B. T. Redstone, Mgr.

La., New Orleans—The Chalmette Oil & Refinery Co., 325 Camp St., plans to build a refinery including tanks, garage and distributing plant, in the square bounded by Virginia, Helena, Conti and St. Louis Sts. Estimated cost, $50,000. J. C. Copping, Gen. Mgr.

Va., Norfolk—The Anheuser Busch Co., Brooke Ave., has had plans prepared for altering and building an addition to its ice plant. Estimated cost, $250,000. Ophuls, Hill & McCreery, 112 West 42nd St., New York City, Archts. and Engrs.

MIDDLE WEST STATES

Ill., Chicago—Fox & Fox, Archts., 38 South Dearborn St. will soon receive bids for the construction of a 5 story, 50 x 142 ft. printing plant on Washington Blvd. and Elizabeth St., for the Bronson Canode Printing Co., 626 Federal St. Estimated cost, $150,000. Noted Oct. 20.

Ill., Chicago—Hetzel & Co., 739 Larrabee St., has awarded the contract for the construction of a 4-story, 54 x 72-ft. sausage factory at 1743 Larrabee St. Estimated cost, $85,000.

Ill., Mt. Morris—Kabel Bros. Co. is having plans prepared for the construction of a 1 story, 96 x 185 ft. printing shop. Estimated cost, $50,000. N. E. Buser, Mt. Morris Archt.

Ill., Peoria—Leshnick Directory Co., 514 Main St., is having plans prepared for a 2-story, 50 x 150 ft. printing shop. Estimated cost, $100,000. B. L. Hulsebus, Jefferson Bldg., Archt.

O., Canton—The Continental Clay Co., Zinninger Bldg., is having plans prepared for the construction of a 1 story, 100 x 300 ft. sewer pipe factory in East Canton. About $300,000. Private plans. Noted Mar. 3.

O., Cleveland — The Federal Investment Co., c/o C. J. Hayes, 2882 Detroit Ave., has had plans prepared for the construction of a 3 story, 65 x 85 ft. addition to its knitting factory on West 29th St. and Detroit Ave. Estimated cost, $75,000. Christian. Schwarzenberg & Gaede, 1900 Euclid Ave., Archts.

Wis., Beaver Dam—Price & Ruland Co. has awarded the contract for the construction of a 2 story, 60 x 126 ft. factory for the manufacture of dairy products. Estimated cost, $45,000.

Wis., Milwaukee—The Amer. Hide & Leather Co., 1320 Elston St., Chicago, is having plans prepared for the construction of a 6-story tannery and power house on Commerce St. Estimated cost, including equipment, $1,000,000. Lockwood, Greene & Co., 60 Federal St., Boston, Mass., Archts. and Engrs. Noted Oct. 20

Wis., Milwaukee — The Milwaukee Bag Co., 206 South Water St., will build a 3 story, 30 x 40 ft. addition to its factory on South Water St. Estimated cost, $20,000.

Wis., Sheboygan—The Northern Furniture Co., South Water and New Jersey Sts., has awarded the contract for the construction of a 4-story, 50 x 100-ft. chair factory on South Water St. Estimated cost, $55,000.

Wis., Waukesha—The Manitowoc Church Furniture Co. will build a 1 story, 60 x 150 ft. factory. Estimated cost, $60,000 C. F. Schuetze, Mgr. Private plans. Noted Sept. 15.

Wis., Waupun—The Paramount Knitting Co. has awarded the contract for the construction of a 2-story, 53 x 182-ft. factory. Estimated cost, $100,000. Lockwood, Green & Co., South Dearborn St., Chicago, Ill., Engrs.

Kan., Wichita—The Wichita Ice & Storage Co., c/o C. W. Southward, Pres., 213 South Rock Island Ave., is having plans prepared for the construction of a 5 story, 75 x 90 ft. ice plant. Estimated cost, $200,000. G. E. Wells, Boatmen's Bank Bldg., St. Louis, Mo, Archt.

Mo., Ferguson—The Republic Photographic Co., c/o E. B. Fish, Pres., is having plans prepared for the construction of a 1 story, 55 x 385 ft. and 77 x 162 ft. factory. Estimated cost, $125,000. J. W. Gerhard, Boatman Bank Bldg., St. Louis, Archt.

CANADA

Ont., Bridgeport—The Buffalo Specialty Co., manufacturers of liquid veneer, plans to rebuild its plant which was destroyed by fire. Estimated loss, $75,000.

Ont., Petrolea—The Peninsular Sugar Co. is having plans prepared for the construction of a sugar refinery, 600 ton capacity. Estimated cost, $2,000,000. F. H. Hubbard, manager of Ohio Sugar Co., Ottawa, Ohio, Pres.

H. I., Honolulu—Loves Biscuit & Bread Co., is having plans prepared for the construction of a 5 story, 80 x 120 ft. biscuit factory. Estimated cost, $100,000. A W. Hoffman, 730 Mashall St., Milwaukee, Wis., Engr.

American Machinist

Volume 55 NEW YORK, NOVEMBER 10, 1921 Number 19

The Control of Machines by Perforated Records

Principles of Pneumatic and Electric Control of Machinery—Difficulties of Automatic Control—Machines Controlled by Paper Records

BY EMANUEL SCHEYER

PERFORATED paper control of machinery was first invented about the end of the Nineteenth Century. Joseph Marie Jacquard, a weaver of Lyons, France, to whom the credit is generally given for the invention was, however, preceded by Falcon and Vaucanson, also French weavers, whose efforts in this field laid the foundations for his work. Jacquard invented the loom which weaves cloth automatically into designs in accordance with the holes in a perforated record. Strictly speaking he used an endless chain of perforated cards, each of which in turn was adapted to be moved towards a row of long thin rods or needles pointing end on toward the card. Wherever there was a hole in the card opposite a needle it would pass through and be undisturbed, while those needles coming opposite an unperforated portion would be pushed by the card. The uncut portion of the card would cause the threads of the warp corresponding to it to be kept down, whereas the holes caused their corresponding threads to be raised. The shuttle carrying the weft thread passed through the shed thus formed, and as different cards were moved against the needles, different threads would be raised and the design as predetermined by the holes in the cards, would be produced.

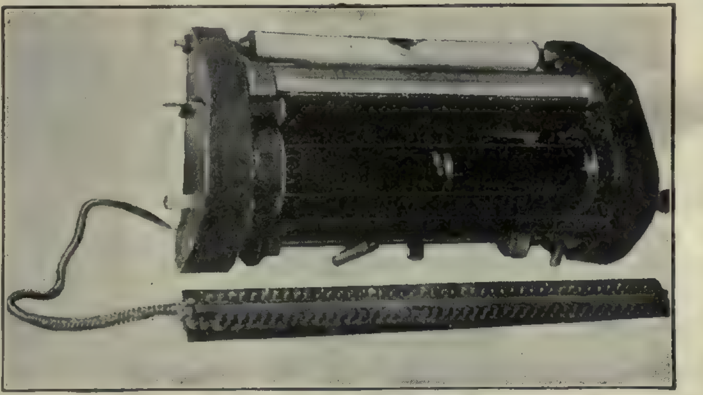

FIG. 1. ELECTRIC CONTROL APPARATUS

Since the time of Jacquard, little has been done in the development of his principle. True, it has been applied to fields other than weaving, notably the playing of musical instruments, the monotype machine, the Hooven automatic typewriter, automatic multiple punches and embroidering machines, but its mode of operation in these other fields, with the exception perhaps of the last two mentioned, is practically the same as it was over a century ago. In some types of automatic embroidering machines, of which more will be said later on, we see the beginning of a development that will some day have far-reaching effects in the world's production.

"It seems entirely within reason to state that no machining operation is so complicated or involves so many movements, so variously timed, as appears in the performance of even a simple musical composition by a mechanical piano-player; and when we consider the accuracy and effectiveness with which the most elaborate compositions are rendered by such machines the applicability of the method to repetition processes in manufacturing seems worthy of consideration. . . .

"The number of operations which may be controlled for any one machine is by no means limited, any more than the number of different musical compositions is limited for any piano equipped for use with the perforated roll. The unlimited possibilities of the Jacquard principle over any other thus constitutes one of its greatest advantages. Any change or modification in a series of operations with the paper strip may be made simply by preparing a different set of perforations, just as one written order of instructions supersedes another; and thus it appears that a form of control in which instructions are positively combined with their execution is available for the most intricate manufacturing operations."*

In most instances where a workman is required to guide a machine in its action, no matter how often its action is repeated in the formation of successive identical pieces of work, he must go through the same motions and mental processes. It is well known that oft repeated thoughts and motions tend to become automatic, requiring little or no mental effort on the part of the operator, in which event he may be said to become a part of the machine itself. Whereas from the humanitarian and social viewpoint this conclusion is cruel and dangerous and should be held erroneous, in the material sense, it is inevitable. Being composed of flesh and blood, the worker must be fed and rested and kept happy, but he is as much a part of the machine he is operating upon as any gear or shaft in it. Owing to constant repetition, a record of his motions is made in his brain, and no matter whether it be a chemical, electrical or physiological transformation, the record exists as a physical fact and the original motions can be reproduced from it at will. Could we but detach this record from him and operatively connect it to the mechanism we would have the very acme of an automatic machine.

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*_Cassier's Magazine_, November, 1912. See also _Literary Digest_, page 126, Jan. 18, 1913.

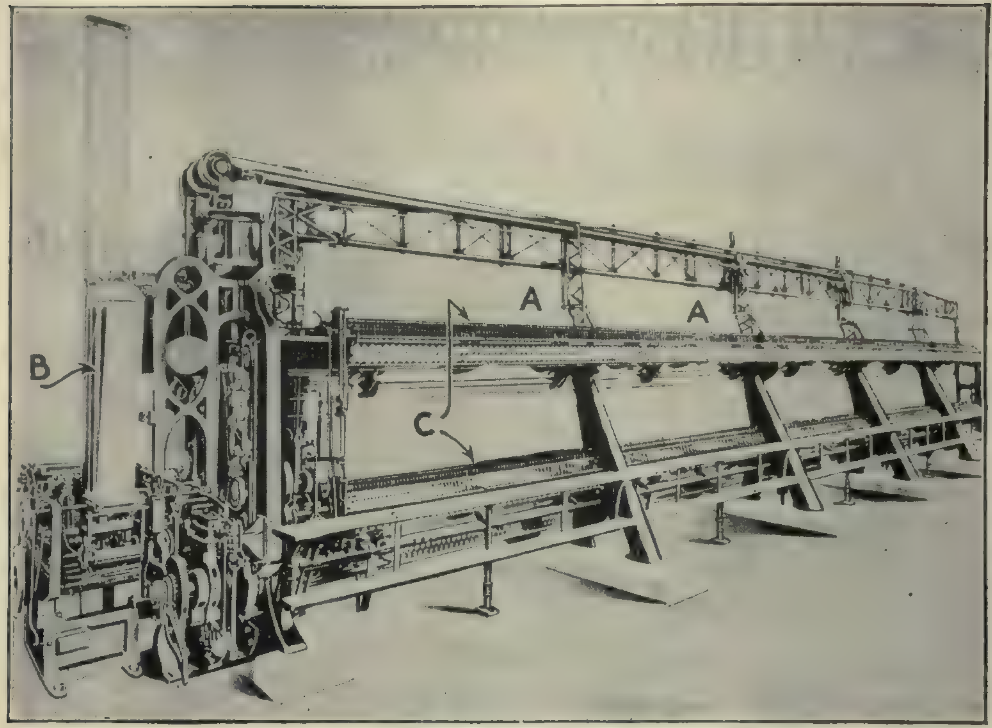

FIG. 2. JACQUARD EMBROIDERY MACHINE

On the other hand, in complicated work, he must keep on the alert and exercise his utmost skill, his actions never becoming automatic, and when duplication is required it seems a great waste that all this mental effort must be repeated.

The comparatively new science of efficiency engineering endeavors to eliminate lost motion and lost thinking in manufacturing operations. Recent progress in this field makes use of the motion picture machine to obtain a picture record of a workman's motions. Gilbreth, an efficiency engineer, analyzes the records thus made and constructs in wire a graph of the path of the hand in performing the operation. It is the next and logical step to replace the hand by a machine part which will imitate the hand's actual motion, the motion being controlled by a previously prepared record.

"There is no more need for the skill of a man's hands to die with him than for the printed record of his thoughts to vanish from the page when he leaves this earth. The movement of the hands, as well as the word spoken by the lips, may become as effectively recorded for future service as the written word or the printed page."*

However, it is not always necessary to imitate exactly the hand's motion as substitute motions better adapted to a machine part may more easily accomplish the same result. The hands and arms are universal tools adapted for all sorts of operations and functions and for none in particular, except perhaps for eating, in which connection the slang expression "lunch hooks" is very illuminating. They are nothing but jointed structures worked by a number of strings and springs of limited range, which may be obviated in a machine designed to order.

The types of control used for producing the motion of the parts of automatic machines can be divided into two general classes. One class is for effecting a pre-determined timing or sequence of action of the parts of a machine, or determines *when* the parts are to come into action. The other class is for bringing about the motion of the parts along predetermined paths as well as for effecting their successive speeds and directions of motion; that is, *how* the parts of a machine are to act. Many controls are combinations of these two classes. An example of the first or "when" class is afforded by the Jacquard loom perforated card mechanism, which determines the sequence in which the threads of the warp are lifted.

It is in the development of the perforated record for controls of the second class, that big things can be looked for. Most automatic machines of this class are controlled by cams, but cams are limited to the control of motion where the distance traveled is short and where the motion follows a fairly simple path. Although the machine itself may run for hours, it is really repeating the same operation over again every few seconds. Linkages may be used in some cases, but they have even greater limitations than cams. The majority of hand-controlled machines are such because no cams can be constructed for the operation of a complicated motion or an operation of long duration through an extended distance. The cams become too

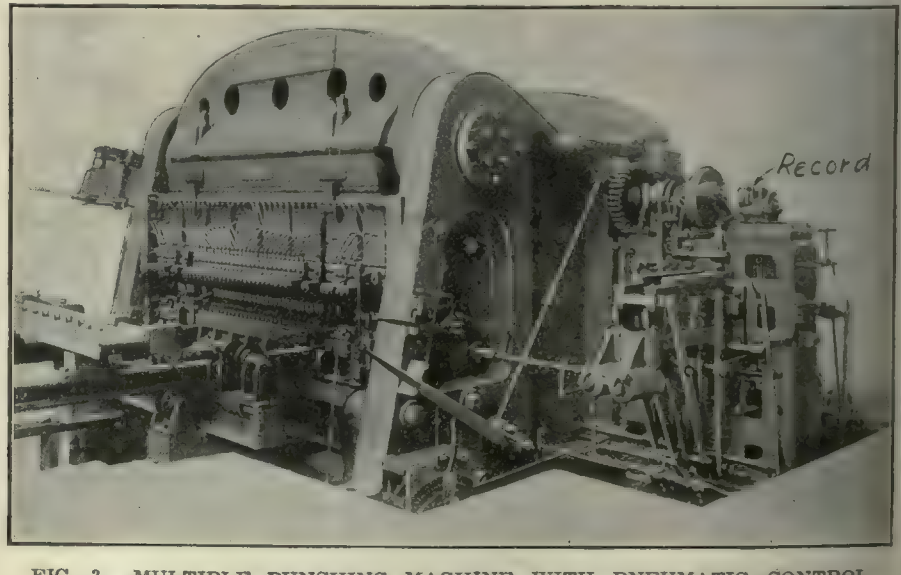

FIG. 3. MULTIPLE PUNCHING MACHINE WITH PNEUMATIC CONTROL. FRONT VIEW, SHOWING ARRANGEMENT OF GAGS AND SPACING [illegible] MECHANISM

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*H. H. Suplee *Scientific American*, page 344, Nov. 1, 1913.

cumbersome and it is often impossible to give them the form necessary for the desired motion. With a perforated paper record, the length of an operation by a machine, be it five minutes or an hour, is of no moment, as paper can be obtained in strips of almost any length. Nor does the complexity of the operation present any difficulty, the only effect being a greater variation in the way the perforations follow each other on the record.

USES OF AIR AND ELECTRICITY

There are two successful types of piano records in use at the present time, one a perforated sheet of very thin paper and the other a perforated sheet of thin brass. While both are perforated they act upon entirely different principles. The paper record controls the admission of air into the operating mechanism, while the brass record, while taking no part itself in the circuits, mechanically operates tumblers to make and break electric circuits. Fig. 1 shows a form of apparatus in which a paper record is used to make and break electric circuits. Here the record controls the admission of air into little cells containing thin leather diaphragms which are puffed in and out against metallic contacts, opening and closing electric circuits thereby.

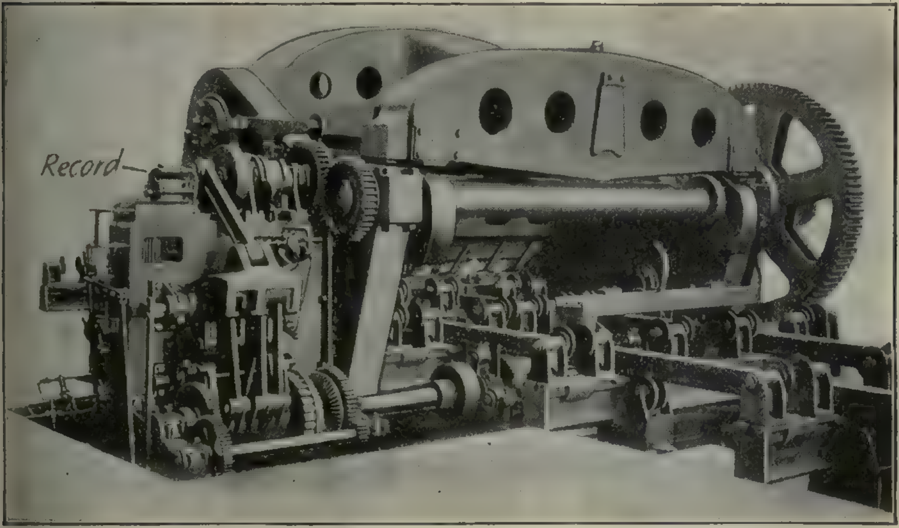


FIG. 4. REAR VIEW. SHOWING DIVIDING WHEELS AND ROLLERS FOR CARRIAGES

Each of the holes shown near the upper part of the mechanism is adapted to close the circuit through a corresponding binding-post. These holes are known as "tracker ducts." In controlling the action of a lathe, the electrical part is omitted, the tracker ducts actuating pneumatic cylinders instead.

It is thus seen that as a piano record is set in motion a series of disconnected impulses are generated, each impulse corresponding to a note to be struck, the various hammers of the piano being actuated at various times. All that is controlled is the time at which the hammers are struck, no control being exercised over its speed or direction of motion. A machine which is to imitate the motion of a hand, or more strictly speaking, a machine which after being put through its various operations under manual control will afterward automatically re-perform these operations, presents a different problem. In this case, all the disconnected impulses acting upon disconnected bodies must be concentrated upon one body and be in continuous control of its motion both as to speed and direction. A step toward this is found in one type of Jacquard controlled embroidery machine, but as will be seen, it is still far short of the desired object.

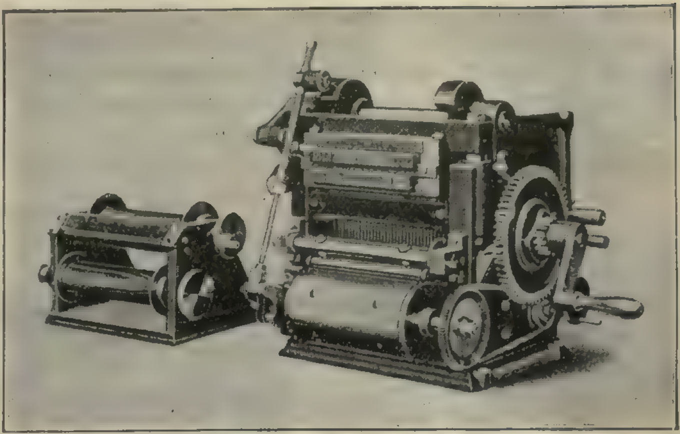


FIG. 5. TEMPLATE PUNCH AND CHECKING STAND

Toward the latter part of the Nineteenth Century the Jacquard mechanism came into use for the control of the motion of the fabric frames of embroidery machines. We see here for the first time the disconnected impulses of the perforated record, concentrated upon the motion of a single body, controlling the extent and direction of its motion for each impulse. To the world in general and even to the engineering world, little is known of these complicated and highly developed machines, one of which is seen in Fig. 2.

The fabric frame of an embroidery machine, which is often as large as 45 ft. long by 10 ft. high, is suspended in a vertical plane. The fabric *A* to be embroidered is stretched over it. The frame is so mounted that it is free to move in any direction in this plane, and counterweighted so that it moves easily and always with a motion of translation. A record *B* which is perforated in accordance with the desired design causes the frame to carry the fabric about in front of the needles *C* whereby the design is embroidered as the needles stitch. All the various motions of the machine are actuated by a rocker shaft which reciprocates a series of links fastened to it at various distances from its center and consequently having different lengths of stroke. The action of the links is controlled by the perforations in the record. The various holes in the record, which is fed intermittently and pushed against rods as in the Jacquard loom, cause a set of driving gears to be rotated. The amount and direction of this rotation deepnds upon the location of the perforations on the record. The driving gears engage with corresponding racks suitably connected to the fabric frame to give it the desired motion.

There is undoubtedly a large and undeveloped field for the application of Jacquard mechanism of the type just described, or some modification of it, to other than embroidery machines. It must be borne in mind that the distinguishing characteristic of this type over the older forms of Jacquard mechanism is that all the different perforations of the record and the isolated impulses resulting from them instead of controlling the time of operation of a number of different bodies, are concentrated upon the control of the motion of a single body, its direction of motion being controlled as well as its time of operation.

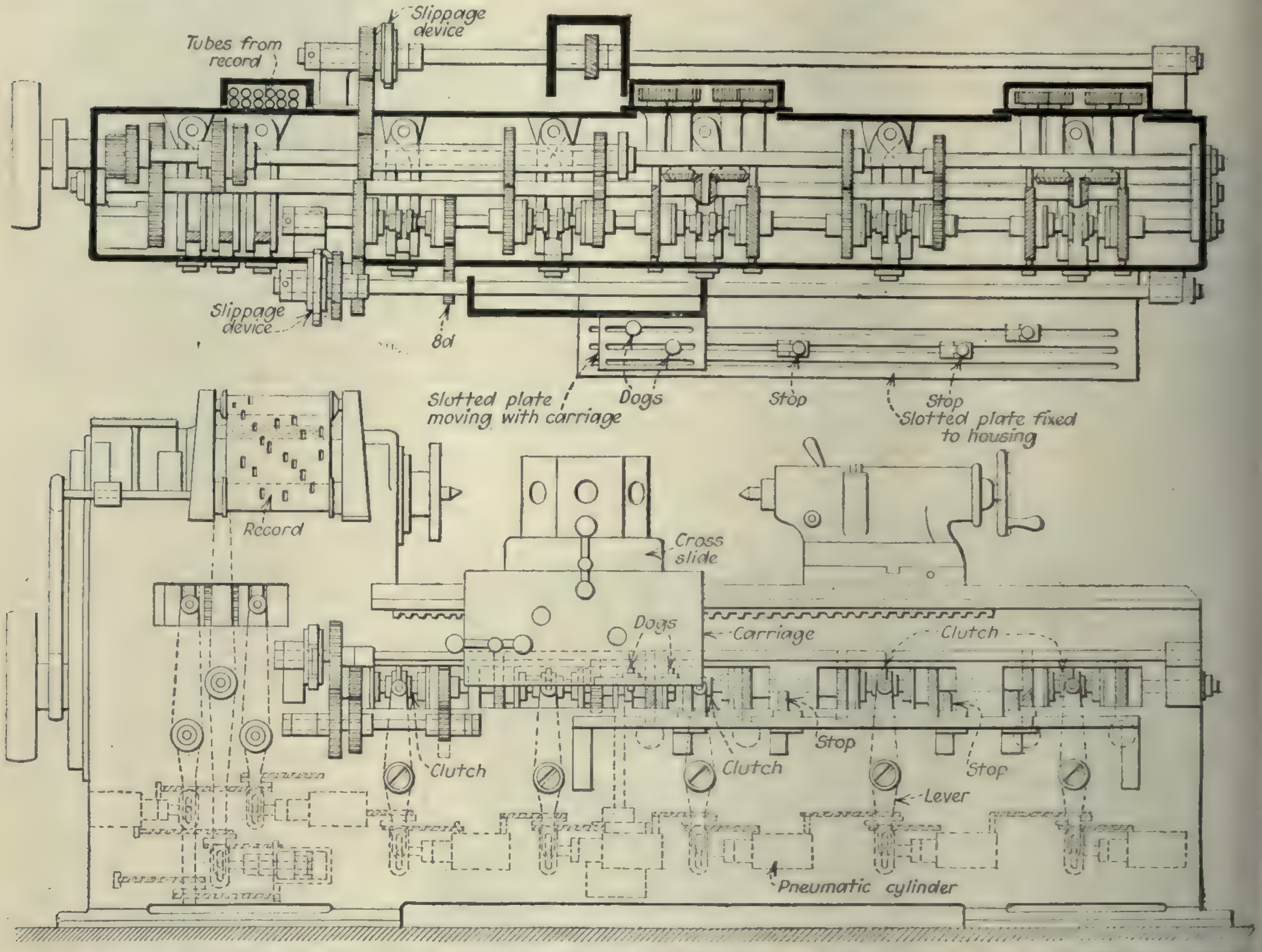


FIG. 6. (Below) FRONT ELEVATION OF PROPOSED RECORD-CONTROLLED LATHE. FIG. 7. (Above) SECTIONAL VIEW JUST BELOW BED OF LATHE

An interesting application of perforated paper record control to metal-working machinery is to be seen in the automatic multiple punches of William Sellers & Co., Inc. The enormous machine shown in Figs. 3 and 4 is controlled by the holes in a frail paper record, heavy structural steel members being moved step by step under the punches which are caused to operate as so many piano keys. Fig. 5 shows the template plate used for making the record.

From a magazine roller, carrying a large supply, located at the back, the paper passes forward under the punches, each of which is controlled by a key bearing a designating figure. The keys are pushed into action by the operator as desired. Each key represents either the engagement of a punch on the machine or a movement of the spacing carriage. After selecting the proper punches and spacing for any stroke of the machine, the crank is turned one revolution which perforates the paper and resets the keys. As the template paper is fed throught the machine it is coiled on a removable roller, and when completed may be transferred to the checking stand shown in the illustration at the left. It is fed through the checking stand by hand and the perforations examined for the detection of possible errors.

In the manufacture of structural steel, it is necessary to punch thousands of rivet holes with all sorts of irregular spacings. Instead of laying these holes out by hand or by the use of templates, a paper record is made in the drafting room. Some of the holes in the record control the distance the steel member is to be moved between punchings, and others of the holes select which of the punches are to come down for each of the settings.

A huge punch bar reciprocates over a row of punches, its downward stroke just falling short of the top of the punches. When a piece of metal, known as a gag block, is thrust between the reciprocating punch bar and the top of a punch, instead of falling short of the punch at the end of its downward stroke the punch bar now drives this particular punch by means of the intervening gag block. A gag block is provided for each punch, and each gag block is attached to the piston of a pneumatic cylinder. A tube extends from each of these cylinders to the record and when a hole in the record comes over one of these tubes, its corresponding piston is pushed out, bringing a gag block in position over a punch. The work is mounted on a carriage which moves over rollers. To the underside of the carriage are attached two parallel racks with which a set of driving gears engage. The rotation of these driving gears, and hence the movement of the work, is controlled by the record. Attached to the driving gears is a ratchet wheel which rotates a partial turn at each stroke of a pawl. The length of stroke of the pawl is controlled in differing amounts by corresponding holes in the record, much the same as described in the embroidering machine mentioned before. As in the embroidering machine, the record is fed with an intermittent motion.

WHY NOT APPLY THIS PRINCIPLE TO THE LATHE?

A modified form of the Jacquard, adapted for the control of machine tools of the turret type, is proposed by the writer.

The lathe equipped with the Jacquard cannot compete with the ordinary cam-controlled automatic lathe for certain classes of work. It is suited for handling work which is larger or more complicated than can be handled by cam-controlled machines; such work as at present can be more economically made on a hand-operated turret lathe or an ordinary engine lathe.

The cross-slide, Fig. 6, is controlled in its motion from a slotted feed shaft in back of the bed of the lathe (Fig. 7) and the carriage is driven by a feed shaft in its usual location in front of the bed. Clutches are used to cause the engagement and disengagement of these shafts with a power shaft, the gearing between them and the power shaft being such that reversals of direction can be obtained by the engagement of some of the clutches. Others of the clutches bring into play different sets of gearing whereby the traverse and feed of the carriages can be varied in speed. Still others of the clutches control the different spindle speeds. All of the clutches are shifted by levers, one end of the lever being forked over the sliding part of the clutch and the other end fastened to the piston rod of a pneumatic cylinder. As air is admitted on one side or other of the piston in the cylinder, the clutch is thrown into engagement with its mating parts. The action of the cylinders is controlled by the perforations of the record, which choose the cylinders that are to operate as well as the length of time the pistons are held in any desired position. The motion of the perforated record, which is fed continuously, is similar to that used in automatic pianos, except that in this case the perforations control the motion of levers instead of operating the keys.

Owing to the fact that when the clutches controlling the motions of the carriage and cross-slide are thrown in by the perforations of the record the carriage and cross-slide may overrun or fall short of the required motion, so a number of adjustable dogs and stops are provided to arrest the motion at the correct places. The cross-slide and carriage have projecting from them slotted plates in which the dogs can be bolted in various positions and in a similar manner the stops are bolted in various positions in corresponding slotted plates fixed to the housing of the machine. Certain perforations in the record control the action of these stops, a stop being able to arrest the carriage or cross-slide only when the corresponding perforation comes into position.

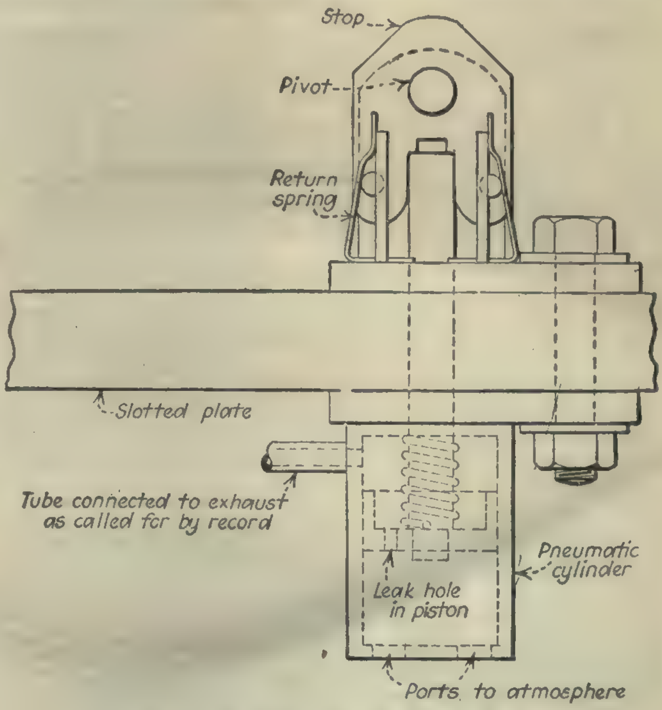


FIG. 8. PNEUMATIC CONTROL-STOP

In Fig. 8 it can be seen that the upper end of the stop is beveled and rounded off while its lower end is bifurcated. The stop swings about a pivot supported in an upright which is fixed to a base, which can be bolted to one of the slotted plates. A piston rod is adapted to enter the bifurcated lower end of the stop and thereby prevent it from turning about its pivot. When a perforation of the record corresponding to a particular stop comes into proper position, air is exhausted above the piston, which causes the piston to rise against the pressure of the spring which normally keeps it at the bottom of the cylinder. As the piston rises it forces the piston rod into the bifurcated end of the stop and now, when a dog fixed to the carriage comes against it, the motion of the carriage is arrested. When any other dog passes over a stop, as there are no perforations calling for the actuation of the piston it is kept down by its spring. As the dog goes by, the stop is rotated about its pivot until the dog clears, when springs bring the stop back to its vertical position. The perforations for the stops are so placed on the record that a stop is thrown in before the perforations calling for the engagement of the corresponding clutch are out of action, thus causing the carriage or cross-slide to be used against a stop, the feed shafts being provided with a slippage device which permits part of the driving mechanism to be rotated by the clutches while the other part is stationary. The slippage device is adjusted to have sufficient grip to hold for the cutting action of the tools, but will give when the carriage is arrested by a stop. It resembles in principle that used in the Hartness flat turret lathe, in which the carriage is fed against a stop which arrests its motion even though the operator continues to operate the feed.

Having determined the operation, speeds and feeds necessary for turning out a given piece, the record is laid out in the drafting room and the lathe is set up by fixing the tools in the turret and setting the dogs and stops in their proper positions. Now as the record feeds (with a continuous motion) the various perforations control the motions of the carriage and cross-slide as well as their speeds of feeding and traversing and the desired successive spindle speeds.

Machining Motor Parts for Northway Trucks

Describing Some of the Jigs and Fixtures Used in One Shop—Method of Lightening a Crankshaft—A Good Milling Fixture

BY ROBERT MAWSON

THE writer has undertaken to describe some of the more interesting operations in the manufacture of the Northway truck, which is made by the Northway Motors Corporation, Natick, Mass. This concern produces two sizes of trucks, having capacities of 2 and 3½ tons, respectively.

The first operations in machining the cylinder head are milling the top and bottom of the casting. This is then bored for the pistons in a "Hole Hog" as shown in Fig. 1. The casting is placed in the fixture resting on the base as shown and forced against the stop screw *A*, at the left, with the knurled head screw *B*, and against a stop at the rear with the screws *G*, after the swinging clamps in which these fit have been brought into position.

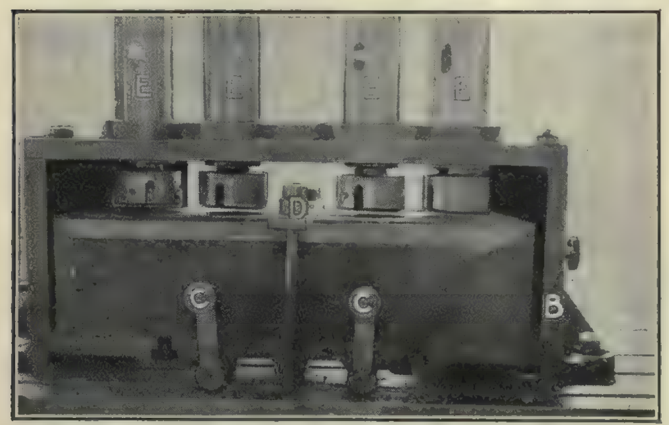


FIG. 1. BORING CYLINDER HEAD

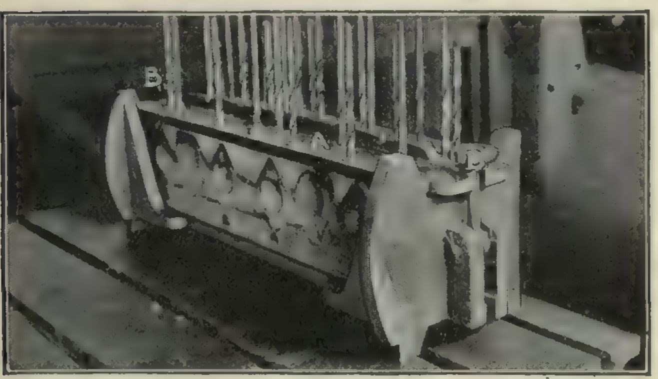


FIG. 2. DRILLING CYLINDER HEAD, VALVE SIDE

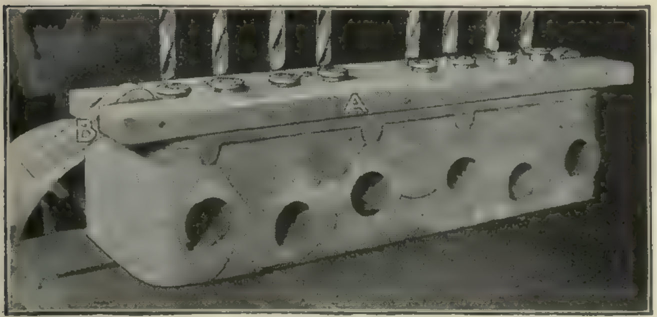


FIG. 3. MACHINING VALVE STEM HOLES

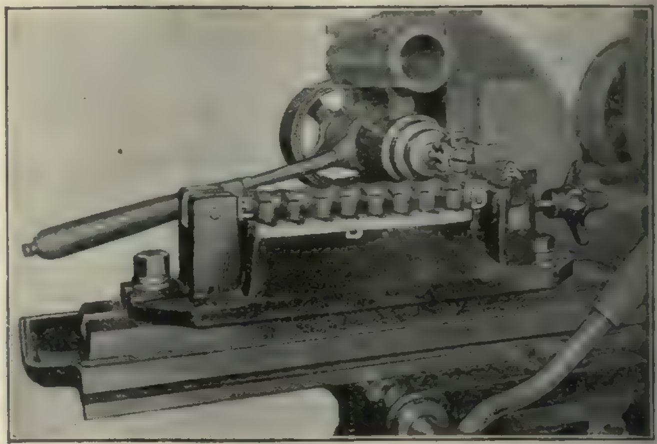


FIG. 4. MILLING ROCKER ARMS WITH FORM CUTTER

The clamp *D* is next tightened and the pressure exerted by it holds the casting securely in position in the fixture. The cutter bars *E* are guided through long bushings in the fixture cover so that the holes are bored parallel, after the spacing of the bars has been once obtained on the machine. Two sets of boring heads are used for the machining operation, the final set leaving enough material in the holes to grind out to the finished diameter of 4 inches.

The next operation is drilling the holes on the valve side of the cylinder head and is performed in the jig shown in Fig. 2. This tool is made with a cradle into which the casting is placed, being located by means of two cylindrical plugs, integral with the jig, which fit into the holes that were bored in the previous operation.

The cover *A* is then placed in position, being located in its relation to the cradle or base with two dowels, the swinging bolts are placed in their respective slots in the cover and as the knob nuts *B* are tightened on the bolts, the cover of the jig is thus fastened down securely on the cradle.

DRILLING STUD HOLES

With the casting in this position twenty $\frac{31}{64}$-in. holes are drilled half way through the cylinder head and six holes are drilled which are later tapped for $\frac{3}{8}$-in. studs and used to hold the rocker arms.

Referring to the illustration, it will be noticed that the jig is made with two circular ribs on one side, these being provided so that the operator can turn the jig over, bringing the base to the top. This feature makes it unnecessary for the man to raise the tool from the table as would be the case if the sides had been made square box shape.

The jig now assumes a reverse position and the operation of drilling the twenty $\frac{31}{64}$-in. holes is completed. These holes are the clearance-holes for the studs by which the head is attached to the cylinder. It will be seen that bushings are provided both in the cradle and cover to guide their respective drills, and the operation is performed in a multiple-spindle drill press.

The casting is then transferred to two multiple drill presses facing each other, where the eight valve stem holes are machined. The set-up for this operation is shown in Fig. 3. The holes are first drilled to $\frac{23}{64}$ in., the piece being again located by means of two circular plugs fitting in the holes bored in the first operation.

The cam levers *B* of which there is one on each end of the jig, are then raised and as the inner end comes under the inside flange of the casting, the jig is forced down and held securely in position. The holes are then drilled, the tools being guided through the bushings shown.

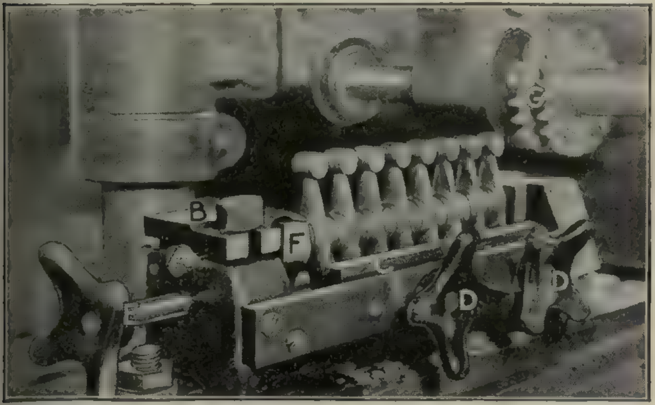


FIG. 5. STRADDLE-MILLING ROCKER ARM BOSSES

The jig and casting are then transferred to the multiple drill press facing the one shown and the bushings exchanged for a set to suit the reamed sizes, after which the eight holes are finished.

Machining Rocker Arms

The first operation in the machining of the rocker arms is drilling the fulcrum pin hole, a simple jig being used which is not shown here. The arms are then placed on the pin, eight at once, in the fixture shown in Fig. 4. The pin with the forgings is then swung down and held with the clamp *A* the pieces resting on two steel surfaces, of which one is shown at *B*.

The binding screw is next tightened by means of the knob *C* and this exerts pressure on the block which forces the forgings along the center pin to the stop collar *E*, thus holding them for the milling operation and preventing chattering. The machining of the pieces is performed with the formed cutter *F*, after which each rocker arm is tested with a gage to see if sufficient material is left on it for the next operation.

The pieces accepted are then placed in the fixture shown in Fig. 5, being placed on the pin *A* which is held by the clamp *B*. The steel bar *C* is next forced against the forgings with the two knob nuts and screws as shown. The action of this bar is to force the various rocker arms back against stops at the rear, thus locating them accurately in relation to the surface machined in the previous operation.

The knob and screw *E* being tightened, force the forgings along the pin on which they are mounted to the top shoulder shown at the rear end of the pin, thus holding them against machining stresses. The gang cutters *G* are properly set to obtain the desired width of boss and as the table carrying the fixture and pieces passes under the revolving mills, the rocker arms are machined as desired.

The milling of the intake manifold is done on a Potter & Johnson automatic using two cutters, one cutter operating on the cylinder flanges and the other on the carburetor flange. The construction of the two fixtures is very similar and the one employed for the latter operation only is shown here.

After the cylinder flanges have been machined, the casting is placed in the fixture shown in Fig. 6, with the finished surfaces resting against the wall *A*, being secured in this position by the screws *B*. Two clamps *C* assist in holding the pieces rigidly in the fixture.

The carburetor flange is then machined with the inserted end milling cutter *E* the empty spindle *F* being used to hold the cutter employed to machine the cylinder flanges when the two fixtures are in use together.

Machining the Crankshaft

Some of the operations followed when machining the crankshaft are of unusual interest. Machining the line bearings on the crankshaft is a simple lathe proposition, as they are all in line and can be turned all at one setting. When machining the connecting rod or throw bearings a different method must be used in order to get the proper throw and also to turn the various bearings so that they will be parallel with the line bearings.

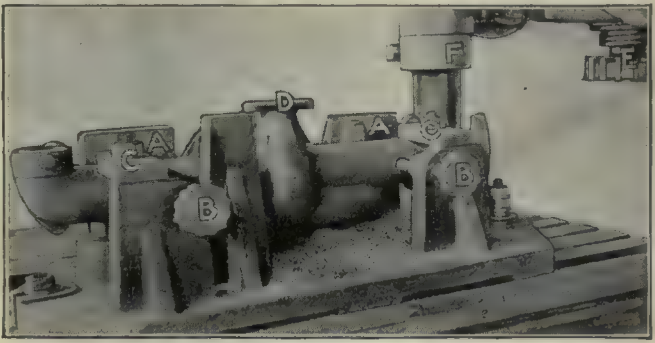


FIG. 6. MILLING FLANGE ON INTAKE MANIFOLD WITH INSERTED TOOTH CUTTER

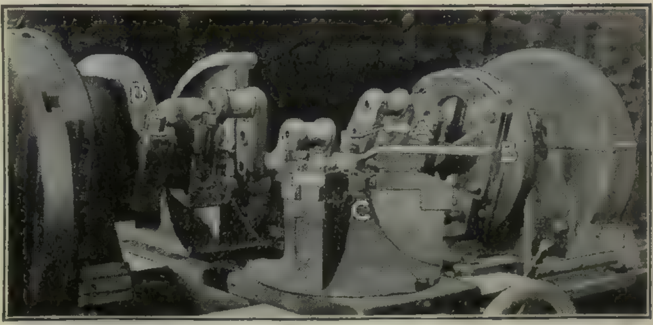


FIG. 7. TURNING CRANKSHAFT BEARINGS

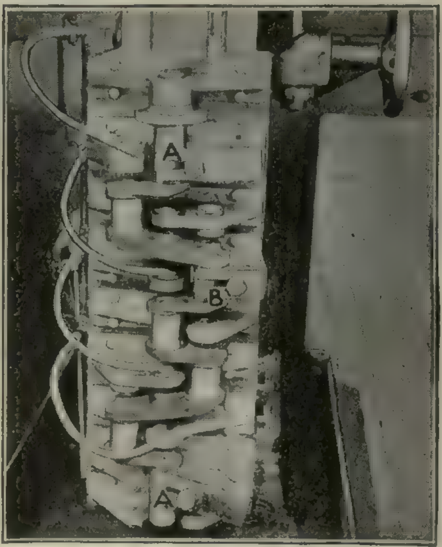


FIG. 8. DRILLING BEARINGS LONGITUDINALLY

The crankshaft lathe shown in Fig. 7 is used for this work. The outside bearings are held in the V-clamps *A*, one at each end, the two faceplates *B* being over from the center an amount equal to half the throw of the crankshaft, and one set of connecting-rod bearings are machined. The crankshaft is then revolved 180 deg. on its axis and placed in the V-blocks again and as the throws are an equal distance from the main bearings, the other set of connecting-rod bearings are in position for the turning operation.

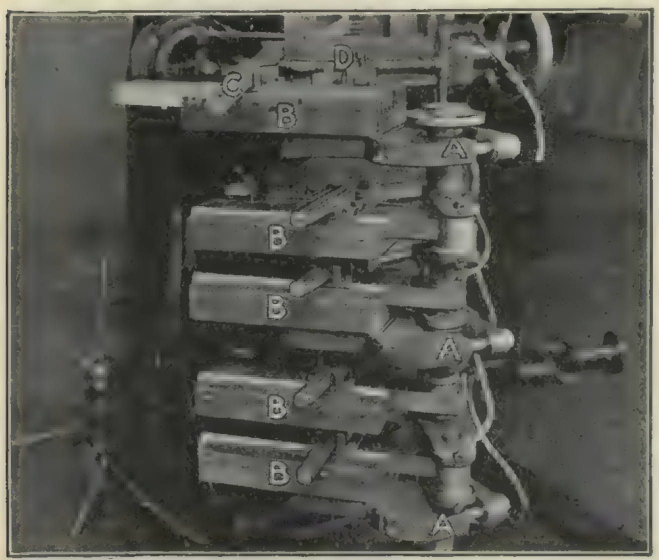


FIG. 9. REAMING HOLES IN CENTER BEARINGS

The tools used for turning these bearings and forming the radii are carried in the special toolpost *C*. It will be seen that the crankshaft is held rigidly in this lathe and the drive is positive so that after the faceplates have been correctly located all the bearings will be the same, having similar throws. As this concern makes all its motors with the same stroke, it is not necessary to change the position of the faceplates after they are once set.

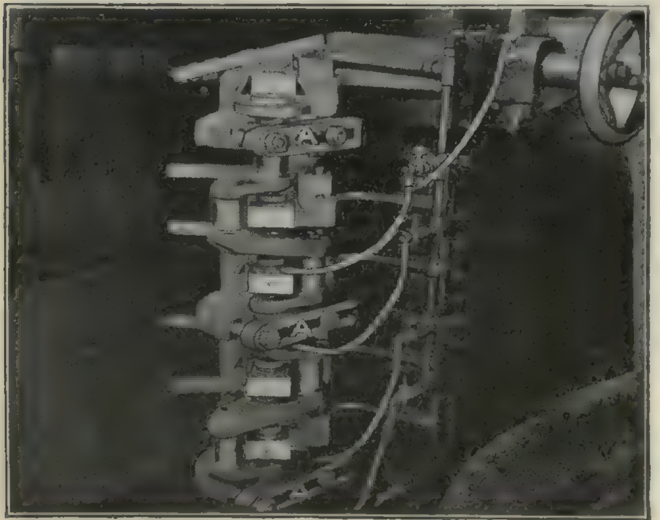


FIG. 10. ANOTHER VIEW OF REAMING FIXTURE

LIGHTENING THE CRANKSHAFT

In order to lighten the crankshaft, holes 1⅛ in. in diameter are drilled through the entire length of each bearing. The jig used for drilling these holes is illustrated in Fig. 8. The shaft is located and held in the jig by clamping both end bearings in V-blocks as shown at *A* and *B*.

Bushings are provided in the jig for each bearing, so that the drill is guided for the entire length of the holes. Lubricant is also fed through the four pipes as shown to assist the drilling operation.

The holes in the main bearings are then finish reamed in the fixture shown in Fig. 9. The shaft is placed in the three V-blocks *A* which act as locating points, being held by the clamps shown.

SLIDING BUSHING BLOCKS

The five sliding bushing blocks *B* are then pushed into position to guide the reamer. The operation of these blocks is rather novel and can be seen better by referring to the top one which is not in position. The man taking hold of the handle *C* slides the block along until he can drop the inner end of the handle between the two blocks (*D*), at which point the bushing is in the correct location.

Another view of the fixture is shown in Fig. 10, from which a better idea of its construction can be obtained. The locating V-blocks and clamps are shown at *A*. It will be noticed that the sliding blocks that hold the guide bushings are of dove-tail construction, provided with gibs for taking up wear and to allow for adjustment.

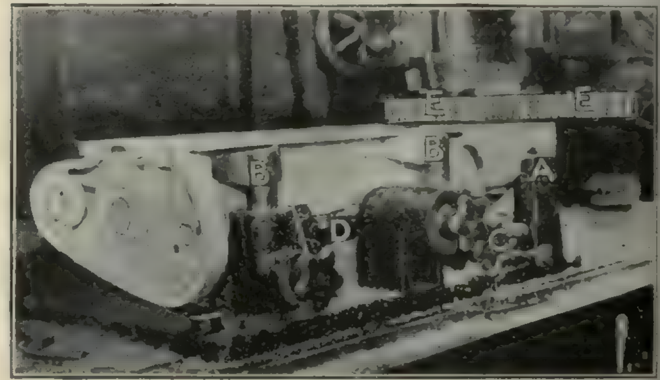


FIG. 11. SURFACE-MILLING CRANKCASE

The two machines on which the driling and reaming operations were performed are next to each other and in close proximity to the crankshaft turning lathe, so that the pieces pass along in sequence of operation to the final assembling of the motor.

MILLING THE CRANKCASE

An interesting fixture shown in Fig. 11 is used to hold the crankcase for milling the cylinder face. The casting is placed on three fixed pins, one of which shows at *A*, the other two being on the rear side. Spring plungers *B* are then allowed to come up against the under side of the flange, where they are fastened in position by means of the knob screws shown.

It will be seen that these plungers are made with large heads, so that the thin flange is well supported. The screw *C* is then tightened and this operates the equalizer *D*, forcing the crankcase against two stop pins at the rear.

Clamps are next tightened on the inside of the piece to hold it and the machining is done with the inserted tooth milling cutters *E*, which are large enough to finish all the surfaces at once.

Why Prices Are Cut Below Cost

Danger of Trying To Maintain Prices on a Falling Market—Effect of Price Guaranties—A Failure Hurts the Whole Community

BY ERNEST F. DUBRUL
General Manager, National Machine Tool Builders' Association

MANY business men who are caught at the crest of a buying wave with a high cost stock seem to think their goods are not going to be sold below that cost, and they hang on in desperation, trying to get their money out, instead of taking their loss. This is because they do not understand how business moves in cycles. They do not understand that the price that they are going to get for their goods has nothing to do with the cost of production of those particular goods.

On a rising market they are very much gratified to find prices going up, and that goods that they have held can be sold out at a higher rate of profit because new goods cost more. Their ignorance of the converse is pitiful. When the wave recedes they cannot understand that the same fundamental principles apply—that is, that *it is cost of reproduction that will govern the price of goods.* They try to hold out in the face of decreasing costs, and to at least get out of their sales the cost of the goods. Those who hang on in desperation finally take a larger loss than they would have had to take if they had quickly reduced their prices with the receding demand, and stepped down easily and gracefully, instead of finally falling over the precipice with a dull thud.

One reason why prices are cut below costs is that business men work themselves into a financial state that compels them to jettison cargo to save the ship. The larger the excess stock, unwisely or unfortunately accumulated, the greater is the loss.

The most common cause of prices going below the real cost of reproduction is due to sacrifices that have to be made by those somewhere in the system who have allowed their tanks to fill up too far and too fast, and who did not realize the rate of flow down through the system, and who did not regulate their own valves so that the supply would be adjusted to demand.

Some men have thought that prices and supply can be artificially controlled. They have gotten together and made agreements to divide territories, or to maintain prices, or to restrict output, and by various other devices to control the flow artificially. But these arbitrary, unnatural devices never have worked for any considerable length of time. They never can, and they never will work. If men, either individually or collectively, attempt to maintain their prices at an artificially high level, they simply bid for additional competition, and the higher the level they maintain, the stronger their bid is, begging competitors to come in and share their ill-gotten gains. And the competitor comes in, at some time or other. One of those who has begged the new competitor to come in begins to realize that the new competitor is getting a large share of the business, and is able to keep his plant full up while those inside the combine are only working to partial capacity. His interests demand that he break his agreement with his competitors—and he does it, and reduces his price—and the rest follow.

In the resulting scramble for business, prices go on down until they go so low that it does not pay anybody to make that particular line of goods, and there they stop, because they cannot go any farther. If the new competitor has provided more facilities than the market justifies, or if the old competitors together have added more facilities than the market actually justifies there is an essential waste of capital, measured by the amount of excess facilities.

Society does not benefit by having an over capacity. That capital came from somewhere—either from profits, or savings, in other lines of business, or out of the same line itself. Perhaps, in the last analysis, it did not come out of income at all, but actually came out of the patrimony of the country in the way of natural resources. An industry in that shape simply has to sit down and wait for the country to grow up to its capacity. The inefficient, or less efficient competitor will finally be wiped out. If his plant is out of date and is not worth salvaging, the plant will be wiped out. But if his plant is able to produce about as cheaply as the others, the plant will not go out of business, but new capital will buy it in at the sheriff's sale at a price below its cost of reproduction, and the new capital will be in a much more favorable competitive position than the old competitors. The reorganized plant will be trading on the losses of the previous owners and will not have to earn as much money to pay dividends on the new capital as the old ones will have to earn. It has been found by hard experience that it does not pay to try to put competitors out of business for that reason. Nature provides its own remedy for economic ill health.

If a man foolishly builds a sky scraper out in the suburbs of a large city, when he tries to rent it he cannot find tenants enough to fill it and to pay his operating expenses, to say nothing of interest and profit on the investment. But very few people are quite so foolish as that in the building line. They know that the demand for sky scrapers is not out in the suburbs, but down in the business sections, where more people want sky scraper offices. Therefore sky scrapers are built where the demand is. In other words, they bring the supply of floor space to meet the demand.

Unfortunately, the ordinary business situation is not so clear, and as a consequence we find a great many industries that are over-built, having entirely too much capacity for the real demand for their product. Very few industries have been able to know indefinitely what is the real amount of their demand.

No man goes into business in which he is sure that he is going to lose money. He perhaps knows that there is some chance of losing it, but he figures the chances as mostly in his favor, and not against him, otherwise he does not go in. If his information is defective and he does go in, not knowing what is the real demand for his product, he tries to keep on forcing his product on the market through lower and lower prices. His competitors follow him on down, and finally prices are below the costs of some of them, and some of them go out of business. This restricts the supply and the next buying wave comes along, increases the demand, and those who are left can make a little money.

The same process is repeated on the next wave with new and equally ill-informed producers.

This is another reason why prices go below the cost of production. Practically all of the reasons get down to mal-adjustment of supply to demand, and that maladjustment is due to ignorance of the amount of both supply and demand.

EFFECT OF PRICE GUARANTIES

In dull times many devices are used in the attempt to force a product on a market that is actually glutted. One such device is the *guarantee of price*. This practice is childish in its futility, but like other things men do through economic ignorance, it simply results in compelling others to cut below the one making the guarantee—it has just the contrary effect to the one expected. A man guarantees a price against decline to save himself from making a cut, not knowing that thereby he compels his competitor to undercut him, and eventually forces down his own price that he wanted to stabilize.

Nobody is ever asked to guarantee prices against decline except when a market is so evidently on the down grade that the buyer feels the need of such protection. When the sellers are hungry for business, they often try to get it by offering inducements other than straight reduction in prices, and then we hear of guaranties of this sort.

The question is, what are such guaranties really worth?

This question can be properly answered only from the point of view of fundamental economics. Last winter demand for automobiles was much below what it was a year before. Large automobile factories faced more or less idleness, and saw their overhead mounting, with relation to their sales. Buyers were apathetic as well as scarce, and the automobile makers were hungry for business. They had large stocks of high-priced materials on hand and did not want to face any more loss than they had to. Some, who evidently knew nothing or cared nothing for the economic law of the general equilibrium of prices, thought it possible to continue operations and stimulate business by guaranteeing not to reduce prices before May 1. They probably honestly believed that prices would not be reduced, then. So the guarantees were made effective.

A few buyers who were flush enough with money to buy anyhow felt that they had some sort of protection, but the orders they placed would probably have been placed anyhow. Other buyers knew that as everything else was coming down it would be impossible for automobiles to retain a price level above their economic basis and simply deferred their purchases or fixed up their old cars for another season. On the whole, it is doubtful if the high cost inventories were actually cleaned out at the higher prices, for by common report the automobile industry continued dull, and the price guaranty did not stimulate the trade in general.

But certain makers did not guarantee and maintain their price, they reduced prices and sold cars, and later reduced again. These few maintained a fair rate of production. But the others stuck to the guarantee. If they had sold a fair number of cars they would have had to rebate large sums in cash, and cash looked good this spring of 1921. The buyer who bought could well look out for himself, but numbers of these are very sore because prices were reduced, and very materially, although the price guarantee was almost universally cited in evidence of the impossibility of that occurrence. Those who maintained their prices have let a good part of their selling season go by, and are trying to get the trade going by making greater reductions than they would have found it necessary to make if that had been done earlier. Those reductions do not get back the good will lost.

Price guarantees lead competitors to cut under a natural price, and then compel the guarantor to go still lower to get back his fair share of the trade he lost by holding out against natural tendencies. They simply set in motion an economic force that acts exactly contrary to what was expected when they were started. Price guarantees are a sure sign of a weak market, and the wise buyer who is compelled to buy at the time is always glad to get them. They eventually give him a price that he really could not get at the time his order has to be placed.

EFFECT OF INELASTIC DEMAND

Price wars frequently start because some men do not realize that their demand is truly inelastic, and imagine that they can take orders enough to fill up their own plant when the actual available demand for a product has shrunk, due to a receding of the buying wave. They figure because overhead distributed over a larger number of units shows lower costs, that they can afford to offer their goods at a lower price and thereby get enough business to fill up the plant. This is true as a manufacturing proposition, but as an economic proposition it is fallacious when applied to a product of inelastic demand.

At the height of a buying wave with all stocks depleted. with the consumption valve wide open, with the manufacturer pushing everything through his "production" as hard as he can, unfilled orders keep mounting up, because he cannot produce as fast as orders are poured into his plant. Such a condition does not continue long before somebody increases facilities to get out all those orders. Yet considering demand over a period of years, the whole industry cannot possibly be run full time all the time. Pretty soon the buying wave recedes, cancellations blow off the excess pressure of unfilled orders, consumption is shut off, and stocks pile up again at a surprising rate. The system clogs. Then concerns that had been running at full capacity get the bright idea that they can keep on running by making lower prices than the economic level of that particular time really justifies for the industry as a whole.

What happens? Soon after their lower prices are made, every competitor is told about them, and probably told some false news as well as the truth. Every competitor knows that if he is going to maintain his relative position in the industry he has to reduce his prices to meet those of the first reducer; and he does it. Then the first man, still trying to fill up his production, makes another reduction. That is followed by the others, till bottom is reached. The attempt to run full time when the restricted market demand does not allow the whole industry to run full inevitably fails.

Suppose that at the peak of the demand the total market and total production facilities were able to produce but 100,000 units a month. The wave recedes, and the market is absorbing only 50,000 units a month. One competitor who had been making 1,000 units a month at the peak thinks that he can maintain more than his relative position and he tries it. For a while he may get a little more; but at the expense of his other competitors. But just as soon as they reduce their prices, he finds that his sales rate is no faster than 500 units a month. He figured his profit on the basis of 1,000 units a month, and he was willing to sacrifice a part of that to maintain a full rate of production, but in the final windup, when his production comes down to 500 units, through his competitors meeting his price, he finds he has sacrified some of his capital. He did not want to do that. He did not deliberately expect to incur a loss, but he did not see that his action would kick back onto himself. He only demoralized the whole industry, which would have been going along on a level of price that would at least carry overhead, and perhaps interest and depreciation over the whole period.

Many men who know nothing about the waves of business make this same mistake. Society as a whole does not profit by it because society as a whole will pay, and must pay the total cost of the goods that it requires; and that cost includes a profit sufficiently great to induce sufficient production, in the long run. If an industry were perfectly well regulated, it would figure its costs in such a manner as to take care of the waves up and down. Profits are of two kinds. One kind consists of normal profits, which are required to produce a normal supply for normal, steady demand, and the other kind are called conjunctural profits, which can be reaped only at times of excessive demand, in relation to supply.

Too many men deceive themselves with the idea of the "normalcy" of conjunctural profits, which are entirely abnormal. If they finance their business only on that basis they are sure to be financially weak when the next depression comes, and they lose their previous profits and a part of their original capital, trying to keep afloat.

If they sink they not only lose their own money, but almost always some of their creditors' money as well.

An Old-Time Radial Drilling Machine

By Milton Wright

The radial drilling machine shown in Fig. 1 is an example of the thoroughness with which the old-time machine tool builders put up their product. The machine was built by the Whitworth Co., Manchester, England, and purchased from them in the fall of 1867 by Baxter D. Whitney for use in his shop at Winchendon, Mass.

Arriving in this country in December of that year it was immediately set up and has been in service practically ever since. A year or two before the European war broke out it was retired to make room for a more modern tool, but during that period of pernicious activity it was reinstated and is on the job to-day, drilling holes within its capacity just as well, if not quite as fast as its neighbor.

It has many of the features of the modern semi-radial type of machine, including the power driven elevating screw for moving the radial arm up and down the column. The screws and gears are in good condition and show little evidence of their half century of service. Except that the drive is too light for so heavy a machine, it is to-day an excellent example of machine design.

It is not a "universal" machine; that type belongs to a later period. It will drill holes only in a direction parallel to the column, but that it will do as capably as if it were built yesterday.

As a reminder of the days when typewriters were unknown and all business correspondence was painstakingly carried on in longhand, the Whitworth Company's bill for the machine is shown in Fig. 2.

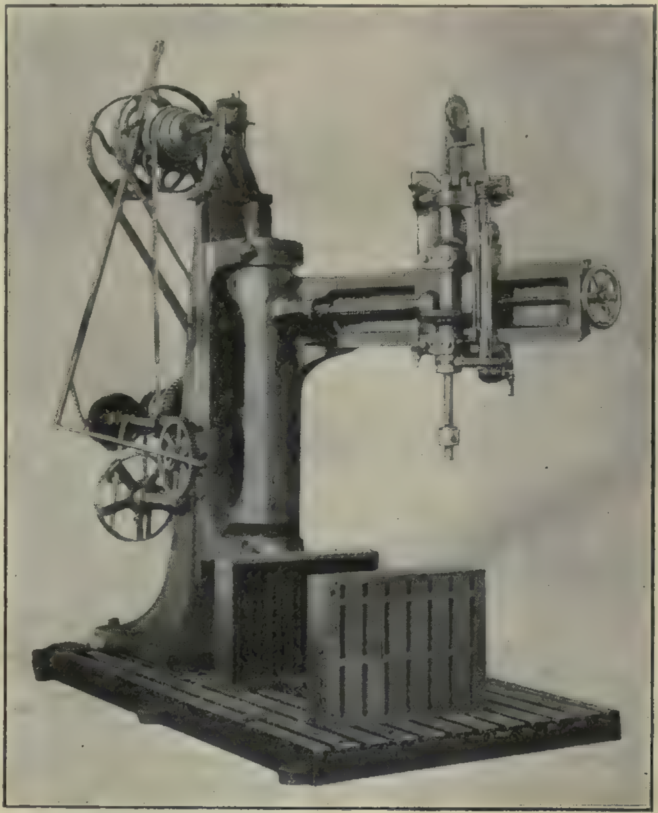
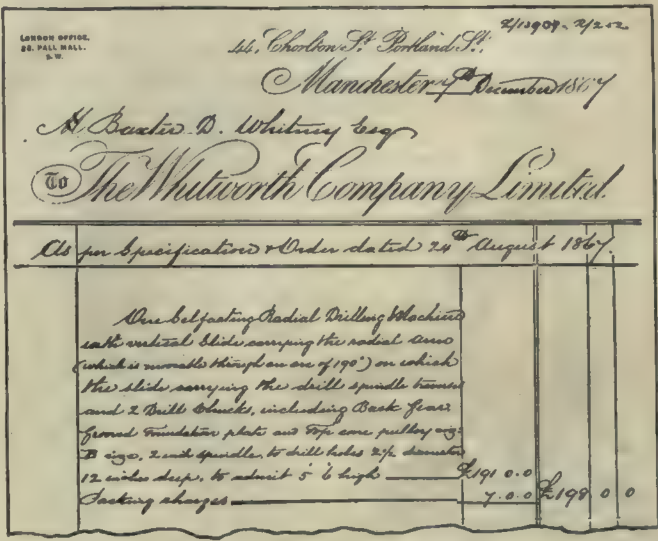


FIG. 1. AN OLD ENGLISH RADIAL DRILLING MACHINE



LONDON OFFICE,
26, PALL MALL.
S.W.

44, Chorlton St. Portland St. 2/13909 – 2/2 12
Manchester 7th December 1867

H. Baxter D. Whitney Esq
To The Whitworth Company Limited.

As per Specification & Order dated 24th August 1867.

One Self-acting Radial Drilling Machine with vertical slide carrying the radial arm (which is movable through an arc of 190°) on which the slide carrying the drill spindle traverses and 2 Drill Chucks, including Back Gear Grooved Foundation plate and Top cone pulley &c. B size, 2 inch spindle, to drill holes 2½ diameter 12 inches deep, to admit 5' 6 high — £191 0.0
Packing charges — 7.0.0 £198 0 0

FIG. 2. AN INVOICE OF 1867

England's New Dreadnaught

The firm of Armstrong, Whitworth & Co., England, is said to have been awarded the contract for one of the new superdreadnaughts ordered by the English Admiralty, at a cost of £7,500,000. It is estimated that it will require three years and the services of 500 men to complete the vessel.

Organization and Management of the Small Shop

IX. Going After Business—Cause and Effect of Readjustment—Opportunity for the Real Salesman—Some Pointers on Advertising

BY E. W. LEACH

SMALL shop managers and owners of large industrial plants are, at this particular time in our country's history, quite alike in one respect—they've got to go after business.

Picture yourself starting out for an automobile trip in a sporty little roadster with so much pep that you think it's going to jump right up off the road and into the air. Your tank is full of gas, you strike a stretch that's smooth and graveled, so you step on the accelerator and let 'er go. But something goes wrong, the engine stops dead, it just naturally quits you cold. On top of that you find you've been running on a flat tire. It's raining, and you're hungry. The service stations are closed.

What's the answer? Do you try to push the car in somewhere out of the rain and start walking home? Or do you take that casing off, look at the tube and get busy with your cement and patch? And do you look over your engine until you find where the trouble is? There are two ways of handling the situation; one is to be a quitter, and the other is to determine that you are going to get where you started for in spite of the hard work and the set-backs that you did not anticipate.

That is exactly the problem the small shop owner faces today in a way he has never faced it before. In other words, the quitters are going to be eliminated along with those who still think they are are on the joy ride that selling was equivalent to during the war; but the go-getters are going to get there.

Early in the fall of 1920 the buyers of the country decided it was time to begin deflation, time to put the prices of commodities on the downhill slide. As a consequence, we had what was called the "buyers' strike." It really did not start with the public at all, but with the manufacturers themselves. They were farsighted enough to see the economic danger in running along indefinitely on the abnormal basis they had been running on during the war.

Curtailment of purchases filtered down through the various links in the merchandising chain until the public, too, was holding back. It was a losing proposition, and the business men who were good sports and good business men took their losses with a smile in the form of reduced prices and reduced values on inventories, and sailed in with a fresh start.

The policy of buying from day to day then went back up the line from the public through the retailer, the jobber and the manufacturer, until the prices of raw materials were affected. As a consequence, the material cost of many manufactured products was lowered. And as there was a lessened demand for goods, there were less goods made, and a great army of unemployed workmen was the result. Those men who stayed by their jobs realized that a new industrial era was commencing, that new standards of efficiency and production would be demanded of them, that the old theory of "the survival of the fittest" was again coming into force. So labor raised its individual efficiency to prevent its wages from being lowered, and labor costs joined with material costs in sliding down the scale.

Lower costs permitted manufacturers to put lower prices into effect; the confidence of the buyers gradually returned; and at the time of writing the tide has definitely turned and business is on the upgrade.

"BACK (?) TO NORMAL"

"Back to normal" is the slogan someone suggested during all the commotion, as an expression of their desire to speed up the readjustment that would take the shakiness and unsteadiness out of Mr. American Business Man and enable him to walk once more with firm feet on solid ground. If we could only have caught that expression before it was put up to the public and changed it ever so little, what a lot of misunderstanding we could have prevented.

Back to normal times—it's that very first word that spoils it, because so many people have unconsciously substituted the word "backwards" and given themselves the unfortunate idea that they and the whole country actually ought to retrogress. This idea is absolutely out of all reason. Do you realize what it would mean to you and me if we had to go back ten years and begin again to build up from that point? Do you realize what a tremendous calamity it would be if all manufacturers jointly issued a bulletin saying, "Beginning the first of the week the prices of our goods will be exactly the same as were in effect before 1914; we will pay 1914 prices for our materials and supplies; we will give our men 1914 wages"?

Just think of what would happen if the back-to-normal idea were carried out exactly as its meaning has been suggested to some of us.

PROGRESSION TO NORMALCY

And is that what we want? No, the good old days of the past are gone forever. We don't want to go back to normal times, we don't want to go *back* to anything. It is true indeed that there must be a gradual change in the relation between price, production and profit; but let's make it a matter of healthy development; let's make the step a forward one! We can get back to normal just as easily and much more satisfactorily by going *ahead* through a new conception of the possibilities of the job before us.

A business never stands still long. When it does stand still, it is losing out. So you cannot stand still during the crucial days that lie ahead. You've got to go one way or the other. It's much easier to slide downhill than to climb uphill; but in the first case you land at a lower level, whereas if you choose the latter you reach the higher grades and put yourself in a position to realize the bigger things that are always to be found at the top.

Let's forget about days that are past and look into a future that can be just what we make it. Let's adopt a slogan, "Bigger business, bigger profits," equip ourselves to go after it, and get busy.

And where do you, Mr. Small-Shop-Owner, step in in this enthusiastic resolve to fight the fight with renewed vigor? Your place is entirely up to you. It can be just what you decide to make it. There is room for all, there is business for all. You only need to stir up some dust and then see how many dollars and cents there are in it. But it is a job that requires many characteristics that have been slighted for a while. It brings again into play a good many muscles we have permitted to become soft. Muscles strengthen through use, through hard work, and that is the kind of exercise the small shop owner must take if he is to experience continued success.

It is a case of exit the order taker, enter the real salesman. A few years ago we had too many orders, now we have too much goods.

And what are the knowing ones doing? Are they sitting fearfully at home hesitating to venture forth into added activity just because there is talk of labor unrest, Bolshevism and war? Are they laying down on the job because that is decidedly the easier thing to do? Are they drawing a line through their advertising appropriation because they feel that the results may not justify the expenditure?

They are not; not a bit of it. They are continually drumming up new business, and finding new ways to increase their sales. Of course that is a busy job, and it doesn't leave them any time to talk about depression. They realize that the business is there even though it is unquestionably harder to get; and they're going after it. During the winter they all tightened up a bit; it wasn't a retreat, they were just "digging in." It was a temporary entrenchment while they strengthened themselves for real aggressive fighting this spring, the kind of fighting that carries a man over the top to win.

NO SUBSTITUTE FOR WORK

The new condition is not a temporary one, it is permanent. Fortunately or unfortunately, as you may wish to look at it, no one has ever invented a substitue for work. The new condition simply is that you have got to work harder to get the same amount of business. It is not a condition that will eliminate the small shop and retain the large industrial organization. No, any process of elimination will not make its division in that way.

Small shops and large ones stand together in the bid for business, and together they will be eliminated who are content to take the business that just comes in to them and accept it as a windfall. But those who continually put more energy and effort into the selling of their products and make that a more definite and more important part of their business will prosper and expand just as surely as modern civilization will endure.

This is my chapter on salesmanship, although I have purposely sidetracked any declaration that I am either the originator or even the proud possessor of the "Ten Sure Secrets of Successful Selling." The only business secret really worth while is to have no secrets. And salesmanshsip is a profession for which no Book of Rules will ever be printed.

COMMON-SENSE AND SALESMANSHIP

A salesman is not a sleight-of-hand performer. In marketing your goods, you cannot adopt the rôle of a clever trickster, overwhelming your prospects with a dazzling line of patter, pronouncing the magic words "plooey plooey" and then retiring gracefully, leaving your man utterly bewildered and wondering how you did it.

Selling is a very matter-of-fact proposition. And marketing your product is a job quite devoid of any presto-chango stuff.

Your product may be but a reflection of your own self, and an indication of your own genius; but your selling methods must breathe the very confidence and absolute sincerity you have in those goods. It is a psychological process. You have some goods, the other man has some money. You want him to trade his money for your goods. He puts up a resistance, always; he offers objections, and you must overcome them. When you have done so, the man is sold. Your job then is to realize that he is sold and not talk him out of it by not knowing enough to quit. It isn't the number of words you put into your sales message that counts, it's their effectiveness. A few well directed shots will have more effect than a whole company of rookies shooting at random.

Whether prices go up or down, whether taxes go higher or lower, whether interest rates increase or decrease, people will have to be clothed, fed and sheltered, and there will always be a demand for exchange of money for the products of the man who is willing to work. A farmer might have the best cultivator in the world, but if he had planted no seed in his field he could harvest no crop. Selling is the process of harvesting the crop, advertising is planting the seed, and so they are very closely related in the work of going after business.

THE FUNCTION OF ADVERTISING

One of a person's most active organs is his "forgetter." Advertising prevents people from forgetting you. It is a continuous barrage of publicity of various sorts that keeps your name and your goods as frequently and constantly as possible before the attention of your trade.

Your advertising should not be a group of picture puzzles—clever, far-fetched layouts that suggest something as far from your product as black is from white, but which try to tempt your reader on through three or four unfoldings or turning of pages until (if he has the time and patience) he finally discovers what you have to sell. I like good, outspoken, short and sweet, "reason why" copy. That's all your prospect wants, it's all he needs, it's enough to sell any article of merit.

TESTING YOUR ADVERTISING

When you write a sales letter or the copy for a folder or a magazine advertisement, go over it a second time and substitute the word "victrola" in each place where the name of your product is mentioned. If the ad sells the victrola as well as your goods, something is wrong. Your message is just full of meaningless generalities, it doesn't tie up directly with your merchandise.

Your sales and advertising messages should not only tie up unmistakably with your goods, but they should be distinctive. By always using your trade mark, by always using the same colors, by using some one typical layout, you can make your messages easily distinguishable as *your* messages. You are not a philanthropist; you are not trying to sell your competitor's goods also. You are rightfully selfish, and you are justified in making your sales message pull business into *your* shop alone. In fact, you might easily be accused of disloyalty to your own business if you were guilty of sending out literature that sold other people's goods as readily as your own.

If your literature is easily distinguished, customers will say at a glance, "Here's something else from the Blank people—wonder what they've got to say this time." Right off the bat you have their attention, and that is half the battle.

I am reminded, in closing, of the village that was temporarily without a pastor for its church. A visiting pastor registered at the hotel one day, and they persuaded him to remain over Sunday and deliver a sermon at the church on the condition that he was to receive half of the free-will offering. As the reverend gentleman entered the church that morning he noticed a box just inside the door over which was a sign, "Free-will offering," and, wanting to present a good example to the congregation, he dropped in a dollar.

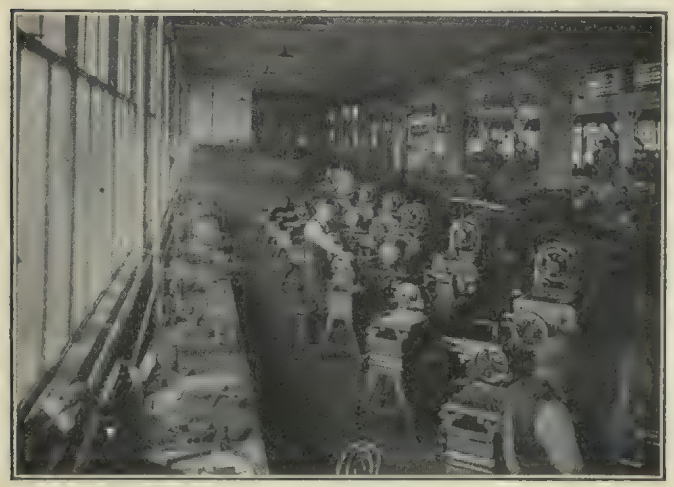
After the service was over, he found only his own dollar in the collection box; but true to his agreement he took half a dollar and left half a dollar. His small daughter, who was with him, noticed that he was not at all pleased with the morning's work, and she said to him consolingly, "Well, Daddy, if you had put more into the box yourself, wouldn't you have gotten more out of it?"

You'll get out of your business in direct proportion to what you put into it. There will be a definite ratio between your sales efforts and your sales returns. The harder you go after business, the more you'll get. The whole world respects and admires the man who is striving to attain a goal.

Saving Space in the Lathe Department

By Amos Ferber

Screw machines are commonly placed at an angle with the line shaft, the machines overlapping for the purpose of making room for the long bars of stock projecting from the spindle. The Waterville Machine Co., Waterville, Conn., adopts the same method of placing motor driven engine lathes for a very different purpose.



PLACING MOTOR-DRIVEN ENGINE LATHES AT AN ANGLE

By placing the lathes as shown in the illustration, with the angle considerably increased over that used in placing screw machines, a passage way is left between each machine, the light is on the faceplate just where the operator wants it, many more lathes may be placed to a given length of bench space the operator is not compelled to go around the machine to reach the bench, as is the case when lathes are placed back to back in double parallel rows.

An added advantage of this method over the double row lies in the fact that the headstock of one lathe cannot throw oil all over the work and operator of the lathe in the rear.

How Long, O Lord! How Long?

An editorial that appeared in *Electrical World*, Oct. 29

Before the people of the United States today there stand some of the most serious, complex and pressing problems that any nation has ever faced. They call for honest analysis, for balanced judgment, for positive decision, for constructive legislation and for prompt action. In Washington are ninety-six senators and four hundred and thirty-five representatives, each one selected, empowered and paid to do this job—and Congress talks and talks and talks.

The country is burdened with an unjust system of taxation that is hard to pay. People are sick of it. They know that a different arrangement—preferably the sales tax—will produce the needed revenue and yet make taxes easier. The administration has promised it. The country waits. But Congress talks and talks.

The old economic relationships between America and Europe are turned topsy-turvy. Our export trade has gone to pieces. The tariff must be readjusted. Business needs it. The administration has promised it. The country waits. And Congress talks.

The railway systems of the country cannot pay the dividends their stockholders are entitled to. They cannot even maintain their equipment and replacements. They are powerless to better these conditions until they receive a settlement from the government. This settlement will loosen a flood of railway orders that will bring tremendous stimulus to business everywhere. The administration has promised it. The country waits. But Congress talks and talks.

America has a huge fleet of merchant ships. A few are profitable. Many are running at a loss. Hundreds upon hundreds are tied up idle. They cannot operate under our existing shipping laws in competition with foreign flags. The administration has promised to right the situation. The country waits. And Congress talks and talks and talks.

How long, O Lord! How long?

America today is pleased with its administration. President Harding and his well-chosen cabinet have the confidence of the country. These men are doing their utmost to work out these and our other problems, to support our industries and to restore good times—while in Congress this one orates about the glory of the Republican (or Democratic) party and that one declaims about the perfidy of the honorable gentlemen on the other side.

The *Electrical World* believes that the situation has reached a stage where it has become the duty of business executives and individuals to call upon their senators and representatives in Congress by letter, by wire and in person, and ask them flatly: "What have you done or even said to hurry through the work we pay you for?"

A bulletin is being prepared weekly, having begun on Oct. 15, 1921, by the Western European Division of the Bureau of Foreign and Domestic Commerce, which contains abstracts of communications from the representatives of the Department of Commerce in western Europe not otherwise appearing in print, as well as abstracts of items of news culled from the many periodicals and newspapers received by the bureau from western Europe not readily accessible to many who are interested in foreign trade in that part of the world. The buttermilk will be mailed free upon application.

A General Method for Spring Design

Types of Springs—Economy Index and Load-Deflection Rate—General Formulas and Table of Constants—Parallel Scale Chart—Importance of Material Index

BY JOSEPH KAYE WOOD
Engineer, Western Electric Co., Inc., A. T. & T. Co.

WHEN an engineer finds he needs resilient action of some kind in a certain piece of mechanism or machine he is designing, the questions which confront him are:

1. What type of spring will best fit the allotted space?
2. What load-deflection rate is required?
3. Will the spring criterion of the spring selected to satisfy the first and second requirements be *less* than the material index of the material selected; or in other words, will the spring be safe?

To find the answers to these questions the engineer usually consults a handbook first, and if not satisfied with the brief information found there, he secures a book on the mechanics of materials, which also will give incomplete or indefinite information on springs. There are, however, a few noteworthy treatises on springs, chiefly in pamphlet form, which he may consult, but which usually will lead him into a maze of complex formulas briefly described. This very often results in confusion.

The above statement is not intended as a criticism of the authors of these treatises. On the contrary, we should be indebted to them, but the trouble is due to the generally indifferent attitude shown toward the development of this branch of engineering, which compelled these men to cover an immense subject in a very brief space. For instance, in "rigid construction" design the subject of elasticity was extensively studied in order to limit and allow for its undesirable effects, while in spring design where elasticity is fundamentally essential it was not so carefully studied. Spring design has a greater claim on the subject of elasticity; and, for this reason, should not the combined interest of engineers, mathematicians, metallurgists and chemists be directed toward a careful and thorough investigation of elasticity as applied to this branch of engineering?

It very often occurs that an engineer will make a short investigation in order to secure the information he requires, and then again, a great many engineers will make a "guess" of the various dimensions of the spring. All of these attempts to secure the information necessary for the design of the spring, or "guessing," will, I venture to say, in 60 per cent of the cases involve considerable loss of valuable time and labor. To be able to confidently design a spring within practical limits in the shortest possible time requires, I believe, a grouping of the widely scattered information and data on springs in a careful and systematic manner. To this purpose I am writing this article as a nucleus around which the complete subject of spring design from an engineering standpoint may be built.

GENERAL FUNDAMENTALS

Resilience is the energy which we can obtain from some materials when stressed, due to that inherent property called "elasticity." The distribution of a highly elastic material, as some metals, in a given space, so as to obtain a certain resilient force at any desired point constitutes what is known as spring designing. There are, however, an infinite number of ways a material may be distributed; but, as a general rule, it is done in such a way that the force delivered at a certain point can be predicted within practical limits by the use of formulas derived from a few fundamental laws discovered by experiment.

Consider a straight piece of highly elastic material whose length is L, and whose cross-section is constant in area and shape. The line parallel to the length and passing through the center of gravity of the cross-sections may be called the "geometrical axis" of the material. Now there are four general ways in which this material may be stressed in order to obtain an amount of resilient energy W, as follows:

(a) Stretching, or plain tension.
(b) Bending, or flexure = tension and compression.
(c) Twisting, or torsion = tension and compression.
(d) Combined bending and twisting = tension and compression.

Cases (a) and (b) were covered in the last two articles by the author (*American Machinist*, pages 40 and 674) on spring design, and (c) was covered in the three previous articles on helical spring design. Subject (d) has not yet been made the subject of an article.

Hook's law, which was discovered by experiment, is the fundamental law upon which all spring formulas are based, and is written as follows:

"Strain is proportional to stress for loads within the proportional limit of the material."

In all except case (a), there are some fibers which are not stressed when a load is applied to the material. In case (b) these fibers lie in a "neutral" plane perpendicular to the load and coincident with the geometrical axis, while in case (c) the "neutral" fibers are coincident with the geometrical axis. Therefore, a second fundamental law, also determined by experiment, covering cases (b) and (c) is as follows:

"The stress increases uniformly from zero to maximum from the neutral plane or axis to the outermost fibers of the cross-section of the material."

This law is true only for the twisting of the "neutral" plane due to bending alone in case (d), but the stresses of the entire section occurring in the outermost fibers resisting the combination of twisting and bending are not covered by this law.

Therefore, from these two laws the following general formula for total resilience was derived in the previous articles:

$$W = U \times \frac{S^2}{2E_T} \times \textit{volume}, \qquad (3)$$

Where S (maximum stress in volume) and E_T modulus of elasticity for tension) are approximately constant for any one material; and U, which may conveniently be called the "economy index," depends on the method of stressing and the cross-sectional shape.

In stretching, case (a), every fiber in the material is stressed an equal and maximum amount, i.e., to a value just within the proportional limit. In this case, then, the maximum possible amount of resilient energy is obtained, which gives as a result the most economical

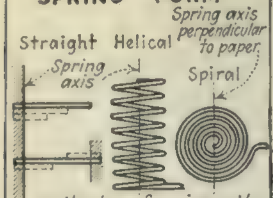
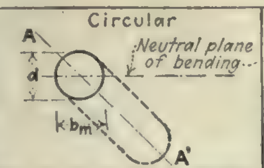
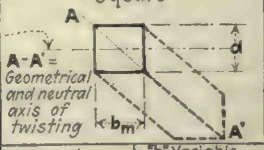
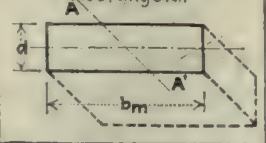
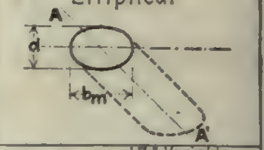
SPRING FORM				MATERIAL FORM (Cross Section)																							
 Straight Helical Spring axis perpendicular to paper Spring axis Spiral				Circular 						Square  A A-A' = Geometrical and neutral axis of twisting d b_m A'						Rectangular 						Elliptical 					
				Section constant			Section variable			Section constant			"b" Variable $s=\frac{b_c}{b_m}$			Section constant			"b" Variable $s=\frac{b_c}{b_m}$			Constant			"b" Variable $s=\frac{b_c}{b_m}$		
η = Number of spring units				ψ	ϕ	υ	ψ	ϕ	υ	ψ	ϕ	υ	ψ	ϕ	υ	ψ	ϕ	υ	ψ	ϕ	υ	ψ	ϕ	υ	ψ	ϕ	υ
Method of stressing	Bending	Straight (Cantilever)	Free end	6.8	0.67	0.08				4.	0.67	0.11	$\frac{12}{S+2}$	$\frac{2}{S+2}$	$\frac{1}{3(S+2)}$	$\boxed{1A}$ 4.	0.67	0.11	$\boxed{1A}$ $\frac{12}{S+2}$	$\frac{2}{S+2}$	$\frac{1}{3(S+2)}$	6.8	0.67	0.08			
			Constrained end	1.7	0.17	0.02				1.	0.17	0.028	$\frac{3}{S+2}$	$\frac{1}{2(S+2)}$	$\frac{1}{12(S+2)}$	$\boxed{2A}$ 1.	0.17	0.028	$\boxed{2A}$ $\frac{3}{S+2}$	$\frac{1}{2(S+2)}$	$\frac{1}{12(S+2)}$	1.7	0.17	0.02			
			Leaf spring free end													$\boxed{1A}$ $\frac{6}{\eta}$	1.	0.17									
			Leaf spring constrained													$\frac{3}{2\eta}$	$\frac{1}{4}$.	0.06									
			Load at any point $k\ell$ where $k<1$	$\psi=3.4(2-3k+k^3)$	$\phi=0.33(2-k-k^2)$	$\upsilon=0.08(1-k)$				$\psi=2(2-3k+k^3)$	$\phi=0.33(2-k+k^2)$	$\upsilon=(1-k)\div 9$	$\psi=\frac{6(2-3k-k^3)}{S(1-k)+(k+2)}$	$\phi=\frac{\psi}{6(1-k)}$	$\upsilon=\frac{\psi}{36(1-k)^2}$	$\boxed{1A}$ $\psi=2(2-3k+k^3)$	$\phi=0.33(2-k+k^2)$	$\upsilon=(1-k)\div 9$	$\boxed{1A}$ $\psi=\frac{6(2-3k+K^3)}{S(1-k)+(k+2)}$	$\phi=\frac{\psi}{6(1-k)}$	$\upsilon=\frac{\psi}{36(1-k)^2}$	$\psi=3.4(2-3k+k^3)$	$\phi=0.33(2-k-k^2)$	$\upsilon=0.08(1-k)$			
		Straight (simple)	Load at the middle	0.42	0.17	0.08				0.25	0.17	0.11	$\psi=\frac{3}{4(S+2)}$	$\phi=\frac{1}{2(S+2)}$	$\upsilon=\frac{1}{3(S+2)}$	$\psi=0.25$	$\phi=0.17$	$\upsilon=0.17$	$\psi=\frac{3}{4(S+2)}$	$\phi=\frac{1}{2(S+2)}$	$\upsilon=\frac{1}{3(S+2)}$	0.42	0.17	0.08			
		Helical $w=\frac{R}{\ell}$	Load at end of ℓ	$\psi=128.00w\eta$	$\phi=12.57w\eta$	$\upsilon=0.125$				$\psi=75.43w\eta$	$\phi=12.57w\eta$	$\upsilon=0.17$				$\psi=75.43w\eta$	$\phi=12.57w\eta$	$\upsilon=0.17$				$\psi=128.00w\eta$	$\phi=12.57w\eta$	$\upsilon=0.125$			
		Spiral $w=\frac{R+r}{\ell}$	Load at end of ℓ	$\psi=64.w\eta$	$\phi=6.28w\eta$	$\upsilon=0.125$				$\psi=37.7w\eta$	$\phi=6.28w\eta$	$\upsilon=0.17$				$\psi=37.7w\eta$	$\phi=6.28w\eta$	$\upsilon=0.17$				$\upsilon=64\,w\eta$	$\phi=6.28w\eta$	$\upsilon=0.125$			
	Twisting	Helical $J=\frac{b}{d}$	Constant ℓ	$\psi=160.\eta$	$\phi=15.71\eta$	$\upsilon=0.31$				$\psi=94.3\eta$	$\phi=11.1\eta$	$\upsilon=0.21$				$\psi=4.71\eta\left(\frac{1+J^2}{J^3}\right)$	$\phi=7.9\eta\left(\frac{\sqrt{1+J^2}}{J}\right)$					$\psi=80\eta\left(\frac{1+J^2}{J^3}\right)$	$\phi=11.1\eta\left(\frac{\sqrt{1+J^2}}{J}\right)$	$\upsilon=0.31$			
			Variable ℓ conical	$\psi=80\eta$	$\phi=7.85\eta$	$\upsilon=0.16$				$\psi=47.1\eta$	$\phi=5.36\eta$	$\upsilon=0.114$				$\psi=23.5\eta\left(\frac{1+J^2}{J^3}\right)$	$\phi=3.8\eta\left(\frac{\sqrt{1+J^2}}{J}\right)$	$\upsilon=0.114$				$\psi=40.\eta\left(\frac{1+J^2}{J^3}\right)$	$\phi=5.6\eta\left(\frac{\sqrt{1+J^2}}{J}\right)$	$\upsilon=0.16$			

FIG. 1. TABLE OF CONSTANTS FOR DIFFERENT SPRINGS AND LOADS

condition in the use of this volume of material as a source of resilience. Hence, the economy index *U* for case (a), which is equal to unity in formula (3), is greater than *U* for the other three cases (b), (c) and (d), because in these cases every fiber is not worked to its maximum limit. From the values of the economy index given in the table, it can be seen that for the bar of material under discussion now, the method of twisting, case (c), has a higher economy index than bending, case (b). This is because there are more idle fibers contained in the neutral plane of bending than in the neutral axis of twisting.

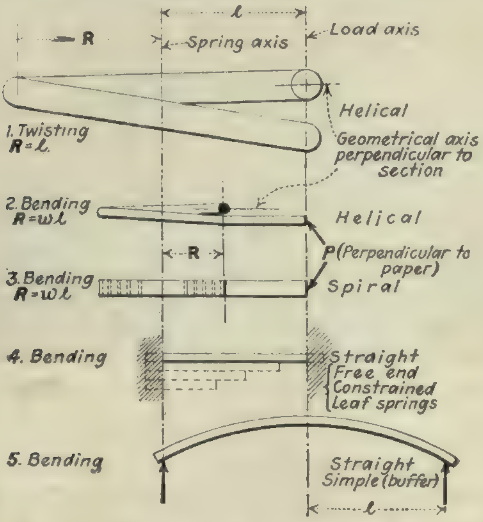


FIG. 2. METHODS OF LOADING SPRINGS

Furthermore, the economy index for stretching, case (a), remains unity no matter what the cross-sectional shape happens to be, but the economy index for all other cases is greater for a section which has the material distributed more remotely from the neutral plane or axis, i.e., a greater moment of inertia, because in this way more fibers are stressed to a maximum and nearly maximum value, i.e., a higher average value.

ECONOMY VS. DEFLECTION RATE

However, for the materials used for springs the modulus of elasticity is relatively high (5,000,000 to 35,000,000), which, in the cases where the economy index is unity or nearly unity, has the effect of making the "force" component of the resilient energy very large and the "distance" component very small. For this reason the "stretching" method, case (a), is found impractical for use as springs. If a highly elastic rubber rod which has a very low modulus of elasticity were stretched, the distance component would be fairly large for moderate loads; but, of course, it is quite obvious that rubber is unsuitable for springs. It is also obvious that the necessarily long lengths required would be impractical for use for resilient members.

It follows, therefore, that only a part of the maximum possible amount of the resilient energy of the volume of material under consideration should be utilized at the cost of economy, i.e., of a high economy index, in order to decrease the force component so as to give a low deflection rate suitable for springs. That is, in a general way, we might say that the low deflection rate as indicated by the value of the modulus of elasticity for spring materials must be greatly reduced by the methods of design in order to give a suitable low deflection rate for resilient members of mechanisms. We might, therefore, speak of the latter low deflection rate as the "modulus of elasticity for the spring *M*," as distinguished from the modulus of elasticity for the material *E*.

Bending, case (b), as we said before, does not call upon all the fibers to do the maximum amount of work safe for the material used. Hence, in every case of bending, the economy index is less than unity. However, the value of the economy index for bending may be varied over a wide range by varying the inertial shape of the constant cross-section with respect to the neutral plane; and the greater the moment of inertia the greater the index. It may also be increased, but to a less extent, by varying the sectional dimension parallel to the neutral plane, or the breadth, throughout the length *L*; for instance, the tapered spring. Then again, this index may be increased by the manner in which the load is applied; i.e., by constraining only one end of the spring, or by applying equal and opposite couples to the ends of the material as in coiled springs. In these latter instances the increase in the economy index is brought about due to the fact that more fibers are stressed to a maximum and nearly maximum value, the tapering and coiling tending to stress all the outermost fibers to a maximum value.

In the constrained cantilever the outermost fibers at the two constrained ends are stressed to a maximum value, which reduces the average stress for the whole volume; whereas, in the unconstrained cantilever only the outermost fibers at one end are stressed to a maximum, thereby increasing the average value. Increasing the economy index in these various ways for the particular volume of material under discussion, decreases the "modulus of elasticity for the spring," and will make this modulus too low for practical use if the moment of inertia of the cross-section is not limited For this reason, the section dimension *d*, Fig. 1, perpendicular to the neutral plane, is usually a great deal less than the dimension *b*, parallel and coincident with the neutral plane. The square section which should be the limit in this respect has a moment of inertia ⅓ greater than that of the circular or elliptical section of the same area, and consequently has a greater number of fibers in the maximum stress zone.

In twisting, case (c), the spring also has its economy index increased and the "modulus of elasticity of the spring" correspondingly decreased, when the moment of inertia is increased. The "modulus of elasticity for the spring" corresponding to the circular section is most commonly used, and that of the square section occasionally used, while those of the rectangular or elliptical sections are rarely used.

Combination bending and twisting, case (d), having the limitations of cases (b) and (c), will permit a higher economy index because more fibers are stressed to a maximum or nearly maximum value.

SPRING FORMS

So far, we have considered a definite volume of a highly elastic material of length *L*. Now, if *L* is made very large as compared with the dimensions of the cross section, that is, keeping the volume the same as before, in either case (b), (c) or (d) the economy index will be constant, with a correspondingly large increase in the load-deflection rate. But, a very long piece of material would be impracticable as a resilient member in a mechanism, hence the material is coiled helically or spirally, in which form it is more conveniently fitted to a given space. These forms are called springs. For a thin material in the spiral form (clock springs) the load-deflection rate will be so large that nearly constant loads may be obtained for appreciable deflections, thereby making this form of spring ideal as "storage tanks" of resilient energy. Each convolution or turn may be considered as a spring unit, and the line passing through the centers of these convolutions as the axis of the spring.

The greater the length *L* per given volume, the greater the number of turns (n), or spring units that can be formed per given maximum diameter of convolution, 2*R* or *D*. The increase in (n) gives a corresponding decrease in the deflection rate. The load *P* may be amplified by the value of *R* or *l* without changing the value of the economy index when keeping the cross-section and the volume constant, because then the deflection or "distance" component of the resilient energy is also amplified to the same extent. The load-deflection rate will vary as the first power of *l* in the latter case. Then again, a very wide sheet of spring material is inconvenient without modifying its form, which is done by cutting the material up into several parts or spring units and superimposing them as in leaf springs. As more fibers are stressed to a maximum value in this way, the economy index is increased, which means that for a large number of spring units (n), the load-deflection rate is decreased, which is just opposite to the reasoning for the helical and spiral forms.

SUMMARY

Summing up the foregoing statements, it is found that for a given material the load-deflection rate or modulus of elasticity for the spring *M* depends upon the value of the economy index, which index in turn depends upon the average value to which the fibers in a volume of material are stressed. This average value is always less than a safe maximum value *S*, hence the economy index is always less than unity, i.e., the index value for pure tension. Considering only the form of section, the index is lower for a smaller moment of inertia, and smaller to a great extent for a rectangular moment (bending) than for a polar moment of inertia (twisting). The index is further increased by tapering the material, and by certain methods of loading. For a given length and volume, an increase in the diameter, or a decrease in the number of spring units of a coiled spring increases the load-deflection rate but not the economy index, while an increase in the number of spring units in leaf springs decreases the load deflection rate and will increase the economy index. For different materials and a constant economy index the resilient energy varies as the square of the maximum safe fiber stress, and inversely as the modulus of elasticity for the material.

Consequently, with these general fundamentals, the following general formula for springs has been derived, the derivation of the two principal constants ψ and ϕ being covered in previous articles, with the exception of a few cases. Once the previous matter is read, it need not be referred to again; but that which follows is intended as a permanent guide for the design of springs in general.

GENERAL SPRING DESIGN

All springs whose elastic curves are mathematically determinant may be designed from the following two formulas:

$$\frac{F}{P} = \frac{\psi}{E} \times \left(\frac{l}{d}\right)^3 \times \frac{1}{b} \qquad (1)$$

$$\frac{F}{l} \Big/ \frac{l}{d} < \phi \frac{S}{E} \qquad (2)$$

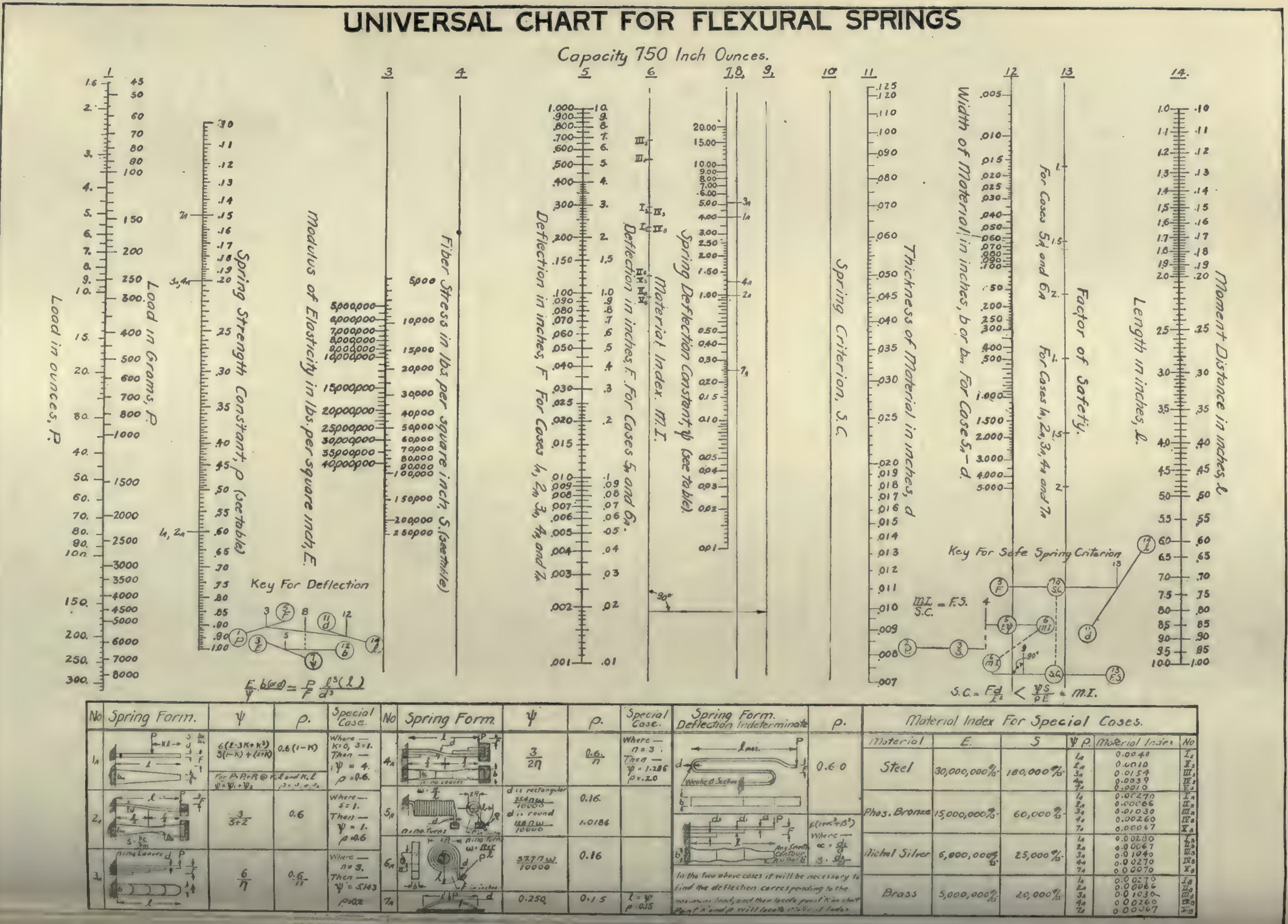


FIG. 3. UNIVERSAL CHART FOR COMPUTING SMALL SPRINGS

Material Index For Special Cases.

Material	E.	S	ψ ρ.	Material Index	No
Steel	30,000,000 #/□"	180,000 #/□"	1A 2A 3A 4A 7A	0.0040 0.0010 0.0154 0.0039 0.0010	I_s II_s III_s IV_s V_s
Phos. Bronze	15,000,000 #/□"	60,000 #/□"	1A 2A 3A 4A 7A	0.00270 0.00066 0.01030 0.00260 0.00067	I_B II_B III_B IV_B V_B
Nickel Silver	6,000,000 #/□"	25,000 #/□"	1A 2A 3A 4A 7A	0.00280 0.00067 0.01040 0.00270 0.00070	I_8 II_8 III_8 IV_8 V_8
Brass	5,000,000 #/□"	20,000 #/□"	1A 2A 3A 4A 7A	0.00270 0.00066 0.01030 0.00260 0.00067	I_B II_B III_B IV_B V_B

Formula (1) is the general load-deflection rate formula, in which the symbols have the following meanings:

$\frac{F}{P}$ is a measure of the load-deflection rate, F being the deflection in inches measured along the path described by the load or force P in pounds. The load-deflection rate or the modulus of elasticity for the spring M, as it may be called, is inversely proportional to the modulus of elasticity for the material E_T.

$\frac{l}{d}$ is cubed in the formula, and for this reason a small change in it will produce a large change in the load-deflection rate. This ratio, which can be called the spring index, consists of the distance l in inches, which is the normal distance from the fixed point of a spring to the point of application of the load. The fixed point of a spring lies in the spring axis, which is shown for all spring forms in Fig. 2. The symbol d represents the dimension in inches of the cross-section of the material which is perpendicular to the neutral plane in the case of bending, and which is a maximum in the case of twisting. This dimension is shown for different sections in Fig. 1.

In the formula, l is cubed for the following three reasons: (1) for increasing the length of the volume of material, which unaffects the economy index but increases the load-deflection rate; (2) for increasing the volume, which increases the load-deflection rate; and (3) for amplifying the load P, which increases the load deflection rate. The reason d is cubed is due entirely to its derivation from the moment of inertia of the section, and a small increase in d means a large increase in the cube of d and consequently a large decrease in the load-deflection rate.

A uniform decrease in the l's of the spring units (conical-helical springs) means an increase in the economy index or a decrease in the load-deflection rate. In this case, the l in the formula is the maximum l.

In $\frac{1}{b}$, the symbol b is the dimension in inches of the cross-section, perpendicular to d. A uniform decrease in b, as in tapered springs, gives an increase in the load-deflection rate. In the latter case b in the formula is the maximum dimension.

E_T is the modulus of elasticity for tension in pounds per square inch for cases of bending, and is also the modulus of elasticity for tension for cases of twisting. In the constants given in the table for the spring forms of the twisting type the constant $\frac{5}{2}$ is included in ψ, $\frac{5}{4}$ in ϕ and $\frac{5}{8}$ in U; which is based upon the assumption that E_G for torsion is equal to $\frac{2}{5}$ E_T for tension, and S for torsion is equal to $\frac{S}{2}$ for tension. This is done in order to bring the different spring forms down to a comparative basis. For accurate results the exact E_G of the material should be used.

The value of ψ is the means by which we may compare the relative load-deflection rates of the different spring forms in order to satisfy requirements (1) and (2) given in the first part of this article. The constant ψ which is always a pure number is made of several component parts which vary with the economy index U. The components are (1) Geometrical shape; (2) method of stressing (bending or twisting); (3) number of spring units; (4) variation in dimension l, b and d (very rarely, because not commercial) for any one spring. The values of ψ for all springs are given in Fig. 1, and the illustrations of the corresponding spring forms are given in the table for the chart, which will be described later.

Formula (2) is the spring criterion formula, which shows how the various dimensions of a spring for a certain deflection are limited by the material index, in order that the spring may safely be designed for the material selected and the service conditions. The symbols have the same meaning as in formula (1) but are grouped as follows:

$\frac{l}{d}$ is not cubed as in formula (1), its exponent being of the first power. It is well to note, however, that there is another l in the formula, but which is separated for reasons made obvious later in this article.

The ratio $\frac{F}{l}$ is important, because F is always measused at the end of l opposite to its end at the spring axis, and where the load P acts.

$\frac{S}{E_T}$ when multiplied by ϕ is called the Material Index.

$\frac{S}{E_T}$ depends entirely on the material used and the ability of the material to withstand service conditions.

ϕ is the Material Index constant, which shows comparatively how much each form of spring may be safely deflected for equal spring dimensions and for the same material.

Fig. 1 gives the values of the constants ψ, ϕ and also U, the economy index, for each method of stressing except method (c) or combination bending and twisting, covering all spring and cross-section forms, each loaded in various ways. This table is useful in that it shows at a glance, for any one material, which type of spring gives the desired load-deflection rate and at the same time suits the particular space to which the spring is to be fitted. It also shows the extent to which the spring may be worked safely. The economy index U will give the comparative amount of resilient energy per volume that may be obtained from the different types of springs. It is suggested here that a unit of measurement of resilient energy be created for use in spring design, and be defined as follows: a "resilient" is equal to the work required to deflect a spring 1 in. by a load of 1 pound. Hence if it required a load of 10 lb. to deflect a spring 1 in., its maximum allowable amount, then the capacity of the spring would be equal to $PF \div 2 = (10 \times 1) \div 2 = 5$ "resilients."

Now, so far we have only two formulas and a table to keep in mind to cover the whole matter of spring design. The computation work involved in the determination of the constants shown in the table is very simple, but for the two general formulas it is quite considerable.

PARALLEL-SCALE CHART

Hence a parallel-scale chart, shown in Fig. 3, has been prepared in order to facilitate the computation of the two general spring formulas for small springs of a capacity up to about 47 "resilients" or 750 inch-ounces. The parallel lines are numbered at the top and the scales on them are named according to that symbol in the general formulas which they represent. Special attention is called to the scale on line 7 on which the value of the constant ψ is located. As the constant ϕ of the material index in the spring criterion formula is equal to $\frac{\psi}{\rho}$, ρ being the constant taken from the load-stress relation, only the ρ scale is provided on line 2 and the corresponding ϕ is determined by an operation on the chart. This was done simply for convenience in using the chart. The ψ and ρ values for the various types of springs are given in the table below the parallel lines. As space is limited, only springs of the bending or flexural order are given, and hence the chart is called the "Universal Chart for Flexural Springs." However, by applying the proper values of the constants ψ and ρ, which latter $= \frac{\psi}{\phi}$, the springs of the twisted order may be designed by means of this chart.

In Fig. 1 the small numbers, such as 1_A and 2_A, in the upper left-hand corners of the boxes mean that the illustration of the type of spring which the constants in a particular box represent may be found in that part of the chart table, Fig. 3, numbered similarly. The chart table also gives a method by which springs whose elastic curves are mathematically indeterminant, that is, those which have no load-deflection formula, may be designed within safe limits, provided that the load-deflection rate is determined beforehand by experiment. Finally, the chart table gives special values of E and S for certain materials and the corresponding values of the material index for the types of spring shown. The material index values are also located on the material index, line (6), which considerably shortens the work in using the chart. However, these special values of S and E should not be used unless they actually represent the material contemplated for use in the design of a spring.

In manipulating the chart, the two keys shown thereon are used in the following manner: The values of the symbols shown in the circles of these keys are joined together with a straight line, and this line is then intersected on the line indicated by its designating number. These intersections are joined as indicated, the extremities of a broken line being considered as two coincident points. The numbers in the circles correspond to the number of the line on which the scale of the associated symbol is located. In going from line 6 through line 10 to line 13, it will be noted that the computing line is drawn perpendicularly to an intermediate line 9 as indicated, and from this intersection a straight line is drawn through the desired values on lines 10 and 13.

Up to this point we have covered general spring design by two principal formulas. Inasmuch as ordinary helical springs (twisting) of both the extension and depression type are the most common type of springs used, a slightly different method of design was devised and presented in the article by the author on page 628, Vol. 54, of the *American Machinist*. The only other diversion from the general spring design method will be used in the case of eliptical springs, which, due to their extensive use in the automobile industry, should be treated in a special manner.

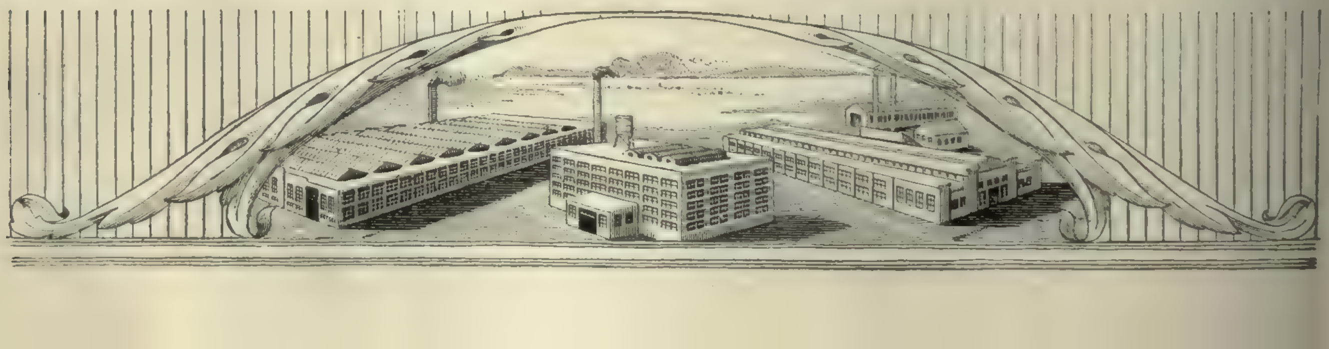
The values of S and E should accurately represent the material contemplated for use in the spring being designed by the formulas. In formula (1) only E appears, in which it varies inversely as the load-deflection rate. For any one spring only a change in E (and not S) will change the load-deflection rate; but formula (2) will show that the allowable deflection F (not the load-deflection rate $\frac{F}{P}$) will be limited by the value S directly and inversely by E, i.e., by the material index of the metal used.

It happens that the value of E for any one material remains practically constant under all conditions, while the value of S will vary considerably due to many conditions. The values of S and E and, consequently, the material index depend upon certain factors to the following extent:

	E	S
1—Major constituent of material.	Mainly	Mainly
2—Chemical impurities	Slightly	Considerably
3—Chemico-physico unequilibrium.		
3.1—Hot working	Slightly	Considerably
3.2—Cold working	Slightly	Considerably
3.21—Direction of rolling in flat material	Very little	Little
3.3—Heat-treatment	Very little	Considerably
3.4—Relative size of cross-section		
3.41—Large	Slightly	Considerably
3.42—Small	Slightly	Considerably
4—Electroplating of material (Fe):		
4.1—Cleaning in acid 4.2—Electroplating Occlusion of Hydrogen	None	Possibly
5—Corrosion (indirectly on 4)	None	Possibly
6—Fatigue		
6.1—"Endurance Limit" below proportional limit	None	Considerably
6.11—Condition of outer surface	None	Considerably
6.12—Homogenity of material	None	Considerably
6.2—"Endurance Limit" above proportional limit	None	None
7—Under constant high temperature	Appreciably	Considerably

The principal materials used for springs are steel music wire, alloy steels, phosphor-bronze, and nickel silver, the overall range of S being about 15,000 to 200,000 lb. per square inch, and of E being about 5,000,000 to 35,000,000 lb. per square inch.

Future work will be required to bring out the limitations and approximations of the formulas used. The previous articles brought out the fact that in the derivation of every deflection formula some approximations were made, which cause inappreciable errors for moderate deflections, but are of a large magnitude for large deflections. The methods for determining E and S for bending and twisting may be made the subject of a future article.



Stimulating Business Revival

An Address by James H. McGraw, President, McGraw-Hill Co., Inc., New York, Before the Annual Convention of the Associated Business Papers, Inc.

THERE are two great classes in the world today—those who look on the world in chaos and see no hope for the future and those to whom the world disaster is but an inspiration for greater effort. I am putting the business papers in the latter class.

Someone has pointed out that there are people who liken existence to life in a squirrel cage—eternal movement and eternal sameness—but the leader of today is the man looking straight ahead with new thoughts or with new vision of old thoughts. The business publisher must grapple with the great problems before him with new thought and new vision of world conditions confronting him in order that they might be solved and harnessed for the welfare of humanity.

Let us picture these world conditions for the moment.

The European Crisis

Across the Atlantic the financial systems of Central Europe are going down in a horrible crash. The Austrian kronen and the German mark sell at 1/300 and 1/50, respectively, of their gold value, and since there is no such thing as isolation in the economic world, we, innocent of the cause, must share the burden with Europe.

Germany is in the throes of another cabinet crisis, with the danger of losing the gains of some eighteen months of political peace.

Russia daily slips deeper into the slough of economic dissolution—though possibly the deeper she goes, the quicker will come the day when her 180,000,000 people will again buy from the outside world—a buying, by the way, essential to a normal world functioning.

Petty wars still wage in Europe, despite the normal advent of peace three years ago.

American Conditions

Such, in brief, is the situation in Europe. In America conditions are more hopeful.

We have a tremendously improved banking and credit situation and plentiful evidences that we have passed the low point in the curve.

The oncoming disarmament conference has awakened the hopes of the world in the possibility of turning into productive lines millions of treasure that go into armaments. The disarmament conference deserves emphasis, too, because it is one of the biggest business conferences ever held. It will discuss reduction of armaments, but before it proceeds to that theme it must first settle the terms on which America and all other nations shall do business with China. The center of possible world disturbance has shifted from Central Europe to the Pacific, and there, let us hope, under the American standard of equal opportunity for all, will be waged the friendly war of honorable business competition, instead of the bloody wars which are sure to be consequent upon greedy exploitation and land seizure.

While, however, there are bright spots in the American business firmament, there are also heavy clouds. Right before us looms a nation-wide railroad strike. When the cloud has dissipated, or after it has been weathered, we shall probably find ourselves hard up against a strike in the bituminous coal-mining fields, for, while the operators are ready to agree to arbitration in settling the wage scales which come up for renewal on March 1, the coal miners are unwilling to give up the strike weapon.

Quite disturbing, too, is the fact that 4,000,000 of our people who want to work to make the goods and build the houses necessary to make up for our war depletion and shortage, are unable to work, and between 10 and 20 per cent of them are either in want now or will be with the advent of cold weather. While this in itself is disturbing, far more important is the evidence it affords of our failure to have developed the sound social system, in which the functioning of industry must necessarily prove an integral part.

Business is stagnant, yet the dallying Congress, imitating Nero, plays the fiddle of back-home politics while business goes to pot. The tax bill languishes on Capitol Hill. The tariff measure, universally condemned, has been shelved, casting just so much added doubt upon the business future. The railroad refunding bill makes no progress. All that could stabilize business and restore confidence is neglected, despite the urgings of an administration that displays a gratifying amount of business sense.

Interpreting the Situation to Business

Such are some of the features of a world situation unprecedented in complexity, in difficulties and in the number of discouraging features.

Each and every one of the situations referred to has a present-day bearing on American business. What is more, some of them will determine how America is to do business for many years in the future. If American business is to function up to the new position that has come to it during the war, and that necessarily flows from the fact that the center of world finance and of world influence has shifted to our shores, these governing conditions must be interpreted in terms of their influence on every industry. We may become, if we have but the knowledge, the foresight, and the energy, what England has long been—the market center of the world. But we can take this position only if we have a race of business men equal to the occasion—a race worthy of a world-wide commercial dynasty.

How shall American business men get this conception, how shall they rise to this opportunity unless the business press carries the message to them in each issue, strong with knowledge of the situation and its bearing on American business, convincing in the wisdom of the remedies it suggests, invincible in the enthusiasm and courage it displays?

It is no job for weaklings, but for the broadest-gaged man that the country commands. It will not be accomplished by editors chained to their desks, nor by mere reporters, nor by publishers who are bearish on America's future. It can only be accomplished by broad vision and the gospel of work.

As to European and other world factors which bear on American business, there must be a wise policy carried home constantly by the business press. We must help mobilize American opinion on the stabilization of European currencies. We must not be squeamish in manfully demanding whatever re-arrangement of the German reparations may be necessary for the stabilization in Germany—realizing that a stable Germany is essential to a normally functioning economic world. When Russia comes back, as she must, when the other weakened powers are in a position again to buy in normal quantities, the business press must picture the opportunity and be the apostle of whatever credit structure is necessary to bring these nations again into the world economic family.

Likewise, as to every other factor in the European and the world situation, business papers must arise to the occasion and see to it that American business has a wise and courageous policy.

This task of interpreting world conditions to American business is not an easy one, yet it is only part of the great job which American business paper editors and publishers must do. We must necessarily be concerned with the affairs of the world, but naturally our first responsibility is for our own country, for our own industrial, economic and social conditions. Studying the problems that are closer to home, we find many avenues along which business papers can work in speeding the revival of business.

WASTE AND EXTRAVAGANCE PRODUCTS OF WAR

War breeds extravagance. In spite of the noble ideals which inspired this nation to take up the great conflict across the seas, the inevitable result was the accumulation of innumerable wastes and habits of extravagance. We became wasteful of our time, our money, materials and even life itself. We could not help it, but we can and we must overcome the habits and tendencies which were developed throughout our entire social and industrial fabric by that terrible conflict.

As a tangible example of what can be done, Herbert Hoover, has focused the attention of industry upon the unnecessary wastes which are sapping the vitality and reducing the productivity of our nation.

We are appalled when our attention is called to criminal wastes of life through accidents and negligence, the prodigal waste of our natural resources through under development or political chicanery, the prodigious waste of materials through mismanagement and inefficiency. But of all wastes which affect our happiness and prosperity, the waste of time and human effort is the greatest and has the most damaging influence.

If the business papers collectively and individually can instill into the minds of the thinking men of industry the gospel of intelligent work, we will have performed a tremendous service.

I will not attempt to recount all of the factors which enter into the problem of adjustment which is before us. But I do want to bring a thought before you, which is given in the words of Thomas Hughes:

"Who has the clearest and intensest vision of what is at issue in the great battle of life, and who quits himself in it most manfully, will be the first to acknowledge that for him there has been no approach to victory except by the faithful doing day by day of the work which lay at his own threshold."—I repeat the last clause, "except by the faithful doing day by day of the work which lay at his own threshold."

In brief, I bring to you as leaders of thought among thinking men that what this country needs more than anything else is to learn anew the gospel of work.

Intelligent work, untiring work, work in its most homely sense.

We cannot talk ourselves into prosperity. We cannot argue ourselves into stability, but we can work ourselves out of the valley of depression and up to the heights of plenty. We can do these three things.

First, everybody get busy at his present task, and make the most of it.

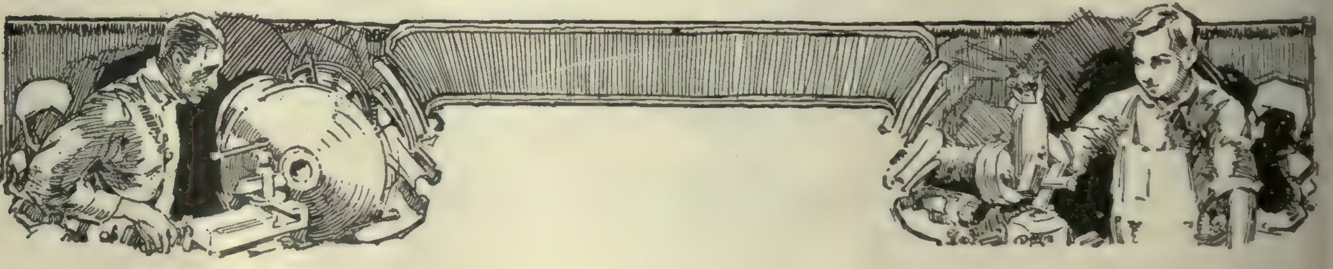
Second, everybody consider winning the peace in the same spirit as characterized the winning of the war.

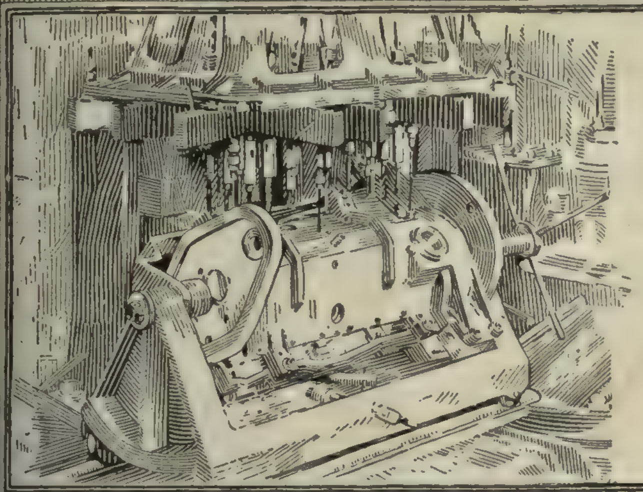
Third, the business papers, by article, editorial and personal service, show that selfishness has now no more place in war time. That interest in the welfare of all men, individually and as society, lies at the basis of prosperity.

In conclusion, let me say we must consecrate ourselves to giving a full measure of the best service we have within us. As a nation, and as publishers, we must quit our petty quarrels and arguments and devote ourselves to the tasks that lie before us. We had to fight and destroy to win the war. We will have to work and build to win the peace. The first nation that gets hold of the idea that only salvation comes from work will come out on top and really win the peace.

Demand for Trucks in Borneo

The British Chamber of Commerce for the Netherlands, East Indies, reports in *Eastern Engineering* that, as a result of the rapid development of Northeast Borneo, the volume of freight is growing. Several good roads have been constructed and the projected railway from Pontianak to Sambas will afford very much needed transport facilities. The market, actual and potential, for commercial motor vehicles is particularly worthy of exploitation, and it is stated that there is an ever-present demand in Northwest Borneo for the 3- to 5-ton type of vehicle. The projected railway can hardly absorb all the traffic which now uses the roads, and the estates will require transport for their produce to the nearest railway. The making of good roads and the facilities with which motor trucks can handle plantation produce have already led to a rapid increase in the numbers of commercial vehicles used.





Tool Engineering

By

Albert A. Dowd and Frank W. Curtis

President and Chief Engineer

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Design of Second-Operation Turret-Lathe Fixtures Continued—Standard Face Plate as a Fixture—Fixture for Different Sizes of Work—Chuck for an Eccentric Casting

IN APPLYING the principle of the floating-scroll lathe chuck to the handling of work which has been previously machined, the nature of the work must be carefully considered. The portions which are to be held by the chuck jaws may be finished or in the rough. If in the rough, there may be considerable variation which might not be taken care of by $\frac{1}{32}$-in. float in the scroll. If, however, the work is located for a previous operation by surfaces approximating those which are to be used for the second holding, then in all probability the amount of float mentioned will be sufficient to take care of variations. It is advisable wherever possible to grip the work by a previously finished surface, which will naturally be approximately concentric with the other portions. When this is done, there is little chance for trouble, and satisfactory results can be obtained without difficulty. Fig. 245 shows a piece of work *A* which is to be machined at *B*, *C* and *D*. The piece has been previously finished in the hole *E* and it has been faced and turned at *F*, *G* and *H*. Due to the fact that the entire casting is somewhat fragile in construction, it might easily vibrate considerably unless so held as to eliminate any trouble of this kind.

A locating bushing *K* is fitted to the center hole in the chuck *L*, as shown. This bushing has a flange on which the work rests at *F*, and it is also fitted with a plug *M* which enters the hole *E* in the work. Special jaws *O* are so arranged that they grip the thin flange in three places on the inside at *C*, the float of the scroll allowing them to adjust themselves to any slight variations in concentricity. These jaws are not strictly used for centering the work, but only for holding it to prevent vibration. Therefore they should not be brought up tightly, but only with sufficient pressure to make sure of a contact. After this is done, the setscrews *P* are tightened with a socket wrench, thus obtaining a metal-to-metal contact which gives an excellent drive for the work and prevents vibration.

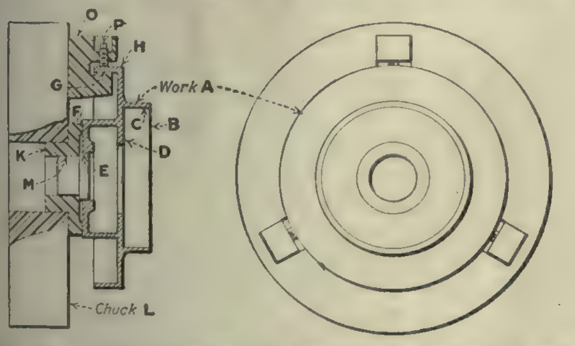

FIG. 245. APPLICATION OF A FLOATING SCROLL CHUCK

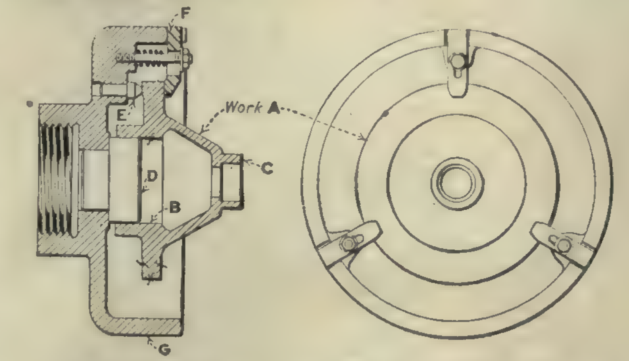

FIG. 246. SECOND-OPERATION FIXTURE FOR A MALLEABLE-IRON FLANGE

The two examples given of the use of a floating scroll chuck are sufficient to illustrate its advantages. It should be noted, however, that any chuck in which the scroll ring has been refinished so that it will float, can not be used for centering and holding work of the ordinary kind.

Simple Fixture for a Flange

In Fig. 246 is shown a piece with a form somewhat similar to that just illustrated, but here the work *A* has been machined on the inside in a previous operation, and it is necessary to hold it by the portion *B* in order to machine the end *C*. This is another example of a fixture designed to be screwed directly to the end of the spindle, yet it could be mounted on an adapter if desired. The work locates on a plug *D* and rests on three hardened pins *E* in the body of the fixture. These pins strike against the finished surface of the flange and serve also to give correct end location to the work, so that the end *C* will be machined in a fixed relation to the

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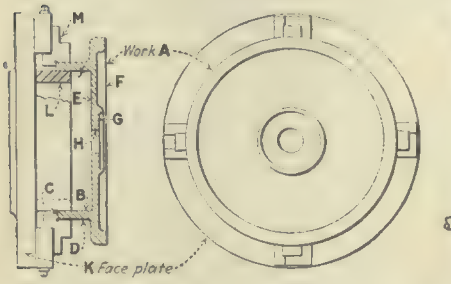
For the authors' forthcoming book.

flange, and will at the same time be concentric with the portion *B*. A simple method of clamping is used in this case, the clamps being shown at *F*. In order to keep the outside of the fixture clean and avoid trouble which might be caused by a projecting flange, the outer portion of the fixture is carried up in the form of a ring *G*, which is slotted to receive the ends of the clamps, as indicated. This is a type of fixture which is simple and efficient; and for other similar conditions the principles shown here can be applied.

In Fig. 247 is shown another method which can be used to grip and drive work that has been previously machined, and that is located in a central position by means of a plug or ring in a previously finished hole. The work *A* has been machined at *B*, *C*, *D* and *E* prior to the operation indicated. It is necessary to locate it by the inside surface *B* and by the end *C*. The work to be done in this operation is the facing of the surface *F* and the machining of the portion at *G* and *H*.

A standard faceplate *K* is used for the work. It is fitted with a locating ring *L* on which the work is placed. There are four standard faceplate jaws *M* mounted in the slots on the faceplate. These jaws are cut out as shown, so that they will form an end stop for the portion *C* of the work. They also grip on the outside surface *D*. The standard jaws are operated independently by means of screws, so that they come up against the outer flange and hold it tightly against the locating ring. This method gives ample driving power so that the work can be held without danger of its moving under the action of the cutting tools. Another advantage is that the metal-to-metal method of gripping kills vibration and prevents chatter. The only objection to this scheme of holding is the fact that it is somewhat slow, as each one of the jaws is set up separately. It is, however, quite cheap and can be adapted to a number of conditions of a similar kind.



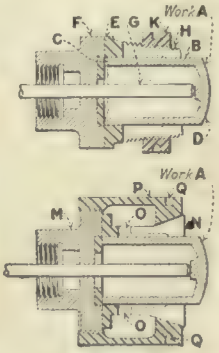


FIG. 247 (LEFT). STANDARD FACEPLATE USED AS A FIXTURE. FIG. 249 (RIGHT). SPECIAL COLLET CHUCK FOR LARGE WORK

Fixture for a Ball Pipe Joint

When work of a spherical nature is to be held, considerable care must be used in the design of the fixture. In the first place, the seat on which the spherical portion rests must be formed out so that it will fit the work closely. In the example shown in Fig. 248 the work *A* has been previously finished on the spherical end. The other end *B* is to be faced at *C* and *D* in the operation shown. A fixture *F* is mounted on the adapter *E* and provided with four inserted jaws *C*. These jaws are wide enough so that they each have a contact of about 60 deg. on the outside of the spherical portion of the work, which they are bored out accurately to fit. The fixture *F* contains four toggles *H* which are mounted on pins at *K*. There is a small amount of float allowed on these pins in order to equalize any roughness on the inside of the casting. Coil springs are provided at *L* in order to throw the toggles toward the center, so that the work can be removed when desired.

The bar *M* extends through the spindle and is operated by a handwheel at the rear end. When this bar is thrown back between the toggles the tapered portion forces these outward and at the same time pulls them back, so that they contact with the inside of the casting and hold it back firmly against its seat. In connection with this device it is necessary to use a centering plug, such as that shown at *N* in the turret. It is brought up and remains in the position shown while the clamps are being tightened, after which the turret is backed away and the tools used for the work operate in sequence. A centering device of this sort is often necessary when holding work during the operation of chucking.

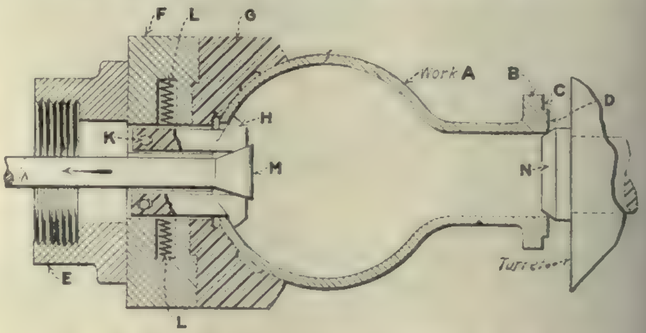


FIG. 248. FIXTURE FOR A BALL PIPE JOINT

There is an old saying that people learn more from their failures than they do from their successes. This is quite evident in tool work, for a man who has designed any kind of a mechanism which does not work properly and which gives trouble in operating, will be sure to hear about it in an unpleasant manner. If he is at fault in his design he will appreciate the trouble caused and will remember the conditions, so that he is unlikely to make the same error again. This is a costly method of learning how to do a thing correctly, and an example of a successful and an unsuccessful design is given herewith to bring out the point forcibly.

In Fig. 249 is shown a piece of work *A* which has been previously machined on the outside portion *B* and also at the end *C*. The curved end *D* is to be machined in this setting. A special form of spring collet *E* is mounted on an adapter *F* which is screwed to the spindle. The rod *G* is used as an ejector to force the work out of the chuck after it has been machined. This rod is operated by a collet mechanism at the end of the machine. The portion *H* is split in eight places, so as to allow it to spring as contracted by the nut *K*, which operates on the tapered thread. It was the intention of the designer to make this in such a way that by placing a pin in the holes shown, the collet would be contracted by the revolution of the ring according to its position on the tapered thread. The design however is faulty, and a great deal of trouble was experienced in operating it. It was practically impossible to contract the chuck sufficiently to hold the work and there was a great deal of friction on the threads, which doubtless had considerable to do with its faulty operation.

Another design, also shown, was made to take its place, the operation of the new device being perfectly satisfactory. In this case the adapter *M* was fitted with a spring collet *N* having a tapered end. This collet was split in twelve places and large holes were drilled at *O* in order to give more spring to the collet jaws. The operating sleeve *P* was threaded to the adapter as indicated. In operating the device, the revolution of the sleeve *P* was accomplished by means of pins in the holes *Q*. The tapered portion caused the collet to contract and held the work rigidly. An ejector was provided similar to that shown in the other example. In this design a great deal of the friction which was caused by the tapered thread was overcome. The action was much smoother and the chuck was easier to operate.

When several pieces of the same general character but of different diameters are to be held in a fixture, it is sometimes possible to design this so that adjustments can be made to suit the various pieces. Even in cases when production is high, it might be advisable to follow this method and make up several fixtures of the same kind, adjusting them for the different pieces as required. By an arrangement of this sort the same patterns can be used for all of the fixtures; and the other parts, being uniformly designed, could be manufactured cheaper than if three or more fixtures all different and made from separate patterns were built.

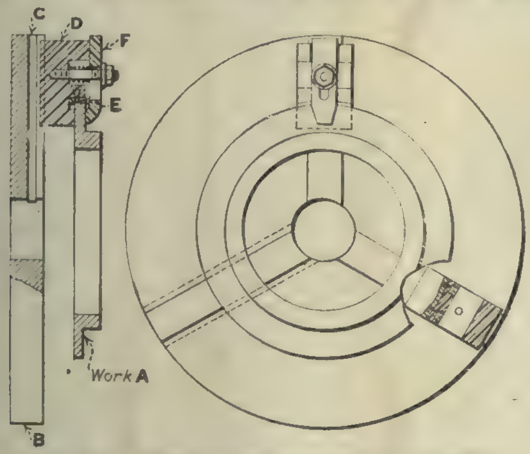


FIG. 250. SPECIAL FIXTURE FOR DIFFERENT SIZES OF WORK

An example of this kind is shown in Fig. 250. There were a number of pieces like the work shown at *A*, the pieces being practically the same except that their diameters varied considerably. A special faceplate *B* was made up and mounted on an adapter. It was slotted in three places, as shown at *C*. The slots were made up in T-form to receive keys, and the three jaws *D* could be adjusted readily in these slots to the diameters required for the different pieces of work. Several rings or grooves were scored on the face of the plate, so as to give the approximate position for each diameter required. The work to be handled is located in soft inserted jaws, shown at *E*. These jaws are bored out in place on the fixture, according to the diameter which is to be handled. The work is placed in these locating jaws and clamped in place by means of the sliding clamps *F*. The fixture is inexpensive and simple in design. It is often possible for the designer to effect substantial economies in the use of fixtures by a method similar to that shown; and therefore it is the part of wisdom to consider any pieces of similar character which are to be handled in the same general way, before proceeding with the design of the fixtures.

In setting up a piece of work which is to be turned eccentric to some previously finished surface or hole, care must be used in the design to make sure that the center of rotation is correct, in order to produce the desired results. The matter of location is important, and the method of clamping must be carefully studied, so that there will be no tendency to force the work out of position and thus produce an eccentric which is not in the right relation to the hole from which it is located. There are a number of ways in which an eccentric fixture can be made, but much depends upon the nature of the work and the degree of eccentricity required. Sometimes it is necessary to machine two surfaces in the same setting, and a fixture must be designed which can be indexed or thrown over from one position to another during the progress of the work. Fixtures of this kind will be discussed later.

The example shown in Fig. 251 is a piece of work *A* which has been finished at *B* in a previous operation. The end *C* has also been faced. It is necessary to machine the portions *D*, *E* and *F* and the interior surfaces *G*, *H* and *K* eccentric to the hole *B*. The fixture *L* is mounted on an adapter which screws on the end of the spindle. The locating plug *M* is placed eccentrically to the center of rotation of the fixture *N*. The portion to be machined is eccentric in the direction of the lug *O*, which thus provides a convenient method of locating the work. The arrangement used for the purpose consists of a pair of swinging arms *P* and *Q* operated by a screw bushing and bayonet-lock device, which has been previously described under the subject of drill jig design. The work is clamped in place by a large special clamp *R*, which straddles the hub and bears on both sides of it in line with the center of the work which is being machined. In considering the features of design brought out in this fixture, attention is called to the projecting screw at *S*. This would not be considered good design, unless some protection were provided so that the screw would not be likely to catch on the clothing of the operator. Provision should be made to prevent such an occurrence, by making a guard around the fixture, or using a piece of sheet metal fastened to it in such a way as to protect the end of the screw and yet leave it free so that a wrench can be applied without difficulty. The matter of protection to the operator should never be forgotten by the designer. Fixtures are usually improved as to their appearance also if care is taken to avoid all projecting lugs, clamps and screws. Furthermore, production is probably increased to some extent, because the operator is not afraid of being caught on any projections.

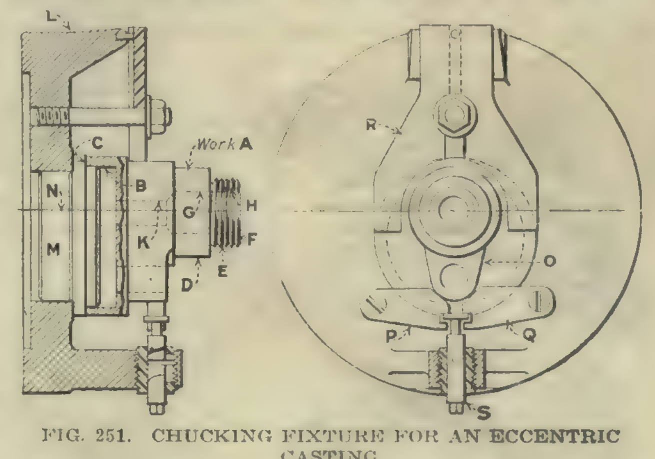


FIG. 251. CHUCKING FIXTURE FOR AN ECCENTRIC CASTING

Artificial Seasoning of Steels

Review of Available Data on Length Changes and Spontaneous Generation of Heat in Hardened Steels—Results of Preliminary Experiments on Artificial Seasoning

BY H. J. FRENCH[*]

THE fact that steels, under certain conditions of work and thermal treatments, undergo changes with time at ordinary atmospheric temperatures has long been known or suspected, and it has also been definitely established that these changes can be hastened by suitable heat-treatment or other artificial seasoning methods. Very little is known, however, regarding the nature of such changes, and there are relatively few publications available which deal with this question.

So-called tempering of hardened steels in hot water (aging) has long been used. While the discovery of the fact that hardening is effected by quenching from 100 deg. C. is credited to Langley and Metcalf[1] (1892), Hetzel[2] calls attention to earlier experimental work carried out along similar lines by H. Carron in 1872-73.

Schottky[3] has noted spontaneous generation of heat in hardened carbon steels when tempered at 100 deg. C., the magnitude of this effect apparently depending upon the carbon content and quenching temperature as well as on other factors.

BRUSH'S WORK ON HEAT GENERATION

Brush[4] has also shown that high-carbon tool-steel and chromium-tungsten "high-speed" steel spontaneously generate heat in appreciable quantity for at least several weeks after water-quenching from a high temperature and that the rate of generation steadily diminishes with time. Samples of hardened carbon tool-steel likewise shrank progressively when tempered to "straw color," to "light blue" and finally annealed, while after hardening, certain samples gave evidence of spontaneous shrinkage for many days in measurable amount. The behavior of these latter specimens was similar to that of the former in the gradual decrease in magnitude of the observed effect, which suggested a relationship between the two phenomena. Contraction was not considered the prime cause of the spontaneous heat generation, because calculations showed it to be inadequate in amount.

In more recent experiments carried out by Brush and Hadfield[5] specimens of a nickel-chromium steel behaved similarly when quenched from a temperature just above that of decalescence. The magnitude of the observed heat-effect was increased by a repeated treatment and persisted even when the specimen was heated for a third time and allowed to cool very slowly to a temperature where complete recovery of magnetic susceptibility was attained before quenching. Because of this anomaly further investigation by Brush, Hadfield and Main[6] was undertaken and some interesting facts were brought to light.

Attention is called to the fact that absorption of heat resulted from quenchings made at rising temperatures which generally had not previously been exceeded and that carbon tool-steel showed none of the eccentricities of the nickel-chromium steel when quenched below the hardening temperature; but when quenched above they behaved very much alike. It was also found that the rate of contraction of quenched steels followed the same law as the rate of evolution or absorption of heat which, after a short initial period, is approximately in inverse ratio to the time after quenching. It is generally considered that such contraction is due, at least in good part, to completion of the partly suppressed allotropic transformation.

JAPANESE STUDIES ON AGING

Matsushita[7] has studied the nature of the slow contraction of hardened Krupp carbon steels and concludes that in well-hardened samples there is always a gradual contraction, whereas in imperfectly hardened steels there is a gradual elongation or an elongation associated with a subsequent contraction. It is stated that elongation results from the imperfect A_1 transformation, while contraction is ascribed to the separation of an unstable cementite from its solid solution (martensite) which does not affect the hardness. Complete separation of the first unstable carbide at room temperature requires several months or longer, while the same separation follows within two hours by heating the steel to 100 deg. C. The author also reports that the elongation or contraction of hardened steel is always accompanied by heat evolution.

Low elongation and reduction of area values have been noted by Reinhardt and Cutler[8] in tensile tests made immediately after heat-treatment and machining of test-bars taken from 5¾-in. square steel billets containing 0.49 to 0.55 per cent carbon. Aging at room temperatures for twelve to twenty-four hours sometimes increased ductility more than 100 per cent, whereas similar beneficial effects were obtained in very much shorter time by heating to 120 deg. C. (248 deg. F.). Evidence is presented that complete restoration of ductility, which required about sixteen days at room temperatures, could be obtained at 120 deg. C. in twenty-five hours.

Honda and S. Saito[9] have recently studied the effects of two artificial seasoning treatments on the properties of K. S. magnet steel of the following composition:

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[1] Discussion of paper by A. M'Cance, "A Contribution to the Theory of Hardening," *J. I. & S. Inst.*, 1914. No. 1, p. 250.

[2] E. Hetzel, "Tempering in Hot Water," *Rev. Metal.*, vol. 12 (1915), p. 584.

[3] H. Schottky, "On a Thermometrically Recognizable Tempering of Quenched Steel at 100 deg. C.," *Ferrum*, vol. 10 (1912), p. 274.

[4] C. F. Brush, "Spontaneous Generation of Heat in Recently Hardended Steel," *Proc. Am. Phil, Soc.*, vol. 54 (1915), p. 154.

[5] C. F. Brush and Sir R. A. Hadfield, "Spontaneous Generation of Heat in Recently Hardened Steel," *Proc. Roy. Soc.* (London), vol. 93A (1917), p. 188.

[6] C. F. Brush Sir R. A. Hadfield and S. A. Main, "Further Experiments on Spontaneous Generation of Heat in Recently Hardened Steel," *Proc. Roy. Soc.* (London) (abstract), vol. 95 (1918), p. 120.

[7] T. Matsushita, "On the Slow Contraction of Hardened Carbon Steels" (abstract), *Proc. Tokyo Math.-Phys. Soc.*, vol. 9 (1917-18), p. 312.

[8] G. A. Reinhardt and H. L. Cutler, "Effect of Time and Low Temperature on Physical Properties of Medium-Carbon Steel." *Bull.* A.I.M.E., vol. 151 (1919), p. 1091.

[9] K. Honda and S. Saito, "On K. S. Magnet Steel," *Proc. Phys.-Math. Soc. Japan*, 3d series, vol, 2, No. 3, p. 32.

	Per Cent
Carbon	0.40— 0.80
Cobalt	30.0 —40.0
Tungsten	5.0 — 9.0
Chromium	1.5 — 3.0

Residual magnetism was not appreciably diminished by prolonged heating for 10-hour intervals at 100 deg. C. (212 deg. F.), while mechanical aging, carried out by dropping a bar 850 times on a concrete floor from a height of 1 m., decreased the magnetization by 6 per cent of its initial value.

NATURE OF SPONTANEOUS CHANGES

Undoubtedly the spontaneous evolution of heat, dimensional changes and other observed effects such as have been described above are directly associated with the initial stresses and suppression of the transformations resulting from rapid cooling (quenching). As recently pointed out by Jeffries,[10] the presentation of an adequate explanation of such phenomena offers extraordinary difficulties. Admittedly an atomic rearrangement takes place in hardened steels at room temperature and because of the resistance of mechanical cohesion the time factor is pronounced.

If the character of the dimensional changes (contraction or elongation) occurring in quenched steels is dependent upon the adequacy of hardening as reported by Matsushita,[7] it would appear that for each steel there would be a critical time-temperature relationship in quenching which would at least decrease the magnitude of such changes, and investigation of this point might well be undertaken.

STABILITY OF GAGES

Dimensional changes with time are often encountered in hardened reference gages, and their magnitude and occurrence have been found to vary considerably in gages produced from the same materials under similar conditions of manufacture. In this case, where the steel is used as a standard of measurement, changes in length and planeness of the order of 0.00005 in., which ordinarily might be neglected, become of considerable importance, as do also the methods capable of hastening their completion.

TABLE I. COMPOSITION OF STEELS TESTED

Code Letters	Chemical Composition, per Cent									Suggested for Investigation B.cause of
	C	Mn	P	S	Si	Cr	Ni	W	V	
HC	0.96	0.35	0.014	0.017	0.25	1.31	0	....	..	Use for bearings requiring high hardness, permanence, wear. resistance, etc.
K	0.87	1.10	0.017	0.10	0.23	0.46	0	0.43	0.12	Avoidance of cracking and warping in hardening.
DR	1.18	0.20	0.016	0.013	0.21	0.08	0	....	....	High hardness obtainable in heat-treatment.
ST	0.29	0.36	0.009	0.014	0.70	13.20	0	....	....	Non-corrodible qualities.
DB	1.18	2.20	0.008	0.026	0.26	18.10	0	....	....	Non-deforming qualities and high cutting value.

TABLE II. HARDENING OF THE STEELS TESTED

Code Letters	Oil Quenched from		Remarks
	Deg. C.	Deg. F.	
HC	850	1,562	Note.—Temperatures approximating those recommended by the manufacturer have been used.
K	800	1,472	
DR	800	1,472	
ST	955	1,751	
DB	955	1,751	

TABLE III. SEASONING TREATMENTS USED

Code Letter	Description of Treatment
A	No treatment after hardening.
B	Heated in oil 3 hr. at 100° C. (212° F.) and air-cooled.
C	Heated in oil 3 hr. at 150° C. (302° F.) and air-cooled.
D	Heated in oil 3 hr. at 200° C. (392° F.) and air-cooled.
E	10 alternate 5-minute dips in oil at 200° C. (392° F.), and water at 0 to −5° C. (32 to 23° F.)
F	80 alternate dips as for E above.
G	44 alternate dips of 3 minutes in gasoline at 35 to 20° C. (—31 to —4° F.) and 7 minutes in oil at 200° C. (392° F.).
H	Heated in oil 1 hr. at 275° C. (527° F.).
I	Heated in oil 4 hr. at 275° C. (527° F.).

During 1919, at the request of the Ordnance Department, U. S. A., a systematic investigation of the effects of seasoning of gage blocks was planned, using five steels already employed in the manufacture of gages or those which appeared to offer possibilities for such work. A large number of gages were produced and seasoned in various ways, following which changes in dimensions were noted over an extended period. While it is not possible to draw any definite general conclusions from the results obtained, it is believed that presentation of the following data will be of interest and possibly benefit those who may at some future time elect to investigate this subject, or perhaps it will bring to light existing information not yet published.

All gages used were prepared in the gage section of the Bureau of Standards, while the actual work in carrying out the various heat-treatments was performed by H. R. Yerger, formerly of the staff, who also planned the investigation in consultation with various members of the metallurgical division, gage section and optics division. C. G. Peters and assistants of the interferometry section of the last named division of the Bureau have carried out all the measurements for flatness and length of the gages as reported in this paper.

MATERIALS AND PROCEDURE

Five steels were chosen for the work on permanence as shown in Table I. They were received in the form of 1-in. hot-rolled rounds and were first annealed and then examined microscopically for excessive non-metallic inclusions and surface decarburization. As a result of this examination a few bars were discarded, while the remainder were machined and ground into rough gages. These latter were then hardened by heating in a lead bath (equipped with suitable pyrometric control) and quenched in oil. After grinding, the blocks were seasoned in various ways and the gages were then finished in accordance with the Hoke method.[11]

The hardening treatments used for the five steels are shown in Table II. Temperatures chosen are not very different from those ranges recommended by the manufacturers, though in one case preliminary quenching experiments were also carried out to determine what would be a suitable treatment. In selecting the various seasoning treatments listed in Table III, time and temperature variations as well as relatively rapid changes between temperatures above and below that of the room were considered important. The latter class of treatments may or may not involve a change in state depending upon the hardening conditions, whereas the former is considered to decrease the resistance of mechanical cohesion.

In making tests for planeness (flatness), the usual opticians' method of testing plane surfaces was used. Length tests were made by comparing the gages with the standard precision gages at the Bureau of Standards. The standard and unknown gage were brought into close contact with a plane glass surface and the difference in length was determined from the displacement of the interference fringes occurring when a second glass plane was made to form wedge-shaped films of air over the upper surfaces of the gages, and the film illuminated by monochromatic light at nearly perpendicular incidence. This method for testing gages is described by Peters and Boyd.[12]

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[10] Zay Jeffries, "Physical Changes in Iron and Steel Below the Thermal Critical Range," *Mining Met.* (Feb. 1920), vol. 158, section 20.

[11] H. L. VanKeuren, "Manufacture of Hoke Precision Gages at the Bureau of Standards," *Am. Mach.*, April 3, 1919, p. 625.

IMPORTANCE OF EARLY OBSERVATIONS

A summary of the results of these measurements over an extended period, together with records of Shore scleroscope hardness and intervals between date of hardening, first and last measurements, is given in Tables IV and V for each of the five steels under consideration. It would have been desirable to have the first measurement made on each gage on the day of seasoning, which in turn might have been carried out after a definite number of days from the day of hardening. However, this was not found possible on account of the number of operations and length of time required in finishing the blocks and because of the large number of measurements for length and planeness which would of necessity have to be made on any given day. A schedule approximating this procedure as closely as possible was therefore adhered to. Though others are perhaps not in agreement with this, the writer is of the opinion that under these conditions a very important period for studying permanence (the time immediately following the hardening and finishing of the gages) has, by force of circumstances, been neglected, assuming that the changes in any given short time interval (a few days or weeks) are within the limits of experimental error of measurement. That this assumption may be in error is indicated by the behavior of gages DB3 and DB4.

TABLE V. PLANENESS CHANGES IN ¼ INCH GAGES IN MILLIONTHS OF AN INCH

Steel	First Meas., No. of Days After Hardening	No. of Days Between First and Last Measurements	Ave. of 4 Gages	Max. of 4 Gages	Min. o 4 Gage
K	14	211	7	17	0
DR	8	227	29	58	5
	8	227	5	23	0
	8	227	13	69	0
	8	227	6	23	0
	8	227	8	34	0

which received no artificial seasoning treatments (treat ment A Steel DB of Table IV). These gages, which u to the time of their fifth measurements had shown n change in surface, became so badly deformed durin the period between their fifth and sixth measurement that they could not be made to adhere to the glass plat at the later date. It was found that the surfaces ha become cup-shaped, the inner half being fairly plan but sloping irregularly upward to the edges, the dept of the cup-shaped figure being from 0.0001 to 0.0002 ir for DB4 and from 0.0002 to 0.0005 in. for DB3.

The work of earlier investigators as briefly discusse

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[12] C. G. Peters and H. S. Boyd, "The Calibration and Dimensional Changes of Precision Gage Blocks," *Am. Mach.*, Sept. 30 and Oct. 7, 1920.

TABLE IV. SUMMARY OF DIMENSIONAL CHANGES IN QUENCHED 2-IN. REFERENCE GAGES WITH AND WITHOUT SEASONING TREATMENTS AND SHORE HARDNESS VALUES

Each seasoning treatment was applied to 4 gages. Where no changes in length or planeness occurred equal to or greater than 0.00001 in., no figures are given.

		Hardening		—Seasoning Length Changes in Millionths of an Inch*—					Shore Hardness of Seasoned Gages		
Steel	Annealing	Heated in Lead Bath to	Treatment	No. of Days After Hardening	No. of Days Between First and Last Measurements	Average of 4 Gages	Max. of 4 Gages	Min. of 4 Gages	Average of 4 Gages	Max. of 4 Gages	Mi of 4 Gag
HC	900° C. air-cooled then 800°C. furnace cooled............	850° C. and oil quenched....	A	..	...	.....	....	....	93	95	92
			B	2	217	70	80	50	96	98	94
			C	2	217	17	20	10	92	95	89
			D	2	217	10	20	0	84	87	81
			E	2	217	7	20	0	90	92	84
			F	..	...	.....	....	....	89	94	82
			G	13	245	—7	—20	0	86	90	80
			H	..	...	.....	....	....	86	88	85
			I	..	...	.....	....	....	84	85	81
K	830° C. air-cooled then 800°C. furnace cooled............	800° C. and oil quenched ..	A	12	212	—140	180	0	85	88	83
			B	12	212	—2	—10	0	89	90	88
			C	..	...	.....	....	....	88	91	83
			D	..	...	.....	....	....	85	88	83
			E	..	...	.....	....	....	87	88	85
			F	..	...	.....	....	....	85	86	83
			G	14	216	—2	—10	0	78	85	75
			H	..	...	.....	....	....	84	88	80
			I	..	...	.....	....	....	86	87	85
ST	900° C. air-cooled then 800°C. furnace cooled............	955° C. and oil quenched...	A	16	212	5	10	—10	66	67	65
			B	16	212	17	30	—10	72	75	69
			C	16	212	12	20	0	68	69	67
			D	16	212	7	30	0	68	72	65
			E	..	...	.....	....	....	70	73	68
			F	16	212	2	10	0	71	75	67
			G	13	220	10	20	0	64	68	60
			H	13	220	5	20	0	68	70	65
			I	13	220	12	30	0	65	70	60
DR	800° C. air-cooled, then 770°C. furnace cooled............	800° C. and oil quenched...	A	12	229	5	20	0	73	75	72
			B	12	229	5	20	0	78	85	70
			C	12	229	12	20	0	79	88	75
			D	12	229	5	20	0	79	85	73
			E	..	...	.....	....	....	75	78	72
			F	..	...	.....	....	....	80	83	76
			G	14	219	25	40	20	68	72	63
			H	14	219	22	30	20	71	72	70
			I	14	219	20	20	20	71	72	70
DB	900° C. air-cooled, then 880° C. furnace cooled............	955° C. and oil quenched...	A	(See note below)			...	....	66	70	60
			B	..	...	.....	....	....	70	75	65
			C	..	...	.....	....	....	84	88	8
			D	..	...	.....	....	....	66	71	6
			E	..	...	.....	....	....	75	85	6
			F	..	...	.....	....	....	81	87	7
			G	..	...	.....	....	....	70	75	6
			H	..	...	.....	....	....	68	70	6
			I	..	...	.....	....	....	73	75	7

* Negative signs before length changes refer to decrease; all other figures to an increase.

NOTE.—The 2-in. gages DB3 and DB4, subjected to treatment A, which showed no change in surface up to the time of the fifth measurements, became so ba deformed thereafter that no further measurements could be made, as detailed in the text. Attention is drawn to the fact that blocks of steel ST, DB and DR are general considerably softer than those usually employed in production of gages. Blocks of steel HC and K are nearer the low limit of hardness generally used.

in the introduction further supports the writer's contention that early changes are more rapid than those occurring at a later date.

CONCLUSIONS

Based on total change from first to last measurements, the following conclusions may be drawn:

(*a*) The short gages (⅛ in.) showed no appreciable changes in length with or without artificial seasoning over a period of approximately seven months (first measurement one to two weeks after hardening). No appreciable changes in planeness occurred in the long gages (2 in.) with the exception of the two unseasoned blocks DB3 and DB4 mentioned above.

(*b*) Longer gages than those used (2 in.) would be more desirable for studying length changes with time, because of the extremely small variations actually occurring. About 6 to 8 in. is recommended.

(*c*) Variation in behavior of duplicate gages is confirmed by the K steel blocks subjected to no artificial seasoning treatment. One of these blocks showed no dimensional changes in 217 days between first and last measurements, while a duplicate decreased 0.00018 in. in the same period. Likewise duplicate artificially seasoned gages show differences as illustrated by steel ST, treatment D, Table IV.

(*d*) Except in the case of the plain carbon steel (DR) the changes in planeness are not appreciable.

(*e*) Gages produced from steels ST, DR and DB are softer than reference blocks ordinarily used. The latter are kept between about 90 to 100 Shore hardness. From this standopint, steel ST is unsatisfactory, as it is not possible with ordinary treatment to maintain the hardness within the limits described. A higher-carbon alloy of this type would be more desirable, with possibly a decrease in chromium content so as not to impair its stain resistance and at the same time reduce production costs.

(*f*) The plain-carbon steel DR (containing 1.18 per cent carbon) appears to be the least desirable from the standpoint of permanence, showing in the main the greatest changes in length and planeness during a period approximating seven months from first to last measurements. Probably the most desirable are steels HC and K subjected to definite seasoning treatments, the former being the steel generally used in production of reference gages at the Bureau of Standards and closely agreeing with the composition of Johanssen blocks.

(*g*) None of the seasoning treatments applied has been effective in preventing dimensional changes (within the limits of measurement) in all five steels. Also all seasoning treatments applied appear to effect permanence in Steel DB (containing 1.18 per cent C, 2.20 per cent Mn and 18.10 per cent Cr). Treatments H and I, however, have decreased the hardness.

RECOMMENDED HEAT-TREATMENT

(*h*) Seasoning treatments E and F, consisting respectively of ten and eighty alternate 5-minute dips in oil at 200 deg. C. (392 deg. F.) and ice water at 0 to —5 deg. C. (32 to 23 deg. F.) are the most generally effective treatments tried for obtaining permanence. Probably less than eighty would in many instances suffice to bring the steel in a state of rest under conditions of treatment and manufacture as previously outlined.

Measurements made at intervals of approximately one and two weeks, one, two, four and seven months after initial readings of length and planeness do not give very much information regarding the progress of the changes taking place. Unsuitable steels exhibiting the greatest instability in either length or planeness appear to increase progressively in error with time. In many cases of more suitable steels possessing great constancy these changes seem to occur in the intervals immediately following the first measurement, the gages thereafter remaining constant. However, no very definite statements may be made in this respect.

SHRINKAGE IN STEEL

In a majority of the blocks examined showing dimensional changes there is an elongation, but in the case of steel K shrinkage only is observed. This is unusual, as the changes observed in hardened blocks are usually of the latter type—i.e., decrease in length. Four unseasoned gages produced from this latter material (containing 0.87 per cent C, 1.10 per cent Mn, 0.46 per cent Cr, 0.43 per cent W, 0.12 per cent V) will illustrate progressive shrinkage in hardened steel over an extended period. (Table VI.)

TABLE VI. PROGRESSIVE SHRINKAGE IN RECENTLY HARDENED STEEL

Chemical composition, per cent, C, 0.87; Mn, 1.10; Cr, 0.46; W, 0.43; V, 0.12.

Sample No.	Date of Measurement	Length in Inches	Shrinkage in Inches
K17	Sept. 8, 1919	1.89995	....
	Sept. 25, 1919		0.00004
	Oct. 24, 1919		0.00007
	Dec. 26, 1919		0.00012
	April 7, 1920		0.00018
K18	Sept. 8, 1919	1.89996	....
	Sept. 25,. 1919		0.00002
	Oct. 24, 1919		0.00003
	Dec. 26, 1919		0.00006
	April 7, 1920		0.00008
K19	Sept. 8, 1919	1.89995	....
	Sept. 25,. 1919		0.00003
	Oct. 24, 1919		0.00005
	Dec. 26, 1919		0.00008
	April 7, 1920		0.00014
K20	Sept. 8, 1919	1.89996	....
	Sept. 25, 1919		0.00004
	Oct. 24, 1919		0.00006
	Dec. 26, 1919		0.00011
	April 7, 1920		0.00016

No satisfactory explanation for such difference in behavior can be given at this time, but it is of interest to note that microscopic examination indicates more complete hardening of the K steel blocks (martensite-troostite throughout) than is obtained by oil-quenching the carbon-steel gages (DR) which show a less uniform structure consisting of troostite and sorbite at the surface and sorbite in the interior, indicating but local and partial suppression of the transformations and less complete hardening. In view of this fact the work of Matsushita[7] and his conclusions that the type of dimensional change (elongation or shrinkage) is related to the character of hardening becomes of particular interest.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Gear Tooth Rounding Attachment

By J. M. Henry

An ingenious device for rounding the ends of gear teeth to permit the gears to be meshed together while in motion, as is the case with automobile transmission gears, is shown in Figs. 1 and 2. It is designed to attach to the table of a No. 2 Pratt & Whitney milling machine and is complete in itself, requiring no movement of the machine to which it is attached save the rotative one of the cutter.

The body of the attachment is bolted firmly to the table of the miling machine, a tongue, fitting into the table groove, bringing it into alignment. The working parts are carried in a movable bracket fitted to slide in the body in a direction parallel to the longitudinal movement of the machine table.

The device is driven by a belt from an extra pulley on the countershaft of the machine and is entirely automatic in its action. By changing a single selective gear to match, gears having any number of teeth from ten to forty may be operated upon.

The gear to be worked is held centrally against the faceplate by means of an expanding stud, or arbor, projecting from the spindle of the device, and is positively located circumferentially and driven by the locating piece *A*, Fig. 1, which is adjustable radially upon the faceplate to accommodate different diameters of gears. Upon the other end of the spindle is keyed the selective gear *B*, Fig. 2, which must have the same number of teeth as the gear being worked.

The selective gear is driven directly by a worm located in the housing *C*, Fig. 2, which is adjustable vertically to accommodate different diameters of gears, and the worm is in turn driven from the pulley shaft through an adjustable train of tumbler gears which may be set to mesh in any position of the worm housing.

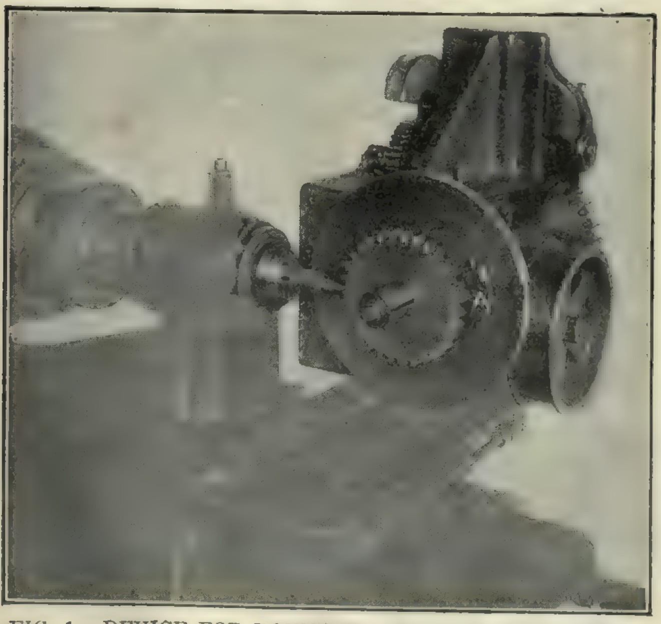


FIG. 1. DEVICE FOR ROUNDING ENDS OF GEAR TEETH

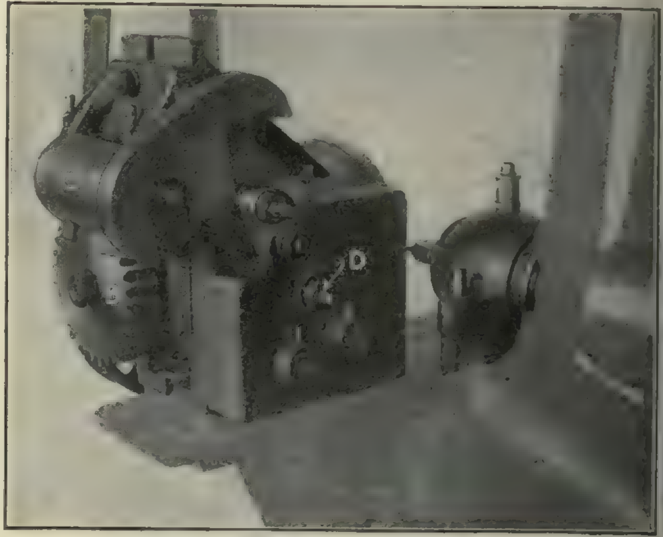


FIG. 2. REAR VIEW OF DEVICE

The pulley shaft drives, through suitable reduction gearing, a camshaft the rear end of which may be seen at *D* in Fig. 2. The cam upon this shaft advances the movable bracket of the device toward the cutter, the return movement being actuated by a spring so that there is one complete forward and back movement of the work for every tooth. The shape of the cam determines the shape of the end of the gear tooth and may be modified to meet requirements.

How to Machine the Brass Disk

By A. Harpham
Rugby, England

Referring to the inquiry on page 959, Vol. 54, of *American Machinist*, as to how a certain brass disk should be machined, I would say that the work should be done on a boring mill as follows: Soft jaws, previously turned in place on the mill should be used, leaving plenty of bearing surface and a shoulder about ⅛ in. deep for gripping.

Operation No. 1: Grip the disk lightly by the periphery and finish the boss side all over, using disk lugs in the holes to do the driving.

Operation No. 2: A solid spigot plate bolted to the mill table should be used, which should be recessed to a depth of 5/16 in. to fit the boss. This plate should have a ¾ in. tapped hole in the center and a bolt, with washer 3½ in. in diameter, will serve to hold the disk flat. By using the driving lugs as before, no difficulty will be found in machining this side; the bolt and washer being removed to permit finishing the small space covered by the washer.

To machine the large tapped holes the disk should be located by the central hole on a stud and, by using a radial drill of suitable size, no difficulty should be experienced in drilling and tapping the holes.

Punch and Die Design

By J. H. Hemminger

Much has been written on the designing of punches and dies, but most of it seems to treat on construction. The writer will endeavor to describe a few important and often forgotten details in planning the systematic designing of dies.

The designer should always be given data concerning the style and number of presses available for making the part. This data should contain shearing capacity, stroke, adjustment and maximum or minimum closed die space for each press. Some designers ignore this data and as a consequence the work is poorly distributed, as some presses are heavily overloaded while others remain idle.

On receiving a detail of the part to be made the designer usually figures the number of operations necessary. Too often designers fail to investigate the function this part performs in final assembly. Extreme accuracy may be required in some places while wide allowances may be permissible in others.

A data sheet of bolsters, die shoes, and punch holders should be given the designer. The bolster data should give size and shape of opening in each bolster, and the location of die shoe bolt holes. I have seen cases in which too small a die shoe has been used for the prescribed press bolster opening, and at other times the bolster opening has been too small for the spring or rubber bumper clearance.

Some drawings of punches and dies reach the toolroom with data regarding everything but the information as to what operation they are to perform, also the condition of the material before reaching the die and the condition in which it should leave the die. In giving the toolmaker this oft forgotten information he is better able to see and plan his objective. In the case of forming dies some designers will draw the position of the part in the die after forming, but ignore the information regarding the piece before it comes to the die, leaving this part for the toolmaker to figure out to the best of his ability.

The usual sectional view of punches and dies if drawn in the closed position, will clearly show if there are any interferences or not sufficient clearance, or if the prescribed press will take the die.

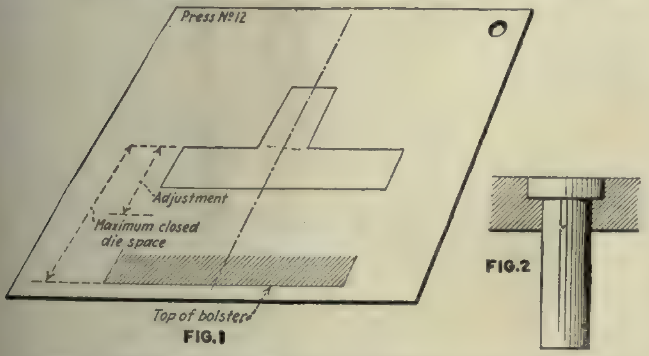


FIG. 1

FIG. 2

FIG. 1. TEMPLET OF DIE OPENINGS IN PROCESS
FIG. 2. SHOULDERED PUNCH SHANK

In designing a large number of dies it is good practice to have die shoes and punch holders printed on drawing paper in their relative press positions. If this is not done a good way of checking the die space with the prescribed press is to make a checking templet, as shown in Fig. 1, out of transparent celluloid. This templet can be used for checking all future dies for that press and will show if any discrepancies exist to prevent successful operation.

If in placing shouldered punches in a punch plate, as shown in Fig. 2, consideration be given to the counterbore sizes available in the shop, it would mean a saving of time as well as a convenience to the toolmaker.

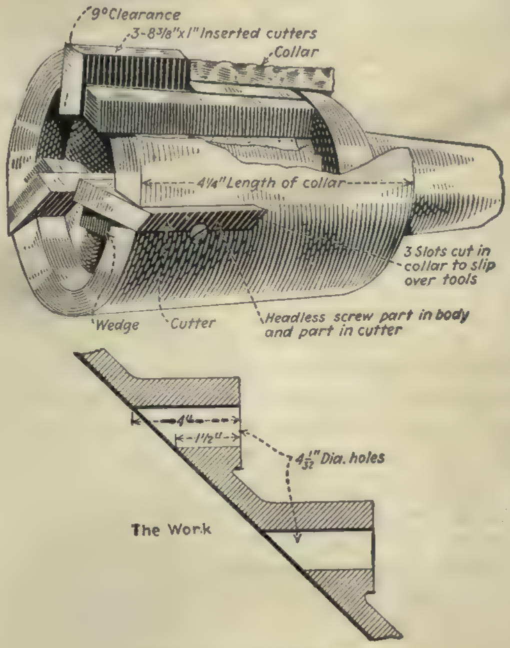
A Special Boring Head

By P. S. Klick

Recently we had some conical bronze tube sheets, about 13 ft. in diameter with over five hundred $4\frac{1}{32}$-in. reamed holes to machine.

The cored holes measured $3\frac{1}{2}$ in. and we had the usual fins, sand and hard scale to contend with. Moreover, most of the cores were not straight.

To rough the holes out, we made a tool as shown in the sketch. As soon as the three inserted tools began to cut to size, the slip collar followed in the hole, and helped to guide the tool straight. By the time the intermittent cut began the collar had a bearing of $1\frac{1}{2}$ in. The slots in the collar also helped to support the cutting edges of the tools. The collar was removed when tools had to be sharpened. About $\frac{3}{64}$ in. was left for the finishing reamer, and very good time was made on heavy radial drilling machines. Water and Oakite were used as a coolant.


9° Clearance
3-8 3/8"x1" Inserted cutters
Collar
4 1/4" Length of collar
3 Slots cut in collar to slip over tools
Wedge
Cutter
Headless screw part in body and part in cutter
4"
1 1/2"
4 1/32" Dia. holes
The Work

SPECIAL BORING HEAD

Extend the Use of Commercial Diamonds

By C. J. Arthur

It is surprising that diamonds are not put to more general use in the shop. Carbons and splints are in service for truing grinding wheels and an occasional diamond turning tool may be seen, but in very few plants are diamonds put to work in as many ways as could be done to great advantage.

It is not much of a trick to mount and grind commercial diamonds, but my experience has taught me that in most cases it is more profitable to call upon the companies specializing in this work to furnish the diamond mounted and ground to the desired shape. In a few instances it may be necessary to true or square up the steel mounting in order to bring the working face or edge of the diamond into proper position of relation, but this may usually be done without difficulty.

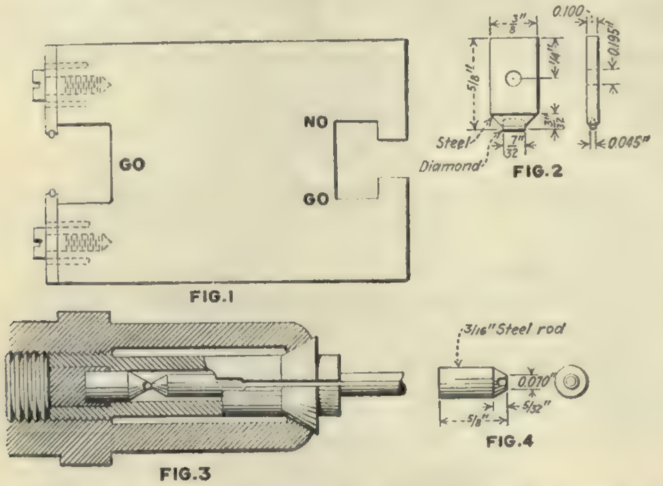


FIG. 1. A SNAP GAGE WITH JAWS OF DIAMOND. FIG. 2. DETAILS OF THE JAW. FIG. 3. A STOP IN A CHUCK. FIG. 4. ALL INSTRUCTION NECESSARY FOR THE DIAMOND SETTER

I will enumerate a few ways in which the diamond has been used to advantage:

(1) The jaws of the "go" side of a snap gage as in Fig. 1. The snap gage is used for gaging vast quantities of work—the work being gaged is dirty and sometimes carries considerable abrasive. Gages of this kind outlast the regular steel jaw gages at least two hundred times. In making up this gage a sketch, Fig. 2, was sent to the diamond firm, which provided the steel pieces and mounted and ground the diamond inserts to the desired form and size. When the steel pieces with diamond inserts were received they were fastened on the body of the gage so that the surfaces of the diamonds were parallel and the proper distance apart.

(2) A stop in the chuck of an automatic machine. In this chuck, Fig. 3, pointed pieces must be gripped accurately to length. A hardened steel stop wore out too quickly, requiring replacement every 25 hours. The diamond stop has outlasted the life of dozens of chucks and does not show any signs of wear. Fig. 4 shows all the specifications that were furnished to the diamond man for his share of the work.

(3) Jaws of a multiplying gage. We used the diamond for the jaws of a multiplying gage. Hardened steel jaws needed redressing every week, while diamond jaws have been in use for three years and show no wear.

(4) Turret stop of automatic machine. We have inserted small diamonds in stop for the screw machine where work with small pointed ends must be accurately chucked to length.

Chatter in Milling Machines

By Elam Whitney

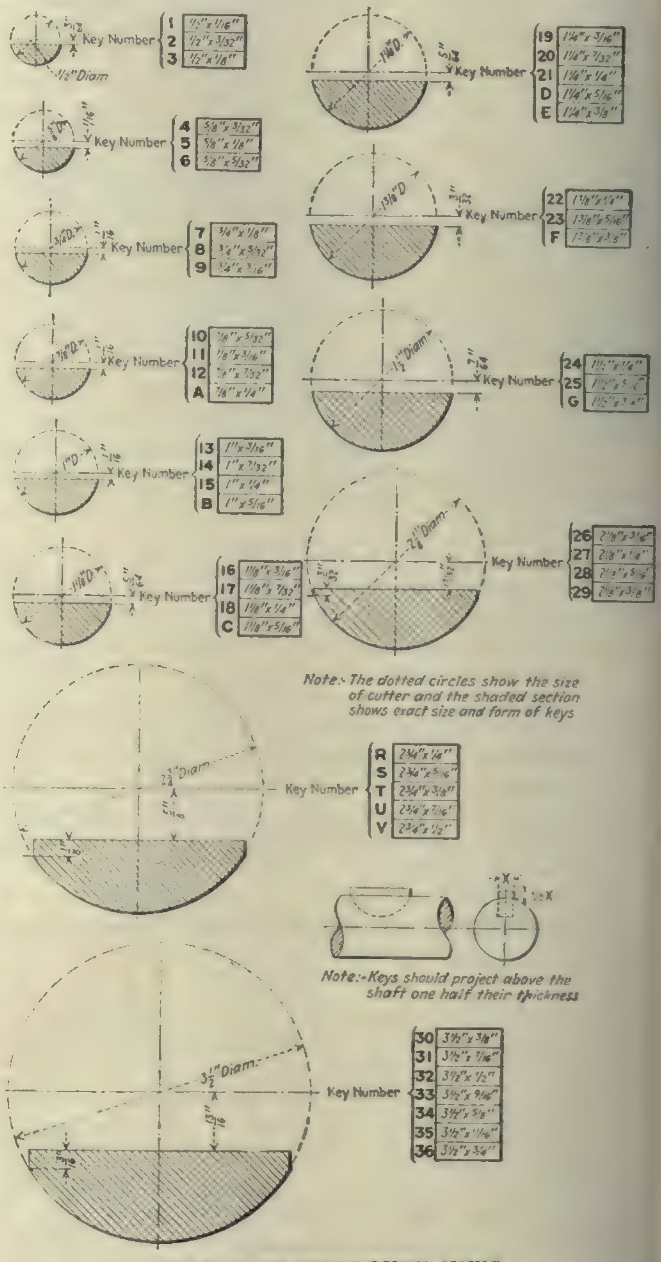
Referring to P. V. Vernon's article under the above title on page 386 of the *American Machinist*, revealing a heretofore unpublished cause of chatter, it seems to the writer that the so-called sharp tooth was only another name for either an incorrect cutting or face angle, or an insufficient clearance angle which condition was temporarily corrected or at least improved when the cutter teeth were stoned.

Dimensions of Woodruff Keys

By H. W. Hardy

I have used the accompanying table of Woodruff keys for many years, and as its arrangement is so convenient and self-explanatory and as I have not seen it compiled thus in any standard works of reference, I thought it would be of interest to your readers.

Where more than two keys are standard for a certain diameter of shaft the medium or middle-size key should be used. As stated on the table, the dotted lines show the size of cutters and the shaded sections show the exact sizes and forms of keys. The keys themselves should project above the shaft one-half their thickness.



Note:- The dotted circles show the size of cutter and the shaded section shows exact size and form of keys

Note:-Keys should project above the shaft one half their thickness

TABLE OF WOODRUFF KEYS

Erratum

We regret that in the article "A Device for Inspecting Gears," by Frederick Franz, in the issue of Oct. 13, the following errors appeared: The illustration showed the rack teeth with curved, instead of straight sides; pitch *diameter* in the line next to the bottom of the first column, should have read pitch *radius*.

EDITORIALS

The Twenty Per Cent That Means Prosperity

SOME one has said that there is a difference of only twenty per cent between the production figures of prosperity and depression. This ratio may be too high for some industries and too low for others, but in the machine tool field it is not far from the proportion exported in normal times. It might be otherwise stated that the value of the exported product often determines whether the yearly balance is in red or black.

Since the war the demoralization of the exchange situation has made it almost impossible to do business with Europe in any line and especially so with American machinery which has to be sold on a quality basis in any event. We must not lose sight of the fact, however, that times are going to get better on the other side of the Atlantic before long and that when they do, good-will will be a priceless asset to the American manufacturer.

Loyal and efficient dealers are not innumerable and for this reason, if for no other, should be accorded considerate treatment. Just remember that they are facing an even tougher problem than is the American manufacturer, for he at least has what is left of the domestic market where exchange troubles do not enter in.

Here is a question that every machinery builder should put to himself for a candid answer, "If I were the foreign agent for the tools built in this plant, would I be entirely satisfied with the treatment accorded me and anxious to do everything in my power to push those tools?"

The Railroad Labor Board

THERE are many opinions as to the merits of the Railroad Labor Board and as many on the need for its continued existence. As for us, we rather sympathize with those who believe that some regulation of organized railroad labor is necessary but that the regulating, if it is to be centralized, should be in the hands of the same body that regulates rates. We have certainly seen enough of the inequality and injustice of regulating rates and labor by two independent commissions.

There has also been severe criticism of the way the board averted the threatened strike. It would have been a seven-days wonder if everybody had been satisfied. Nevertheless, we venture to say that the majority of those most affected by the strike, the people of the United States breathed a sigh of relief when the news came over the wires that the strike was called off. As remarked on this page a week or two ago, our embryo business revival could scarcely have withstood the shock of a national railroad strike.

One disquieting feature of the board's action has arisen. The docket is so full of pending cases to be decided that it will be a long time, perhaps a year, before another wage reduction can be considered, provided the disputes are taken up in order. As a matter of fact, while another ten per cent wage cut would undoubtedly save the railroads a lot of money, the revision of the working rules to an equitable basis would probably save more. Most of the pending cases are disputes over the vicious rules inherited from the late, but not lamented Railroad Administration, and much good will come if they are decided according to the ideas of common justice. Savings so made would be fairer to all concerned than those obtained from a flat reduction all along the line and would cause less discontent. The same principles apply as in the case of flat increases or decreases in freight rates.

The board is to be congratulated for its statement of October 30 where it points out that a strike in violation of a finding of the board forfeits for the strikers all rights before the board. The statement also brings out clearly the interest of the public in a transportation tie-up. Here are two points for labor leaders to consider carefully.

All things considered we feel that this Railroad Labor Board has done about as good a job as is possible under existing legislation.

Let the Army Help Commercial Aviation

LEST we forget that other nations are developing commercial aviation even if we are lagging behind, it is interesting to note that France has five international air-lines. These are Paris-London, Paris-Brussels-Amsterdam, Paris - Strasbourg - Prague - Warsaw, Toulouse-Casablanca, and Bayonne-Bilboa-Santanden. In addition there is the Bourdeaux-Toulouse-Montpelier line which is entirely within French borders. The total is about 3,500 miles.

Reports for the first half of 1921 show that over 565,000 miles were flown with very few accidents, two pilots and two passengers being killed and three pilots and one passenger injured, out of 3,388 passengers carried. Parcels and packages weighing over 161,000 pounds were carried, showing a decided improvement over the previous year.

These lines are partially subsidized by the Air Department of the French government, while we have never been strong for this kind of encouragement. The fact remains, however, that as all tariffs are indirect subsidies this would be no marked departure from our previous customs.

Instead of subsidies, however, it would seem better to provide public landing fields, and to equip the important points with supplies and repair facilities. A portion of the Army could well be assigned to this duty and thereby secure good training, while at the same time aiding commercial aviation in a substantial manner.

This is an excellent chance for co-operation between the cities or states and the Federal Government. The cities or states might well supply the landing fields to be manned by the Army for the development of aviation for all purposes. We have too long neglected our opportunities and as a result many European countries are leading the way. Isn't it time we woke up and got busy?

Shop Equipment News

Van Norman Piston and Valve Grinding Machine

A machine especially adapted to the use of garages and service stations for the repairing of automotive engines, but equally serviceable in other shops where there are small parts to be turned and ground, has been brought out by the Van Norman Machine Tool Co., Springfield, Mass. Combining many of the functions of the lathe with those of both the internal and external grinding machine, it lends itself readily to the turning, regrooving, and grinding of pistons, refinishing of valves and wristpins and for similar work upon many of the small parts that require renewal or repair.

The machine, as shown in Fig. 1, is self contained. The work spindle and the grinding wheel spindle are driven by independent motors of ⅛ and ¼ hp., respectively, and to put the machine into service requires only the attachment of two plugs to lamp sockets. The bed is a single casting. The work table, carrying the headstock and the tailstock, slides upon ways and has a traverse of 14 in. It is operated by the capstan wheel at the left and has an adjustable stop to limit its movement in one direction, so that it may be returned to position with certainty after being run out for the purpose of gaging or inspecting the work. The work spindle is of steel, carbonized and hardened, and runs in taper cast-iron bearings, so that by means of thrust collars and ring nuts it may be adjusted to compensate for wear. There is a hole through the spindle, and the nose is fitted to receive standard draw-in collets up to ¾-in. capacity.

The motor is mounted directly above the spindle and drives it through spur gearing, change gears being provided for a range of spindle speeds from 63 to 170 r.p.m., with a speed of 1,700 r.p.m. of the motor. The head swivels at the base through a range of 50 deg. either side of the center, the base being graduated to facilitate setting. A taper pin locks this movement at either zero, 30 deg. or 45 deg. on either side.

The wheelslide is gibbed to the base and has a cross travel sufficient to enable an 8-in. grinding wheel to be used upon external surfaces of work 8 in. in diameter, and also to bring the wheel spindle forward of the center line when using small wheels to grind internally. The cross movement is actuated by the handwheel to the right, and the screw is fitted with a micrometer dial. The wheel spindle runs on ball bearings at a speed of 2,800 r.p.m., being driven by a belt from a motor mounted on the same slide. The position of the motor is adjustable, for the purpose of maintaining the belt tension. The spindle carries an 8 x ½-in. abrasive wheel, and there is also a taper hole in the end to take arbors for carrying the small wheels for internal grinding.

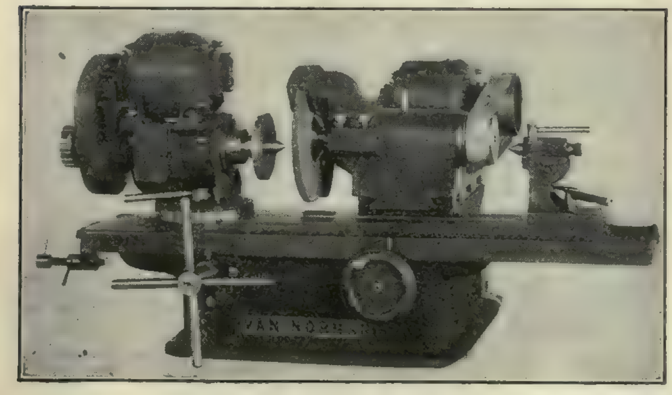


FIG. 1. VAN NORMAN PISTON AND VALVE GRINDING MACHINE

Upon the front end of the cross-slide there is a boss for carrying a toolholder for standard ¼ and 5/16-in. toolbits. As both longitudinal and cross movement are available, with a tool in the holder the machine becomes a lathe. When so used the wheel is, of course, dismounted and the wheel spindle remains idle. The tailstock is provided with a socket for holding a diamond with which either the internal or external wheels may be trued. The machine will swing work 8 in. in diameter and take 12 in. between centers.

Besides the draw bar for the collets, there is a special draw bar for holding pistons by means of a pin passed through the wristpin hole. The small driving plate is recessed to take adapter plates, which are merely disks of cast iron, with a boss on one side to fit the recess, while the other side is fitted to the piston. Pistons are mounted, dismounted or returned to place with accuracy, being centered by the bore of the skirt.

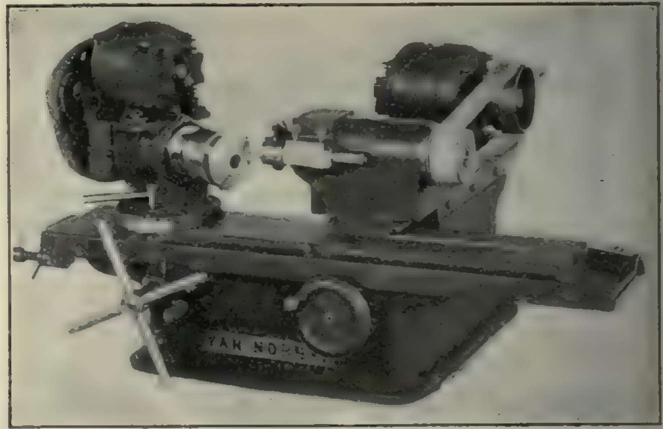
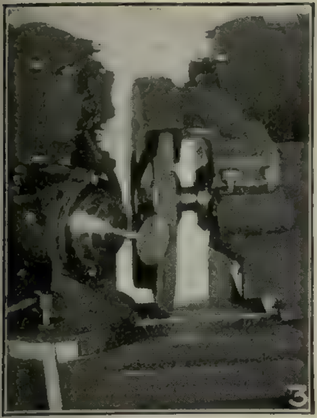


FIG. 2. SET-UP FOR ANGULAR TURNING

With the wheel dismounted and a tool in place in the holders, as in Fig. 2, a piston may be turned, faced, and the grooves trued up, at the same setting in which the grinding is done. The illustration shows how angular boring, turning, or facing is done on work held in the chuck, employing the swiveling feature of the head.

In Fig. 3 is shown the method of grinding poppet valves. The valve-seating reamer is ground as in Fig. 4, by using the machine as a cutter grinder with the swiveling head locked in the 30-deg. position. After the cutter is ground, the valves are held by the stems in spring collets and ground without disturbing the angular setting, insuring absolute mating of the surfaces. The seating reamer and finger rest constitute a part of the regular equipment.

The machine may be used for general machining work



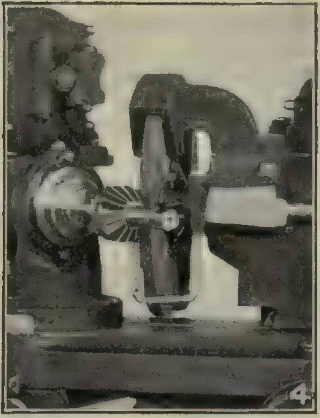


FIG. 3. GRINDING A VALVE. FIG. 4. GRINDING THE CUTTER

on jobs arising in a garage. With a turning tool in the holder, the commutator of a generator armature may be turned; and by turning the tool over on its side and running the table back and forth by means of the capstan wheel, the mica separators may be scored out between the bars. Substituting the wheel for the turning tool, the commutator may be finished by grinding, if desired.

The machine occupies a bench space of 3 x 4 ft. and weighs 330 lb. The absence of countershafts or other external means of driving renders it available for use in cramped spaces, or where there is no source of power other than the lighting circuit. Motors for any standard voltage and frequency, or for direct current, can be furnished.

Davis-Bournonville Line of Tube Welding and Fabricating Machinery

The Davis-Bournonville Co., Jersey City, N. J., has recently placed on the market an entire line of machinery for the manufacturing of welded steel tubing. The line consists of slitting, forming and welding machines for making the rough tubing from the plate, as well as other machines for performing the fabricating processes such as straightening, grinding the seams, drawing, swaging, bending and cutting off. The machines are intended for use by manufacturers of products requiring tubing in large quantities, the number, type and size of the machines used depending upon the character of the tube products turned out.

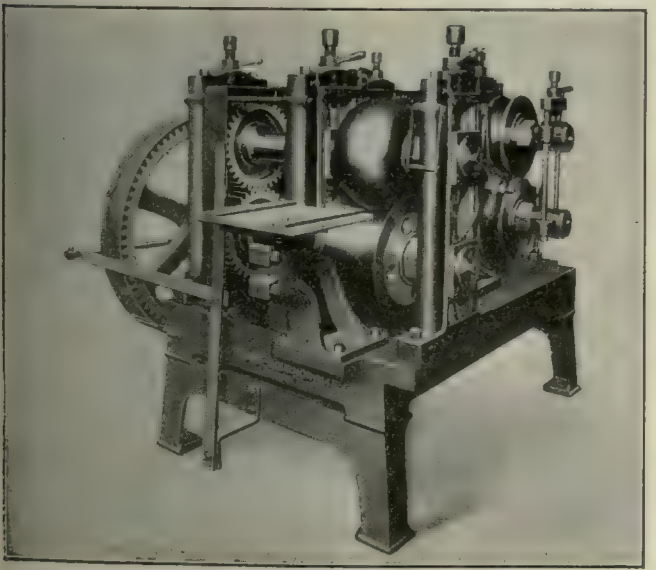


FIG. 1. DAVIS-BOURNONVILLE TUBE-FORMING MACHINE NO. 2

The first step in the process of making the tubing is to slit sheet steel into strips of the required width. For this purpose a gang slitting machine is furnished, steel up to 10-gage thickness and from 18 to 52 in. in width being handled, according to the size of the machine.

The strip stock is then run through a forming machine, in order to give it the required shape. Fig. 1 shows the No. 2 tube-forming machine, having a capacity range from $1\frac{5}{16}$ to 3 in. in diameter and capable of handling steel up to 14-gage. The machine is also made in No. 0, 1, 1½ and 3 sizes. A hollow conical conductor between the roll stands completes the forming started by the first pair of rolls, and the second pair compresses the tube into a true circular shape. A two-roll stand is shown, although three-roll stands can be furnished for use on large tubing. The machine can operate continuously and requires but one attendant.

The tubing is then welded on a machine of the type shown in Fig. 2. This machine is made in two sizes, the No. 2 machine having a capacity from 1¼ to 4 in. in diameter on 10-gage steel, being illustrated. The rolls are not in place on the machine shown, it being easy to remove them because of the fact that the spindles holding them are over-hung. In order to vary the speed of the tubing through the machine, a d.c. adjustable-speed motor giving welding speeds from 24 to 168 in. per minute is provided. The bearings that are subjected to heat are water cooled. The bearings in the base are lubricated from a central oiling station. An oxy-acetylene torch is carried on an adjustable arm, and the welding is done continuously as the tubing passes through the machine. The welding torches are of the multi-flame type, the number and arrangement of the flame depending on the diameter and gage of the tubing being made. The larger tips are cooled by the circulation of water through chambers in them. Acetylene generators can be furnished in order to supply gas for the torches.

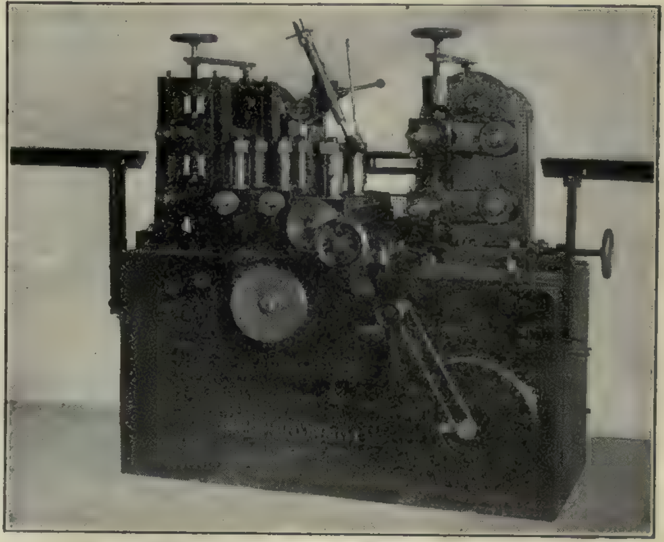


FIG. 2. TUBE-WELDING MACHINE NO. 2

A machine is made for straightening the tubing after it has been welded and passed by the inspector. In Fig. 3 is shown a machine for grinding off the ridge made on the outside of the tubing by the welding. The machine consists of a 7½-hp. a.c. motor, provided with

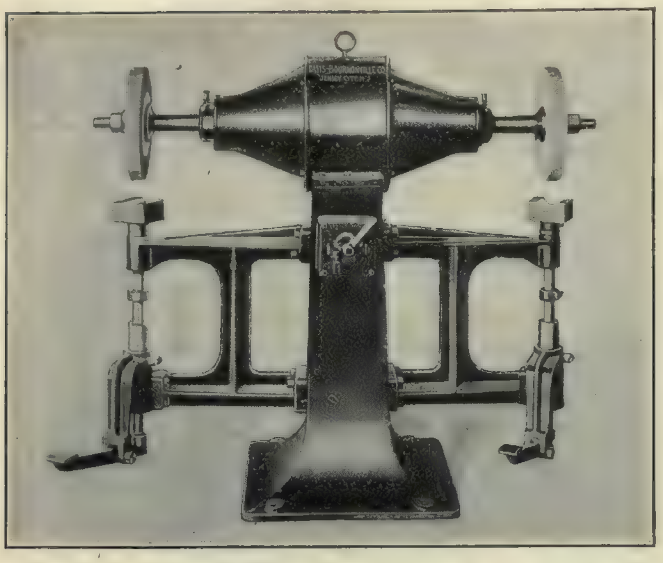


FIG. 3. MOTOR-DRIVEN TUBE-GRINDING MACHINE

a starting device and carrying two grinding wheels. The foot control is so attached to the tube guide as to vary the pressure of the tubing against the wheel, and also to permit of swinging the work to any angle. The tubing is passed under the wheel at a slight angle, and the "flash or bead" is removed by the wheel, which becomes worn concave to fit the form of the tubing.

When the tube is finished by drawing, the grinding operation is not necessary. Draw benches are furnished in two sizes, the smaller having a capacity up to 2-in. tubes and the larger up to 3-in. tubes of 14-gage steel. If it is desired that the inside of the tube be smooth, it is necessary to draw it over a mandrel. Tube-swaging machines are furnished in three sizes. By their use, rectangular, hexagonal, and other shapes may be made from the round tubing, roller dies being employed and the tubing forced over a mandrel or block of the required shape.

A cutting-off saw is provided for cutting the tubes to the proper length. The motor is mounted in the bottom of the machine on an oscillating head, which carries the saw arbor. The pressure of the operator's foot on a treadle tilts the head, so as to bring the saw in contact with the tube to be cut. The saw ordinarily used is 14 in. in diameter, its ball-bearing arbor being driven at a speed of 3,000 to 4,000 r.p.m. by means of a 5-hp. motor.

For bringing the tube to the shape desired, tube-bending machines in three sizes are made by the concern. The machines are ordinarily equipped with double-clutch pulleys, to provide for operation in either direction. Back benches and power attachments can be furnished, as shown in Fig. 4. It is said that the construction of the bending mechanism makes possible the bending of thin-wall tubing without wrinkling or distortion.

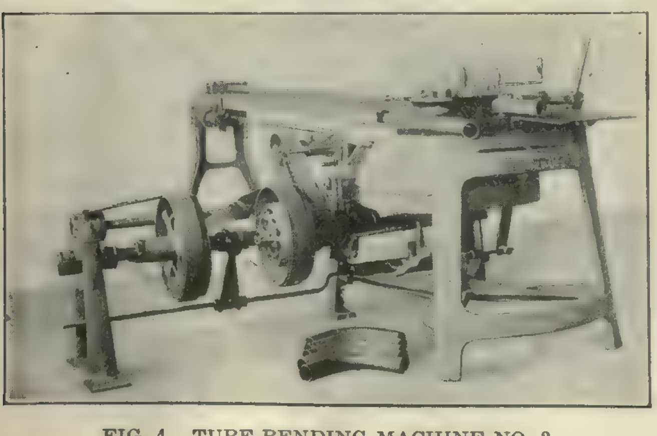
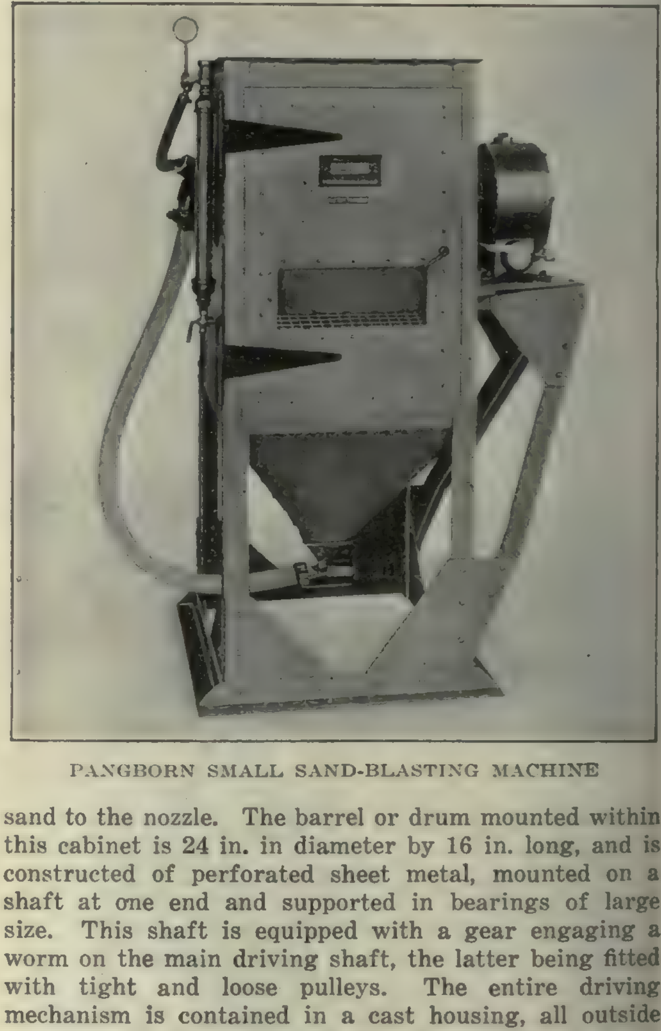


FIG. 4. TUBE-BENDING MACHINE NO. 2

Pangborn Sand-Blasting Machine

The illustration shows a sand-blasting machine recently placed on the market by the Pangborn Corporation, Hagerstown, Md. The machine is of the barrel type, and is especially intended for use in small industrial plants where the parts to be cleaned are not large and where only comparatively small capacity is required. It is said to be applicable to use in small brass foundries, and for cleaning small heat-treated parts or pieces to be galvanized, plated or enameled, or work that requires machining or grinding.

The device consists of a sheet-metal, dust-tight cabinet or housing, on a structural steel frame. The bottom is a hopper to receive the abrasive, and is equipped with a feed box to which is attached a hose that conveys the sand to the nozzle. The barrel or drum mounted within this cabinet is 24 in. in diameter by 16 in. long, and is constructed of perforated sheet metal, mounted on a shaft at one end and supported in bearings of large size. This shaft is equipped with a gear engaging a worm on the main driving shaft, the latter being fitted with tight and loose pulleys. The entire driving mechanism is contained in a cast housing, all outside the cabinet and integral with the structural frame.



PANGBORN SMALL SAND-BLASTING MACHINE

An opening at the side opposite the driving gear receives the nozzle, which is mounted on a swinging bracket to permit of easy access. Dust-tight doors close the barrel housing and opening for the nozzle. The interior of the barrel drum is fitted with baffles, which turn the load as it rotates slowly, bringing all pieces and all faces under the blast action. The spent abrasive drops through the perforations of the drum, through a screen tote box beneath the drum, and into the hopper for re-use. The tote box receives the load when the barrel is dumped.

A door the full length of the drum is held in place by a double spring latch. An opening is provided in the top of the cabinet for attaching to an exhaust system. The machine occupies a floor space of 2 ft. 7 in. x 3 ft. 6 in. and is 5 ft. 6 in. high.

St. Louis "Western" Polishing Machine No. 10

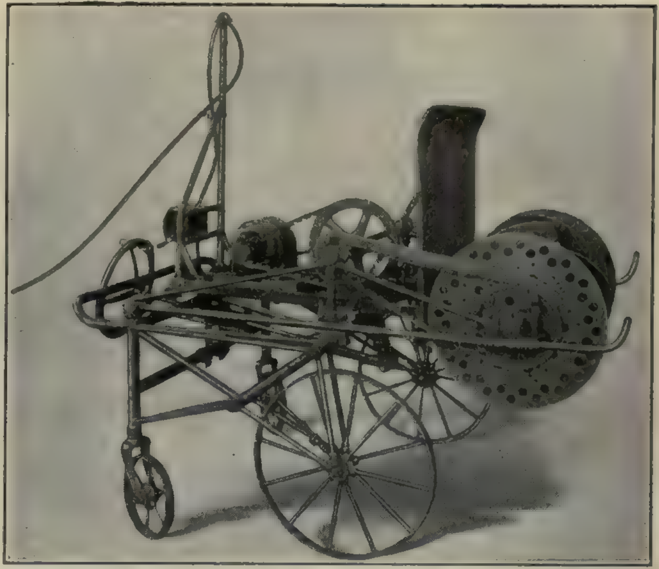
The St. Louis Machine Tool Co., 932 Loughborough Ave., St. Louis, Mo., has recently placed on the market the No. 10 size of its "Western" polishing machine, shown in the accompanying illustration. The machine carries an arbor 48 in. long, so that there is considerable overhang on each side. The wheels are 38 in. apart and the bearings are 1½ by 9 in. in size. Low-frictioned metal is used in the bearings, which are self oiling.

The arbor is made of 0.40 carbon steel, and the threads are of square section and coarse pitch. The height of the center of the arbor above the floor is 34 in. Taper-pointed arbors can be supplied. The machine can be furnished either with a plain pulley, as shown, for use with a countershaft, or with tight and loose pulleys. Either a plain or a pull-type countershaft can be provided, its weight being 165 lb. The countershaft tight and loose pulleys are 8 in. in diameter and 5 in. wide. The weight of the countershaft is 165 lb., and that of the polishing machine itself 260 pounds.

"WESTERN" POLISHING MACHINE NO. 10

American Foundry Equipment Co. Sand-Cutting Machine

The American Foundry Equipment Co., 366 Madison Ave., New York, N. Y., has recently placed on the market the Type H small sand-cutting machine, shown in the accompanying illustration. The machine employs power only for the rotating of the cutting cylinder. It is propelled and guided by hand, a handle for the operator being provided at the front of the frame. The machine weighs less than 700 lb., it being stated that lightness is obtained without sacrificing strength, by the use of seamless tubing for most of the members.



AMERICAN HAND-PROPELLED SAND-CUTTING MACHINE

The bronze-bushed front wheels are of the caster type, and 12 in. in diameter. The rear wheels are 26 in. in diameter and mounted on roller bearings. The cutting cylinder, which is 36 in. wide and 26 in. in diameter, is carried in approximate balance upon a tilting frame which has its fulcrum just forward of the center of the rear wheels. The frame can be tilted backward by means of a handwheel at the front of the machine, so as to lower the cutting cylinder. For the sake of safety, it is possible to instantly raise the cylinder by hand, independent of the handwheel.

Current is brought to the motor, which is of 2 hp. capacity, through a flexible cable from a plug located conveniently in the foundry. A V-belt and a roller chain serve to transmit the power to the cylinder itself. The machine is 7 ft. 4 in. over all in length and 55 in. wide, while its clearance above the floor is 20 in. It is especially intended for use in small foundries, where the sand is ordinarily cut and tempered by means of a hand shovel. It can be adapted to use on core and facing sand, as well as on the ordinary floor sand.

"Industrial" Indexing Table

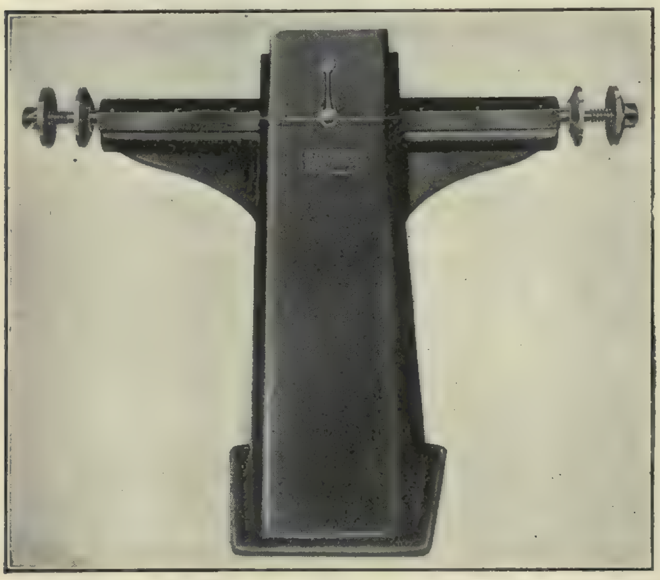
The Industrial Engineering Co., 407 E. Fort St., Detroit, Mich., has recently made some additions to its line of auxiliary indexing tables or "index bases" intended for use on machine tables, and described on page 529, Vol. 54, of the *American Machinist*. The device there described can be indexed to but two positions for each revolution. The table is now furnished to index at either three or four positions per revolution. The size and the principle of the device are the same in each case.

The circular table is indexed and clamped by but one movement of the lever, so that work can be rapidly brought to the required position for milling, drilling or reaming operations. The device is made in two sizes, the table being 10 and 16 in. in diameter. If desired, it can be furnished to index at other positions than at 90 and 120 deg., so as to suit special work.

St. Louis No. 7 Ball Bearing Polishing Machine

The accompanying illustration shows the No. 7 ball bearing polishing machine recently placed on the market by the St. Louis Machine Tool Co., 932 Loughborough Ave., St. Louis, Mo. The arbor, which is 56 in. long and 1¾ in. in diameter in the collars, is supported in four ball bearings, two near the wheels and two near the pulley. The parts can be easily dis-assembled when it is desired to inspect the bearings.

The base of the machine is a heavy casting, the front of it being vertical, while the rear face is at an angle, so as to increase the floor space of the machine. The rear of the base is 4 in. wider than the front, so as to give a greater support and larger footing to the machine without decreasing the standing room for the operator. Since the pull of the belt is usually toward the rear, the construction enables the machine to stand more solidly. The total size of the base is 23 x 24 in., and the height to the center of the arbor is 38 inches.



ST. LOUIS NO. 7 BALL BEARING POLISHING MACHINE

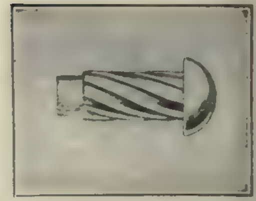
The machine is shown equipped with a belt guard for use when driving from an overhead pulley. The handle at the front is for shifting the belt when both tight and loose pulleys are mounted on the arbor. When an overhead countershaft is used, the shifting mechanism is not employed. The machine can be driven from beneath the floor, the belt being enclosed in the base and a guard being placed over the arbor pulley. When tight and loose pulleys are used on the arbor of the machine, the belt-shifting device is operated by a lever placed at the side of the base and under the head.

A self-oiling countershaft, having a drop of 12 in. and 10 x 6-in. tight and loose pulley, can be furnished. The weight of the countershaft is 250 lb. and that of the polishing machine 530 pounds.

Parker Nameplate Drive-Screw

The illustration shows a device recently brought out by the Parker Supply Co., Inc., New York, N. Y., primarily for permanently attaching nameplates and trade marks to machines. The drive screw has a thread of very quick pitch and a slotless head.

To insert it, holes of a size a trifle larger than the cylindrical point or pilot are drilled, and the screw is driven in with a hammer. Since the entire screw is hardened and heat-treated, the steep-pitch threads cut their way into gray iron or any soft metal. Since the head is not slotted, the screw cannot be removed except by cutting off, thus making it difficult to substitute another nameplate for the one originally fastened to the machine. It is adapted to other uses where a quickly made, permanent fastening is required.



PARKER DRIVE-SCREW

Industrial Spur Gears

The recommended practice of the American Gear Manufacturers' Association as adopted April 28, 1921, is as follows:

The width of face for industrial spur gearing shall follow the following recommended practice: 10 divided by the diametral pitch.

It is recommended that the following table be used for convenience, as closely adhering to the above formula:

Diametral Pitch	Inches Face	Diametral Pitch	Inches Face
1	10	5	2
1¼	8	6	1¾
1½	7	7	1½
1¾	6	8	1¼
2	5	10	1
2¼	4½	12	¾
2½	4	14	¾
2¾	3¾	16	⅝
3	3½	18	½
3½	3	20	½
4	2½		

The thickness for rim for spoked spur gears of cast iron for industrial work is recommended to follow the formula:

4 divided by diametral pitch, or 1.3 x cir. pitch.

Suggestions or recommendations for the improvement of the above recommended practice should be sent to the office of the secretary—4401 Germantown Ave., Phila, Pa.

Hours To Minutes

What are you doing in your firm, to reduce hours to minutes?

This is one of the vital questions that measures your efficiency. Nearly all profits and high wages and low costs depend upon reducing *hours to minutes.*

For instance, a typewriter with a quick typist writing sixty words a minute, reduces an hour to twenty minutes.

A comptometer reduces an hour to fifteen minutes, as it does the work of four clerks.

A steam shovel reduces an hour to three minutes, as it does the work of twenty laborers.

A printing-press reduces an hour to perhaps one-fortieth of a second, as it would take forty men one hour to write one copy of a ten-page newspaper which a press prints in a second.

In these days of high cost it is the *time element* that makes you or breaks you.

The Pharaohs of Egypt were never bothered by the time element. They could take a whole lifetime just to build one pyramid; but you and I are not so lucky.

Our one main hope of success is in reducing hours to minutes—in getting more work done in less time.—*Efficiency Magazine.*

NEWS SECTION

Industrial Relations Association Convenes at New York

Spreading its meetings and conferences over a period of four days, the Industrial Relations Association of America held its annual convention at the Waldorf-Astoria Hotel, in New York City, on Nov. 1, 2, 3 and 4. The convention was one of the best attended which the association has ever held, and the subjects discussed had a most important bearing on the problems of present day industrial enterprise.

Most of the speakers were directors of personnel work, or employment managers in large corporations. They brought to the conference a diversity of ideas, which they exchanged freely on the speaking platform, thus giving an unusual opportunity for the audience to absorb an invaluable amount of information and data on a subject which is receiving a lot of attention during this time when employment is one of the greatest of our industrial problems. Many suggestions were offered as a panacea for present employment ills, and no doubt much good will come from the open and instructive lessons that were presented.

On Friday evening a dinner meeting was held at the Hotel Astor in conjunction with the Academy of Political Science. The Hon. Herbert Hoover, Secretary of Commerce, presided and also delivered the introductory address, his subject being, "The Value of Good Will and Co-operation in Industry."

The convention ended on Saturday with another joint session of the two organizations at which subjects of mutual interest were discussed. In our next week's issue we hope to publish a more comprehensive report of the convention, giving if possible, abstracts from the more important addresses.

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Taylor Society Meeting

A tentative program has been announced for the annual meeting of the Taylor Society, to be held in the Engineering Societies Building, Thirty-ninth Street, New York City, on Dec. 1, 2 and 3. One session will be devoted to an examination and discussion of the evaluation sheet devised by Secretary Hoover's "Committee on Elimination of Waste in Industry." Other sessions will be devoted to sales engineering, production managers and plant executives, sales cost accounting, scientific management and labor management.

Business meetings, luncheons and dinners will be held at stated periods during the convention.

Motor Service Costly To Postal Dept.

The joint commission on postal service has submitted its report to Congress. That portion of the report referring to the motor vehicle service reads as follows:

"The survey has brought to attention that the cost of motor vehicle service in all the cities investigated is enormous and that it constitutes one of the largest items of expense. It has developed that in all the different cities there has been lack of uniformity in the fleet, necessitating the maintenance of most varied stocks of miscellaneous stocks for repairs and replacements. There has been the added embarrassment that the chauffeurs have unnecessarily been called upon to operate different makes of trucks, so that they have not been able to develop that familiarity with any one type which would enable them to operate it with a maximum efficiency and at the minimum cost. The Postmaster General, to whom these facts have been submitted, has recently placed at the head of the motor vehicle service a man who has been selected as an expert. Among other reforms it is planned to reduce the type of machines from 30 to 8, and various necessary improvements are under way.

"The cost of operation per hour and per mile, and the cost of repairs in certain cases, has been so great as to prompt inquiry as to whether or not a contract system would not be more advantageous to the Government than ownership, but at this time no recommendation on this point is made."

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Better Packing Needed for Far Eastern Climate

Complaints are coming to the Department of Commerce from many quarters that automobiles and machinery of different kinds are reaching their destination in the Far East much damaged by rust and moisture, owing to inadequate protection in packing against the damage which is likely to be suffered from a hot and moist climate. Certain American manufacturers are making waterproof papers to meet this need, some of which are wide enough to cover the full width of the standard sizes of automobile cases, so that the cases are completely lined without seams except at the corners. This matter of protection against moisture is of very great importance, as existing methods make purchasers unwilling in many instances to buy American machinery.

Publishers Discuss Ways to Speed Revival of Business

Representatives of 122 publishers of technical, trade and business papers, comprising the Associated Business Papers, Inc., met in Chicago on Oct. 24, 25 and 26 to discuss the publishers part in speeding the revival of business.

The key-note address, delivered by James H. McGraw, president of the McGraw-Hill Co., Inc., was received with great enthusiasm.

Harry Newman Tolles, vice-president of the Sheldon School, portrayed the causes of lazy habits of salesmen, which grew up during the prolonged sellers' market.

Earl B. Hill, chairman of the surplus property committee, gave a report of the economic service rendered by the business papers in disposing of millions of dollars worth of surplus government property through advertising. A large percentage of this advertising was placed in business papers and the results have proved so satisfactory that several foreign governments are considering the adoption of similar methods.

David Rosenblum, vice-president of the Business Training Corporation, New York, explained the course in industrial publishing which has been initiated by the New York Business Publishers.

Among important business matters receiving attention of the convention was the auditing of publications of free circulation by the Audit Bureau of Circulations. A resolution was passed requesting the "ABC" to discontinue the auditing of such publications, since free circulation is contrary to the basic principles of legitimate publishing, and circulation statements have the effect of misleading advertisers who have come to associate the "ABC" with ethical standards of publishing. The new officers elected for the ensuing year are as follows: President, James H. McGraw, McGraw-Hill Co., Inc.; vice-president, A. O. Backert, Penton Publishing Co.; treasurer, Fritz Frank, Iron Age Publishing Co.

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German Oil-Engined Plane

To reduce the cost of "airway" working, by replacing the petrol motor by an engine using crude oil and working on the semi-Deisel principle, is now the aim of Professor Junkers, whose German all-metal monoplanes are well known. Professor Junkers has been experimenting for some time with adaptations of the Deisel system, and it is now reported that an experimental six-cylinder engine has been used in an airplane and has worked promisingly.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

(Copyright, Theodore H. Price, Publishing Corporation, 16 Exchange Place, New York)

In so far as America is concerned nearly all the facts of the commercial and financial situation are encouraging. Credit is abundant. The reserve ratio is again higher at 71 per cent. We have a gold reserve so large that it is plethoric. It gained fourteen millions last week. Interest rates are coming down, as witness the reduction of the rediscount rate by ten Federal Reserve Banks last week.

Commodity prices are so low that distributors run but little risk in stocking up. Making allowance for the decline in prices bank clearings indicate that the turnover of goods is as large as it was a year ago and nearly every one whose opinion carries weight is talking optimistically.

Feeling is, however, as important as facts and it must be admitted that the business complex lacks resiliency. Enthusiasm is wanting and doubt of the future seems to have laid its chill hand on the entire community. The reasons for this discouraging apathy are mainly political. I mean political in a philosophic and not a partisan sense.

There is a consciousness that the problems of government are becoming increasingly difficult. The future of civilization depends upon the ability of statesmen to maintain peace, preserve order and equitably distribute the cost of government while adequately protecting the rights of the governed and their property. There seems to be a fear that with the burdens and the enmities that war has created this will prove to be impossible and the present hesitancy is a consequence of this fear.

There is an eager hope that at the Disarmament Congress to convene this week a way will be found to resolve international antagonisms and make it impossible for the nations to fight by taking away their weapons but there is also a realization that the effort may fail and that the world may remain an armed camp for the maintenance of which society would have to bankrupt itself. It is this latter contingency that causes men to pause and makes it the duty of every one to work and pray that a meeting of minds may be brought about at Washington.

Meantime the business outlook reminds one of an unfrequented street paved with cobblestones between which the grass persists in growing despite the discouragement of the stones and the passage of an occasional vehicle.

One of these stones is the tax bill which the Senate is trying to fashion. Most business men will join with Senator John Sharp Williams in his appeal to both sides of the chamber "to do more voting and less talking and let the American consumers and the American taxpayers find out where they are."

Another stone is the predicament in which the Western farmers find themselves as a result of the decline in wheat and corn and the high freight rates. One of them who lives in Indiana writes me that many of his neighbors will be unable to pay the taxes now due because of the heavy losses they have made on the year's operations. He argues that since the Government guarantees the miner $18.60 an ounce for his gold and has under the Pittman act recently undertaken to pay $1 an ounce for silver of American production the farmer is entitled to similar quarantees for the product of his toil, and adds that unless something is done to reduce the speculative hazards of agriculture it will be abandoned.

A third stone is the labor unrest which though it was quieted in the case of the railroad workers is again manifest in the New York milk strike and the strike of the bituminous coal miners which may involve nearly 200,000 men.

It is reassuring and really surprising that in the face of so many untoward developments some markets have advanced and that no commodities except grain have declined seriously.

As to wheat and corn it seems a clear case of a surplus and no demand for export. Cotton has been steady but the demand for cotton goods is becoming less active. Coffee is up another half cent on buying attributed to the Brazilian government but more probably due to a public realization of the smallness of the supply held in this country. Raw sugar is firmer for the same reason. Reports from the steel industry are conflicting but agree as to the increased output of both iron and steel.

More copper is being sold but prices are not much changed. A further advance of 50 cents a barrel in Pennsylvania crude petroleum is announced. If the trade reports are to be believed lumber is higher and more building is being undertaken as winter draws near, which is at least unusual, while the year's totals to date show the amazing increase of nearly 200 per cent over the 1914 figures. With the steady revival of industry this accounts for the decrease of a million in the number of unemployed reported during the month.

The European outlook like our own is beclouded by political and social unrest. The Irish question has again become acute. The dexterity of Lloyd George is being sorely tried in dealing with it but the indications are that he will succeed. The Bank of England has reduced its rediscount rate to 5 per cent. Marks are again lower at 47 cents a hundred in New York and the shelves and shops of Germany are being swept clear by those who are trying to exchange marks for goods. It is officially announced that the Reparation Commission has allowed two weeks of grace on the payment due Nov. 15. Just how a financial debacle can be avoided in Germany is not clear.

But on the New York Stock Exchange, where all these perplexities and troubles should be first reflected, placidity has reigned. Many securities are higher and but few are lower. Railway shares are steady but no higher as the remarkable increase in net earnings is offset by the fear that public sentiment which is becoming very insistent will shortly compel a general reduction in rates, and there is further evidence that railway managers realize this in the cuts announced by the Southern Pacific and Union Pacific. The vigorous propaganda of the railway companies whose purpose seems to be the exploitation of their own property says nothing about the increase in traffic that lower rates would induce.

The bond market shows increased strength and the ease with which new offerings are absorbed is remarkable. They run into the millions and anything that can be called a bond seems to be salable. This is of course due to the decline in interest rates but it is to be observed that the default of the Chinese government in meeting the loan of $5,500,000 due Nov. 1 has somewhat dampened the American demand for foreign securities. This loan was payable in dollars and was placed here in 1916, being one of the first foreign loans sold in this country after the war had commenced. One result of the default may be to reconcentrate the investment of American capital in America. If so it will probably be impossible much longer to avert the inflation which most economists agree will sooner or later be a consequence of our continued importation of gold.

As interest rates fall and gold becomes cheaper it will be exchanged first for bonds, as at present; then for stocks and afterwards for merchandise.

This has always been the case in the past and there is no reason to expect any change in the sequence or the event.

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International Chamber To Meet at Rome in 1922

Announcement was made last week by the American Section of the International Chamber of Commerce, that the second annual meeting of the International Chamber will be held in Rome, Italy, during the week of Sept. 18, 1922. At the first annual meeting held last June, in London, more than 200 American business men attended.

The date for the next meeting was decided upon at a meeting of the Council of the International Chamber just held in Paris. The United States was represented at this meeting by Owen D. Young, vice-president of the General Electric Co.; E. A. Filene, president, William Filene's Sons Co., Boston; and Elliot H. Goodwin, vice-president of the Chamber of Commerce of the United States.

Eighteen countries now hold membership in the International Chamber, and a number of other countries have applied for admission. The countries already admitted are: Argentina, Australia, Austria, Belgium, Czecho-Slovakia, Denmark, France, Great Britain, Italy, Japan, Luxemburg, Netherlands, Poland, Spain, Sweden, Switzerland, and the United States.

Industrial Cost Association Holds Second Conference in Pittsburgh

With headquarters at the William Penn Hotel in Pittsburgh, Pa., the Industrial Cost Association held its second National Industrial Cost Conference on Nov. 2, 3 and 4. The meeting was well attended and the members departed with the comfortable feeling of having accomplished a creditable amount of useful work.

After registration and the other formalities had been gone through on Wednesday morning, the president, Horace S. Beck, controller S. K. F. Industries, Inc., New York, called the first session to order and made a short address. He commented on the work done by the association during its first year of existence and commended the officers and members on what had been accomplished. He also stated that it was planned for the coming year to have presented at each local section meeting a paper prepared under the direction of the executive committee of the association, in order to assist in the work of the sections.

The afternoon session was opened by an address of welcome from Mayor Babcock, of Pittsburgh, who presented the members with the freedom of the city and offered his own assistance and that of the various city departments to those members who were unfortunate enough to get into difficulties. The conference then listened to a paper read by S. B. Taylor, general manager, S. K. F. Industries, Inc., N. Y., on "What the Sales Manager Should Have From the Accounting Department." Mr. Taylor enumerated various details and figures that must be supplied by the accounting department. He laid particular stress on the need for cordial co-operation between the members of the accounting department and the members of the sales department. The plea for co-operation was strongly endorsed in the discussion which followed his paper.

E. C. Grimley, Victor Talking Machine Co., Camden, N. J., then discussed the matter of taking inventories, contrasting the time required and the benefits accomplished from the old-fashioned annual or semi-annual inventory which necessitated shutting down the plant, and the more modern perpetual inventory as practiced in most progressive plants. The discussion on this paper was read by Christopher Haigh, General Electric Co., West Lynn, Mass., and brought out many different points of view on inventory matters.

In the evening papers were read by F. S. Willett, controller, Dodge Manufacturing Co., Mishawaka, Ind., on "Responsibility of the Controller or Accountant in Times of Business Depression," and by T. W. Dinlocker and A. W. Wainwright, both of S. K. F., on "Idleness and Its Relation to Industry in Retrospect." Mr. Willett had a blueprint illustrating the operation of a business in a way to bring home to the lowest employee in the plant the problems facing management. It was examined with much interest by those present. He told of a successful plan for executive meetings as practiced in the Dodge plant and brought down the house with a parody on the recent "popular" bank statement of the Corn Exchange Bank in New York. Messrs. Dinlocker and Wainwright brought up to date the topic upon which they had read a paper at the previous conference in May, and started a discussion which was not completed at 10:30 p.m. when the conference adjourned to the Press Club for an entertainment provided by A. W. Bendig, McIntosh-Hemphil Co., Pittsburgh.

The Thursday morning session was opened by an interesting paper by Addison Boren, Yale & Towne Manufacturing Co., Stamford, Conn., on "Terminology." At the conclusion of the discussion, H. S. Britenstein, chief accountant, department of the controller, City of Pittsburgh, told in some detail of the preparation of the municipal budget and suggested ways in which the methods used by the municipality might be applied to the industrial plant and office.

After luncheon at the Heinz plant the dedegates listened to addresses by J. B. Ayres, sanitation and safety engineer, and Major Wm. Hogg, assistant to the vice-president, National Tube Co., Pittsburgh. These gentlemen described some of the safety and sanitation work of the United States Steel Corporation and outlined the actual savings in dollars and cents possible to attain.

An informal banquet was held in the evening with President Peck as toastmaster and with Sanford Robinson, New York, and Clifford B. Connelley, commissioner of labor and industry of the state of Pennsylvania, as the speakers. A number of vaudeville acts were put on to entertain the diners between the courses and served to make the dinner a memorable affair. The speeches were sent out to some 40,000 wireless receiving stations all over the world by means of the Westinghouse amplifying and transmitting device which was installed beneath the speaker's table. Commissioner Connelley warned against the dabbling in industrial relations by those people unacquainted with the problems involved. He said that his experience had shown that the possibilities for harm in such matters were much greater than for any good being accomplished. He criticised the daily press for its unwillingness or inability to supply the kind of reading matter that would educate and enlighten the masses of the people.

Mr. Robinson, who is an expert on federal taxation, started his address by outlining the history of federal taxation by the Government of the United States since its foundation, and followed that up by a short history of income tax legislation throughout the world. He called attention to the fact that until a few years before the war the tariff had been the principal means of raising revenue in this country. He then took up the various income tax laws made possible by the adoption of the 16th amendment to the Constitution and gave credit to the treasury officials for the sane and generous manner in which these harsh laws had been interpreted. Mr. Robinson stated that he anticipated a long period of general decline in prices with probable fluctuations of three or four years' duration. He said that a sales tax under such a long-time trend would in his opinion be unworkable and gave several of the stock arguments against the sales tax.

At the meeting of Friday morning, J. M. Howell, General Electric Co., Schenectady, N. Y., read a paper on "How Can a Cost System, Although Efficient, Demoralize an Organization?" In his paper he criticised the ready-made cost system as applied by certain consulting accountants and told of the harm it could do when local conditions were not taken into consideration.

Export Manufacturers Get Lesson on Postal Laws

About one hundred members of the American Manufacturers Export Association gathered at a luncheon in the Hotel Pennsylvania on Nov. 2, to listen to an address on postal regulations by O. K. Davis, secretary of the National Foreign Trade Council and a delegate to the Pan-American Postal Congress, recently held in Buenos Ayres, Argentina. The address was more in the nature of a censure of American business men and their ignorance—or laxity—in the matter of postal regulations existing between the United States and the various South American countries. Mr. Davis is well qualified to speak on this subject and his remarks, though interspersed with humorous references, were given serious consideration.

Mr. Davis told of the careless manner in which our business houses ship or mail merchandise to foreign countries by parcel post. He related some particularly flagrant instances of total ignorance of postal regulations and showed the difficulties experienced by our trade representatives in these countries to straighten out some of the tangles.

In telling of the origin of the Postal Congress, he said:

"There was no general international arrangement for the handling of international mails. Each country made its own arrangement with the other country. The Postmaster General of the United States undertook to develop some uniformity and his action led to the formation of the Universal Postal Congress.

"Every postal convention includes a paragraph right at the beginning to the effect that the provisions of the convention shall apply to letters, post cards, printed matter of all kinds, commercial papers and samples.

"Parcel post, however, is a very different business. Parcel post is a distinctly commercial affair. It is designed for the benefit and is occupied with the benefit of interchange of goods and commercial matters.

"In 1911 the ten countries of South America held a convention and established the South American Postal Union. That was held in Montevideo. That union was due to hold another meeting this year and they decided very naturally to expand it to a Pan-American Union. So they invited all the countries of Pan-America including the United States.

"There is an enormous complaint arising about the parcel post service between the United States and South American countries. A very large part of it is due to the carelessness, ignorance and indifference of our own shippers in the use of the mails. I venture to say that outside of the Postal Service in the United States there isn't one person in a thousand that knows anything about the United States Postal Guide.

Here Mr. Davis related some humorous incidents, showing the red tape and seemingly ridiculous regulations which now exist. For instance, it cost a trade commissioner in one South American city, $17.17 and a week's work to retrieve a parcel post package which contained twelve tubes of tooth paste, valued at $2.50. Other like incidents were mentioned and the apparent indifference and carelessness of American business men to postal regulations was strongly emphasized.

Effect of Railroad Strike on Mine Workers

Official Washington literally heaved a sigh of relief last Friday morning when the railroad strike order was countermanded. It was a case of the night being blackest just before the dawn, as it is known to have been the opinion within the administration on Thursday that the odds in favor of the strike had increased. While the administration had gone further in its preparation to meet this threatened strike than ever before, it was admitted generally that Federal officials are so surrounded by limitations as to be in a poor position to handle any such emergency.

In spite of everything that could have been done it is admitted on all sides that the strike would have entailed losses and would have interfered with all activities to such an extent as to bring it within the category of a national disaster. The fact that the strike has been avoided without the surrender of any principle means that the country and its business have been saved a very serious blow. There is a feeling in railroad executive circles that there never will be a better time for a "show-down." Some railroad officials are not entirely satisfied that the settlement is the blessing most people regard it. This is predicated on the assumption that the strike simply has been delayed and that no lasting impression has been made upon the labor unions. There are many, however, who believe that organized labor as a whole has been taught a lesson. Public opinion never before weighed as heavily in a labor dispute. The action of the administration in taking such prompt and effective steps to counteract the consequences of a strike came as a great surprise to many labor leaders. In fact it establishes a new policy of Federal procedure—one that has proven popular and which is likely to be followed in the future. The steps that were taken to accumulate stocks of necessities at strategic points probably will not be abandoned. Through co-operation with state and municipal authorities, none will be surprised if a plan is worked out looking to the emergency assembly of necessities at central points, so as to insure the maximum of protection to the public when a situation of this kind arises in the future.

Opinions differ as to the effect which the calling off of the railroad strike will have on the mine workers. Some believe that they will be impressed by the sentiment manifested against a railroad strike and by the attitude of national and state officials. Others are very firmly of the belief that a coal strike cannot be avoided. It is admitted by all, however, that much will depend on the conclusions that will be formed as to who is the winner of the railroad controversy. If the developments of the next few weeks are such as to make it appear as anything less than a defeat for labor, the affect on the coal strike will be correspondingly less.

Advices to the Department of Commerce indicate that during the week ended Oct. 29 as much coal was moved as the railroads could handle. Some are of the opinion that there will be a decided slump in the movement of coal because the strike is not to be called. Others think that the strike had the effect of reminding consumers that they had better lay in their supplies and wait no longer on possible reductions in freight rates and in prices. Such analysis as it has been possible to make of this coal movement indicates that large consumers were not heavy buyers. To start with the public utilities and certain other large consumers already had laid in considerable reserves of fuel. Even those consumers who had small reserves made little effort to get coal on the assumption that a strike that would prevent their getting coal also would prevent receipts of raw material and the shipment of output. Since they faced conditions which would necessitate a shut-down for other reasons, they did not worry much about the coal supply.

While the returns are not complete from the survey of coal stocks made by the Department of Commerce, enough figures were collected to indicate that stocks taken as a whole are not far from normal. Domestic stocks at this time of year always are at the low point, but even in their case there are indications that the experience of the war has had the effect of influencing some to buy coal early. Retail stocks seem to be normal with reserves sufficient for domestic consumers' normal needs for periods varying from three to six weeks. Some crumb of comfort was occasioned by the fact that considerable stocks of anthracite were available at points near tidewater and by the fact that considerable stocks of by-product coke had been built up in cities where it could be utilized to the best effect.

A thorough survey of coal stocks is to be made this month by the U. S. Geological Survey. It also is the intention to make another survey sixty days later. This survey was decided upon before the strike situation developed. In view of the possibilities of a coal strike in the spring, it is regarded as being unusually important to secure exact data as to stocks as of Nov. 1, and as of Jan. 1.

Germany Working Overtime

James B. Spencer, treasurer and general manager of the United States Hoffman Co., of Syracuse, N. Y., maker of clothes pressing machinery, returned this week from a trip to Europe. He visited England, Ireland, France, Belgium and Germany. He spent three months abroad visiting the foreign branches of the Company.

Business depression has been general in England on account of the coal strike, he says. Unemployment is general.

The rate of exchange is one factor which is holding back England's business revival, Mr. Spencer said. This is one reason, and the main one, he thinks, why English merchants are not dealing with America.

In Germany, Mr. Spencer says there is less unemployment than in any other European country. The Germans are working 12 and 14 hours a day, and while the low value of the mark is a deterrent in some ways, it is an aid to business and manufacturing revival, he says. It allows the manufacturer to get his products into foreign markets at a very low cost, and the money changed into German marks gives him a larger return than he enjoyed during the most prosperous times.

Theater Owners Aid Campaign of Education

The Motion Picture Theater Owners of America, an organization comprising several thousand members distributed all over the United States, has thrown its resources into the campaign for industrial education which is being sponsored by the Bureau of Economics at Washington. On Saturday, Oct. 29, at the Criterion Theater, New York, a conference on "Industrial America" was held; several hundred prominent educators, editors and business men attended.

The theater owners have offered the use of their properties to the Bureau of Economics, on Saturday mornings and at any other time when a regular performance is not scheduled. At these times, the bureau will supply moving pictures of branches of commerce and industry, showing how various commodities are made, prepared for market, transported and all other phases of modern trade. This is a means toward aiding the school boy or girl in choosing a vocation. Other films on subjects of interest to tradesmen, manufacturers and business men in general will also be shown.

Secretary of Labor Davis, who was unable to attend the conference, sent a message congratulating the association for its good work and promising the co-operation of his department in furthering the plans.

Speakers who addressed the conference were: Nathan D. Williams, National Association of Manufacturers; Dr. Henry E. Jackson, director, National Community Bureau; Dr. Newell Dwight Hillis, Plymouth Church on "Better America"; Francis Holley, director, Bureau of Commercial Economics. Sydney S. Cohen, president of the Motion Picture Theater Owners of America, and who is given much credit for this campaign, spoke in behalf of the owners.

First Auto Show In China

In reports received from Shanghai showing the progress of the First International Chinese Automobile Show to be held the week of Nov. 26 to Dec. 3, Consul General E. S. Cunningham states that cable requests from German and Japanese manufactures have been received, and officials of the show have given notice that exhibitors of any nationality will be allowed to take part in the exhibition.

French Airplane Construction

A London financial journal states that the French Military Air Service will next year have over 40,000 airplanes, if the army budget passes. The French Flying Corps would then be composed of 286 regiments, each of 12 squadrons. French airplane constructors are at present in a very strong position, mainly because the French government did not cancel all its war contracts, but allowed constructors to execute the greater number of them. It was thought that this would be the best way of subsidizing the French air industry.

In addition, the French constructors had in hand substantial orders from Japan and South America. It is to this policy and to the most intelligent co-operation of the French military technical services with civilian aviation that France owes her present lead in the air.

Swiss Locomotive Industry

On account of the electrification of the Swiss Federal Railways as well as most of the private lines, the building of steam locomotives has been almost entirely abandoned in this country. The Swiss Locomotive works, of Winterthur, which formerly exported a great number of steam engines to many European and transoceanic countries, is now turning out electric engines on a large scale. This company, which is the leading and largest of its kind in the country, has just published its last annual report, from which the following is gleaned.

Extensive Exports

The company was well occupied with orders during the entire year. Four steam locomotives were built for the account of the Phosphate Mines of Gafsa, in Algeria, quite a number of cog-wheel locomotives were shipped to Spain and Brazil, while considerable orders calling for locomotive boilers were booked from France, British India (South Indian Railway Company), and the Argentine Republic (Buenos Aires Western Railway). Considering the fact that Switzerland has to import every pound of coal and every pound of iron for her industries it is certainly remarkable that in spite of these drawbacks and in spite of cheap competition the Swiss works are able to export to such an extent. The Swiss Federal Railways placed an order for thirty-two heavy electric locomotives, which are among the largest ever built in any country. The largest type of electric locomotives, however, is being built for the Swiss Rhetian Railways. The above locomotive works furnish for these engines, which are the largest in the world, the mechanical parts, while the rest is built by the well known Brown Boveri Electric Co. in connection with the Oerlikon Electric Works, of Oerlikon, near Zurich.

For the Paris-Lyon-Mediterranean Railway a good deal of repair work was done on steam engines, and oversea orders for a number of Diesel motors of a capacity of 1,000 hp. were also booked. As an entirely new line of manufacture the company has also started the manufacture of motors for airplanes, for which a number of orders was placed with the company by the Swiss Army Department. Considerable orders in this line are expected as soon as the final models have been decided upon. The works of the company are also busily engaged in the manufacture of especially constructed railway compressors for the generation of compressed air for the brake apparatus of electric locomotives. These will be made in great numbers.

Superpower Report of Geological Survey

Secretary of the Interior Fall has transmitted to the President the completed report of what has been popularly called the "Superpower Survey," an engineering study conducted by the United States Geological Survey. The appropriation act under which Congress provided for this work refers to it as "the special investigation of the possible economy of fuel, labor, and material resulting from the use in the Boston-Washington region of a comprehensive system for generating and distributing electricity to transportation lines and industries." Congress expected this intensive study to be completed within the fiscal year ended June 30, 1921, and in compliance with this expectation the manuscript report was in the hands of the director of the Geological Survey on July 1.

The superpower project makes its appeal to the general public as a means of saving coal and of increasing the productivity of labor. The Nation's business demands greater and cheaper production and better and cheaper transportation, and the electrification of industries and railroads is the answer to that demand. To connect all the large generating plants—both steam and water power—in one great system means more and cheaper electric current, because each ton of coal will be used to the best advantage and our idle rivers will be made to turn wheels, especially in the regions farthest removed from the coal fields.

Looking ahead to 1930, with the increased demand for power that can then be reasonably expected, the total coal saved annually under the unified system will be 50 million tons. Under motor operation the industries could save $190,000,000 annually in their power bill and could make a greater output of product. The ordinary citizen should also profit directly by the superpower system because it promises a reduction of one cent a kilowatt hour in the first cost of the current as put on the transmission lines. Cheaper electricity and more of it will bring comfort to the home as well as efficiency to the workshop, even though the reader may search this engineering report in vain for any basis whatever for the pleasant vision of electric-heated homes throughout our land. Superpower does not stand for the impossible but only for the wider application of practical engineering and sound economics.

The success of the Government's short-period study of so large a subject is due to the hearty co-operation with the Government bureau selected to administer the work of the engineering profession and of all the industries affected by the proposed larger electrification. W. S. Murray, of New York, who has been the moving spirit in urging the advantages of a unified power system, was appointed chief of the engineering staff and promptly organized the work. An advisory board of business men representing the railroads and industries interested added driving force to the investigation and gave a larger practical value to the completed report, which is now published by the United States Geological Survey as "Professional Paper 123." Secretary Fall has asked the members of this board to continue their public service in the further consideration of the legal and financial aspects of the superpower project, only the engineering features of which are presented in the report.

Collapsible Airplane

A baby airplane built to carry two hundred pounds and fitted with collapsible wings to allow it to be housed in a small garage has been set up at the General Electric Co.'s works in Pittsfield, Mass., by A. C. F. Isaac, a former designer for the Curtiss Airplane Co. The Pittsfield Aircraft Corporation is interested in the machine and its manufacture may be undertaken in Pittsfield. A feature of the plane is the quick-stop device, enabling it to alight in a small space. It is claimed the plane will start with a 25-ft. run from the roof of a building.

Japan Adopts Metric System

Since Japan broke her seclusion and joined the family of nations, how to adjust her weights and measures has been a problem of vital importance to her. The Japanese people are faced with the necessity of using three standards of measurement; their own age-long system; the pound, ounce, inch and foot measurements of America and England; and the metric system in use among the Latin nations. The inconveniences and hindrances to trade and industry arising from such different standards of weight and measure can easily be imagined. The Japanese government has, consequently, been studying the problem for several years from various angles. As a result the bill for the reform of weights and measures was drafted and introduced into the last session of the Diet. The House of Peers passed it with slight modifications. The amended bill also passed the House of Representatives on March 25 of this year, and was proclaimed by the Emperor, on April 12, as Law No. 71.

The bill stipulates that within the period of three to five years the metric system be adopted by government offices, government works, most of the leading factories, technical schools and others. The period of twenty years to come is, however, allowed for the adoption by the general public, after which the use of the metric system will be made compulsory. The reform is a marked step toward internationalization of Japan's economic structure, and ranks in importance with the adoption of the Gregorian Calendar at the beginning of the Meiji era.

The reasons for the reform bill and the procedure for its execution were fully set forth by the chairman, Dr. Imaidzumi, of the House Committee on the bill, when he reported it to the House Committee on the bill, when he reported it to the House of Representatives on March 25. He emphasized his belief that the metric system will in no distant future be adopted by America and Great Britain, the tendency toward which can be gaged by the recent resolution adopted by the League of Nations to recognize the Metric System Agreement made at Paris in 1876. He told the House that Japan will take no radical steps to introduce the reform, but proceed gradually to unify the standards of weight and measure. For government offices, technical schools and others, where the metric system has been used to some extent for the past ten years, three to five years will be sufficient for its complete adoption. So it will be with most of the factories. The exception has, however, to be made with the shipyards, cotton mills and the like, which import from America and England much of their machinery and materials. Much time will also be expended for the accomplishment of the reform in land cadaster. Strict enforcement of the law can be made within a certain period in all commercial transactions, while education would be the only means to secure general adoption by the public. Children learn in schools the use of the metric system, as the measurement is already adopted in their text-books. As the army uses the metric system, the sons of farmers and tradesmen who serve under the colors will return home accustomed to the use of the system. Consquently, twenty years are not short for the universal adoption of the system by the Japanese people.

Business Items

The Missouri, Kansas & Texas Railroad has sent out inquiries for machine tools comprising seventy-five items. This is said to be the largest list sent out by any railroad this year.

The Package Machinery Co., Springfield, Mass., has resumed full-time production on a basis of a 48-hour week. Wages were reduced simultaneously with the change of schedule.

The S. B. Sexton Stove and Manufacturing Co., Baltimore, Md., has purchased the entire property, equipment, etc., of the Isaac A. Sheppard Co., Excelsior Stove Works, Baltimore, for $101,000. The property was sold at auction by the receivers.

The Union Chain and Manufacturin Co., of Seville, Ohio through Walter Hay, vice-president and general manager, has purchased the plant of the Sandusky Drop Forge Co., in West Sandusky, and will locate there as soon as necessary alterations can be made.

Additional men are being put back to work at the plant of the Standard Steel Car Co. and manager W. C. Graham has announced that the plant would be operating 90 per cent of normal in a week. The plant employs about 600 men when operating capacity.

The Crane Machinery Co., 501 Morgan Bldg., Buffalo, N. Y., has been appointed exclusive distributor of the Sundstrand 9-in. manufacturing lathe in the Buffalo territory. The Crane company will also represent the Rockford Milling Machine Co., in Buffalo.

The Aumon Machinery Co., Baltimore, Md., has been appointed exclusive distributor for the Rockford Milling Machine Co. and the Rockford Tool Co. of Rockford, Ill., in the Baltimore territory.

The Seneca Falls Foundry Co. has recently rented the foundry of the Seneca Falls Manufacturing Co., Seneca Falls, N. Y.

The Peerless Machine Co., Racine, Wis., manufacturer of high-speed metal saws, announces substantial reductions in the prices of its Peerless saws. A dealers' discount on all types and sizes averages about 17 per cent.

The Anderson Piston Co., Bowling Green, Ohio, has purchased the plant and equipment of the Vim Motor Co., same city, and will establish its business in that factory. Work of remodeling the Vim plant is now under way, directed by C. C. Anderson, who will manage the new concern.

Consolidation of the Richardson-Phenix Co., Milwaukee, Wis., and the S. F. Bowser Co., Fort Wayne, Ind., with $10,000,000 assets, is announced. Personnel and names of both companies are to be retained, with headquarters in Fort Wayne. Pumps and storage systems have been the specialty of the Bowser concern, while the Rirchardson-Phenix Co. has manufactured appliances for the automatic lubrication of machinery and reclamation of lubricating oil.

The American Drop Forging Institute, Hanna Bldg., Cleveland, Ohio, has prepared a book for laymen entitled "What is a Drop Forging?" The book is said to cover the subject in an authoritative manner and is easily read by the student or non-technical man. A copy of the book will be mailed free upon request to the Institute.

Loy E. Nawrath Co., Newark, N. J., manufacturer of sheet metal machinery, has opened an office at 30 Church St., New York City.

The Cincinnati Hy-Speed Machine Co., Cincinnati, Ohio, has made exclusive selling arrangements with Niles-Bement-Pond Company. New literature on hy-speed drilling and automatic tapping machines is now being distributed.

The Oakley Machine Tool Co. has moved its factory and general offices from Cincinnati, Ohio, to Middletown, Ohio, where it will share a building with the Willard-Middletown Machine Co.

Personals

H. E. Witham, for twenty years with the Warner & Swasey Co., Cleveland, Ohio, has resigned his position as district sales manager in Chicago.

C. E. Neubert has been appointed district sales manager in Chicago for the Warner & Swasey Co. He was assistant to H. E. Witham in this territory for some time.

Lieut. Col. Edwin S. Hartshorn has been relieved as director of sales of the War Department and as the War Department's member of the Federal Liquidation Board. His successor has not been named. The change was made necessary by the fact that Col. Hartshorn has completed a four-year term of duty with the General Staff. Since no exceptions are permitted in this statutory requirement, he must be given another assignment.

B. T. W. Burgess, of London, England, has joined the factory staff of the Gilbert & Barker Manufacturing Co., of West Springfield, Mass., to obtain factory training prior to taking up his work in England for the general sales department.

J. F. Caratini, of the general sales department of the Gilbert & Barker Manufacturing Co., Springfield, Mass., recently sailed from New York for Progresio, Mexico, and will proceed from there to Vera Cruz and Mexico City, in the interests of the company.

Elmer E. Yake, formerly head of the Engineering Department of the Gilbert & Barker Manufacturing Co., Springfield, Mass., returned to the company on Oct. 1 to assume the duties of works manager, to which he was recently appointed. Mr. Yake left the Gilbert & Barker Co. in April, 1920, and went with the Walworth Manufacturing Co., at Kewanee, Ill., and at Boston, Mass., and later went with the C. & G. Copper Co., and had his offices at No. 30 Church Street, New York.

Philip W. Goewey, general manager and treasurer of the Pittsfield Machine and Tool Co., Pittsfield, Mass., has resigned. John Parker has been elected treasurer and Walter C. Reed manager.

Walter E. Heibel, for the past two years Eastern district manager of the Wilmarth & Morman Co., has resigned to accept a position with the B. F. Sturtevant Co., Boston, Mass. Mr. Heibel will be located in New York.

Ernest Reich, formerly vice-president of the Hill Pump Valve Co., Chicago, and general manager of plant of the Chicago Pressed Steel Co., has just returned from a seven months trip in Europe and is now engaged in utilization and marketing of domestic and foreign patents. Owners of meritorious inventions are invited to communicate with him, with the view of selling or exchanging the manufacturing rights of American patents for foreign inventions.

R. W. Shore, manager of the New York office of the Defiance Machine Works, Defiance, Ohio, has returned to the home office.

E. E. Barto, for the past three years production manager of the Indiana Rolling Mill Co., New Castle, Ind., has joined the Warren Iron and Steel Co., Warren, Ohio, as production manager. For 15 years prior to his Indiana Rolling mill connection, Mr. Barto was rolling mill superintendent for the Jessop Steel Co., Washington, Pa.

W. F. Abel has been appointed assistant general manager of sales of the Electric Alloy Steel Co., Youngstown Ohio.

George L. Sawyer, formerly sales manager of material building machinery for the Barber-Greene Co., Aurora Ill., has been appointed New York representative of the Universal Crane Co of Elyria, Ohio, with offices at the Allied Machinery Center, New York City

Frank H. London of Chicago, Ill. has been made district representative in the Chicago territory for the Falcon Steel Co., Niles, Ohio.

Obituary

John Boyd Dunlap, known as the inventor of the pneumatic tire, died a his home in Dublin, Ireland, on Oct. 24 He was 81 years old. His invention first introduced in 1888, revolutionized bicycling and was a forerunner to the success of automobiling.

Catalogs Wanted

Ernest Reich, formerly vice-presiden of the Hill Pump Valve Co., and general manager of the Chicago Presse Steel Co., Chicago, Ill., is now established at 11 So. LaSalle St., Chicag Ill., as exporter and importer. H would like to receive catalogs and qu tations for novel manufacturing equipment, for which he has established markets abroad.

Forthcoming Meetings

The third annual convention and exhib tion of the American Gas Association wi be held in the Congress and Auditoriu Hotels, Chicago, Ill., on Nov. 7 to 12.

The twenty-fifth annual convention the National Founders' Association will held in the Hotel Astor, New York Cit on Nov. 16 and 17.

The annual meeting of the Taylor Socie will be held in the Engineering Societi Building, New York City, on Dec. 1, and 3.

The annual meeting of the America Society of Mechanical Engineers will held in the Engineering Societies Buildin New York City, on Dec. 5 to 9.

NEW *and* ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Mass., Boston—Hill, Clark & Co., Inc., 1560 Oliver St.—one 18 in. Gisholt turret lathe and one 110 in. vertical boring mill.

Mass., Worcester—The Baldwin Chain & Mfg. Co., A. W. Warren. Purch. Agt.—Schuster riveting machine having capacity of ¾ in., ⅞ in. up to 1⅛ in.

N. Y., Buffalo—The Electro Refractory Co., Ellicott Sq., (steel crucibles) L. V. Milward, Secy.—equipment and machinery for machine shop and factory.

N. Y., New York—The Tiffany Electric Co., 165 Bway.—radio drill and wet grinder for new plant in Jersey City.

N. C., Salisbury—The Amer. Fdry. Co., T. G. Shelton, Mgr.—machine tools, including lathes, drill presses, planer, shaper, hack saw, pipe threading machine, etc.; foundry equipment, including 3 to 4 ton per hour capacity cupola, blower, tumbling barrels, brass furnace, ladles, etc. (used if in good condition).

Tenn., Memphis—The Riechman Crosby Co., 235 South Front St., H. H. Crosby, Purch. Agt.—one key-seater to have range from ¼ in. to 1 in. inclusive. Davis, Mitts Merrill or similar preferred (used).

Va., Richmond—Hackley Morrison Co., 1010 4th Ave.—one 16 in. and one 20 in. crank shaper. One 4 in. centrifugal sand pump. Two 20 in. upright drills.

Ill., Aurora—The All Steel Equipment Co.—two No. 6 Magara presses (not geared).

Mich., Detroit—J. C. Austerberry, 684-690 East Congress St.—Morton auto parts grinder or its equivalent, one No. 55, No. 60 and No. 65 Heald grinders, one Springfield lathe to take 14 in. by 60 in. swing or its equivalent, and one Etna swaging machine, capacity to take ¾ in. copper tubing.

Mich., Niles—The National Sandard Co., M. Johnson, Purch. Agt.—swaging machine to point ¾ in. diameter. copper tubes having at least 6 in. die length.

O., Columbus—The Bull Co., 602 Hartman Bldg., C. H. Bull, Prs. and Genl. Mgr.—shop machinery for the manufacture of new style spark plug.

O., Columbus—The Carroll Chain Co., 63 Smith Pl., D. Carroll, Prs.—$25,000 worth of equipment for forging chains.

Wis., Columbus—The Columbus Auto Repair & Paint Co., F. Menke, Purch. Agt.—pneumatic brushes and equipment including presses, lathe, etc. for auto repair shop.

O., Findlay—The Adams Axle Co.—special machinery for machining axles.

O., Marion—The Noles Water Filter Co., 180 North Main St., C. M. Burkett, Purch. Agt.—metal working machinery.

Wis., Darien—Matteson & Bartlett, F. Matteson, Purch. Agt.—machinery for auto repair shop.

Wis., Eagle River—J. B. Cook, (machinist) machine shop equipment including drill press.

Wis., Glenwood City—The Glenwood City Auto Co., J. P. Johnson, Purch. Agt.—auto repair shop equipment including air compressors, lathes, etc.

Wis., Hartford—H. Lohr, North Main St.—presses (1 and 2 tons), lathe and equipment for auto repair work.

Wis., Mazomanie—L. P. Schoelkopf—machine tools including presses, etc., for garage.

Wis., Milwaukee—Kaczmarek & Nowicki, 6 Chambers St.,—lathe and possibly a drill press for machine work and blacksmith shop.

Wis., Milwaukee—Smith Specialty Mfg. Co., 503 East Water St.—30 in. squaring shears.

Wis., Neenah—The Bergstrom Paper Co.. Orbison & Orbison, Appleton, Engrs.—equipment including lathes, hammer, etc. for proposed machine shop.

Mo., Joplin — The Mooman Tool & Machine Co., 113 Main St.—machinery for the manufacture of lathes, boring machines and tools.

Mo., St. Louis—The Missouri, Kansas & Texas R.R., G. E. Scott, Purch. Agt., has issued a supplementary list for machine tools requirements

Mo., West Plains—The Bd. Educ.—lathes, machinists and carpenters tools, for machine shops on Main St.

Ont., Amherstburg — The Midwestern Tractor Wheel Co., H. H. Lane, Mgr.—equipment including metal working machinery, lathes, planers, etc., for proposed factory.

W. I., Haiti, Santiago—E. J. Espaillat—one 15 in. x 7 ft. or 15 in. x 8 ft. south bend gap lathe or similar, regular equipment and combination chuck 12 to 15 in., (used).

Md., Hagerstown — Vicama Mica Co., 3 Hamilton Row —J. W. Feldman, Purch. Agt.—machinery and equipment for mining mica and feldspar, also grinding machinery for mica and feldspar.

N. J., Newark—Kreuter & Co., 571 18th Ave.—one No. 2 B. American rotary carbonizing furnace.

N. Y., Buffalo—The Amer. Grain & Feed Corp., 303 Chamber of Commerce, L. R. Veatch. Prudential Bldg., Engr.—flour mill machinery, also equipment and machinery for the proposed elevator and feed mill.

Pa., Johnstown—The Pennsylvania Bedding Mfg. Co., 121-23 B. St., mattress making machines for plant at Morrellville.

Pa., Philadelphia—Collins & Aikman, 51st St. near Parkside Ave. weaving machinery, looms, etc. for proposed plush factory.

Ala., Fort Payne—The Fort Payne Ice Co., A. A. Miller, Purch. Agt.—machinery and equipment for a 10-ton ice plant.

Ga., Woolsey—J. A. Spurlin—machinery for the manufacture of Tupelo gum trays also machinery to make handles from hickory wood.

Miss., Meridian—The Bang-Go Soap Mfg. Co., L. L. Gunn, Vice-Pres. and Mgr.—machinery and equipment for the manufacture of soap in cake and paste form, including cooking, cooling, pressing and wrapping machinery.

N. C., Bessemer City—J. M. Torrence (stone crushing)—jaw crusher with elevator and screen, 60 to 125 ton daily capacity of 2 in. or smaller stone (used if in good condition).

N. C., Littleton — E. E. Wollert & Son, band resaw (used).

S. C., Badham—Dorchester Lumber Co., V. C.. Badham, Pres. and Treas.—8 ft. band saw mill, 60 in. edger, 5 saw trimmer, No. 6 Mitts & Merrill hog, 5,6 and 7 ft. band resaw (prefer vertical Mershon), self feed bond rip saw, two 6 x 16 in. 6 knife planers, etc., for proposed mill at Garnett.

S. C., Camden—S. F. Brasington, woodworking machinery for manufacture of spokes and handles.

S. C., Saluda — R. M. Etheridge—planer knife grinder.

Tenn., Dayton—The Print Shop, W. H. Moss, Purch. Agt.—printing machinery and supplies, including rule and lead cutting machines (new or used), also small and medium priced paper cutters.

Ill., Amboy—The Bd. Educ.—manual training equipment for proposed high school.

Ill., Chicago—The Trio Camera & Film Co., 6500 East Ravenswood Ave.—one 2-A Brown & Sharpe universal miller.

Ill., Danville—The Bd. Educ., c/o W. Smith, Prs.—manual training equipment for proposed High School.

Ill., Freeport—The Bd. Educ., c/o S. E. Raines, Supt.—manual training equipment for proposed high school.

Wis., Beaver Dam—The Beaver Dam Bottling Wks., O. H. Strum, Racine, Purch. Agt.—electric power machinery, bottle capping machinery, washers, etc.

Wis., Hartford — Gehl Bros.—marble polishing machines.

Wis., Merrill—The Lincoln Milling & Elevator Co., P. Gebhardt. Purch. Agt.—machinery for grinding grain.

Wis., Milwaukee—W. Erni, 3928 Vliet St.—one medium size electric spot welding machine.

Wis., Milwaukee—R. C. Schumacker, 2037 Fond-du-lac Ave.—one 12 to 16 in. paper cutting machine.

Wis., Oconomowoc—F. Pabst Co.—humidifier, ice machine, coolers, and special machinery for the manufacture of dairy products.

Wis., Rib Lake—C. R. Claussen and G. F. Braun—woodworking machinery for the manufacture of furniture and chairs.

Wis., Stevens Point—The Bd. Educ., J. M. Pfiffner, Chn.—wood-working machinery for proposed vocational school on Clark St.

Ark., Eureka Springs—H. D. Jenkins—machinery for ice plant at Gravette.

Mo., Ash Grove—The Ash Grove Ice Plant Co.—ice making equipment and machine tools for handling ice.

The Weekly Price Guide

This Week's Market

Structural steel shapes, plates and bars, still quoted at the Pittsburgh mills at $1.50 @ $1.65 per 100 lb., the lower figure applying mostly to the larger tonnages, small tonnages selling at $1.60 @ $1.65 per 100 lb. Mill shipments, New York, of structural shapes and plates are quoted at $1.88 @ $2.03; bars at $1.80 @ $1.88 per 100 lb. Warehouse prices and quotations on mill shipments have remained firm throughout the week; with the exception of blue annealed steel sheets, which have advanced 25c. per 100 lb. on all sizes at the New York warehouses. No. 10 blue annealed sheets are quoted at $3.53 as against $3.28 per 100 lb. one week ago.

No other changes.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$24.50
Northern Basic	22.52
Southern Ohio No. 2	23.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	30.26
BIRMINGHAM	
No. 2 Foundry	20.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	22.75
Virginia No. 2	28.74
Basic	20.75
Grey Forge	21.75
CHICAGO	
No. 2 Foundry local	22.70
No. 2 Foundry, Southern, sil 2.25@2.75	26.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	22.96
Basic	21.96
Bessemer	21.96

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50	3.53	3.10	3.38
No. 12	2.55	3.58	3.15	3.45
No. 14	2.60	3.63	3.20	3.48
No. 16	2.80	3.73	3.30	3.58
Black				
Nos. 17 and 21.	2.85	4.05	3.55	3.95
Nos. 22 and 24.	2.90	4.10	3.60	4.00
Nos. 25 and 26.	2.95	4.15	3.65	4.05
No. 28	3.00	4.25	3.75	4.15
Galvanized				
Nos. 10 and 11.	3.00	4.25	3.75	4.15
Nos. 12 and 14.	3.10	4.35	3.85	4.25
Nos. 17 and 21.	3.40	4.65	4.15	4.55
Nos. 22 and 24.	3.55	4.80	4.30	4.70
No. 26	3.70	4.95	4.55	4.85
No. 28	4.00	5.25	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel			Iron		
Inches	Black	Galv.	Inches	Black	Galv.
BUTT WELD					
1 to 3	68½	56	¾ to 1½	44½	29½
LAP WELD					
2	61½	49	2	39½	25½
2½ to 6	65½	53	2¼ to 4	42½	29½
7 to 8	62½	49	4½ to 6	42½	29½
9 to 12	62½	49	7 to 12	40½	27½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66½	55	1 to 1½	44½	30½
2 to 3	68½	56			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59½	48	2	40½	27½
2½ to 4	63½	52	2½ to 4	43½	31½
4½ to 6	62½	51	4½ to 6	42½	30½
7 to 8	58½	45	7 to 8	35½	23½
9 to 12	52½	39	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded.	60%	46%	60½%	47½%	60%	46%
3½ to 6 in. steel lap welded.	51%	37%	58½%	44½%	57%	43%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	5.00	6.00	*3.78
Spring steel (light) (base)	6.00	6.00	*2.93
Coppered Bessemer rods (base)	8.00	8.00	*6.03
Hoop steel	3.88	3.29	3.48
Cold rolled strip steel	7.50	8.25	6.75
Floor plates	4.85	....	5.23
Cold finished shafting or screw	3.88	3.50	3.83
Cold finished flats, squares	4.38	4.00	4.35
Structural shapes (base)	2.88	2.74	2.88
Soft steel bars (base)	2.78	2.64	2.78
Soft steel bar shapes (base)	2.78	2.64	2.78
Soft steel bands (base)	3.43	....	3.48
Tank plates (base)	2.88	2.92½	2.88
Bar iron (2.15@2.25 at mill)	2.78	3.52	2.78
Drill rod (from list)	55@60%	55%	50%
Electric welding wire			
$\frac{3}{32}$	8.50		12@13
$\frac{1}{8}$	7.15		11@12
$\frac{5}{32}$ to $\frac{1}{4}$	6.75		10@11

* Price to Dealers.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	13.62½
Tin, 5-ton lots, New York	28.50
Lead (up to carlots), St. Louis, 4.60; New York	5.00
Zinc (up to carlots), St. Louis, 4.97½; New York	5.37½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.00	20.00	20.00
Antimony (Chinese), ton spot	5.50	6.50	6.00
Copper sheets, base	20.75	21.50	22.50
Copper wire (carlots)	16.50	16.50	15.75
Copper bars (ton lots)	19.00	23.00	19.00
Copper tubing (100-lb. lots)	20.50	23.00	22.50
Brass sheets (100-lb. lots)	16.25	17.00	18.25
Brass tubing (100-lb. lots)	18.00	19.00	20.00
Brass rods (1,000-lb. lots)	14.25	16.00	15.25
Zinc sheets (casks), (8% dis. carlots)	11.00	11.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ½), (case lots)	19.50	23.50	18.00
Babbitt metal (best grade)	70.00	39.00	34.00
Babbitt metal (commercial)	30.00	13.50	8.00

—*Shop Materials and Supplies*

MONEL METAL—Base price in cents per lb., f.o.b. Bayonne, N.J.:

Shot	35.00	Hot rolled machined rods (base)	53.00
Blocks	35.00	Hot rolled rods (base)	42.00
Ingots	38.00	Cold drawn rods (base)	56.00
Sheet bars	40.00	Hot rolled sheets (base)	55.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grades "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

OLD METALS--Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.50	10.25
Copper, heavy, and wire	9.50	10.50	9.50
Copper, light, and bottoms	8.00	8.00	8.25
Lead, heavy	4.00	3.75	3.75
Lead, tea	3.00	2.75	3.00
Brass, heavy	6.50	6.00	8.00
Brass, light	5.00	4.00	4.75
No. 1 yellow brass turnings	5.25	4.50	5.25
Zinc	3.00	2.00	2.75

TIN PLATES—American Charcoal Plates—Bright—Cents per lb

	New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:			
IC, 20x28, 112 sheets	21.50	......	....
IX, 20x28, 112 sheets	24.00	......	....
"A" Charcoal Allaways Grade:			
IC, 20x28, 112 sheets	18.50	......	....
IX, 20x28, 112 sheets	21.50	......	....
Coke Plates, Bright			
Prime, 20x28 in.:			
100-lb., 112 sheets	14.00	13.00	14.50
IC, 112 sheets	14.30	13.30	14.80
Terne Plate			
Small lots, 8-lb. Coating:			
100-lb., 14x20	7.50	6.25	7.25
IC, 14x20	7.75	6.50	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb	0.07\frac{1}{2}$@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb	.055@.09	.09	.10
Wiping cloths per M., 13$\frac{1}{4}$x13$\frac{1}{4}$	....	55.00	55.00
Wiping cloths per M., 13$\frac{1}{4}$x20$\frac{1}{2}$	....	65.00	65.00
Sal soda, 100 lbs	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb	2.55	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.72	.80	.72
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 75 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville	per ton	$3.25@3.50	
Coke, prompt foundry, Connellsville	per ton	4.25@4.75	

SHOP SUPPLIES

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in	—50%	—60%	—60%
$1\frac{1}{8}$ and $1\frac{1}{4}$x3 in. up to 12 in	—40%	—60-10-10%	—55%
With cold punched sq. nuts	—30%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	—40%	.....	$3.25 off
Button head bolts, with hex. nuts	—20%	$3.90 net	.....
Hex. head and hex. nut bolts	—20%	....	.....
Lag screws, coach screws	—50-10%	....	—60%
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	—50-10-10%	50-5%
Bolt ends, with hot pressed nuts	—50%	....	—55%
Tap bolts, hex. heads	—20%	....	.....
Semi-finished nuts all sizes	—70%	—75%	—80%
Case-hardened nuts	—60%	....	.....
Washers, cast iron, $\frac{1}{2}$ in., per 100 lb. Off list	$5.00	$5.50	$4.50
Washers, cast iron, $\frac{5}{8}$ in. per 100 lb. Off list	4.25	3.75	4.50
Washers, round plate, per 100 lb. Off list	3.00	....	4.50
Nuts, hot pressed, sq., per 100 lb. Off list	2.00	3.00	3.25
Nuts, hot pressed, hex., per 100 lb. Off list	2.00	3.00	3.25
Nuts, cold punched, sq., per 100 lb. Off list	1.50	3.00	3.25
Nuts, cold punched, hex., per 100 lb. Off list	1.50	3.00	3.25
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	-50-10%	60-10-10%	-60-10%
Rivets, tinned	-50-10%	60-10-10%	4$\frac{1}{2}$c. net
Button heads $\frac{3}{4}$-in., $\frac{7}{8}$-in., 1x2 in. to 5 in., per 100 lb (net)	$3.70	3.50	3 68
Cone heads, ditto (net)	3.80	3.60	3.78
$1\frac{1}{8}$ to $1\frac{7}{8}$-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
$\frac{7}{8}$ in. diameter *EXTRA*	0.15	....	0.15
$\frac{1}{2}$ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in *EXTRA*	0.25	....	0.25
Less than 200 lb *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$4.28 base
Copper rivets	—50-10%	—40-10%	—50-10%
Copper burs	—25-10%	—15%	—10%
Lard oil, pure, (50 gal. bbl.) per gal	0.95	.....	.....
Lard cutting oil (50 gal. bbl.) per gal.	0.60	.....	.....
Machine oil, lubricating, per gal.	0.40	.....	.....
Belting—Present discounts from list in fair quantities ($\frac{1}{2}$ doz. rolls)			
Leather:			
Light grade	50-5%	....	50-5%
Medium grade	45%	.....	.....
Heavy grade	40%	.....	.....
Rubber and duck:			
First grade	50-10%	.....	.....
Second grade	60-5%	....	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	$9.00 less 20-10-5%	....	-20-10%
Emery paper	11.00 less 20%	.....	-20%
Emery cloth	32.75 less 10%	.....	-10%
Flint cloth, regular weight, width $3\frac{1}{2}$ in., No. 1 grade, per 50 yd. roll	$4.50 net	....	list+10%
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	$1.65 less 20%	.....	-10%
Cloth	$3.55 less 10%	.....	-10%

Mo., Carthage—F. W. Steadly, 930 Oak St., tools and machinery for stone quarries.

Mo., St. Louis—Larkin & Pratt, 876-8 Arcade Bldg., D. Larkin, Purch. Agt.—machinery and equipment for sugar plant with capacity of grinding 400 ton of sugar cane per day, including cane crushed, mill triple-effect evaporator and equipment, filter, presses, boilers, pumps, etc., also machinery and apparatus for canning plant, etc.

Ont., Chatham—The Chatham Chrystal Ice Co.—machinery for artificial ice plant.

Ont., Walkerville—The School Bd., A. E. Cock, Secy.—equipment for chemistry laboratory and manual training work.

Metal Working Shops

NEW ENGLAND STATES

Conn., Meriden—Griswold, Richmond & Glock Co., 2 West Main St., has awarded the contract for the construction of a 1 story, 50 x 160 ft. addition to its sheet metal plant on West Main and South Grove Sts. Estimated cost, $40,000.

Mass., Boston—Tuck & Gilman, Archts., 34 School St., are receiving bids for the construction of a 2 story, 75 x 150 ft. garage on Maywood St., for H. Freedman, c/o architects. Estimated cost, $75,000.

Mass., Brookline—L. A. Vachon, 653 Washington St., has awarded the contract for the construction of a 2 story, 60 x 148 ft. garage and service station on Washington St. Estimated cost, $80,000.

Mass., Cambridge—The Mack Motor Truck Co., 185 Massachusetts Ave., has awarded the contract for the construction of a 1 story, 45 x 110 ft. factory addition on Osborn St. Estimated cost, $40,000.

Mass., East Long Meadow—The New England Steel Castings Co., Shaker Rd., is receiving bids for the construction of a 1 story, 70 x 125 ft. casting plant. Estimated cost, $40,000. M. W. Maloney, 145 Chestnut St., Springfield, Archt. Noted June 23.

Mass., Southbridge — The Southbridge Fdry. Co., has awarded the contract for the construction of a 1 story, 50 x 100 ft. foundry on Worcester St.

R. I., Providence — W. G. Richards, Archt., 17 Exchange St., is receiving bids for the construction of a 2 story, 90 x 120 ft. garage and service station, for the Dorrance St. Garage, Dorrance and Friendship Sts. Estimated cost, $75,000.

MIDDLE ATLANTIC STATES

Md., Cumberland—The Paragon Motor Car Co., 133 Baltimore St., has awarded the contract for the construction of a 1 and 2 story, 60 x 400 and 400 x 540 ft. motor car plant. Estimated cost, $1,000,000. Noted June 9.

N. Y., Brooklyn—The Royal Metal Furniture Co., 125 8th St., will build a 3 story, 75 x 200 ft. foundry and paint plant on 8th St.

Pa., Morrellville—(Johnstown P.O.)—The Pennsylvania Bedding Mfg. Co., 121-23 B. St., Johnstown, manufacturer of mattresses, springs, cot-beds, etc., has awarded the contract for the construction of a 3 story, 36 x 86 ft. factory on B. St., here. Eestimated cost, $40,000.

Pa., Philadelphia—The Dept. of Pub. Wks., City Hall, will soon award the contract for the construction of a 1 story, 50 x 160 ft. garage and machine shop on Fairmount and Delaware Aves. P. B. Sinkler, City Hall, Archt.

Pa., Philadelphia—E. Shoppe, Archt., 315 South 15th St., will receive bids until Nov. 15 for the construction of a 1 story, 60 x 100 ft. sales and service station at 4653 Paul St., for the Roth Buick Co., Frankford Ave. and Oxford Pike. Estimated cost, $50,000.

SOUTHERN STATES

Ky., Louisville—Yost & Cook, 231 South 5th St., have awarded the contract for the construction of a 1 story, 150 x 200 ft. garage at 649-657 South 3rd St. Estimated cost, $80,000.

MIDDLE WEST STATES

Ill., Centralia—J. Longenfeld has awarded the contract for the construction of a 2 story, 80 x 106 ft. garage. Estimated cost, $40,000. Noted Oct. 27.

Ill., Chicago—A Bromstedt, 6440 South Green St., has awarded the contract for the construction of a 1 story, 50 x 200 ft. garage at 6022-24 Stony Island Ave. Estimated cost, $40,000.

Ill., Chicago—Spingola & Sons, 750 Taylor St., have awarded the contract for the construction of a 2 story, 75 x 120 ft. garage at 1918 South Morgan St. Estimated cost, $50,000.

Ill., McHenry—The Bogner Auto Co. is having plans prepared for the construction of a 2 story garage. Estimated cost, $40,000. H. B. Dox, Lehmann Bldg., Peoria, Archt.

Mich., Ferndale—The Leasia Motor Sales Co., c/o Arnold & Shreve, Archts., 308 Homber Bldg., Highland Park, has had plans prepared for the construction of a 2 story garage, service and sales building on Woodward Ave. and Nine Mile Rd. Estimated cost, $40,000.

O., Warren—D. E. Miller has awarded the contract for the construction of a 2 story, 80 x 120 ft. garage on West Market St. Estimated cost, $64,000.

Wis., Madison—The Purcell Wischau Co., 219 East Washington St., has awarded the contract for the construction of a 2 story, 117 x 132 ft. garage on Gilman St. Estimated cost, $150,000. Noted Oct. 27.

Wis., Mazomanie—L. P. Schoelkopf has awarded the contract for the construction of a 2 story, 60 x 95 ft. garage. Estimated cost, $55,000.

WEST OF THE MISSISSIPPI

Kan., Council Groves—E. A. Roberts has awarded the contract for the construction of a 2 story garage. Estimated cost, $45,000. Noted Nov. 3.

Minn., St. Paul—W. Fernholz, 1046 East 4th St., plans to construct a 1 story, 50 x 180 ft. garage on Hastings Ave. and Cypress St. Estimated cost, $40,000. Architect not selected.

Mo., Joplin—The Mooman Tool & Machine Co., 113 Main St., plans to construct a factory. Estimated cost, $50,000. Architect not selected.

Mo., St. Joseph—W. T. Littlejohn, 6106 Kinghill Ave., has awarded the contract for the construction of a 1 story, 54 x 135 ft. garage on Kinghill Ave. and Valley St. Estimated cost, $45,000.

Mo., St. Louis—J. E. Dougherty, 127 Blow Ave., will build a 2 story garage on 39th and McRee Aves. Estimated cost, $45,000. Noted Nov. 3.

Mo., St. Louis—The White Co., (auto trucks), 3442 Lindell St., will build a 1 story service station on Laclede and Vanderventer Sts. Estimated cost, $75,000. Noted Nov. 3.

Mo., West Plains—The Bd. Educ. has had plans prepared for the construction of a 2 story, 80 x 120 ft. machine shop for vocational training, on Main St. Estimated cost, $12,000. Heckenlively & Mark, Landers Bldg., Springfield, Archts.

WESTERN STATES

Cal., Stockton—San Joaquin County will soon award the contract for the construction of a garage and shop building at the San Joaquin General Hospital. R. P. Morrell, Stockton, Archt.

CANADA

Ont., Amherstburg — The Midwestern Tractor Wheel Co. has purchased a site and plans to build a factory. Estimated cost, $50,000. H. H. Lane, Mgr. Private plans.

General Manufacturing

NEW ENGLAND STATES

Mass., Salem—The Atlantic Oil Refining Co., 1211 Chestnut St., Phila., Pa., is having plans prepared for the construction of a large oil plant on Jefferson Ave., here. Private plans.

MIDDLE ATLANTIC STATES

N. J., Homestead—The Atlas Finishing Co., will soon award the contract for the construction of a 3 story factory on Patterson Rd., for finishing dyes, etc. Estimated cost, $100,000. R. G. Gory, 50 Church St., New York City, Archt. and Engr.

Pa., Braddock—The Diamond Ice Co. has awarded the contract for the construction of 1 and 2 story, 30 x 44 ft., 10 x 40 ft. and 15 x 29 ft. additions to its ice plant on 6th St. Estimated cost, $50,000.

Pa., Dorranceton (Kingston P.O.)—M. F. Fadden has had plans prepared for the construction of a 2 story, 58 x 91 ft. ice cream plant. Estimated cost, $90,000. The McCormick Co., Century Bldg., Pittsburgh, Archts.

Pa., Harrisburg—The School Dist., 121-23 Chestnut St., has awarded the contract for the construction of a 1 story, 120 x 200 ft. shop. Estimated cost, $21,231. Noted Oct. 20.

Pa., Philadelphia—Collins & Aikman, 51st. St. near Parkside Ave., have awarded the contract for the construction of a 3 story, 55 x 65 ft. plush factory on 51st. and Viola Sts. Estimated cost, $35,000.

D. C., Langdon (Washington P. O.)—The Fleischmann Yeast Co., will soon award the contract for altering and building an addition to its plant. Milburn, Heister & Co., Union Savings Bank Bldg., Archts.

SOUTHERN STATES

N. C., Raleigh—The State School for the Blind will soon award the contract for the construction of an institutional school, including a laundry, etc., on the campus. Estimated cost, $200,000. J. A. Salter, Commercial Bldg., Archt. Noted Oct. 13.

MIDDLE WEST STATES

Ill., Centralia—The Chicago, Burlington & Quincy R.R., 542 West Jackson Blvd., Chicago, has awarded the contract for the construction of a round house and coal chute, here. Estimated cost, $125,000. Noted Oct. 20.

Ill., Jonesboro—The Union Grain & Milling Co., plans to construct a 2 story flour mill. Estimated cost, $40,000. Architect not selected.

Ill., Lockport — The Northern Illinois Cereal Co. is having plans prepared for the construction of a 1 story, 80 x 350 ft. factory. Estimated cost, $100,000, C. W. Buckley, Prs. C. W. Webster, Cutting Blk., Joliet, Archt.

Ill., Peoria—Leshnick Directory Co., 514 Main St., will soon award the contract for the construction of a 2 story, 50 x 150 ft. printing plant. Estimated cost, $100,000. B. L. Hulsebus, Jefferson Bldg., Archt. Noted Nov. 3.

O., Cleveland—Pavelka Bros., 2978 East 37th St., have awarded the contract for the construction of a 1 story, 57 x 65 ft. addition to their sausage factory on 37th St. and Bway. Estimated cost, $40,000. Noted Oct. 20.

Wis., Oconomowoc—F. Pabst has awarded the contract for the construction of a 1 story, 62 x 70 ft. cheese factory on his farm near here. Estimated cost, $20,000.

Wis., Rhinelander—The S. Miller Gold Storage Co., Marshfield, plans to construct a 2 story, 80 x 150 ft. cold storage plant, here. Estimated cost, $150,000. Architect not selected.

WEST OF THE MISSISSIPPI

Kan., Coffeyville—E. R. Lawson, Nowata, Okla., has awarded the contract for the construction of a 1 and 2 story ice plant, here. Estimated cost, $100,000. Noted Oct. 6.

Minn., Minneapolis—The Franklin Co-operative Creamery Assn., 2601 Franklin Ave., plans to construct a 2 or 3 story creamery on the North Side. Estimated cost, $55,000. H. I. Norby, Pres. Architect not selected.

Mo., Ash Grove—The Ash Grove Ice Plant Co. plans to build a 1 story plant on Main St., for the manufacture of ice. Estimated cost, $15,000. Private plans.

Mo., Carterville—F. W. Wasserman, Joplin, is having plans prepared for the construction of a 1 story, 40 x 80 ft. factory on Main St., here, for the manufacture of concrete blocks with marble face. Estimated cost, $5,000. Private plans.

CANADA

Ont., Chatham — The Chatham Crystal Ice Co. is having plans prepared for the construction of an artificial ice plant. Estimated cost, $60,000. J. W. Leighton, Bartlett Bldg., Windsor, Archt.

Ont., Sandwich—The Essex County Council, c/o W. P. Coyle, 472 Sandwich St., Windsor, will soon receive bids for the construction of a 2 story, 150 x 200 ft. jail, including a laundry, etc. Estimated cost, $250,000. Nichols, Sheppard & Colthurst, Windsor, Archts.

American Machinist

Volume 55 NEW YORK, NOVEMBER 17, 1921 Number 20

An American Engineer's Experiences in Russia

Form of the Present Bolshevik Government—Dismal Attempts to Harmonize Capital and Labor—A Word-Picture of Lenin

BY ROYAL R. KEELY

IT IS recognized by most thinking people that upon the settlement of the Russian question hangs the problem of peace in the world. There is much talk of crop failure, hungering, of concessions, trade treaties and business relations with the Bolsheviki. Therefore, the experience of one pioneer in the field may be of interest.

As a consultant in industrial economics, in America my chief interest and difficulty was in the labor problem. I wished to see how labor acted under Bolshevism, and what the prospect was of eventual trade relations with the United States of America.

My suggestion of a visit to Russia was welcomed with enthusiasm by Lomonossoff, special commissioner of the Soviet government in the United States. We sailed from New York on May 24, 1919, and after many difficulties and delays crossed the border into Russia on Sept. 12, of the same year. On the eighteenth we were welcomed by the chief officials in Moscow. For eight months I was given every opportunity to travel and to see and understand the industrial and economic situation.

As long as the Bolsheviki thought that there was a chance of my being permanently enlisted in their cause, everything that this poverty stricken country could provide was lavished upon me—secretaries, a special car on the railways, the finest hotel accommodations and food from the Kremil, the stronghold of the Bolsheviki. In May, 1920, all vises, permits and documents, signed, countersigned and red-stamped were received and I left Moscow, (May 7).

On May 12, at the border in Yambourg, I was seized, just five minutes before the train was ready to proceed across the border, taken back to Moscow under armed guard and thrown into their big Bouterki prison—the Sing Sing of Russia. There was no official warrant presented, no explanation, no charges, hearing, trial or sentence.

"TRIED" AND SENTENCED

After suffering for a whole year all the insults and deprivations which they could inflict on a freedom-loving American, I was brought, with mock solemnity, into their highest tribunal and, after a two days' session, was sentenced to two years in a concentration camp, dating from the day of arrest. The only evidence brought against me in this "trial" was certain letters and memoranda written to my relatives in New York. By them the Bolsheviki saw that I knew too much. Therefore, in my "sentence" they said that I was a spy, that I had collected news of the economic and industrial situation for the American capitalistic press, that I had a contract with the *Chicago Daily News*, and that, therefore, I should be sentenced to two years in prison.

A few days later, after another solemn court setting, my sentence was changed to two years of compulsory work. That was on May 24 of this year, exactly two years after my departure from New York. Before my compulsory work began, there came the order for my freedom and a permit to leave Russia, due to the demands of the American Relief Association.

On Sept. 1 of this year I again received all permits to leave Russia, and at once went to Riga, where I was most warmly received by the U. S. Commissioner and the American Red Cross. All my personal needs were generously provided for, and I was made to feel that I was again a free man.

HOW RUSSIA ATTEMPTED TO HARMONIZE CAPITAL AND LABOR

The great industries of America have been largely built up by the personality and driving force of a single man. The school for the management of the business has been the industry itself, progressing stage by stage. Those of the new generation, stepping into their father's shoes, have not had the developing school. Therefore, the biggest problem before the gigantic industrial enterprises is co-ordination, unification and scientific management. The human problem is the all-absorbing one. How can one bring about harmony between the factory owner and the working man—between capital and labor?

Russia has attempted to solve these problems in a new way—by the "nationalization" and "centralization" of the entire means of production and ways of communication and all business. The State has attempted to take over all private business and all industry. It has attempted to socialize and centralize all human activity. Therefore, the experiment must be of great interest, not only to industrial economists, engineers and factory executives, but to all Americans.

On entering Russia, one of the first things to attract my attention was the censorship. If this new workers' and peasants' republic was so good, why did those in charge not want to convert all the world by showing their results? Why should they struggle to prevent all news of their work and conditions from passing to the outside world, and with equal diligence guard against the entrance of all news from foreign countries? It has been their plan to receive in their own hands all foreign news as well as that of local and internal affairs. There is no free press and the Bolsheviki give out such matter as they choose through their two dailies, the *News* and *Truth*. Most of the leading papers from other nations are received in the foreign office, but they are not for the general public.

During my last three months news of the outer world came through an English speaking friend who had a special permit to read the various papers and to make digests of important news items for the head of one of the departments.

Lately the censorship is breaking down, but not through any change in policy of the Bolsheviki. The change is being brought about through foreign commissions which have uncensored mail privileges and through courier service. The entrance of the American Relief Association has opened the way for more freedom in communication with this country.

It is difficult for an American, accustomed to private initiative, private business and private homes, to understand this upheaval where all has been nationalized or requisitioned by the government. In Russia there are no public hotels and no living apartments for which one can bargain privately. All the houses are under the control of the central housing committee in Moscow. The factories also have been centralized and each has its own executive committee.

PRESENT FORM OF RUSSIAN GOVERNMENT

Before the revolution, the large part of the population did not come in very close contact with the central government, except through the tax collector. The vast majority of the population of Russia lived in small villages that were largely self-governing through a direct voice in local meetings. This idea has been enlarged to embrace the entire nation. The form of organization is so worked out that each assemblage elects delegates to the next higher, until the highest authority in Moscow is reached.

The central Moscow government has some twenty departments, very much as in our own government. They include the war department, the state department, the military department, etc. One of the departments is called the "Supreme Council of National Economy." Its function is to operate, manage and control the entire means of production and ways of communication. Under its control are all factories, the railways, the telegraph and the telephone. As subdivisions of this council there are the Railways Department, the Metal Department (which embraces the majority of the metal-working factories), the Automobile Department (which has charge of building and repairing automobiles), etc. The Railway Department has charge of the repair of locomotives and cars.

In such a wholesale centralization, there are many details which have not been completely worked out, for example, whether the building of locomotives should come under the metal-working department or under the railway department. Also, if the locomotive building is to be under the metal-working department, then should not the locomotive repair come under the same department. This obviously offers difficulties as to whether the repair work should come under the production or the operating department. The same question has come up as to the automobile factories; are they under the automobile or the metal department? Another subdivision of the metal department is called "Gomza," which controls all machine tools for factories.

The centralized organization plan calls for executive control centering in Moscow. For example, the metal department is now under the direction of Martens, former Bolshevik agent in this country. In the matter of production management, each factory is supposed to have its production manager, supervised by production managers for the city, the government and the whole of Russia. The same applies for all other departments of manufacture, such as accounting, stores, design, development, tac.

AN INTERVIEW WITH LENIN

When I arrived in Moscow, Lomonossoff took me to see one of the most talked-of men in the world—no less than Lenin himself. For entrance into Kremil and his private sanctum, we required special passes which were carefully scrutinized by some ten or fifteen armed guards at various stages of our path of entrance. Lenin spoke fairly good English and my translator sat by only to translate the occasional word which did not come to him readily. His outer office was filled with stenographers and clerks. His own office was a large, well-lighted room on the top floor of a six-story building. It was finely furnished, much like an American business man's office, except for the heavy red window curtains and many telephones.

Open upon his desk was a book against Bolshevism written by an Englishman. He laughed over the errors of this writer and explained to me how he had completely failed to comprehend or appreciate the ideals of this wonderful new "Workers' Republic." He impressed me as an impractical idealist, who was, to a large extent, shut off from the work-a-day world and the difficulties and privations of his people, and who had little experience or ability in directing the organization and reconstruction of such a great nation. He was surrounded by men, who, like himself, perhaps, may have been good revolutionists, but who had no executive ability for directing the enormous task which they had taken upon themselves.

Lenin repeated to me the invitation of Lomonossoff that I go into all the factories and see the actual conditions and the psychology of the working force. In return for this freedom, he asked me to give him reports on anything that I saw which was not in accordance with American practice.

As he suggested, I went into most of the factories in Moscow and the surrounding districts and talked personally with all classes of people, including the workmen and foremen of the various factories. In my next article, I shall describe my discoveries in this field.

Automotive Service Methods and Equipment

III. Tools Used in Re-machining Pierce-Arrow Transportation Units—Re-boring Fixtures —Valve Spring Tester—Welding and Re-milling Axle Shafts

BY HOWARD CAMPBELL
Western Editor, *American Machinist*

THE operations of servicing cars and trucks as exemplified by the Long Island service station of the Harrolds Motor Car Co., New York dealers for the Pierce-Arrow Co., are productive of some very interesting material.

All of the motors and other parts that go into the machine shop for repairs pass through the cleaning room first. This room is shown in Fig. 1, where an operator is seen lowering a crankcase into a wash tank. The use of an overhead trolley and an air hoist makes this work comparatively easy.

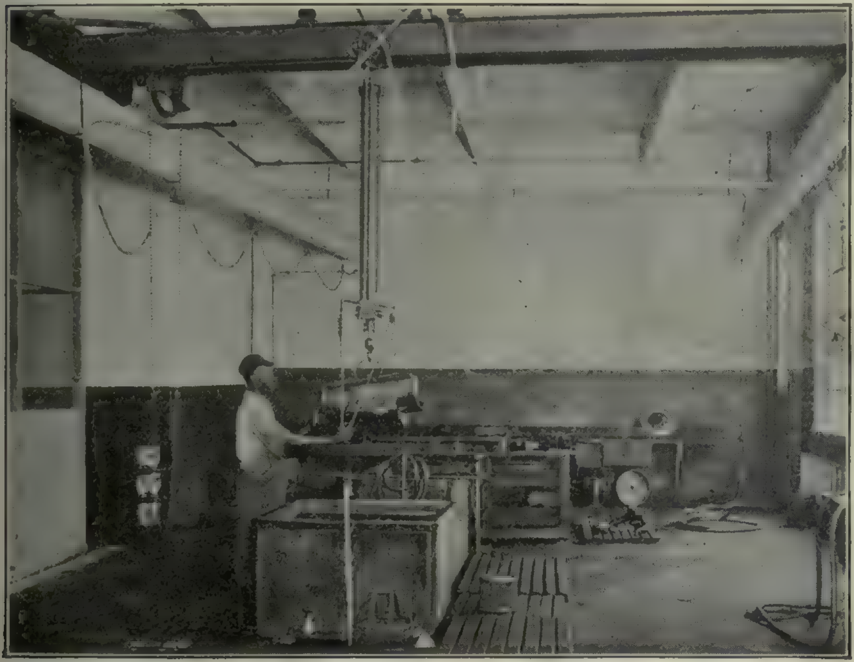


FIG. 1. CLEANING ROOM IN THE HARROLDS PLANT

At the present time there are four sizes of Pierce-Arrow connecting rods to be repaired. The lathe fixture shown in Fig. 2 is made to accommodate all four of these rods for re-boring. To one end of the fixture is attached a plate in which are four holes—one for each size of rod. To the other end is attached another plate in which are four pins which are numbered—as are the holes—from one to four. Each of these pins is turned so that it will fit the small end of one size of rod and is located so that when the plates are in position for boring a rod, as shown, the center distance between the holes will be correct. Each plate has four steel-bushed holes into which a locking pin fits, as shown at *A*. The clamp which holds the large end of the reamer in place is shown at *B*. Each of the four pins is threaded as at *C*, and a knurled nut *D* holds the small end of the rod firmly in position. The boring tool is a Davis boring bar with micrometer adjustment. When a set of rods is brought in for re-boring, the operator "mikes" each one of the crankshaft pins and bores the rods to the exact size of the pins on which they are to fit.

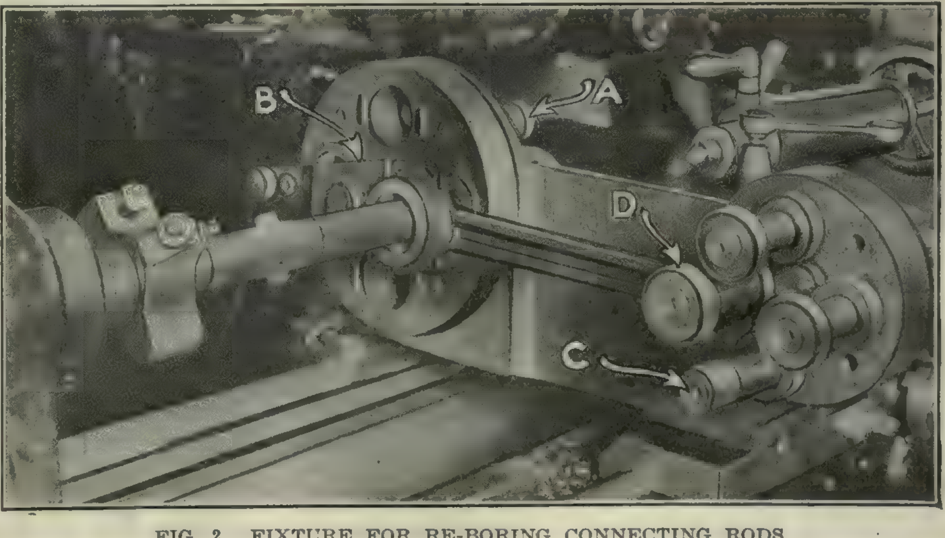


FIG. 2. FIXTURE FOR RE-BORING CONNECTING RODS

Another connecting rod tool is shown in Fig. 3. This is for facing off the ends of new bearings which either have been bored or are of the correct size so that they do not have to be bored. The rod is held in place by means of an expansion bushing which is tapered inside to fit the tapered end of a pin. This pin is made with the large end of the taper at the end of the pin and the taper on the inside of the bushing tapered the opposite way to correspond. The rod is placed in position, the pin is put through the bushing and both pin and bushing are put into the rod. The pin, which is threaded on the straight end to fit the locking handle *A*, extends down through the plate so that the handle can be tightened, thus expanding the bushing and locking the rod in place.

The upper plate *B* is hinged at the back so that it can be tipped up out of the way when putting in or removing a rod. The tool *C* is held in the shaft *D*, which is turned by the handle *E*. This shaft is a sliding fit in the part *F* which can also be turned by the handle *G*. The locking spring-pin *H* is attached to part *F*, and by locking this pin in one of the holes in the collar *J*, the shaft and the threaded shell turn together,

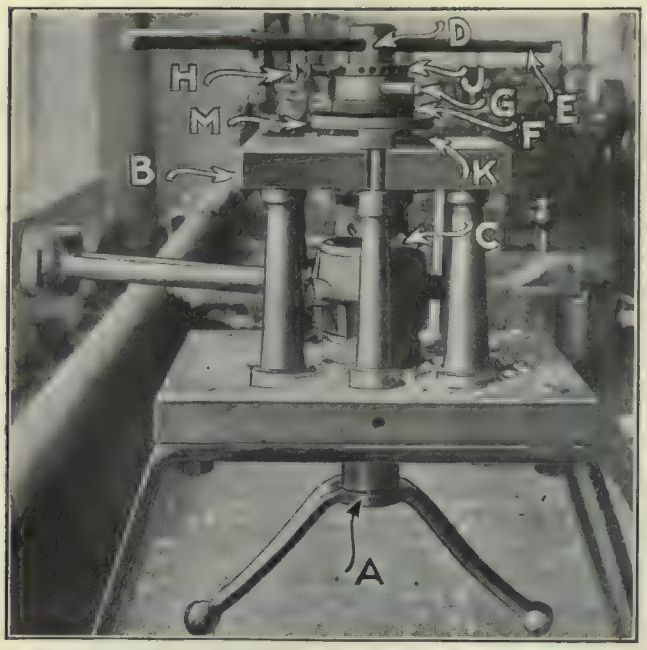


FIG. 3. TOOL FOR FACING OFF ENDS OF BEARINGS

thus feeding the tool to the work. Part *F* is threaded to fit a similar thread in a hardened steel bushing *K*. When the tool has been fed far enough, the locking pin is pulled out and the upper handle *E* is turned until the face of the bearing is even. A stop-collar *M* is provided so that a number of rods can be faced to the same dimension without measuring. The collar is set so that when it rides on the bushing *K*, the tool can go no further.

A HANDY GAGE

The tool shown in Fig. 4 is a gage for testing the grinding of valve heads. It is made in two parts, as shown. The interior of the large end of part *A* is ground to the taper required on the valves. The straight part of *A* is knurled on the outside so that it may be gripped firmly in the hand, and is bored through the inside for the bushing *B*. This bushing is one of several which are all made the same size on the outside, to fit the hole in part *A*, but have different size holes through them to fit the different sizes of valve stems, thus making it possible to test the grinding of all valves with this gage.

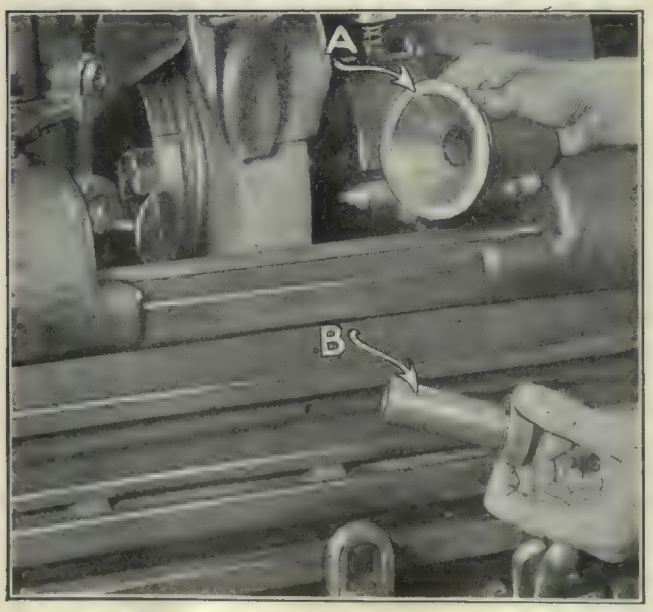


FIG. 4. GAGE FOR TESTING VALVE HEADS

When the angle on a valve head has been ground practically to a finish, a bit of Prussian blue is rubbed on the surface of the gage. Then the valve is inserted and turned around while the head rubs against the blue. In this manner the slightest variation in the angle can be detected, and all valves have to show a good full seat before being considered as finished.

RE-BORING MAIN BEARINGS

An interesting arrangement for locating the proper center distances for re-boring main bearings in a horizontal boring mill is shown in Fig. 5. The crankcase is mounted on the fixture as shown, supported at either end by a piece similar to the part *A*, the two supports also aligning the case so that the main bearings will be parallel with the cylinder bores. Then a stub arbor carrying a crank gear *B* is put into the spindle of the machine and the table is adjusted so that the crank gear meshes with the two camshaft gears. Then the table of the machine is adjusted both vertically and horizontally until just the right amount of back lash in the gears is obtained. When this result has been accomplished, the table is moved toward the tail end of the machine until the stub arbor can be taken out and the boring bar inserted in the spindle, after which the operation of boring the bearings proceeds.

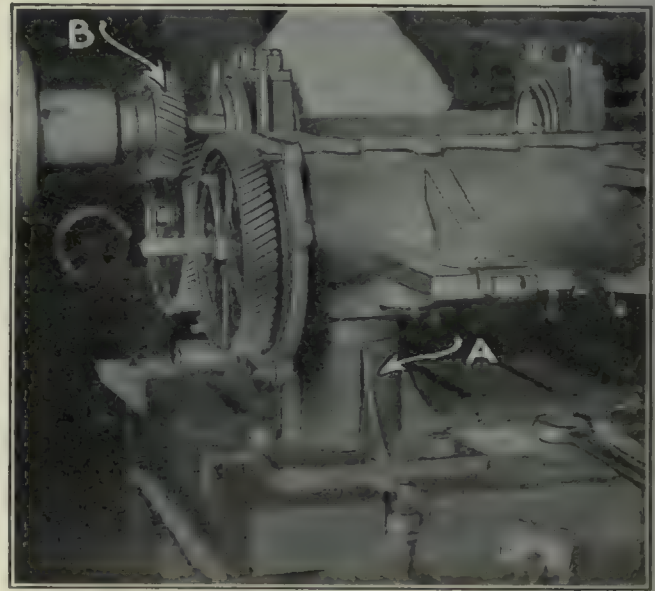


FIG. 5. FIXTURE FOR LOCATING CENTER DISTANCES

A valve spring testing machine is shown in Fig. 6, where the operator will be seen in the act of testing a spring. The major parts of this tool are the scrap cylinder block and an ordinary scale. The scale is attached to the bar *A*, of which only part shows in the photograph. This bar is connected by the rod *B* to the lever *C* so that when the operator lifts the lever, he also raises the scale. To the scale is fastened the part *D*, which closely resembles a large C-clamp. At the lower end of this piece is a seat into which a valve spring fits. The upper end of the spring will, when the spring is raised, seat against the piece *E*. To test the strength of a spring, the operator places the spring in position and then raises the lever, which also raises the scale, the C-clamp and the spring. The

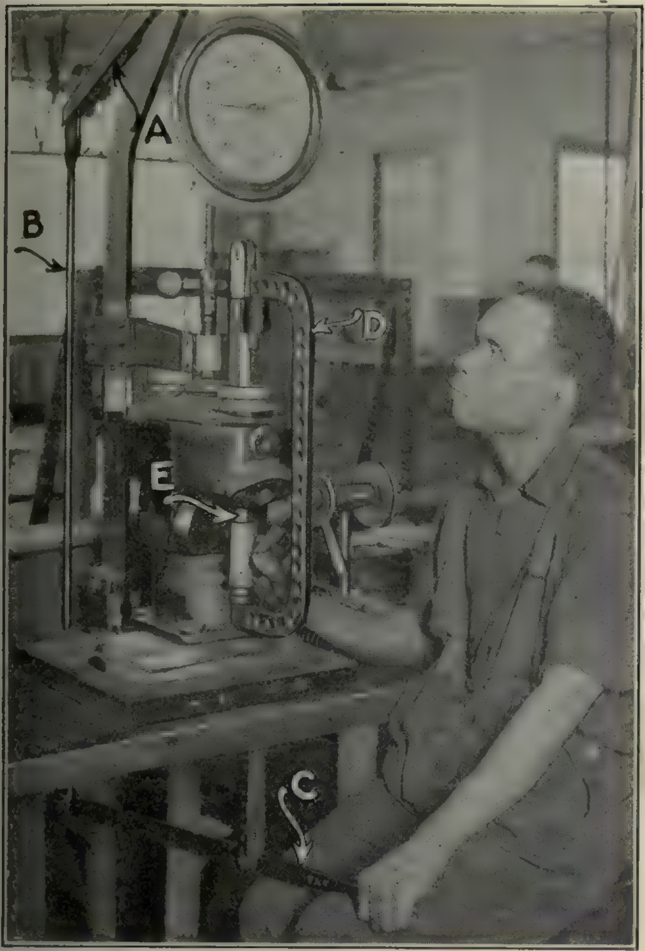


FIG. 6. VALVE SPRING TESTING MACHINE

result is that the spring is caught between the two seats and as the lever is raised further, the spring is compressed until the gage will just fit between the two spring seats. Obviously, if the spring is weak, very little pull will be necessary, while if the spring is strong, its strength will be reflected on the dial.

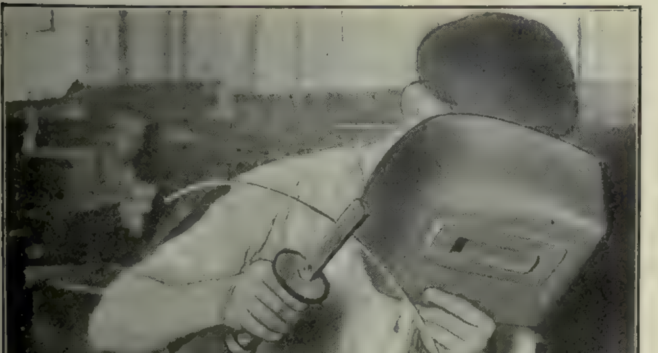


FIG. 7. REPAIRING AN AXLE SHAFT BY WELDING

A great deal of money and material is saved at this plant in the reclaiming of axle-shafts which would otherwise be scrapped. The operator shown in Fig. 7 is welding metal into the splines of an axle-shaft which had become so badly worn that it was useless. The welding is done with the aid of an electric current which is transformed through a Wilson plastic arc generator from 220 v., 16.8 amp., to 37.5 v., 150 amp. One pole of the generator is connected to the large iron ring on the table, and the other one is connected to the electrode which the operator is holding in his hand. Held in this electrode is a piece of $\frac{1}{16}$-in. steel wire through which the current travels to the point of contact. When the operator touches the end of the wire to the steel shaft, an arc is formed and the wire melts off, filling the splines with solid metal.

The next operation is the re-milling of these splines as shown in Fig. 8. This is a simple milling operation requiring, so far as special tools are concerned, a center and a dividing head with a chuck.

Electrification of Italian Railways

Reports forwarded by assistant commercial attaché Osborne, of Rome, indicate that the director general of the State Railways is suggesting that the government have the reparations account settled in part by requiring the Germans to hand over material which could be used in electrifying government railways. The office of the auditor general is said to oppose this means of settlement and to consider it preferable to have the adjustment of reparations made on a strictly money basis.

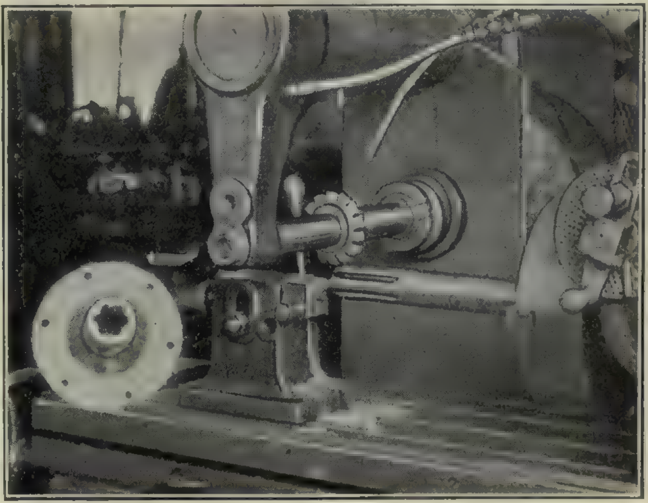


FIG. 8. RE-MILLING OPERATION ON SHAFTS

The reports state that plans have been completed for the electrification of the Bologna-Verona-Brenner, Pisa-Leghorn, and Venezia Giulia lines, as well as for a shortened route between Rome and Naples.

In order to carry out this extensive program the Director of Railways is negotiating with the Ministry of the Treasury in order to obtain the necessary funds. According to information just received from commercial attaché H. C. MacLean, of Rome, the *Official Gazette* of Oct. 1 published law decree No. 1298 whereby the State Railways Administration is authorized to expend the sum of 160,000,000 lires (about $6,400,000 at present exchange) for the purpose of 120 electric locomotives.

Industrial Ventilation

The Relation of Ventilation to Efficiency—Various Methods of Natural and Artificial Ventilation—Humidity and Temperature Govern Comfort

BY R. L. GOULD AND E. L. HEWITT

INDUSTRIAL ventilation is fast becoming the accepted rather than the unusual practice and it has undoubtedly come to stay in the modern industrial world, because our health, happiness and efficiency depend largely upon the degree of purity of the air we breathe. The reduction of lost time due to poor health and the increase of productivity to a maximum by providing proper conditions, are factors included in practically all of the larger schemes of production today. The human body is more or less a miniature furnace. The food which we eat supplies the fuel for this furnace and the resultant heat must be dissipated from the body in some way after satisfying bodily needs. The effectiveness of any general system of ventilation is determined by its proficiency in removing the excess heat from the body.

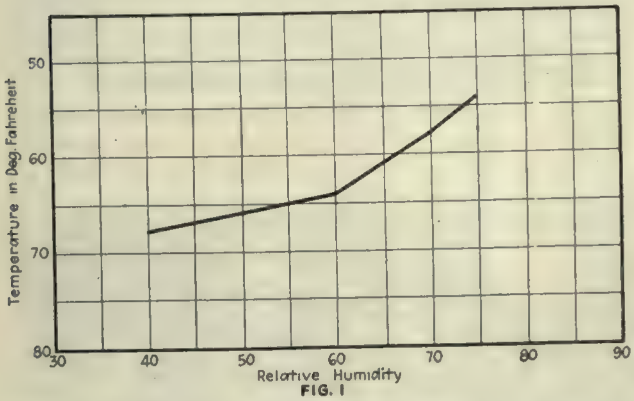


FIG. I

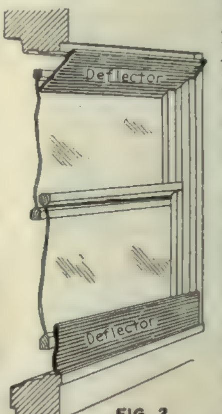


FIG 2

FIG. 1. THE CURVE OF COMFORT SHOWING TEMPERATURE IN DEGREES FAHRENHEIT AND RELATIVE HUMIDITY. FIG. 2. TYPICAL WINDOW DEFLECTOR MAY BE MADE OF BOARD, GLASS OR SHEET METAL, ACCORDING TO THEIR APPLICATION

The transfer of heat by radiation, evaporation and conduction applies to the human body as well as to material. To afford the proper degree of comfort the air in an office or workroom must have such a quality as to aid heat loss from the body by one of these three methods. There are three factors which have a direct effect upon the rapidity with which the body will give off its excess heat: (1) Relative humidity; (2) temperature; (3) air circulation.

Air at a definite temperature will hold a certain amount of water vapor or moisture. When the point of saturation is reached, the moisture comes out in the form of dew or rain. At this point of saturation, the relative humidity is considered to be 100 per cent. In other words, the air has suspended in it all the water vapor it can hold at that temperature.

In as much as the relative humidity gives the moisture content in the air, it has a very direct influence upon the heat loss from the body by evaporation. The less degree of moisture in the air, the more rapid is the evaporation and the consequent cooling effect on the body. The effect of high relative humidity is manifest especially during the summer months, and that same effect less pronounced has a tendency to reduce the productiveness of the worker.

The relative humidity taken alone does not have any very definite meaning. The degree of comfort of a room depends upon the combination of the temperature and relative humidity together with the air circulation. There has been plotted a "Curve of Comfort," Fig. 1, showing the proper relation between temperature and relative humidity. Reference to this will show that for a temperature of 54 deg. F. the relative humidity may run as high as 75 per cent, and the room still be comfortable. At a temperature of 68 deg. F. a relative humidity of more than 40 per cent will be found to decrease the comfort of the individuals in the room.

Consensus of opinion has determined that 70 deg. F. is the maximum temperature allowable for any room. The New York State Commission on Ventilation advocates the following standard temperatures where employees are doing work that requires strenuous physical exertion: 60 to 64 deg. F., and where the work is comparatively light, 66 to 68 deg. F.

The circulation of air is a factor which has an important bearing upon the comfort of the workers. In a room where there is little or no circulation, a blanket of dead air surrounds the body. To this blanket of air the body gives off its heat and impurities by means of radiation, evaporation, and conduction. If this air blanket is not disturbed, the air surrounding the body rises in temperature and the body becomes uncomfortable. When this air blanket is periodically removed by new air, its temperature is not permitted to rise to an uncomfortable degree and the loss of the heat from the body goes on at its normal rate. It is essential therefore, that there be proper air circulation to insure the replenishing of this blanket. The manner of providing adequate circulation may be one of many types; indeed the methods of ventilation and their application are so diversified as to warrant special consideration later.

The type of room, the operation performed in it, and the workmen employed therein, all have a direct bearing on the space allowed per employee. Some mechanical or chemical processes require more air space than that necessary in a room where some light operation is being performed. A male adult requires more air space than a female. Both of these should have a greater allowance than that provided for a minor. The strenuousness of the work performed is a factor to be considered because the more physical exertion demanded by the operation, the larger the allotment of air space should be.

There is somewhat of a variation in the requirements of the different states for the cubic feet of space allowed for each individual worker. The allowance of 250 cu.ft. per person should be the absolute minimum and this should be the exception rather than the rule. Illinois requires 500 cu.ft. of air space per employee and this undoubtedly more nearly approaches a proper limiting figure.

A change of air three times an hour is hardly perceptible to the workers and provides for an adequate supply of fresh air under normal conditions.

METHODS OF NATURAL VENTILATION

The principal methods of obtaining the proper amount of air, without any attempt to condition it, by natural means are: (1) Window ventilation; (2) doors and transoms; (3) elevator shaft, stairwells and courts; (4) roof ventilators.

WINDOW VENTILATION

Window ventilation is undoubtedly the most frequently used in industry today. One of the principles of good ventilation is to avoid drafts. If not controlled properly, ventilation by means of windows is apt to provide for the greatest infringement of this rule. To forestall the possibility of a strong draft reaching a worker, window deflectors are of great value. The variations of the principles involved are many, but practically all types serve to deflect the air upward and allow for the proper circulation without direct draft on the workers. Fig. 2 shows a typical deflector. In many cases the arrangement of the window shades prevents the proper air circulation. Shades should be so arranged at the middle of the windows that they will pull both up and down. This arrangement does not interfere in any way with the proper entrance and exit of air at the top and bottom of the windows.

Window ventilation is limited as to its application, although it is in use in a large proportion of the older plants at the present time. In a comparatively wide building the effect of window ventilation is apt to be entirely nullified by the time it reaches the center of the room. Then too, a draft which will cause a proper amount of circulation in the center of such a room would be very undesirable to those workers near the windows.

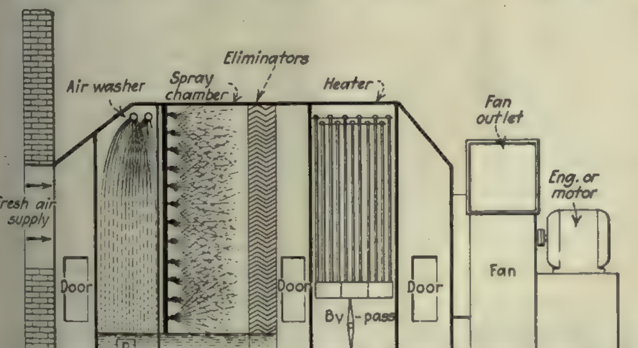


FIG. 3. PLENUM SYSTEM OF VENTILATION SHOWING AIR CONDITIONING EQUIPMENT

In summer, when the room temperature is approximately that of the outside air, there is very little natural circulation taking place. In winter, cold air coming into the room is objectionable to the workers. This difficulty may be remedied somewhat by the installation of radiators under the windows, but the human factor involved where the windows are opened and closed by employees is apt to determine the success or failure of such a system.

In general, the window system of ventilation is adaptable to rooms where the windows have been properly equipped with deflectors and have the proper arrangement of shades. It is not apt to be a success in a comparatively wide building. Window ventilation should be confined to work rooms which have a fairly large allotment of air space per employee and where there is no special dust or fume hazard.

DOORS AND TRANSOMS

While ventilation by means of doors and transoms forms but a minor part of the problem of ventilation as a whole, it cannot be ignored, especially in small rooms or offices. An open transom often affords a means of circulation and the opening and closing of a door creates a circulation which, although slight, tends to make the room more comfortable. An open door may greatly benefit the circulation of air in a room.

ELEVATOR SHAFTS, STAIRWELLS AND COURTS

Ventilation obtained by means of open elevator wells often plays an important part in the ventilation of a room. This is especially true if the shaft opens to the outside at the bottom and into the rooms at the various floors. The normal movement of an elevator will cause more or less circulation in the adjoining rooms.

It is borne in mind however that the benefits derived in the way of ventilation should be a secondary consideration to the fire hazards involved in this type of ventilation. Elevator shafts should always be equipped with automatic fire doors, but these need not interfere with the circulation of air obtained from the shaft. Practically the same ideas apply to the use of stairwells and courts as to elevator shafts for natural ventilating purposes.

ROOF VENTILATORS

The principle that warm or hot air rises is the basis for the use of roof ventilators. There are a number of such ventilators on the market at the present time and the essential principle in their construction is to allow warm air from the room below to escape and at the same time to keep out rain, snow, sleet and strong drafts. With this system of ventilation, the fresh air supply as a rule comes from the windows in the lower portions of the room.

METHODS OF MECHANICAL VENTILATION

Experience has shown that for many types of buildings and processes, natural ventilation is inadequate. The development by mechanical means of ventilating offices and work rooms has progressed until today we have a mass of information available on the subject. While various manufacturers of ventilating equipment vary the design of their product, the principles involved in ventilating by mechanical means fall under one of the following systems: (1) Fans for circulation only; (2) vacuum or exhaust system; (3) plenum system; (4) combined methods.

FANS FOR CIRCULATION

Fans perform the function of circulating the air and this circulation materially affects the comfort of the worker by providing for the removal of the surrounding "blanket of air" referred to previously. The present day practice advocates the use of individual fans for circulation for office work only; as the following system affords a more effective and cheaper means of ventilating workrooms. For office use however, fans have a very definite field and will often help to alleviate the uncomfortable condition brought on by warm weather.

VACUUM OR EXHAUST SYSTEM

For workers or employees in a workroom of more or less crowded conditions, where there exists a dust or fume hazard, where excessive heat or humidity is given off by the operation performed, ventilation by mechanical means is the only solution to the adequate handling of the problem.

The so-called "Vacuum System" of ventilation derives its name from the suction action it has in drawing air from a room. It makes no provision for the supplying of fresh air to the room, but depends upon the atmospheric pressure to equalize the partial vacuum formed.

The application of the exhaust system to localized machinery forms the field for the greatest usefulness of this type of ventilation, and will be considered later.

For general room ventilating purposes the direct exhaust system has some application. This consists of placing exhaust fans in the walls or windows of the building. These fans form a suction on the room and exhaust the impure and warm air to the outside atmosphere.

The exhaust method of ventilation assures a change of air to the workers, although the source of the incoming air should be determined, so that impure or hot air will not be drawn into the room. The low cost of installation and the reasonable maintenance cost are the outstanding advantages of this type of ventilating equipment.

PLENUM SYSTEM

The forcing of air into a room by means of force draft fans is known as the Plenum system of ventilation. This type of ventilating permits the air to be properly conditioned before it enters the workroom. This factor often warrants the installation of this system especially in many industries where the character of the products manufactured requires the maintenance of air conditions of a certain quality.

For the ordinary purposes of industry a simple system of this kind readily adapts itself. Heating coils placed in the main duct will remove the chill from incoming air in the winter time. Conversely, if a refrigerating plant is installed in the building, the air may be cooled in the summer before it is admitted to the workroom.

In larger systems of the plenum type the air is often cleaned, humidified and warmed. Reference to the sketch, Fig. 3, will show the principles involved in conditioning air by use of these various methods.

Air may be cleaned by either filtering or washing. Washing the air is the more satisfactory method, although if the cloth through which the air is filtered is changed at regular intervals the filtration method has a very definite application for smaller installations.

Washing the incoming air, in general, is passing the air through a water screen. This water screen is formed by sprays issuing downward from the top of the spray chamber. This spray carries with it to the bottom of the chamber most of the dust and dirt in the air and leaves it "freshened." The water is drawn off from the bottom of the spray chamber and may be used again after being filtered. Air washing allows the air which has been used in the plant to be re-circulated after washing, thus saving the expense of heating the incoming air to the proper temperature.

After passing through the washer the air passes over the eliminator plates which remove the excess water.

Passing through the water screen increases the humidity of the air. Thus, when the air comes to the heating coils any desired humidity may be obtained by controlling the heat supply to the air. This is true, because the higher the temperature the greater capacity air has for holding water vapor and the control of the temperature automatically controls the maximum amount of water vapor which can be suspended in the air at that temperature.

Temperature of the air leaving the system can be controlled to remain within practically any range. This type of installation readily lends itself to automatic control as the heaters may be by-passed by a thermostatically controlled mechanism when the temperature becomes too high, or too low.

In the summer time the heating coils may be replaced by refrigerating coils. As this involves the installation of a refrigerating plant, it is seldom warranted except in large auditoriums or hospitals. A frequent practice however is to run water direct from the factory supply through the coils. This somewhat reduces the temperature of the incoming air and is a much less expensive operation.

COMBINED METHODS

The most satisfactory ventilating installation is a combination of the vacuum and plenum systems.

The removal of the impure and warm air by means of a vacuum or exhaust system connected with a plenum system supplying air under proper conditions is the ideal arrangement.

No definite rule can be set for the installation of a specific type of equipment as each individual case has its peculiarities which need special consideration.

EXHAUST SYSTEMS FOR LOCALIZED INSTALLATIONS

Occupational disease is largely due to the dust or fume hazard prevalent in our industries today. It is not within the scope of this paper to discuss the effect of fumes or dust upon the workers. Let is suffice to say that in general they affect the membranes of the throat, nose and lungs. Metal dust, by its action on the membranes of the lung, renders the worker susceptible to tuberculosis. Lead, arsenic and mercury are apt to cause chronic poisoning. Dust, feathers, and hair may carry germs. Fumes from benzol, aniline and lead affect the blood, heart, eyes and nerves.

The best way to handle the dust and fume hazard is to eliminate it. The installation of wet processes and inclosed machinery has done away with this hazard in some plants.

If it is necessary to perform an operation where dust or fumes result the workman should be equipped with respirators, helmets, and other protective devices and the operation carried on in a dust-tight room or compartment. Where these methods are not practicable, the local system of exhaust ventilation has a wide application.

POSITION AND TYPE OF HOOD

Where localized exhaust systems of ventilation are to be used, the position and type of hood are two very important elements. The hoods should in every case be as close as possible to the source of dust or fumes. If dust is to be removed and is light enough to float in the air, the hood should be over the top of the machine. If the dust is heavy enough so that it settles quickly the hood should be arranged so that the dust will fall into it by the action of gravity upon it. The same type of hood used for removing heavy gases has been found satisfactory for removing the lighter type of dust. In these cases the pipe leading to the exhaust fan is attached to the side of the hopper, so that the fan will not have to handle the heavy particles of dust which would naturally settle in the bottom of the hopper, and may be removed from time to time. It is sometimes necessary, because of the construction of the machine, to place the hood at the side of the machine with a resultant lateral motion to the dust or gas.

Chips or dust particles coming off from grinding wheels are often moving at a rapid rate. This action should be utilized to aid the exhaust to handle the material, and may allow a reduced suction on the system.

Where it is impossible to entirely inclose the process the material should be discharged away from the operator.

CONSTRUCTION OF HOOD

Hoods, when made of galvanized sheet metal, prove generally satisfactory. The gauge of the metal is dependent upon the size of the hood, and the amount of stiffness which is required for that particular process.

In the case of grinding wheels, the hood should serve a two-fold purpose. It should be properly constructed to exhaust the dust, and at the same time, be strong enough to serve as a protection to the operator in case the wheel breaks.

In some cases acid fumes are given off, and the action of these fumes upon galvanized sheet metal is very detrimental unless they are lined with some noncorrosive substance. It is possible in certain cases to make satisfactory hoods of wood, provided they are of the proper design.

Some processes lend themselves readily to the installation of one large hood for several machines. However, the individual type of exhaust hood is more satisfactory for general ventilating work.

The ventilation of workrooms and factories of industrial plants is practically in its infancy today. The effect of improper ventilation upon the health of the workmen and their resultant decreased production is a subject which is at the present time being investigated by several prominent authorities. When the results of these experiments are published a direct connection should be shown between ventilation, production and profits.

The authors wish to acknowledge reference and valuable information from the following authors: "Safe Practices," pamphlets 32 and 37, issued by the National Safety Council which were drafted by W. D. Keefer, safety engineer, National Safety Council. "Heating and Ventilation," by Harding and Willard. "The Modern Factory," By George M. Price.

Engineering Work in Ceylon

Early in October the Ceylon government floated a loan in London which, with earlier installments, totals £6,000,000. The proceeds of this loan are to be used for the construction of the Colombo drainage works, the extension of the Colombo waterworks, the Batticaloa-Maho and Trincomalee Light Railway, and the duplication of the main line and other railway and public works in the colony.

The above is a very substantial sum and indicates that there will be a great deal of activity in general engineering construction lines in Ceylon in the near future.

Nested Steel Compression Springs

BY T. F. STACY

It is frequently desirable to design springs which are to be nested one within another for use in places where the length of the spring is limited, or where the diameter of wire for a single spring is large in comparison to the diameter of the coil. This article deals with the design of such concentric springs so proportioned that all springs are worked to the maximum fiber stress. The amount of compression for the nest is proportional to the load imposed on the springs, as in the case of a single spring.

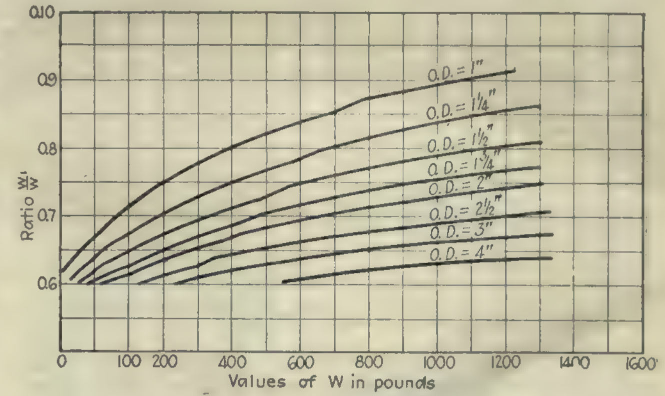


FIG. 1. CHART FOR DETERMINING W FOR A 2-SPRING NEST

On page 581, Vol. 53, of the *American Machinist*, the writer published an article on the design of individual springs; and the curves therein illustrated may be used to advantage in connection with the solution of the problem of this article. In lieu of these curves the various tables published in handbooks may be used to design the separate springs of the nest when the necessary data are obtained as given in the following paragraphs:

The known quantities in the problem are the total maximum load which is to be supported, the maximum outside diameter of the outside spring or nest, and the total amount of deflection. To design a nest of springs, it is necessary to find the load carried by each spring in the nest and the outside diameter of each spring.

The conditions which must be imposed are that the free length, solid height, and total deflection shall be the same for all springs of the nest. The allowable maximum fiber stress shall vary according to the size of wire and as recommended by our leading spring manufacturers. The clearance between springs shall be enough to allow free play. In this article a clearance of ⅛ in. on the diameter has been allowed.

The following notation is used in the formulas:

D = Mean diameter of spring from center to center of wire.
d = Diameter of wire.
F = Total deflection of spring.
f = Allowable deflection per coil.
W = Total maximum load which the spring can support.
OD = Outside diameter of spring.
n = Number of turns in the spring.

When subscripts are added to these characters the subscript 1 shall refer to the outside spring of a nest, the subscript 2 shall refer to the next spring, etc. Where the characters are used without subscripts, they shall refer to a single spring which may be used to replace the nest.

Since the solid height and free lengths of the springs in a nest must be equal, we have

$$n_1 d_1 = n_2 d_2 = n_3 d_3, \text{ etc.} \qquad (1)$$

$$n_1(f_1 + d_1) = n_2(f_2 + d_2) = n_3(f_3 + d_3), \text{ etc.} \qquad (2)$$

The usual formulas of spring design give

$$f = \frac{8WD^3}{d^4G} \qquad (3)$$

$$\text{and } W = \frac{d^3\pi S}{8D} \qquad (4)$$

Whence, from (1), (2), (3) and (4),

$$\frac{D_1}{d_1} = \frac{D_2}{d_2} = \frac{D_3}{d_3}, \text{ etc.} \qquad (5)$$

For a nest of two springs, we have

$$W = W_1 + W_2 \qquad (6)$$

and

$$D_1 = D_2 + d_1 + d_2 + \tfrac{1}{8} \qquad (7)$$

Whence, from (5,) (6,) and (7,)

$$\frac{W}{W_1} = 1 + \left[1 - \frac{2d_1 + \frac{1}{8}}{OD_1}\right]^2 \qquad (8)$$

For a nest of three springs, we have

$$W = W_1 + W_2 + W_3 \qquad (9)$$

$$D_1 = D_2 + d_1 + d_2 + \tfrac{1}{8} \qquad (10)$$

$$D_2 = D_3 + d_2 + d_3 + \tfrac{1}{8} \qquad (11)$$

Whence, from (9), (10), (11)

$$\frac{W}{W_1} = 1 + \left[1 - \frac{2d_1 + \frac{1}{8}}{OD_1}\right]^2 + \left[\frac{(OD_1 - 2d_1)^2 - \frac{OD_1 - d_1}{4}}{(OD_1)^2}\right]^2 \qquad (12)$$

Various values of d_1 and OD_1 were assumed and the corresponding values of W_1 were found from the curves previously mentioned. Values of W were then found in formulas (8) and (12) by substituting the values of d, OD, and W, as mentioned above. The curves shown in Figs. 1 and 2 were then plotted, giving W and OD, which will be the known quantities in a problem on nested springs, and the ratio of $\frac{W_1}{W}$. The values of W_1 may then be determined and the outside spring of the nest designed, since for this spring W_1 and OD_1 are known.

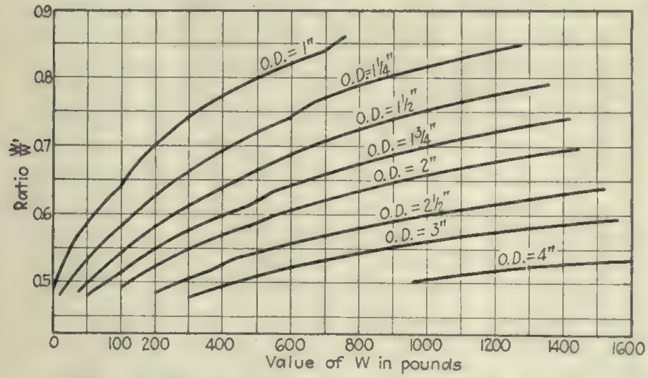


FIG. 2. CHART FOR DETERMINING W FOR A 3-SPRING NEST

One set of curves is for a nest of two springs and one for a nest of three springs. If there are two springs in the nest $W_2 = W - W_1$ and $OD_2 = OD_1 - 2d_1 - \frac{1}{8}$, and the inside spring may be designed since W_2 and OD_2 are known.

If there are three springs in the nest $W_2 + W_3 = W - W_1$ and $OD_2 = OD_1 - 2d_1 - \frac{1}{8}$. The two inside springs may then be designed from the curves for nests of two springs as described above.

In figuring values of W_2 or W_3, subtract from W the the values of W_1 or W_1 and W_2, which were obtained from the proportions given by the curves, and not the actual values used to conform to standard sizes of wire. If this is not done the free length of the last spring will not check with the others.

An exact solution is not possible, because standard sizes of wire must be chosen. The nest should, therefore, be checked for total maximum supporting strength, equal free length and solid height of all springs, and for sufficient clearance between springs. Adjacent springs should be wound opposite hand.

The total load should be taken about 10 per cent in excess of the desired strength of the nest, to allow for variations in the stiffness of the wire.

The breaks in the curves are due to the different fiber stresses assumed for different sizes of wire. For No. 25 to No. 13 W. & M. gage wire, 120,000 lb. per square inch was used; from No. 12 to No. 4 wire, 100,000 lb. per square inch; and from No. 3 to $\frac{9}{16}$-in. wire, 90,000 lb. per square inch. This is in accordance with modern practice.

SOLUTION OF A PROBLEM

The following example will illustrate the use of the curves:

Design a nest of three springs having an outside diameter of 4 in., to support a load of 1,600 lb. with a deflection of 4 in.

From Fig. 2, for nests of three springs we find that $\frac{W_1}{W} = 0.535$. Therefore, W equals $0.535 \times 1{,}600 =$ 856 lb. The outside spring will have an outside diameter of 4 in. and support 856 lb. under a deflection of 4 in., these data being obtained from the article previously referred to. A spring having 5.6 coils of $\frac{7}{16}$-in. diameter wire and a free length of 6.4 in. will fulfill these requirements.

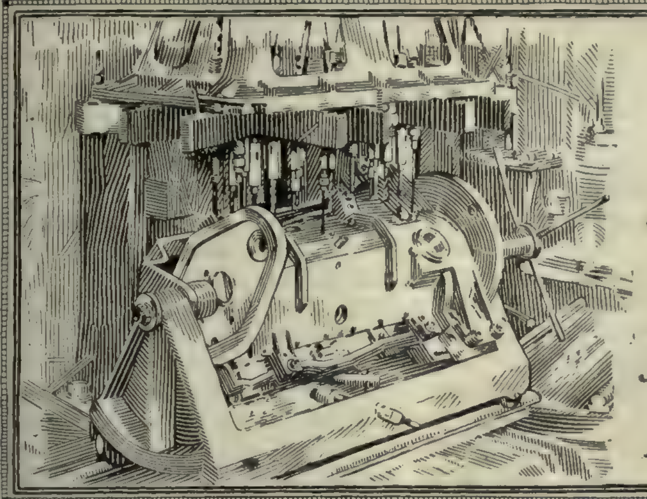
The two inside springs must support $1{,}600 - 856 =$ 744 lb. The outside diameter of the second spring is $4 - \frac{7}{8} - \frac{1}{8} = 3$ in. From the curve for nests of two springs, Fig. 1, we find that the outer spring of the two carries 0.65 of the load carried by the two springs. Then,

$$W_2 = 0.65 \times 744 = 484 \text{ lb.}$$

A spring having an OD of 3 in. and supporting 484 lb. will be made of $\frac{11}{32}$-in. wire and will support 540 lb. Then 7.8 coils are needed, giving a free length of 6.6 in.

The inside spring must support $1{,}600 - 856 - 484 = 260$ lb. and will have an OD of $3 - \frac{11}{16} - \frac{1}{8} = 2\frac{3}{16}$ in. Now, 10.7 coils of No. 3 wire will support 265 lb. and such a spring will have a free length of 6.6 in. The total load which the nest can support is $856 + 540 + 265 = 1{,}650$ lb.

A cut and try method without using the curves is as follows: It can be shown that $\frac{W_1}{D_1^2} = \frac{W_2}{D_2^2} = \frac{W_3}{D_3^2}$, etc. $W_1 + W_2 + W_3 + \ldots$ is also known from the conditions of the problem. Various values of D may be assumed and corresponding values of W computed from the given equations. D and W will then have been found for each spring and they may be designed. They must then be checked for equal solid heights and free lengths, total load, and sufficient clearance between the springs.



Tool Engineering

By

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Work-Holding Fixtures for Turret and Engine Lathes Continued—Second-Operation Tooling on Special Work—Sliding Index, Angular, Counterbalanced, and Other Fixtures

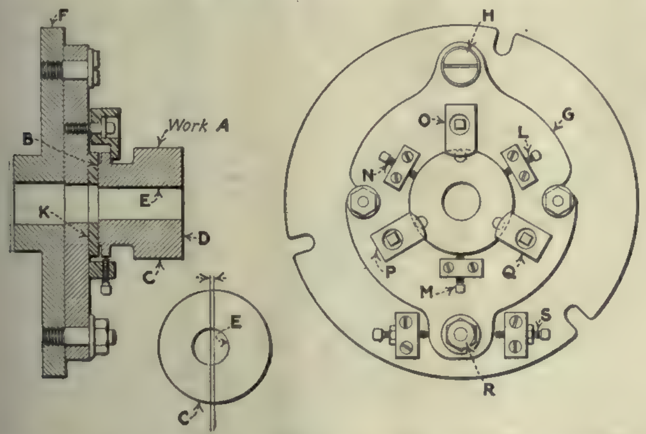

FIG. 252. ECCENTRIC FIXTURE WITH SWIVEL MEMBER

IN FIG. 252 is shown a piece of work *A* which has been previously faced at *B* and which is to be machined at *C, D* and *E*. The hole *E* is slightly eccentric to the portion *C*, as indicated in the diagram. The fixture body *F* may be mounted on an adapter or screwed to the spindle, as desired. The member *G* is mounted on *F* so that it swings on the shouldered screw *H*. The work is located on the hardened plate *K* mounted on a swiveling member, and its position is determined by means of the three screws, *L, M* and *N*. These screws are mounted in steel blocks suitably located. The work is held down by the three clamps at *O, P* and *Q*, these clamps being operated by a socket wrench. After the hole has been machined, the nut *R* is loosened and the swivel is moved over until it strikes the stop screw at *S*. This distance can be accurately determined by using a size block.

A point of importance in connection with a fixture of this sort is the location of the stop screws in relation to the center and to the pivot screw *H*. It is advisable to make the distance the same on each side of the center, so that the eccentricity obtained will be exactly half of the movement between the stop screws. The simplicity of fixtures of this sort for work which has only a small amount of eccentricity makes them very desirable, as their construction is such that they can be made up cheaply. A sliding fixture can be designed which will give the same results, but its cost is somewhat more, due to the necessity for fitting the slide.

In making up a fixture for a piece of work which requires two holes to be put in at some distance from each other, a sliding fixture can be used. A diagram to illustrate this kind of a condition is shown in Fig. 253. The work in this case is a casting *A* having two holes of different sizes 3 in. apart and parallel to each other. The illustration is simply intended to represent the problem in diagramatic form, in order to show the conditions which are found. The faceplate is made up in such a way that a slide of the dovetail variety is mounted on it at *B*. The work is clamped by some convenient method to the slide, and locations for the two holes are obtained either by means of plugs entering bushings or by stop screws suitably arranged. If work is very much heavier on one end than on the other, it may be necessary to arrange some kind of a counterpoise to keep the fixture in proper balance, but unless high speed is to be used this might be found unnecessary. Sliding fixtures of various kinds can be made, according to the nature of the work and the amount of eccentricity required. In locating any piece of work from a tapered hole care must be taken to make the tapered member so that it will float. If this is not done slight variations between the taper and the other finished surfaces may result in an improper location and cause inaccurate work. The flywheel shown at *A* in Fig. 254 is an example of this kind. The work has been previously finished in the tapered hole *B* and also at *C* and *D*. The fixture *E* is designed to be screwed directly to the spindle, but it can also be mounted on an adapter if desired.

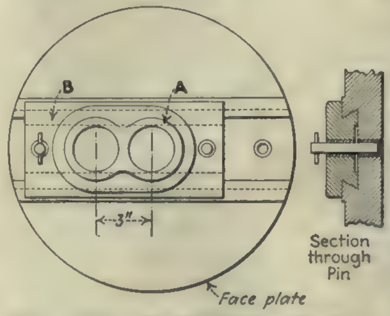

FIG. 253. PRINCIPLE OF SLIDING-INDEX FIXTURE

The work locates on the taper plug *F*, which is so arranged that a coil spring keeps it in contact with

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For the authors' forthcoming book. All rights reserved.

the hole during the chucking operation. It is restrained so that it does not travel too far, by means of a screw *G*, which enters a slot on the outside of the plug. The finished rim on the flywheel locates on a hardened ring *H*, against which it is clamped by means of hook bolts *K*. These hook bolts are operated from the back of the fixture by means of nuts at *L*. The nature of the casting gives an excellent opportunity to apply this method of clamping, as the hook bolts extend up through the cored holes in the casting *M*, leaving room enough so that when the bolts are turned around the casting can be removed readily.

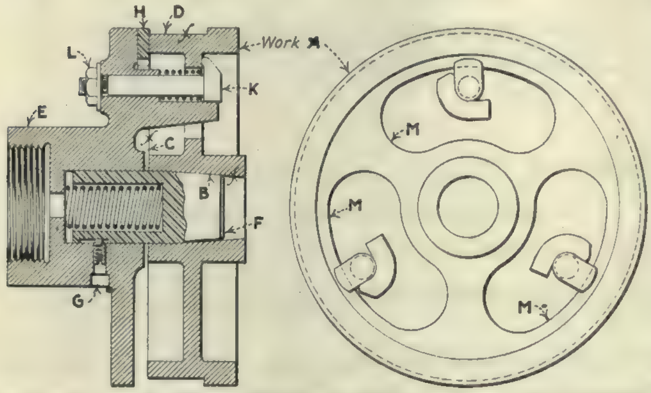


FIG. 254. SECOND-OPERATION FIXTURE FOR FLYWHEEL

In clamping the work down by means of the hook bolts, the taper plug remains firmly in contact with the hole and adjusts itself when the clamps are tightened. If there is any variation between the taper and the finished surface *C*, it will be taken care of if this method is used. A screw taper plug can also be used in place of the spring plug, but this is not as good practice, as it depends upon the operator's "sense of touch" and he is likely to force the plug into the taper too far or too little and thus cause inaccurate work.

Fixture for an Angular Fitting

In Fig. 255 is shown the principles of a fixture designed for holding a piece of angular work *A* while machining the portions *B*, *C* and *D* in a definite relation to a previously finished portion *E*. This example is given to illustrate a principle rather than to show the complete design of a fixture. The work locates in a bushing *F* in the body of the fixture *G*. The fixture is mounted on an adapter by means of the finished ring at *H*.

The method of clamping the work is by means of a sliding jaw *K* operated by a special screw *L*, using a socket wrench. This jaw comes up against the end of the casting at *M*. If the casting is rough it might require a swivel jaw at this point too; but if it has been finished a plain jaw will answer the requirements. The jaw is fitted to a slide, as shown in the end view at *O* and *P*. For the majority of work it would be possible to cut this slide directly in the casting. A better construction is to make two strap clamps at *Q* and *R*, fitting these to the slides where necessary. Angular work of this kind is encountered from time to time, and the designer should study methods which can be applied to suit peculiar conditions.

Counterbalanced Fixture

An example of a fixture having a counterbalance is shown in Fig. 256. The work *A* is to be machined in this operation on the end *B*. The spindle end, which is at an angle to the part to be machined on the counterbalanced fixture, has been machined in a previous operation, so that it is necessary to provide a means of locating the piece from it. The fixture *E* is so designed that it can be attached to a faceplate, locating in the hole by means of a flanged portion *F*. Provision is made so that T-bolts can be used in the slotted portions of the fixture to hold it back against the faceplate.

The work locates in a hardened bushing at *C* and on a ring at *H*. It is drawn down on the surface of the ring by means of a nut at *D*. The finished surface of *M* is at an angle of 1½ deg. with the center of the fixture; and as made here *M* is cast as a unit with the remainder of the fixture. It might be more economically made and easier to machine if it were made in bracket form and screwed and doweled on to the body of the fixture. The work is held in its correct location by means of a setscrew at *K*, the action of which tends to throw it over against stop *L*, which is made adjustable in order to allow for making changes that may be required by variations in the castings. The counterbalance *G* is also made as a part of the fixture, and it would naturally be drilled out or faced off so that it will balance the opposite side with the work in position. It might be possible to design this part also as a separate unit, and fasten it to the body of the fixture by means of bolts.

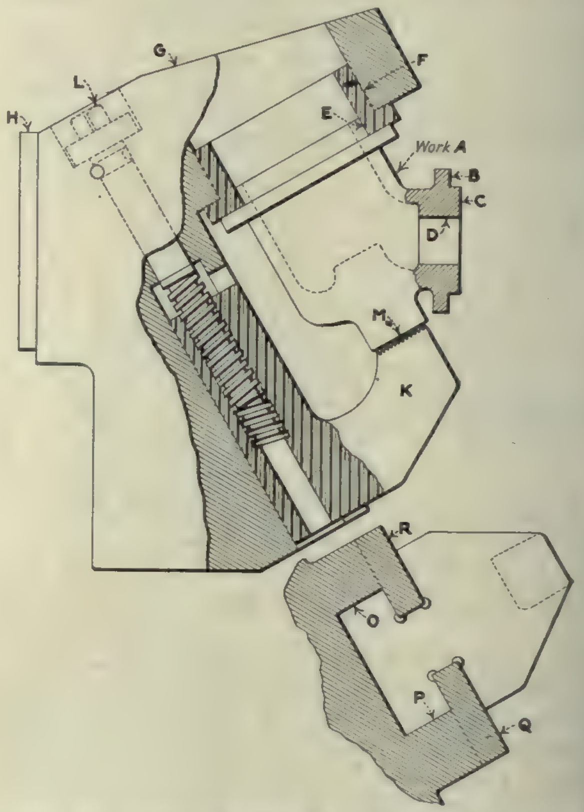


FIG. 255. FIXTURE FOR AN ANGULAR FITTING

Another method which can be used to hold work of this kind would be to make the counterbalance *G* and the bracket *M* in such shape that they can be fastened to a standard faceplate, in which case no fixture would be required other than the parts mentioned. This practice would not be considered very good unless the faceplate were kept as a unit with the fixture, because of the possibility of errors arising from resetting the parts on the fixture.

Another special fixture which can be attached to a faceplate is shown in Fig. 257. The work *A* is a swivel bracket which has been machined in a previous operation at *B*, *C* and *D*. It is required to machine the surfaces *F* and *E* in a certain relation to the other portion, and in order to do this the fixture shown was designed. The body of the fixture *H* is provided with three holes, so that it can be fastened to a standard faceplate. The plug *G* is set in an angular bracket so that the work locates on it, and is held down against the hardened ring by means of the nut and C-washer *K*. The location of the large end is obtained by swinging the flange against the hardened pin *L* and holding it there by means of the screw at *M*. This fixture allows the tools to operate in turning the portion *E* and *F* without interference. The work is held rigidly and its location is fixed so that the proper relation is obtained between the various surfaces.

POT FIXTURE FOR A STAMPING

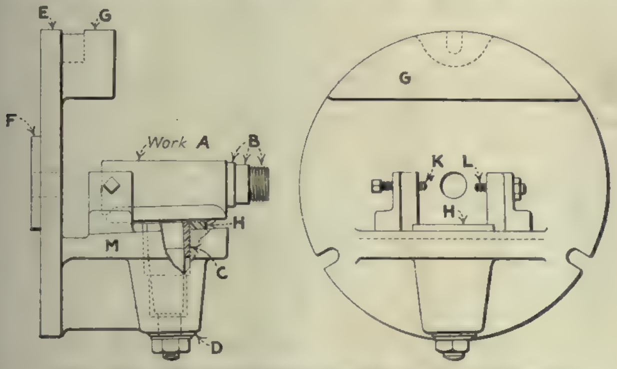


FIG. 256. COUNTERBALANCED FIXTURE FOR STEERING KNUCKLE

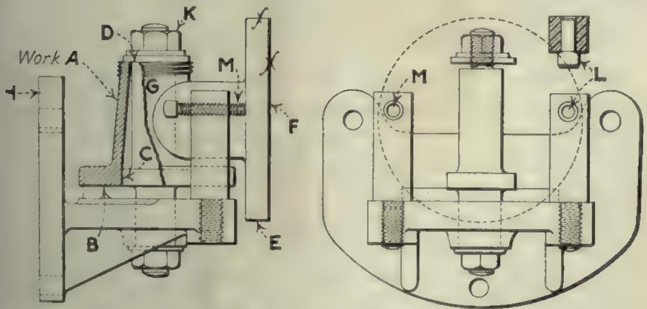


FIG. 257. SPECIAL FIXTURE FOR SWIVEL BRACKET

An unusual fixture is shown in Fig. 258, in which the work *A* is a steel stamping, 12 in. in diameter. The outside of this stamping *B* is held closely to size and the work which is to be done is the turning of the portion *F*, facing of *E*, boring of *D* and back facing of *C*. It was desired to do this in one operation and the fixture was designed for this purpose, special tools being used for the back-facing operation. The fixture *H* is screwed to the spindle of the machine and a ring *K* is fastened to it. The inside of this ring is provided with two other hardened rings *L* and *M* which are ground to such a size as to allow the work to fit into them freely. The work is placed in the fixture until it rests against three locating studs *M*, which determine the end location. For driving the work, a thin spring-steel ring *O* is fastened at *P* and passes entirely around the drum, against which it is drawn up snugly by means of a nut at *Q*. This band has a contact against nearly the entire surface of the drum and gives sufficient driving power to withstand the pressure of the cut.

Work which has been previously machined sometimes requires another operation on it of drilling or hollow milling. When this portion must be held carefully in relation to the previously machined part, provision should be made to guide the drill or hollow mill. An example of this sort is shown in Fig. 259, in which the work *A* has been machined in a previous operation, as shown by the finish marks on the large end. The fixture *B* is designed to fit into an adapter fastened to the spindle. The work locates in a hardened ring *C* in the body of the fixture. It is held in place by means of the two hook bolts, *D* and *E*, the arrangement of which is such that they can be operated very rapidly. Swivel C-washers *F* are used under the heads of each of the bolts *G*, being attached to the hook bolts as shown. One side of the fixture is carried up at *H* to form a bracket in which the guide bushing *K* is located. This guide bushing serves to locate a combination hollow mill and facing tool which is used to machine the stem *L* and the surface *M*, these two portions being required to be concentric with the other end which has been previously finished. In removing the work from the fixture, the bolts *G* are unscrewed slightly and the C-washers thrown back, which allows the hook bolts to spring out until restrained by the collars on the bolts. An ejector is provided at *N* to knock the piece out of the locating ring. One side of the fixture is open at *O* so that the operator can easily reach in and remove the work.

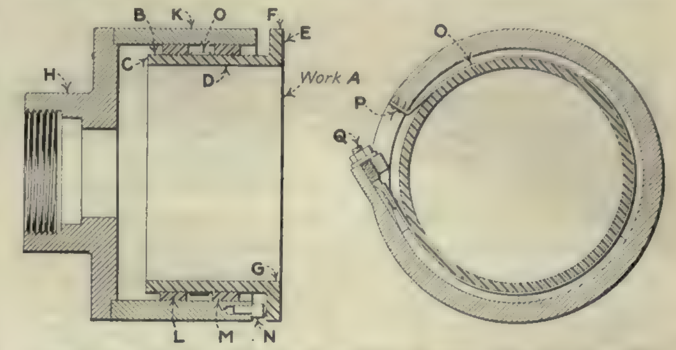


FIG. 258. POT FIXTURE WITH STEEL STRAP CLAMP

In making up fixtures which carry guide bushings for any sort of cutting tools, care must be taken both to provide plenty of room for chips and to give ample hand clearance so that the work can be easily removed and placed. The support for the bushing must be sufficiently rigid to withstand any pressure developed by the cutting action. In cases where cutting lubricant is to be used, provision should be made for it either by carrying the liquid through the tool or by having openings through the fixtures so that the fluid can easily reach the work.

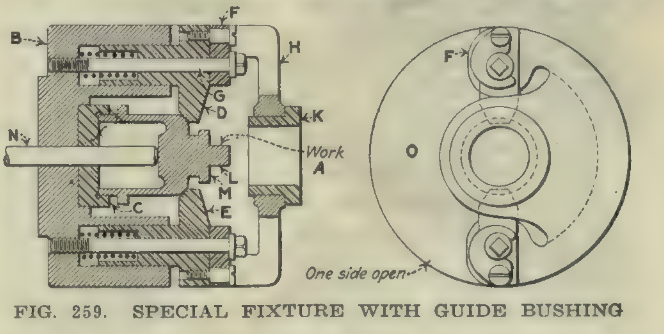


FIG. 259. SPECIAL FIXTURE WITH GUIDE BUSHING

Necessity of Better Application of Economic Principles

Crest of Business Wave a Poor Time to Build Stock—Wages Must Come Down With Other Costs—Stabilization Will Come From Knowledge

By ERNEST F. DU BRUL
General Manager, National Machine Tool Builders' Association

JUST as the necessity of better application of physics and other sciences has been manifested with the growth of industries, so we need better application of economics to improve the fundamental health of business. As long as business men blind their own eyes to fundamental laws and then insist on doing the wrong thing, they cannot realize how much better it would be for them to do the right thing. Some things that can and should be done at one stage of the economic cycle are absolutely the wrong things to do at another. For instance, when a wave is reaching its crest is the wrong time to make stock. The costs are then always the highest, because of many reasons. Yet many business men, as soon as the wave begins to recede, keep on producing as though the wave were to continue at a high level. They put up stock at a high cost, and then liquidate it on the down grade, taking a loss. If they had used their information properly, they would never have incurred such loss. If they had shut off their production, cleaned up their stocks, and kept good financial reserves to begin again when the next wave starts, they would be strong. At the bottom, or just as a buying wave begins to get under way is the best time to increase stocks, because that is when costs are lowest.

Paying the Penalty for Poor Judgment

Many manufacturers in this last wave made that same mistake and are now paying the penalty. They thought that it was a good thing to keep workmen employed and maintain their organization. Many workmen had become extravagant in their own personal expenditures. They were not saving money; they were not even working full time; but on the contrary were indulging in "conspicuous leisure," to show that they did not have to work. Continuing production for stock under these circumstances only gave such workmen additional means to be wasted for a time, and just when they did not need them. Stock production deprived the manufacturer of liquid resources and made it just that much less possible for the manufacturer to finance production when costs were lower, jobs scarcer, and when men needed jobs more than they did at the top of the wave.

Union labor leaders are sadly mixed in their economics when they tell men that they cannot and will not stand a cut in wages when general prices are going down. This situation makes it impossible for the manufacturer to continue production when he might otherwise be able and willing to produce, if his costs could step down with the recession of buying. It is very difficult to get men to accept a cut in wages when a factory is running full. The factory has to shut down before the men know the cut is necessary. Society has often suffered from production lost that could otherwise have been made on the receding side of the wave, because workmen do not want to take a cut in wages while the factory is running. Unless the manufacturer does cut, he produces at high costs and must later take losses that do no one any good. Meanwhile the workmen have perhaps wasted a great deal of what the manufacturer himself later takes as a loss on writing down his inventories.

Union labor leaders do not recognize the futility of their demands to maintain an artificially high level of wages. If railroad labor is overpaid, it means that other labor must be underpaid to overpay the railroaders. Through political control the railroaders may for a while get that overpayment, but it cannot last. Eventually all prices seek their relative level, whether those prices are for commodities or services. Prices based on inflated values during a war boom, whether for railroad labor or anything else are sure to be eventually deflated by the working of economic law. They might get high wages per hour or per day for the little time they work, but their total wage is not enough to buy their living. Some of them then will be willing to take jobs at lower prices, and these men begin to bid for the jobs, instead of the job bidding for the workman. Finally the law of supply and demand works out, and in spite of all the efforts and the fulminations of the union leaders somebody in the industry offers lower wages, and gets plenty of men to work for him. His competitors find him doing business at less costs and making a profit. Finding that they too can get some laborers—even at the cost of a union boycott or strike or what not—they go out and hire at the market price, and they start production at lower costs.

The Danger Line for the High Price Level

The same thing affects the retail storekeeper, manufacturer or anybody else, who in the face of a receding wave tries to hold his price at an uneconomically high level. All such attempts are bound to fail—they cannot be continued indefinitely.

Experience and study show that wherever prices have been maintained at a dead level for any considerable length of time, that level—contrary to the general impression—could not have been uneconomically high. On the contrary that level could have been, and probably was uneconomically low.

A price chart is published every year giving the prices of iron and steel products. On that chart are nine curves of prices of various products. One is immediately struck by the fact that one line goes across that chart from 1901 to 1915 without a break. That line shows the price of steel rails. All other products varied more or less in price, but the steel rail price continued steadily straight across. Now anyone with two grains of sense knows that this price was artificial; it could not have been stabilized otherwise. Other lines show a certain stability for short periods of time on this chart, but these periods of stability in the other products are very short.

Now what made it possible for the steel rail price to be maintained so long? There were only two conditions under which it could exist. Costs of production from 1901 to 1915 certainly would not be constant in steel rails any more than in any other product. Left to the free operation of economic law, the price of steel rails would have varied with the costs, if with nothing else.

The first enabling condition was that there were very few producers in the field. If there had been more competitors the price could not humanly have been stabilized for such a great length of time, any more than the prices on bars, beams and tank plates which give evidence of stabilization for various short spaces during this period. The more producers the less chance of artificial control of price.

WHERE STOCKHOLDERS LOST PROFITS

The second condition was that the $28 price on rails was uneconomically low rather than uneconomically high. Competition between a few strong producers might conceivably have brought about a condition of absolutely uniform costs at a given time, but not even such competition could keep costs uniform one year with another. Certainly direct costs went higher in the boom of 1906 and declined in the dull year 1908. What actually happened was, that economically sound, conjunctural profits were sacrificed in the periods of active business during that long period of 15 years, to the detriment of the stockholders of the rail mills.

If the steel companies had really known their true costs they could just as well have had those profits. Just because they maintained the rail price, it does not follow, however, that the price maintained was economic—all economic experience is against such a conclusion. If uneconomic, it was either uneconomically high or uneconomically low. If it had been an excessively high price, more capital would have been attracted to the rail business in spite of the largeness of the amount necessary. The only reason it kept out was the fact that on the whole the price was uneconomically low. The artificial maintenance of price could only succeed in holding prices down when they should have gone up, and so profits legitimately and economically possible were sacrificed.

PROSPERITY DEPENDENT UPON KNOWLEDGE OF TRUE COSTS

If the few rail manufacturers had really been individually well informed enough to regulate their own prices properly, the price would never have gone below economic cost at any time, and at some other times it would have afforded them much more profit than they got out of the business. Of course, they thought they were doing the right thing—but in view of universal experience in every other economic field, any student of fundamentals must conclude that the actual facts could not justify the belief. Believing a thing to be true does not make it true. Acting on a false belief in business causes many a loss, and prevents many a legitimate gain.

Whenever the full facts become known it is seen that while it is easy to send prices down, and to hold them down to an uneconomically low level, it is hard to put them up, and it is practically impossible to hold them up to an uneconomically high level. Is there any reason to think that steel rails afford the one possible exception to an otherwise universal rule?

The sooner business men recognize both these facts the healthier business will be and the better off will society be. The more business concerns there are in any line, who are really getting their true costs, the less there will be who will offer their goods below cost. One of the best uses of a cost system is to show up inefficiency and to make for lower costs, and thereby lower prices. Another is to tell just how low prices can be made without sacrifice of legitimate profit.

A real cost system coupled with full knowledge of demand will tell a man when to shut down and wait for the next buying wave, and will tell him if his business demands that procedure. Prices must in the long run repay the cost of necessary idleness. Every man has some pegging point for his prices, but many business failures are caused by continuously making prices too low, and thereby sacrificing capital. Men do it because they don't know their true costs. If they did, their pegging points would be higher. If they knew what was the real demand, and how it swings up and down, they would count the irreducible cost of necessary idleness, and figure it into their lowest possible price.

THE DANGER OF UNECONOMIC COMPETITION

Eventually the sharp peaks and dips in prices can be minimized, but not by agreements—only by absolute economic knowledge. As it is now, uneconomic, ill-informed competition is responsible for wide fluctuations. If all business men in every line had good cost systems and a thorough knowledge of the operations of economic laws they would individually adjust their business to the real situation and by better individual adjustment their industry would adjust itself as a whole.

Society would benefit by stabilization of business, but stabilization can be brought about only by better understanding of fundamental principles. It can only come by knowledge deeply imbedded in the soul of the individual.

Rewards for Suggestions

By JOHN MARK MAY

The article by C. J. Morrison on page 448 of the *American Machinist* under the heading "Rewards for Suggestions," should and I think will, strike a responsive chord in many quarters.

Whatever commodity we may have to dispose of, whether it be material, labor, entertainment or advice, is generally offered in a market where a fair return may be expected. I have enough confidence in my fellow man to believe that usually the inclination is not to make a sale that will place the buyer in a losing position, but on the other hand that the sale of the commodity is made because the buyer is in a position to make good use of that particular commodity and therefore can offer a fair price for it. In other words, the buyer is in a position to put his purchase to work and thereby secure a revenue greater than could have been procured by the man who sold it, and by the transaction both parties have made a sane and logical business arrangement.

Their interest has been, and is likely to remain, mutual and not only both parties but the public as well have the use of something that otherwise might have been kept hidden only to rust or mold.

There can be no greater asset for a corporation or an individual than a reputation for square dealing, as Mr. Morrison has so well shown in the examples given.

Power Requirements of Machine Tools

An opportunity to check up the power requirements of the various machines in operation in the Southwestern Shipbuilding Company plant at East San Pedro, Cal., and to make such changes as would increase the effectiveness of the electrical installations was afforded when the company settled down to the construction of ships upon a peace basis.

To obtain the necessary information for a study of the existing conditions upon which improvements might be based, a power survey was made of all the 220 motors installed in the plant. The greater number of these motors were installed during the construction period and therefore it was possible to obtain experimental and operating data as to the peculiar requirements of the work to be performed in this particular plant. As operations progressed and observations of power con-

POWER REQUIRED TO DRIVE VARIOUS MACHINES IN SHIPBUILDING PLANT

No.	Machine	Motor Hp. Make	Poles, R.P.M.	Drive	Duty	Character of Load	Volts	Amp. Max.	Amp. Run	Kw.	Power Factor, Per Cent	Load, Per Cent
1	Crane	30	8	Gear	Hoist	Raise ½ ton	440	94	77	16.25	28	72
		U.S.	..			Lower, light	440	..	81	13.0	21	58
4	Crane	30	8	Gear	Hoist	Raise 4½ ton	422	96	62	28.7	65	128
		G.E.	..			Raise ¾ ton	426	96	46	17.5	52	78
8	Crane	22	6	Gear	Travel	100 ft. per min	420	29	21	4.25	27	26
		U.S.										
11	Crane	25	6	Gear	Travel	150 ft. per min	424	38	24	8	45	42
		W										
17	Crane	22	6	Gear	Boom	Raise 3 ton	418	58	23	10.5	63	64
		U.S.	..			Lower ½ ton	418	..	17	1.25	10	8
22	Crane	22	6	Gear	Swing	Average of right and left swing	426	38	33	4.25	18	26
		U.S.										
26	Crane	20	6	Gear	Swing	Full speed right	424	38	21	6	39	30
		W	..			Full speed left	422	30	19	5	36	22
29	Blower	20	4				426	95	13	8.00	83	54
		G.E.	1,475	Direct		Furnace air	...	..	.....	.....	..	..
30	Gate shear	10	8	Belt		Idle	446	40	7.5	1.75	30	23
		G.E.	865			Shear ⅜-in. channel	446	..	14.0	9.5	88	127
						Flywheel	446	..	15.75	11.25	92	150
31	Angle shear	10	6	Gear		Idle	450	41	6.0	1.87	40	25
		G.E.	1,165			Cut-off 3½-in. x 3½-in. x ½-in. angle iron	450	..	11.5	7.50	84	100
						Cut-off 6-in. x 6-in. x ½-in. angle iron	456	..	15.0	10.0	85	134
32	Angle bender	10	6	Gear		Idle	450	40	6.5	0.75	15	10
		G.E.	1,020			Bending 3-in. x 3-in. x ½-in. angle	450	..	7.3	1.87	63	25
33	Plate punch	7.5	6	Gear		Idle	450	60	6.0	0.625	13	11
		G.E.	1,012			¾-in. hole in ½-in. plate	446	..	7.7	3.75	63	67
34	Vertical punch	7.5	6	Gear		Idle	448	61	6.0	0.625	13	11
		G.E.	1,150			⅞-in. hole in ½-in. plate	448	..	9.0	4.37	62	78
						¾-in. hole in 1-in. plate	444	..	24.0	17.0	92	300
35	Horizontal	7.5	6	Gear..		Idle	446	60	5.25	0.60	15	11
		G.E.	1,020			⅞-in. hole in ⅝-in. plate	445	..	10.75	6.2	75	110
36	Horizontal	7.5	6	Gear		Idle	446	65	5.75	0.62	14	11
		G.E.	1,200			⅞-in. hole in ⅝-in. iron	448	..	11.5	6.87	76	123
37	Punch and shear	7.5	6	Gear		Idle	450	66	5.25	0.625	15	11
		W.	950			⅞-in. hole in ½-in. iron	450	..	7.75	4.0	71	71
						Trimming liner	452	..	8.50	5.50	84	98
44	Two-wheel grinder	3	4	Direct		Idle	446	16.5	2.4	0.225	12	10
		G.E.	1,720			Ave. grinding	450	..	2.5	0.550	28	25
45	Two-wheel buffer	3	4	Direct		Idle	450	13.5	1.95	0.175	12	8
		G.E.	1,720			Buffing, ave. pres	448	..	1.95	0.425	28	19
46	Trip-hammer	2	6	Belt		Idle	448	12.5	1.90	0.25	17	17
		G.E.	1,130			Hammering, full speed	440	..	2.5	1.00	52	67
48	Compressor 17-in. x 14-in. and 10-in. x 14-in.	150	10	Belt		95-lb. pressure	428	544	154	99.2	87	88
		G.E.	595			28-lb. pressure	...	..	95	52.0	73	46
55	Compressor, 22-in. x 16-in. and 13-in. x 16-in.	200	12	Belt		97-lb. pressure	456	784	265	184	58	124
		G.E.	485			25-lb. pressure	458	..	165	104	79	70
58	24-in. circ. ripsaw	20	4	Belt		Idle	418	93	9	2.45	38	17
		G.E.	1,520			3½-in. O. P. plank	418	..	20	12.5	86	84
60	36-in. cutoff saw	10	8	Belt		Idle	433	42	5	2.0	49	27
		G.E.	760			Cutting 4-in. x 12-in. O.P. plank	430	..	12.5	8.25	88	111
63	42-in. band saw, 1½-in. blade	5	4	Belt		Idle	420	48	3.75	2.0	73	53
		G.E.	1,485			Slow feed rip 12-in. wood block.	420	..	8.0	5.0	86	133
64	Two 10-in. wheel grinders	2	4	Direct		Idle	426	13.5	0.9	0.125	19	08
		G.E.	1,480			Average pressure (wood)	426	..	1.1	0.45	55	30
73	8-ft. reversing planer	7.5	6	Belt		Idle	454	37	8.5	1.87	28	33
		G.E.	1,015			At instant of reversals	454	..	15.0	5.25	45	94
							452	..	13.0	4.50	44	80
74	Turret lathe	7.5	6	Belt		Heaviest load	448	34	7.0	3.75	70	67
		G.E.	1,005			Idle	454	..	5.5	1.25	29	22
						Cutting-off	454	..	6.25	3.00	62	54
85	Power saw drill, grinder	7.5	8	Belt		Idle, line shaft	446	36	5.5	0.55	13	10
		G.E.	865	Line shaft		Approx. max. load	440	..	6.3	2.5	52	48
86	Two 20-in. drills, 15-in. lathe, power saw.	7.5	8	Belt		Idle	456	38.5	5.9	0.87	19	16
		G.E.	770			Lathe and drills	456	..	6.2	1.50	31	27
						All machines	456	..	6.5	2.10	41	37
88	Drill grinder, 8-in. wheel.	1	4	Belt		Idle	446	4.4	1.3	0.36	35	48
		G.E.	1,530			Heavy grinding	446	..	1.5	0.57	50	77
90	Grinder	5	4	Direct		Idle	450	31	3.8	0.42	14	11
		U.S.	1,532			Medium grinding	450	..	4.6	2.00	56	54
						Heavy grinding	450	..	5.6	3.00	69	80
91	Two 8-in. wheel grinders	2	4	Direct		Idle	452	8	1.7	0.17	12	11
		G.E.	1,550			Heavy grinding	452	..	2.8	1.75	81	117
						Heavy both wheels	452	..	3.4	2.25	85	150
94	Sensitive drill	1	4	Belt		Idle	444	3.8	1.6	0.22	18	30
		G.E.	1,548			Running idle	444	..	1.6	0.41	32	55
						Drill $\frac{3}{16}$-in. hole	444	..	1.6	0.45	35	60
95	Pipe threader	7.5	6	Belt		2-in. pipe	450	0.37	6.00	0.70	15	12
		G.E.	1,000			Same end of cut	454	..	6.25	0.87	18	16
						3-in. pipe	454	..	7.5	1.62	28	29
97	Power saw threader, 20-in. drill	7.5	8	Line		Line shaft	444	39	6.0	0.62	13	11
		G.E.	770	Shaft		All machines running	444	..	7.0	1.50	28	27
						Threading 7-in. pipe	444	..	7.25	2.25	41	20
99	Two 8-in. wheel grinders	2	4	Direct		Idle	450	18	3.2	0.21	09	14
		G.E.	1,700			Heavy grinding	452	..	3.3	0.50	19	34
130	Bolt threader	5	6	Belt		Idle	452	27	4.3	0.67	20	18
		G.E.	1,015			Run over ¾-in. thread	452	..	4.3	0.82	24	22
						Thread ¾-in. bolt	452	..	4.5	1.20	34	32
131	Nut-tapper	7.5	6	Gear		Idle	456	35	5.8	0.90	20	16
		G.E.	1,010			Tap 4 sizes nuts at once	456	..	6.1	0.95	20	17
132	Two 12-in. wheel grinders	5	6	Direct		Idle	448	30	5.7	0.55	12	15
		U.S.	1,032			Heavy grinding	454	..	5.9	1.00	22	27

sumed were taken, the plant was found to be operating upon a very low power factor. From this it was evident that overloaded and underloaded motors were in use and that unbalanced conditions of load existed. An improvement of power factor would mean a decrease in the cost of power service and an improvement in rating and loading conditions would decrease the cost of maintenance.

Therefore tests were made on the several feeder circuits and on the individual motors wherever possible. Practically all the machines are driven by individual motors, line and counter shafting being used in comparatively few instances. The total number of motors in operation is approximately 220, ranging in horsepower from ⅛ to 200. All are alternating-current motors. For machine-tool operation squirrel-cage types and for train and hoist duties wound-rotor variable-speed type motors are used. All motors rated at 1 hp. and above with but one or two exceptions are operated on 440-volt, three-phase, 60-cycle circuits.

Following the survey it was found that many of the machines were improperly motored and many changes were recommended which would improve the power factor and decrease the operating costs. It was also found advisable to recommend the installation of a number of static condensers at points later to be selected. The investment in such condensers would be well warranted by the saving which would be effected in feeder losses.

In making the tests records were taken from voltmeters, ammeters and wattmeters. Curve-drawing wattmeters were used for varying periods of time from a few minutes to twenty-four hours. In particular cases the paper speed of the curve-drawing wattmeter was increased to as much as an inch in five minutes.

The records taken were entered on forms having coordinate sections at the bottom on which might be transferred the load curves. In a few cases only were the curves transferred from the curve-drawing wattmeter charts to these data sheets. In other cases the charts from the curve-drawing wattmeters were filled with the individual power survey sheets.

An inspection of the column entitled "per cent load" indicates that many of the machines are badly overmotored; which is also evidenced from the very low power factor obtaining, although with but few exceptions the voltage applied to the motor terminals is in excess of the 440 volts required, which should increase the power factor.

A. G. Humphreys,
Electrical Engineer.
Southwestern Shipbuilding Company,
East San Pedro, Cal.

The Only Bolt Works in India

By W. J. Tomes

Locomotive Superintendent, East Indian Railway Co.

Referring to page 904, of vol. 54, *American Machinist*, the article under the above title may give the impression that bolts and the like are not manufactured elsewhere in India. I beg to state that this railway has at Jamalpur a well equipped bolt and nut shop in which all sizes of bolts, nuts, rivets, spikes, coach screws, etc., for use throughout the railway, are manufactured. A smaller equipment is also provided at the Lillooah Works of the carriage and wagon department. This railway has a mileage of 3,525 miles and operates 1,285 locomotives.

Using the Trade Magazines to Capacity

By Oscar E. Perrigo

In the *American Machinist*, Vol. 53, page 489, E. L. Bowman illustrates and describes a method of "Using the Trade Magazine to Capacity," in which he shows a good beginning in the practical use of the very valuable and up-to-date articles written and collected by the editors and published in mechanical and technical journals. And right here let me emphasize very strongly the practical value of these articles, a very large proportion of which should not only be read but studied for their practical value by the professional man and by the practical man for their professional value. Both may profit much by their perusal.

The real question seems to be, do any of us really use these magazines to capacity? And to this question probably any far-sighted man, after a moment's thought, will admit that we do not; also that a very large majority of us make very little effort to utilize the great amount of benefit that the editors thus provide for us. This being acknowledged, how can we improve our opportunities in this respect?

An Impractical Plan

Mr. Bowman advises that the editorial parts of each magazine be placed in a folder lettered according to an illustration which he gives and then filed in a vertical file. The next operation is the indexing. This is done on 4 x 6-in. filing cards, several of which are filled out for each article and the cards distributed to the persons likely to be interested in the subject matter filed. When one of these persons desires any special information he looks through the cards on file and selects the card or cards covering such information and then goes to the vertical file and gets the information wanted, if it is there. If another person has the article there does not seem to be any way provided by which it can be located. This method seems inconvenient and does not fully realize the idea of "using the trade magazine to capacity."

ENGINEERING DIVISION *DATE ISSUED*

This copy of the.................................. is sent to you for your information. You are requested to read the articles noted after your name and promptly pass this periodical back to Mr. Perrigo, marking the date of this transfer.

ARTICLE ON PAGES AS FOLLOWS:

MR. TELLER..................................
MR. WHITEHEAD..................................
MR. MILLHOUSE..................................
MR. THACHER..................................
MR. BRUCE..................................
CAPT. SPICE..................................
MR. MOYER..................................
MR. KNOWLES..................................
MR. WILDER..................................
MR. HOCHMUTH..................................
MR. WILDES..................................
MR. DURKEE..................................
MR. DILLON..................................
MR. RITCHIE..................................
MR. RUSNAK..................................
MR. HARTEN..................................

FIG. 1. ROUTING LABEL

Theory and Practice

Again, W. B. Bennett, in Vol. 53, page 69, illustrates "A Routing Panel," intended to indicate the routing that a technical magazine is supposed to take on its rounds among a number of individuals who are each supposed to keep it 48 hours and then pass it to the next man on the list. The theory is all right provided each man, however busy he may be with necessary and perhaps vital work, adheres to the schedule. However, my experience has been that it will frequently be delayed in transmission, laid aside until the man has leisure to read it, or perhaps forgotten altogether and finally lost.

In arranging our system for a practical use of technical magazines "To capacity" both these plans and many others were considered, the subject was carefully analyzed, and as many of the shortcomings as possible were avoided. By our method as soon as a magazine is received the articles, editorial and contributed, are carefully read and the pages of those especially interesting to the different officials, designers, etc., marked opposite their names on a blank (shown in Fig. 1), which is then pasted on the front cover of the magazine. It is then sent to the first man on the list. He reads the articles indicated and sends it, not to the next man on the list but back to the files, from which it is issued to the next man. Should he neglect to return it within a reasonable time the magazine is called for and issued to the next man on the list. Entries are made with a dating stamp of these issues and returns and the account is filed for future reference. Having tried different methods this is the only one we know of which insures prompt handling and reading of the magazines.

SPECIAL LIBRARY
OF
TECHNICAL INFORMATION.

* * *

Selected from the following Magazines and bound in over fifty "Snap Binders," comprising now over 8000 pages, and to which additions are being continually made

American Machinist,
Machinery,
Iron Trade Review,
Iron Age,
Industrial Management,
Factory,
Foundry,
Tool Engineer, } **English.**
Engineering Production,

* * *

ENGINEERING DEPARTMENT.
PRATT & WHITNEY CO,

1920

FIG. 2. LIBRARY LIST OF SUBJECTS (FRONT)

Preserving the Special Articles

While some of the articles may be of but transient interest, many of them are well worth preserving indefinitely. Therefore when the magazines have been read by the different men they are taken apart and the articles (and frequently pages of illustrated advertisments) are distributed into a series of snap binders, each containing *one subject*, or suitable division of a subject, as shown in Fig. 3. These pamphlets are then placed on the shelves of a bookcase and are issued to *any* employee applying for them similarly to books in a circulating library. Each pamphlet is represented by a 3 x 5-in. filing card headed by the title and number. The card is ruled horizontally and divided by vertical lines into three spaces. When a volume is issued the date is stamped in the left-hand space, the man's name written in the center space and the card placed in the "out" compartment of a card drawer. This shows where the pamphlet may be found if wanted. When the pamphlet is returned the date is stamped in the right-hand space and the card placed in the "in" compartment of the filing drawer.

1. AUTOMOTIVE CONSTRUCTION.
2. BALANCING, Static and Dynamic.
3. BEARINGS, Ball, Roller, Ordinary.
4. BORING and TURNING Machines, Vertical.
5. CAMS, Design and Use.
6. CHUCKS, Lathe, Drill, Air, Magnetic.
7. CUTTING-OFF, Machines, Saws, etc.
8. DRAWING ROOM, Mathematics.
9. DRAWING ROOM, Practice.
10. DRILLING and BORING, Machines and Operations.
11. ELECTRIC and AIR Operated Small Tools.
12. ELECTRIC MOTORS and Controllers.
13. FORGING Machines and Operations.
14. FOUNDRY Equipment, Systems, Pattern Making.
15. GAGES, Manufacture and Use. A.
16. GAGES, Manufacture and Use. B.
17. GEARS and SPROCKETS. A.
18. GEARS and SPROCKETS. B.
19. GRINDING, Machines, Wheels, Operations.
20. INSPECTION and TESTING.
21. IRON, Production, Qualities, Uses.
22. JIGS, Fixtures and Special Tools.
23. LATHES, Engine, Bench, Speed.
24. LATHES, Turret, Chucking, Operations.
25. LUBRICATION.
26. MANAGEMENT.
27. MANUFACTURING PLANTS.
28. MANUFACTURING SYSTEMS. A.
29. MANUFACTURING SYSTEMS. B.
30. MILLERS, Universal, Operations.
31. MILLERS, Horizontal, Lincoln, Planer.
32. MILLERS, Vertical, Auto. Continuous, Spline, Thread.
33. MISCELLANEOUS.
34. NON-FERROUS METALS.
35. ORDNANCE WORK, Ammunition.
36. ORDNANCE WORK, Artillery.
37. ORDNANCE WORK, Small Arms, Navy, Aviation.
38. ORGANIZATION.
39. PLANERS, SHAPERS, Horizontal, Vertical.
40. POWER and TRANSMISSION.
41. PROFILERS, DIE SINKERS, Operations.
42. PUNCHES and DIES, Operations.
43. SCREW MACHINES, Hand, Automatic.
44. SHEET METAL and WIRE, Tools, Operations.
45. STANDARD TAPERS and Tools.
46. STEEL, Manufacture, Qualities, Uses.
47. THREADING, Tools, Machines, Operations.
48. TIME STUDIES, Turret, Screw Machine.
49. TIME STUDIES, Miscellaneous.
50. TOOLS and TOOL MAKING.
51. TRANSPORTATION, Trucks, Cranes, Elevators.
52. WELDING, Electric, Gas, Operations.
53. WOOD WORKING, Tools and Machines.

FIG. 3. LIBRARY LIST OF SUBJECTS (INSIDE)

By this means if a pamphlet is urgently needed for some special information it contains and it is not on the shelf the filing card shows who has it and how long he has had it. If a pamphlet is accidentally mislaid the filing card shows a record of its issues and returns and through whose hands it has passed. Thus it can be readily traced.

These pamphlets are loaned to interested men to take home over night for evening reading, or over Sundays and holidays whenever they desire, which is quite frequently. We think that by our method we are emphatically "Using the trade magazine to capacity."

Making a Pressed-Steel Housing for a Universal Joint

Production Method of Producing a Small Automobile Part—Series of Stamping Operations—No Machining of the Piece—Construction of Dies Used

By H. JAY
Sales Engineer, The Acklin Stamping Co., Toledo, Ohio

THE wonderful progress made in the automobile industry in a comparatively short length of time may be attributed in part to the adoption of manufacturing methods which not only permit speedy production but eliminate all unnecessary wastage of material. Moreover, large quantity production has made it possible to invest in machinery and equipment to provide for fast and economical operations.

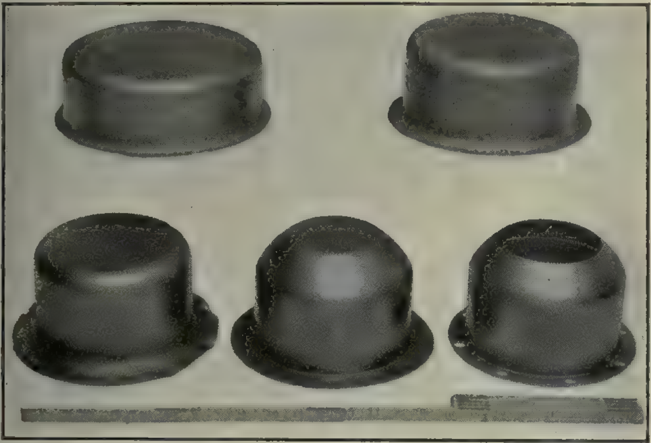


FIG. 1. STAGES OF PRESS OPERATIONS FOR COMPLETING UNIVERSAL JOINT HOUSING

The development of the metal stamping has been the means of reducing the manufacturing costs of many parts used in the automobile assembly. Parts which might ordinarily be made of cast or malleable iron, forged steel, and other materials have been replaced by pressed parts of steel and other metals. Press work permits fast production of light pieces with the minimum amount of material, and yet these parts will attain sufficient strength and stiffness.

The pressed-steel universal joint housing described in the following paragraphs was adopted by a large truck manufacturer because of its many advantages over the leather housing which was originally used for this class of work. The design of the tools and the production of the stampings are the work of the Acklin Stamping Co., Toledo, Ohio. The stages of the operation and the finished housing are shown in Fig. 1.

Those familiar with press work will note that all of the operations were performed in single-action presses and that the various reductions are so made that the work is free from wrinkles of any sort. The press equipment is similar in capacity to Bliss Nos. 74½ and 75½ presses. On runs of ten thousand or more housings, most of the operations average an output of 450 pieces per hour.

In the first operation, a blank is stamped 13⅞ in. in diameter from No. 18 U.S. standard gage, three-pass, cold-rolled, pickled sheet. The standard form of blanking die is used, with which the blanks pass through the press at each cutting stroke.

The tool for the first drawing operation is shown in Fig. 2, and the shape of the stamping is indicated by the heavy line *A*. The drawing die has the usual form for this type of tool with a cast-iron base and punch and tool-steel facings. In place of the usual wrought-iron and tool-steel draw ring, one of cast iron faced with tool steel is used—this being a less expensive construction and fully as satisfactory. A knockout pad of tool steel with the regular knockout attachment removes the work from the tool at the end of the up stroke of the press. Pressure for the pressure plate *B* is provided by five 4 x 8-in. rubbers which have just enough resistance to keep the metal smooth in drawing.

A similar tool is used for the second draw, and the shape and size of the stamping may be seen in Fig. 3.

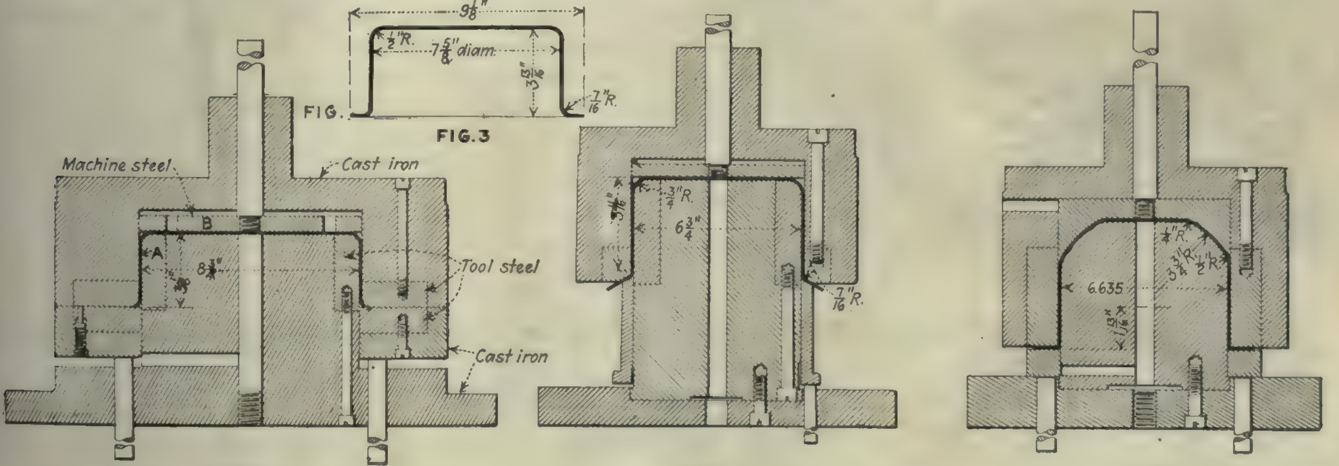


FIG.2 FIG.3 FIG.4 FIG.5

FIG. 2. DIE FOR FIRST DRAWING OPERATION. FIG. 3. OUTLINE OF SHELL AFTER SECOND DRAW. FIG. 4. THIRD DRAWING DIE STARTS TO TURN OUT FLANGE. FIG. 5. DIES FOR SHAPING WORK AND FLATTENING FLANGE

The tool for the next reduction, Fig. 4, also starts to shape the top of the stamping. The base and punch of the tool are of cast iron faced with tool steel. The draw ring is of tool steel, and in other respects the tool is similar to the one previously described. After passing through this operation the stamping has been reduced to its final diameter, and is smooth and free from wrinkles or draw marks.

To give the work its final shape and flatten the flange, the die shown in Fig. 5 is used. By striking bottom at the end of the stroke, the radius at the flange is held to a minimum and the flange itself stamped perfectly flat.

PIERCING AND TRIMMING

The die shown in Fig. 6 is used to cut the hole in the top of the housing. The construction is similar to that of the other dies except for a machine-steel ring operated by rubber pressure to remove the work from the cutting plug at the end of the up stroke.

The flange is next trimmed to the proper diameter and pierced for the assembly bolts. The trimming operation is performed by a built-up type of die, Fig. 7, with tool-steel facings on the cutting edges of both the die base and the punch. A cast-iron plug centers the work, and the scrap is removed quite readily by the use of scrap cutters *A*.

To pierce the holes, the die construction is the same with the addition of a machine-steel stripper plate, *A* in Fig. 8. This plate operates in such a way that the work is raised to clear the die before it is stripped from the punch by the knockout.

The stamping as it comes from the last press operation is ready with no machining to assemble with the other parts of the universal joint. As a housing, it is light and durable and a good protection from the weather.

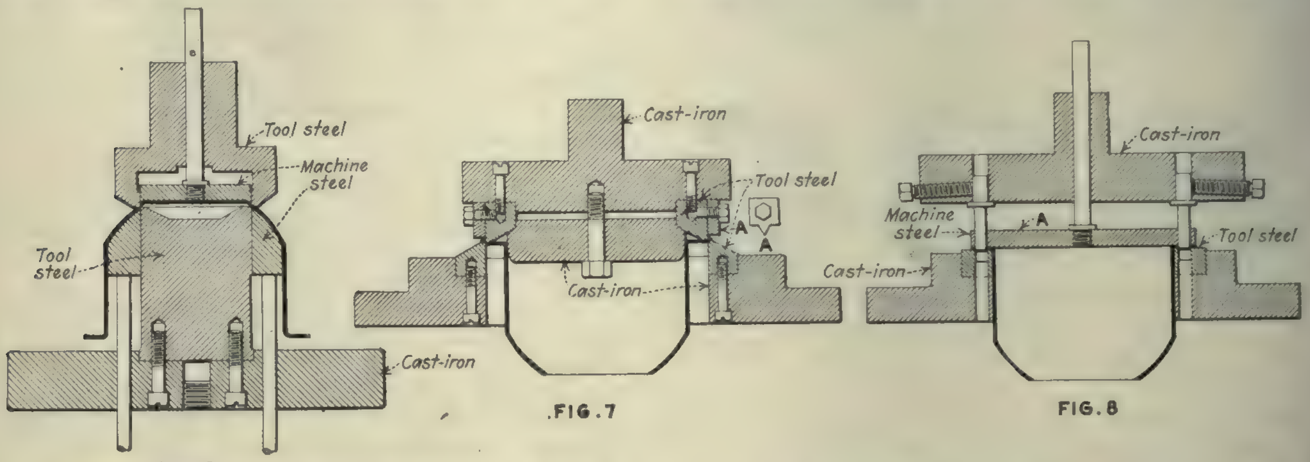


FIG. 6

FIG. 7

FIG. 8

FIG. 6. CUTTING HOLE IN TOP OF HOUSING. FIG. 7. TRIMMING DIE FOR FLANGE OF STAMPING. FIG. 8. DIE FOR PIERCING ASSEMBLY-BOLT HOLES

Cost From the Shop Buyer's Standpoint

By W. Burr Bennett

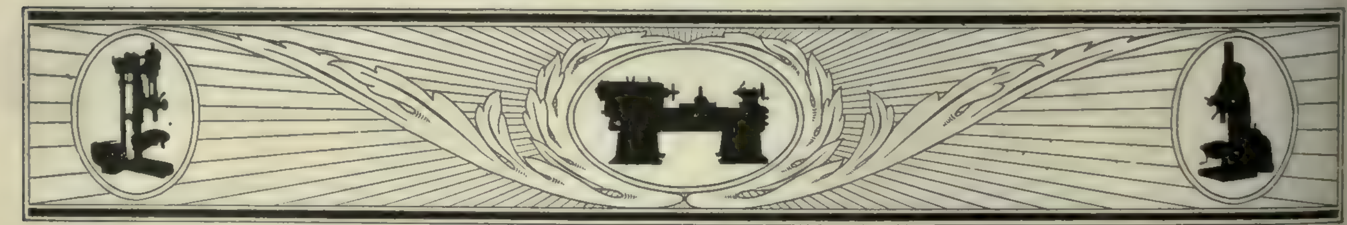
Even though these are strenuous days for the small and large shop, almost every one is doing a little work which means not only the purchasing of some raw material to make up the shortages in existing inventories, but the purchasing of supplies and perishable tools, and, although not running into much money, the buying of some equipment. Because these three items of supplies, perishable tools and equipment are "necessary evils" in the plant's existence, no matter how slow the business is, there is a very widespread inclination to consider only the lowest first price.

First price or the purchase cost—it certainly is human nature to seek the lowest, and providing specific specifications be written it is good business to buy at the lowest price, all things considered. But the point we wish to make is that far too many shops are buying these items at a price they little think they are paying.

Just a small example: All shops buy brooms of some sort or other, and for sake of example, without knowing the price of brooms right now, let us say that two prices are submitted to the man who purchases; the first of $20 per dozen and the second of $30 per dozen. Unless the fact that the second broom will wear say five months as against one month for the first is taken into consideration, the buyer can make a very expensive mistake. The brooms at $20 per doz. are by far the more expensive.

And we are not exaggerating. We have found in our own plant that good things cost the most and that, to use a very common expression "they are cheapest in the long run."

Probably the above expresses what every man on the job knows, but a little glance through some of our shops will show that it is not always practiced.



An Experiment in Railroad Repair Work

Securing Greater Interest by Local Management — Improved Machinery and Buildings—More and Better Work—An Unusual Safety Sign

By FRED H. COLVIN
Editor, *American Machinist*

RAILROAD shops have never been noted for economy in repairing or building locomotives. The machine equipment has nearly always been inadequate, and the lack of any apparent connection between the men and the owners has contributed to the unsatisfactory results. Occasionally a master mechanic or shop superintendent with a strong personality would secure co-operation and improved results. But the uncertain tenure of office of railway officials on most roads, and the lack of personal interest and responsibility due to working for an intangible thing—the huge corporation—have seldom resulted in satisfactory costs in railroad-shop work.

Old machine equipment in most railroad shops and the necessity of "fudging" up devices to do regular work because the management refused to supply standard or special machines, have led to great inefficiency in many places. The cost of makeshift devices has never been fully appreciated and, worst of all, the practice has led to a carelessness of thought regarding real costs.

THE ERIE SCHEME AT HORNELL

The war brought extra stresses on railroad shops as on all other industries and, as in many other cases, the individual efficiency dropped from a number of causes. In order to secure an improvement in efficiency and to see the effect of private management in a railroad shop, the Erie R.R. has been trying an interesting experiment during the past year. On March 6, 1920, it leased its shops at Hornell, N. Y., employing about 800 men, to the Hornell Repair and Construction Co., organized especially for the purpose. This is a corporation consisting of five stockholders, all well known in Hornell and representing a diversity of interests, such as shoes, groceries, gas and electricity, and banking.

The terms of the lease provide a minimum amount which the new company is to receive for railroad-repair work. On all work beyond this amount, the railroad receives a percentage of the profit made. And, in addition to the railroad work, the new company handles repair work of all kinds, such as stationary boiler and engine work, sawmill machinery, road-making machinery and the like.

The experiment is largely a test of management and an effort to establish personal relations between employer and employee. The wages and hours are the same as in railroad shops and the men present their requests and grievances through shop committees. As can be imagined the new plan caused considerable suspicion in the beginning. Any new movement of the kind always does and with almost any class of men. Ulterior motives were naturally ascribed to the change and it took considerable tact on the part of the management to prevent a break before the plan had a fair trial. Robert W. Bull, who is the executive chairman of the new company, gives the shop superintendent T. S. Davey credit for maintaining harmony during the critical period. This was only made possible because Mr. Davey had been with the Erie at Hornell for several years before the change was made and had established an enviable reputation for fairness in all his dealings.

Now that the suspicion has worn off, the men are apparently happier and more contented than before. Likewise they are turning out more work per man, partly because of better machine equipment and partly because they are taking more interest in the shop. It is now a local affair instead of part of a big system with an unknown "big boss" several hundred miles away. They can get much quicker action on all questions, grievances or otherwise, than ever before. There is very little red tape and no long waits for matters to go through the maze of channels that exist in the average large railroad office.

The only routine now in force is that all questions must go through their proper channels, the foreman and the shop superintendent. The door of Mr. Bull's office is open to any man in the organization. And the men like it—delays often fan a smoldering spark into a real blaze.

The men are now paid weekly, in cash, instead of semi-monthly by check. They also have transportation privileges which have always been a part of the railroad man's job. Although the new company cannot issue passes, it does even better. It issues orders on the Erie R.R. for first-class tickets, which can be obtained from the station master and which permit the holders to ride on any train.

The Erie R.R. has no control of the shops during the continuance of the lease. But it maintains inspectors at the shops to be sure that it is getting the proper quality of material and work, and it is common talk that the inspection is much more rigid than ever before.

UP-TO-DATE EQUIPMENT AND SAFETY APPLIANCES

The shop equipment, while still inadequate, has been improved by the addition of several new machine tools and more are to come. Among those already installed are a Bullard vertical turret lathe, a large American radial drilling machine, a Gould & Eberhardt shaper and a Marvel power hacksaw. There is also new electric welding and flame welding and cutting apparatus and equipment for thermit welding.

Other improvements consist of a substantial and sanitary house containing wash rooms and toilets, and an emergency hospital with a nurse always in attendance. Considerable attention is also being paid to safety work and there is an air of improvement which is not found in many railroad shops. Part of the safety work consists in good-size signs with large letters so as to be easily read. These are in some cases lessons in the fundamentals of economics as well. One sign in particular, ties up the whole subject as follows:

WEALTH DEPENDS UPON PRODUCTION
PRODUCTION DEPENDS UPON EFFICIENCY
EFFICIENCY DEPENDS UPON HEALTH
ALL DEPEND UPON SAFETY

While figures of comparative costs of the work done are not available it is stated that both the railroad and the new company are satisfied with the results secured. The men in the shop seem to take a greater personal interest in their work, which is both natural and desirable. The men in the other shops along the line are naturally interested in the experiment and it is understood that they have a feeling that they must not be beaten by the Hornell shop.

Improvement in efficiency at Hornell very naturally puts it up to the other shops to do as well or to look for a similar change of management. Whether such a plan on a nation-wide scale would be advisable, is a subject for serious consideration. It presents the advantage of securing a greater personal interest than has so far been possible with most large corporations. It also points out the weakness of many railroad shops in machine equipment and in suitable buildings and other facilities. Whether great transportation lines can be dependent on individual and separate shops for all their work, is another question.

The experiment is, however, one of great interest at this time, and has many lessons to be taken home for serious study by both railroad officials and the men in the shops.

A Matchplate Pattern for Small Castings

By E. A. Dixie

I have written before of some of the clever expedients used by our boss patternmaker to get out good work in a hurry, or to evade excessive pattern expense where but a single, or at most a few castings, were needed, and he is just as resourceful when it comes to quantity production.

The other day an order came in for some thousands of the small casting shown in Fig. 1. The customer sent a single, nicely finished, little pattern made of iron which the foundry "super" handed to the boss patternmaker with the information that there were so many thousands of that piece wanted.

In Figs. 2 and 3 are shown both sides of the match plate pattern after the boss patternmaker was finished with it. There is nothing extraordinary about it, but there is about the little kinks which were used to get it out—and get it out quickly. The illustrations will help to carry the thread of the story.

It was decided to place fourteen patterns on the matchplate *A*, Figs. 2 and 3. The centers of their location were laid out on the board and fourteen ½-in. holes drilled through the board.

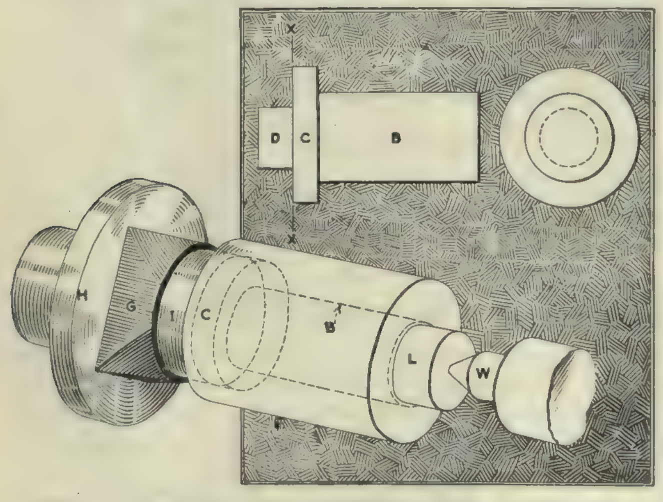


FIG. 1 (ABOVE) THE CASTING. FIG. 6 (BELOW) METHOD OF TURNING *B* AND *C*

The next operation was making the parts *B* and *C*, Figs. 1 and 2. These two parts were made in a single piece as the parting of the pattern was along the line *XX*, Fig. 1. In order to avoid confusion similar letters will be used to indicate similar parts throughout this article.

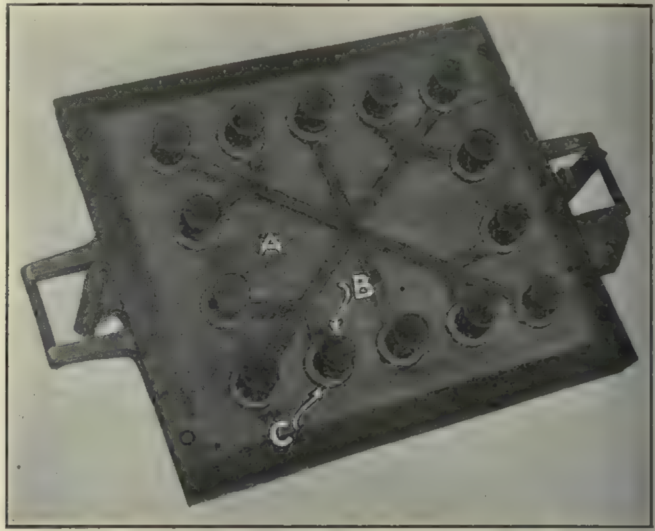


FIG. 2. DRAG SIDE OF MATCHPLATE

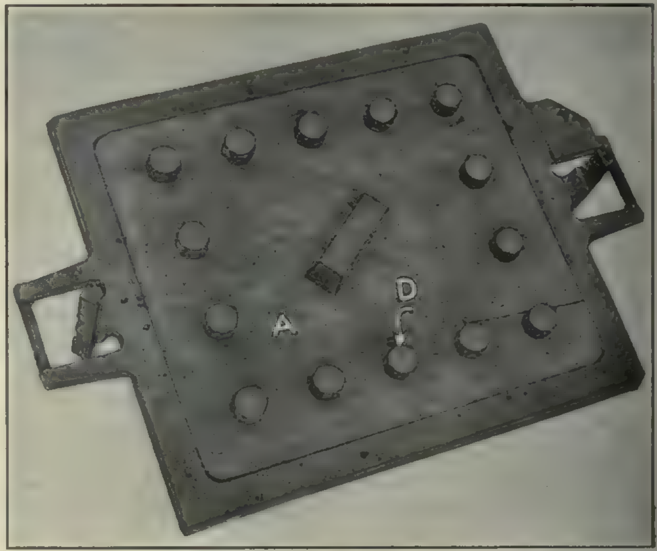


FIG. 3. COPE SIDE OF MATCHPLATE

For the parts *B* and *C* a piece of mahogany was sawed and planed square. Its length was sufficient to make the fourteen pieces and its thickness was a little greater than the diameter of the flange *C*, Figs. 1 and 2.

This piece of wood was then taken to the band saw and sawed into fourteen pieces a little longer than the finished length of the parts *B* and *C*. The pieces then went to the Fox trimmer and one end of each piece was trimmed square with the sides. A wooden stop *E*, Fig. 4, was then clamped to the Fox trimmer as shown and each one of the blocks, as shown at *F*, was dressed to length, thus making the dimensions of all the blocks identical. It will be noted that the block *F*, Fig. 4, is shown with the trimmer cut half-way through it.

Lines were then drawn from corner to corner, across one of the ends of each of the pieces, and at their intersection in the center of the piece a ¼-in. hole was drilled about ⅜ in. deep.

The next job was to prepare the spur chuck shown in Fig. 5. A piece of hard mahogany *G* was secured to the face plate *H* by screws. The diameter *I* was then turned the same size as the flange *C*, Fig. 1, so that when turning the pieces *B* and *C* no calipering would be necessary to determine the size of this flange. All the patternmaker would have to do would be to turn them to the same size as the diameter *I*, Fig. 5.

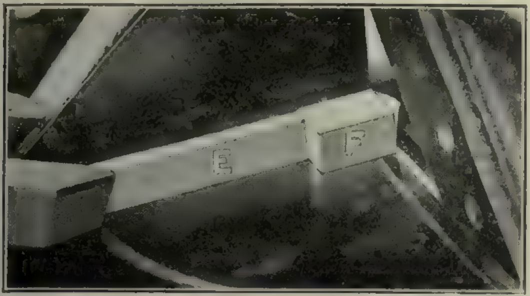


FIG. 4. FOX TRIMMER WITH STOP CLAMPED IN PLACE

The face of the chuck was then turned flat and a ¼-in. hole drilled in its center. Two stout brads were driven into the face of the chuck to form the spurs *J*. These were cut off to leave about ⅛ in. of their length projecting and the points were filed sharp. A ¼-in. dowel *K* was then driven into the ¼-in. hole in the center of the chuck and cut off about ⅜ in. from the face.

The rectangular blocks were then taken one at a time. The ¼-in. hole in the one end was placed over the dowel *K* in the chuck. A piece of hard wood *L*, Fig. 6, with a center in it was placed between the other end of the block and the tail center *W* of the lathe and the center run in. This forced the work against the face of the chuck and the spurs *J* of the chuck into the end of it so that they could act as drivers. The arrangement is shown in the line engraving, Fig. 6, where H is the faceplate, *G* the wooden chuck turned down at *I* to the diameter to which it is intended to turn the flange *C*. The letters *B* and *C* indicate the piece to be turned and *L* the piece of hardwood which steadies the tail end of the work and forces it against the chuck. By dotted lines at *B* and *C* are shown the final turned dimensions of the work.

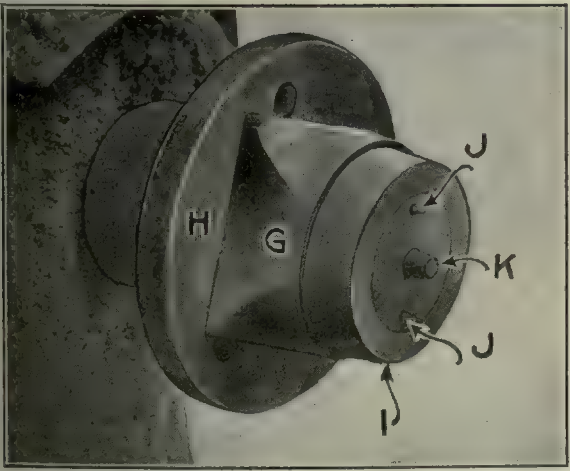


FIG. 5. WOODEN DRIVING AND CENTERING CHUCK

As all the blocks had been cut to exact finished length on the Fox trimmer, all the turner had to do was to turn the part *C* down to the same diameter as the part *I* of the chuck. His only reasurements being the thickness of the flange and the diameter of *B*.

The making of the small part *D*, which fell on the other side of the parting line and on the other face of the match board, shows another example of ingenuity.

A piece of mahogany was dressed to the thickness of the piece *D*, Figs. 1 and 3, and to a width a little more than its diameter. This was then cut into fourteen squares. Cross lines were drawn as on the other pieces *B* and *C* and ¼-in. holes drilled at the intersection of the lines. One of these square pieces of wood is shown at *D*, Fig. 7, the hole in its center showing plainly.

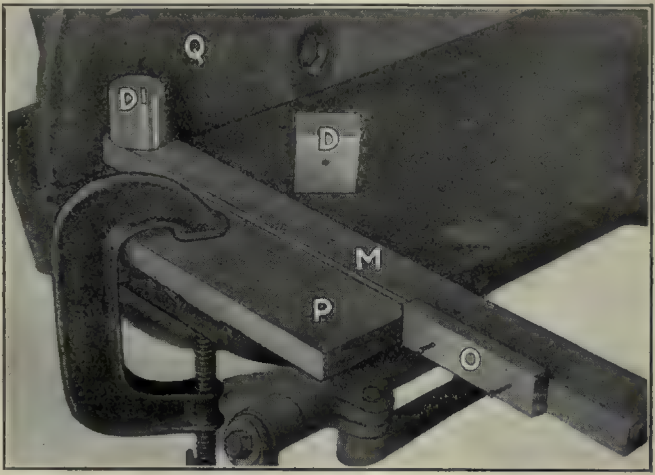


FIG. 7. SHOWING OPERATION OF THE JIG

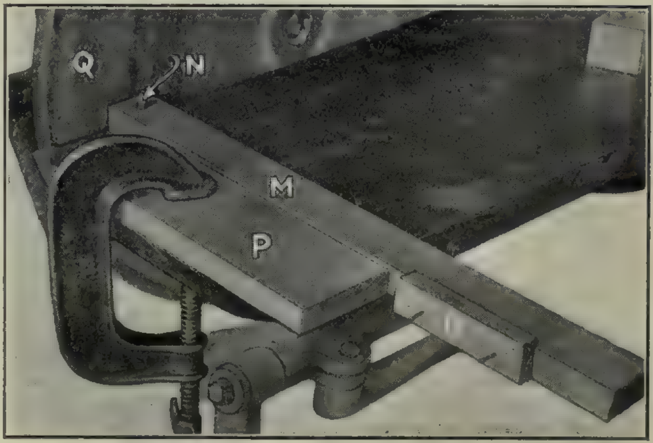


FIG. 8. SIMPLEX JIG FOR SHAPING PART *D*

The rest of the work on this part was done on the sand disk.

The patternmaker prepared a simple little jig which insured all the pieces being exactly the same.

The piece of wood *M*, Figs. 7 and 8, was planed 2 in. wide by about ¾ in. thick. About ½ in from one end a ¼-in. hole was drilled and in this hole a dowel *N*, Fig. 8, was driven and allowed to project about ⅜ in. Near the other end of *M* and on the side of it a stop *O* was secured by brads. A guide piece *P* was then made and clamped to the table of the disk-grinder in such position that when the stop piece *O* on *M* came in contact with the end of *P* the center of the pin *N* would be one-half the diameter of *D* from the face of the sand disk.

The method of operation is shown in Fig. 7. One of the square pieces of wood *D* is placed over the dowel pin *N* and the member *M* pushed forward bringing this piece marked D^1 in contact with the revolving sand disk *Q*. The operator then turns the piece *D* with his fingers, the sand disk dressing it to the desired shape and diameter. During this operation the stop *O* is in contact with the end of *P*.

The assembling of the patterns on both sides of the board was accomplished by driving ¼-in. dowels in the fourteen ¼-in. holes which had been drilled through the match board. These dowels were allowed to project about ⅜ in. on each side of the match board and the parts *B*, *C* and *D* were assembled on each side. The ¼-in. holes in their centers greatly facilitated the work and assured that they were properly centered. The application of the runner was a simple matter and needs no explanation.

From start to finish the whole job took about three hours.

Industry in Switzerland

Swiss a Pessimistic People—Government Aiding Unemployed—Machine Tools at Low Ebb—Whole Business Dependent on Export Trade

BY ADRIEN LAMBERCIER
J. Lambercier, Switzerland

ANYBODY reading a review of the business activity of the Swiss industries, would come to the conclusion that the shops are not doing any work at present. It has been the custom of the Swiss people to complain always about the business situation.

On the other hand, it is the general opinion that the Swiss shops have made very large profits during the period of the war, when they did work for the belligerants. But financial statistics show that the fortunes of the Swiss people have been reduced, due to the extreme difficulties of obtaining food and raw materials during the war; also because the accounts of foreign customers are much depreciated due to the drop in the exchange. So as a rule, Swiss industries are no better off than the industries in other countries.

The Swiss government has two schemes for meeting the problem of unemployment: One plan is to keep as large a number of workmen as possible busy on the electrification of the railroads, and the other scheme is in the form of an indemnity for out-of-work people. According to this latter scheme, all men and women out of employment—whether office workers or laborers—can receive, after they have been unable to find a new position, an indemnity for three months amounting to from eight to twelve francs a day, this in some instances being nearly equal to what they earned in their former positions. This plan has encouraged much laziness and lack of ambition among the working classes. Of this indemnity, one-third is paid by the State, one-third is paid by the county or town, and the other third is paid by individual concerns or associations of concerns.

LITTLE CHANGE IN WAGES

It cannot be said that the wages have been lowered very much as a general rule. A good mechanic still gets from 1.80 to two francs an hour (thirty to thirty-five cents) and unskilled labor from 1.20 to 1.60 francs an hour (twenty to twenty-six cents).

The high cost of living is responsible for the unwillingness of labor to accept lower wages, but the reduction of probably 15 per cent has been usually accepted, while manufacturers are selling their goods now at a reduction of about 40 to 60 per cent less than the high peak prices, so that Swiss manufacturers are not really working for profit under the actual scheme.

Switzerland having no iron or coal mines, with possibly a very few exceptions not worth mentioning, the manufacturers are dependant on foreign countries for their supply of raw materials. Because iron as a rule is still worth about one franc a kilo—or one dollar for about thirteen pounds—in the small tool line, it is believed that the few concerns who started making small tools during the war will not stand and that very few of the old, established concerns will be able to continue.

LITTLE MACHINE-TOOL BUSINESS

In the machine-tool line manufacturing was carried on to a very large extent in Switzerland during the war. It will be remembered that before the war, there was only one concern manufacturing metal-working machinery in Switzerland that would be worth mentioning. There were a few other concerns making small drill presses and some others grinding machines, including the surface grinders. Many small precision bench lathes and precision bench milling machines for the special requirement of the watch making trades, were also produced.

Under the present depression, it is likely that only two concerns will remain manufacturing machine tools of medium size, in Switzerland—Bennezer & Co., of Uzwil, and the Swiss Machine Tool Works, of Oerlickon—the former concern making lathes only and the latter concern making lathes, milling machines and radial drilling machines. The former concern has added lathe manufacturing to its former line which was knitting machinery. The second concern may be incorporated with a large electrical works in Oerlickon.

So, the machine-tool industry in Switzerland will comprise about a half dozen concerns, including those manufacturing the small drill presses and gear cutting and grinding machines, exception being made for the special small precision machine tools for the watch industry.

German competition is, of course, to be reckoned with. The German machine-tool manufacturers are offering their machines in Switzerland at dumping prices, but according to the actual cost of manufacturing these machines in Germany, dumping prices even mean a profit to the manufacturer to an amount averaging not less than 25 per cent.

Switzerland has also been covered by commercia propaganda from Sweden and Holland. Many concerns in these countries are offering very large stocks at attractive prices. Their efforts were in vain, however because the Swiss market is unable to consume, under actual conditions, any important amount of machine tools. A very small amount of machine tools was purchased by Swiss concerns having orders for the electrification of the railroads.

ELECTRIFICATION OF RAILWAYS

The Swiss government has lately issued bonds for 100,000,000 francs at the rate of 6 per cent, to be reimbursed after ten years. It will be remembered that the United States has already loaned Switzerland several hundred million francs for carrying out the plan of electrifying the railroads. According to this plan the first large railway system in Switzerland will be electrified within twenty years, and the smaller lines will require from ten to fifteen years more.

Electric locomotives of the single-phase type, for 600-hp. motors, are now being built in about a half dozen large electrical manufacturing plants. Of course, other shops making switches, electric meters, transformers, connecting outfits, switch-boards, etc., are normally busy and also a few large plants making high-pressure water turbines and electric generators for the electric power plant.

In the electrical industry the large firms, outside of the government work, have very few orders booked in advance for foreign countries, but it is likely that the revival of the export business in Switzerland will create a demand for machine tools, as very few machine tools have been bought to meet the manufacturing requirements of the government orders. Due to some reduction in wages and to better manufacturing processes, a few electrical shops in Switzerland are able to export their electric motors into France, which country has always been a very good customer.

In the railroad repair shops, it is the rule not to make any purchases of machine tools, a few exceptions being granted for small tools necessary for the up-keep of material. This is due to the situation of the Swiss railroads who have had their expenses over-balancing their income for several years.

Swiss manufacturers are allowed to export only a certain number of watches to France. Before the war, Germany was a very good customer for Swiss watches and some important houses in the German sea ports made very large contracts and exported Swiss watches the world over. This trade started again soon after the armistice, but Swiss watch manufacturers have been compelled to suspend their shipments due to the German houses not being able to meet their obligations as the mark went down further, and large accounts are now due to Swiss manufacturers by German import houses. The Swiss watch industry is very dull at present and the factories work between fifteen and eighteen hours a week.

In the textile branch, manufacturers are unable to obtain orders for Swiss consumption because the retailers are selling out their stocks at prices below actual manufacturing prices and as long as stocks last, manufacturing will not be started again. The higher classes are still using imported English goods.

The lace industry is reviving a little due to some orders being received from England. The prosperity of this trade depends upon the fashion.

The leather industry is in better condition, due to a very high tariff preventing the importation into Switzerland of foreign leather goods. It is figured that a 40 per cent duty is to be paid on foreign imported leather goods, so that the Swiss shoe and leather goods manufacturers are enjoying profitable manufacturing. But this protection against competing foreign goods has been much discussed by the press as being detrimental to the lowering of the cost of living.

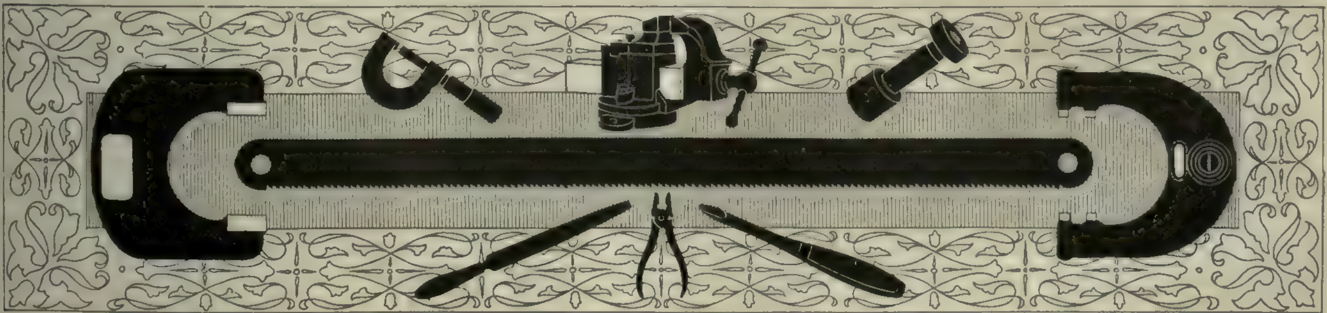
AUTOMOTIVES QUIET

The automobile industry is very quiet in Switzerland. Very good trucks are being manufactured by Swiss work shops, but a great many foreign trucks—a large number of them coming from the army stocks in France—and the liquidation of the stocks of manufacturers in Germany and France, provide enough trucks for many years' consumption in Switzerland. A large truck manufacturing concern—Saurer—is working with a much reduced force and only a few days a week. Other truck manufacturers like Frank are closed, and Martini is working with but a very small force. It is believed that hardly any touring cars will be manufactured again in Switzerland, due to the inability of Swiss shops to meet competition in manufacturing costs and the failure of the large automobile concern Pic Pic of Geneva. I should make exception to electric automobiles, which could find a market if electric power could be obtained cheap enough.

The wood-working industry is suffering less than the metal-working industry and if building construction should start again this industry would be the leading industry at the present time.

The recent new tariff regulation applying since July first on imported machine tools and small tools and shop supplies, is affecting to some extent, the machine-tool business. This tariff calls for an increase of from 100 to 150 per cent on machine tools, according to the respective classification of weight; small tools will pay 150 to 400 per cent more; the usual shop supplies will pay 100 per cent more and precision instruments will pay 300 per cent more than previously.

To conclude, Swiss industry lives on export trade and as long as business conditions do not improve in foreign countries so that Switzerland may export her goods, it is not likely that Swiss industry will be active, with the exception of those plants interested in the electrification of the railroads.



Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Device for Setting the Wires in "Lantern" Pinions

By Amos Ferber

The built-up pinions used in clocks and watches, commonly called "lantern" pinions, are composed of "spools" of brass having steel wires set in holes drilled through the flanges near the periphery in a direction parallel to the axis of the spool, the wires serving the purpose of "teeth" in the pinions.

The spools are turned out at a rapid rate on small automatics, and are drilled in a special machine that indexes the spool around in the same manner as a gear would be indexed, drilling each successive hole clear through one flange and part way through the other. It then remains to set in the small steel wires and swage them in place to prevent them from working out.

Modern clock making demands hundreds of thousands of these pinions of different sizes and varying numbers of teeth and as the wires even in the largest sizes are very small and correspondingly short it would require too much time to set them individually with a pair of tweezers; therefore some sort of device is needed to set them simultaneously with speed and certainty. The illustration shows such a device worked out by the Lux Clock Co., Waterbury, Conn., to accomplish this purpose.

In the barrel of the fixture at *A* a cylindrical plug having a semi-rotary movement operated by a treadle has a ring of holes drilled lengthwise through it, corresponding in location and size to the wires in the pinion. This plug does not pass entirely through the barrel, but abuts against a stationary die of exactly the same section and of a thickness corresponding to the length of the wires in the pinion. The die is held in the front end of the bore of the barrel by suitable setscrews. Both die and plug are, of course, interchangeable with others to accommodate different sizes of pinion.

Each die has a short stud projecting from the center to fit the bore of the pinion and thus position it to receive the wires. In case of pinions in which the spool is already swaged in place on its respective shaft, the die and plug each have a central hole to perform the same function. At *B* is a swinging stop that determines the length to which the wires shall be cut.

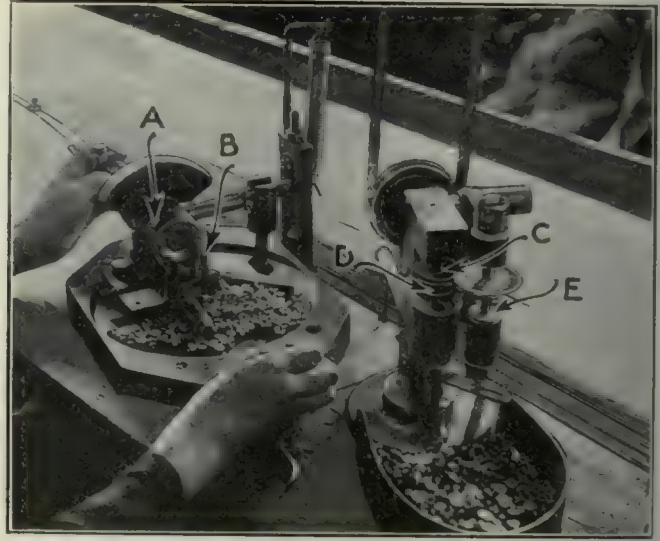
With the treadle at its upper position where it is held by a spring against an adjustable stop, the ring of holes in the plug coincides with that in the die. A bundle of steel wires—seven, nine, or more according to the number of "teeth" in the pinion—is threaded into the holes and bound together at the outer end by a suitable clamp in a position to be convenient to the operator's left hand.

Swinging the stop *B* to its central position, the wires are advanced to meet it, when a depression of the treadle rotates the plug sufficiently to cut them off, leaving the die filled with wires of the proper length. The thickness of the die is about $\frac{1}{64}$ in. less than the required length of wire and the stop set correspondingly, so that these wires project slightly from the face of the die.

Picking up a spool with the right hand, the operator sets it over the central stud and with a slight twisting motion, enters the wires in their respective holes; the wires are prevented from moving back by the blank face of the plug now presented to their inner ends. Releasing the treadle, thus bringing the holes once more into coincidence, the operator advances the bundle of wires with her left hand, pushing the short pieces into places in the pinion and filling the die ready for the next one.

In the device at the right there is at *C* a constantly running knurled wheel driven by the round belt. Two upright shafts at *D* and *E* each carry a small gear with teeth made to mesh with the pinion. Both these shafts rotate freely on pivot bearings but are not turned by the driving belt. Neither do the two gears mesh together, but are set so that when a pinion is put between them it will mesh with both and act as an intermediate gear without having any fixed center of its own.

The shaft at *D* has a slight endwise movement operated by a second treadle. Without depositing the newly filled pinion (which would allow one or more of the wires to become displaced) the operator places it, with the open end of the holes up, between the gears of the swaging device and depresses the second treadle. This movement forces the flange of the pinion against the revolving knurl, which thus becomes the driver and rotates the pinion and the gears with which it is in mesh.



DEVICE FOR SETTING WIRES IN LANTERN PINIONS

The gears have no other office than to support the pinion and allow it to revolve under the knurl, which thus runs around the face of the upper flange and swages the soft metal into the drilled holes, effectively closing them and securing the wires in position. Meanwhile the operator is loading another pinion and pays no further attention to the swaging device other than to keep her foot on the treadle until the next pinion is ready to be inserted.

When the pressure on the treadle is released the pinion drops out and makes way for the next. The two operations are thus carried on together and the time required for loading and swaging a pinion is but a matter of two or three seconds, against as many minutes that would be required were the wires to be inserted and swaged individually.

Handling Materials in Western Shops

By Frank A. Stanley

The halftones illustrate methods and apparatus used in various western plants for handling materials of different kinds. Fig. 1 shows the application of a handy sling, as used for lifting plates in the shops of the Nevada Engineering Co., Reno, Nev. The grab hooks by which the edges of the plate are securely gripped, have broad bases of heavy metal bent to extend well under the edges of the plate, while in the forks of the upper ends are pivoted cam shaped forgings through the tops of which are passed links of the chain slings. The lower ends of the cam-shaped members are so shaped that the greater the weight of the work, the more tightly will the hooks grip the sheet.

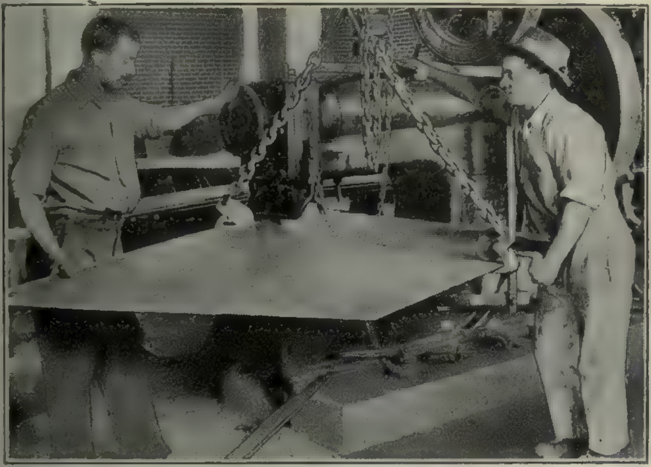


FIG. 1. CONVENIENT HOOKS FOR HOLDING METAL PLATES

In Fig. 2 is shown a sling for picking up driving wheels and axles for placing in the wheel lathe and for removing them after completion of the turning operations. The sling has a triangular body fitted with a clevis for suspension by the crane hook and has two large hooks at opposite ends for supporting the driving axle.

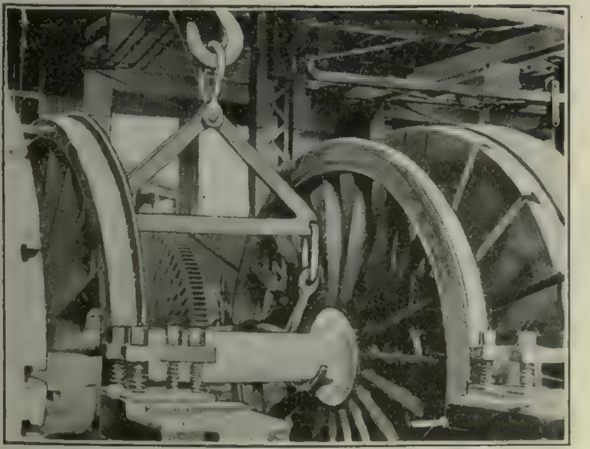


FIG. 2. SLING FOR HANDLING LOCOMOTIVE DRIVING WHEELS AND AXLES

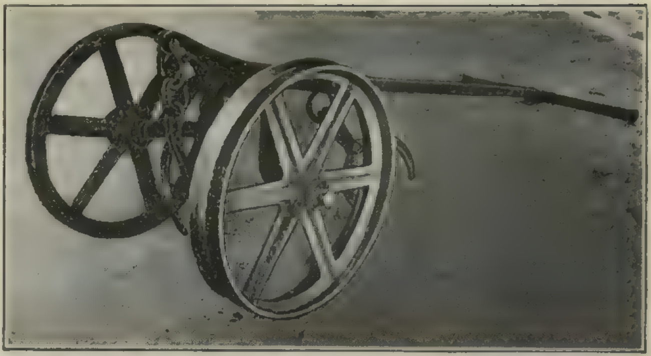


FIG. 3. TRUCK FOR HANDLING SHORT SHAFTS

Special Truck for Short Shafts

In Fig. 3 is shown a special truck used in the Nevada Engineering Works for picking up heavy shafts, axles and similar work. This truck is quite similar to some of those used in railroad plants for handling driving axles. The truck is entirely of metal with the axle bent upward to bring the handle at sufficient height above the floor to permit the two "ice tongs" gripping hooks to clear the surface of the ground when the truck is in motion. The truck is simply run over the axle or short shaft to be lifted, the tongs dropped over the work and the entire outfit can then be used to carry the shaft to any desired point.

The stand or table shown in Fig. 4 is in reality a truck having two wheels at one end and handles at the opposite end to enable it to be moved from point to point, as in the pressroom where heavy dies have to be handled to and from the storage benches and presses. The top of the framework is fitted with a pair of light rails which are of the right height to come practically flush with work benches and with storage shelves back of the presses. Heavy bolsters, dies and punches can be slid directly from the benches onto the top of the truck or vice versa and the handling between truck and press bed is accomplished with equal facility. This is one of the appliances used by the Gilro Machine Co., at Oakland, California.

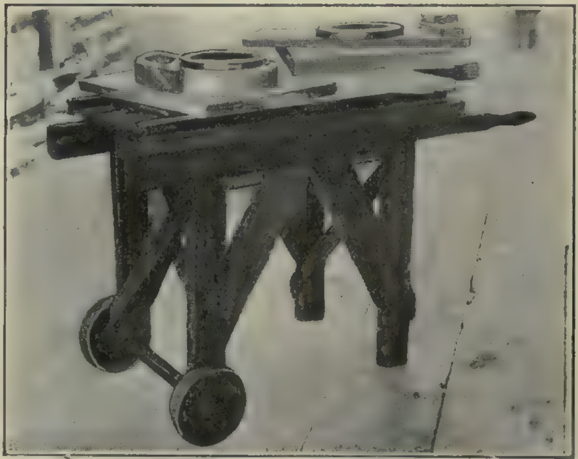
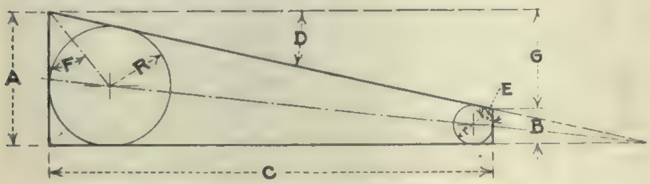


FIG. 4. DEVICE FOR HANDLING HEAVY PRESS TOOLS

Taper Gage Disks

By G. Strom

Figuring the diameters of disks used to set the final taper of gages, or checking similar work when the angle of taper is as shown in the accompanying illustration is often very puzzling. No solution is given in the standard handbooks that I have examined. I have seen much time spent in trying to solve this problem by ordinary arithmetic, using a formula in which both angles are equal, and adding or subtracting constants.



MEASURING A TAPER BY MEANS OF DISKS

The problem is easily solved by trigonometry:

$$G = A - B$$

$$\text{Tan } D = \frac{G}{C}$$

$$\text{Angle } F = \frac{90° - D}{2}$$

$$\text{Angle } E = \frac{90° + D}{2}$$

$$R = \frac{A \times \text{Tan } F}{1 + \text{Tan } F}$$

$$r = \frac{B \times \text{Tan } E}{1 + \text{Tan } E}$$

Following is a solution of an actual problem:

$$A = 0.7 \text{ in.};\ B = 0.2 \text{ in.};\ C = 4 \text{ in.}$$

$$G = 0.7 - 0.2 = 0.5 \text{ in.}$$

$$D = \tan^{-1} \frac{0.5}{4} = \tan^{-1} 0.125 = 7° \ 8'$$

$$E = \frac{90° + 7° \ 8'}{2} = 48° \ 34'$$

$$F = \frac{90° - 7° \ 8'}{2} = 41° \ 26'$$

$$\text{Tan } E = 1.1329$$

$$\text{Tan } F = 0.88265$$

$$R = \frac{0.7 \times 0.88265}{1 + 0.88265} = \frac{0.617855}{1.88265} = 0.3382 \text{ in.}$$

$2R = 0.6764$ in. diameter of disk at large end.

$$r = \frac{0.2 \times 1.1329}{1 + 1.1329} = \frac{0.22658}{2.1329} = 0.1062 \text{ in.}$$

$2r = 0.2124$ in. diameter of disk at small end.

Method of Making a Small Eccentric Bushing

By Gus Haessler

The small eccentric bushing shown at *A* in the cut is a part of a gage, six of which were to be made. The dimensions, including the amount of eccentricity which was 0.025 in., were required to be very accurately maintained and the method here described of doing the work was adopted.

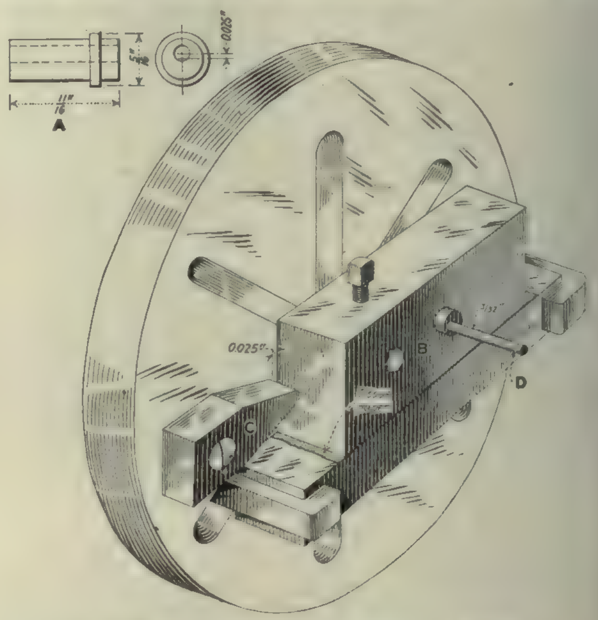
The bushings were made of $\frac{5}{16}$-in. drill rod and, after being roughed out, were drilled and reamed by means of the jig shown at *B*. A piece of cast iron of suitable dimensions was first machined square and true, and a hole for the setscrew drilled and tapped near one end.

Mounting the piece upon the faceplate of a bench lathe to which a parallel had previously been clamped, and with the work bearing upon strips of tissue paper placed between it and the parallel, the work was positioned and a hole bored transversely to the setscrew hole to take the bushings.

The locating piece *C* was then clamped to the faceplate to bear against the end of the jig and the latter moved along the parallel for the distance of 0.025 in.; being located in its new position by means of feeler gages between it and the locating piece. It was then an easy matter to drill and ream as many of the bushings as desired, holding them by means of the setscrew.

The same jig and methods were used in grinding the bushings after hardening. Another hole was made in the piece to take the shank of the stud *D*, and when this had been hardened and ground the jig was moved 0.025 in. along the parallel by the use of the locating piece *B* and feelers, as before.

Two or three thousandths of stock had been left upon the bushings for grinding, and it was only necessary to force the bushings lightly upon the stud and indicate them true, when they were ready to grind.



JIG FOR DRILLING AND GRINDING SMALL ECCENTRIC BUSHINGS

Cylinder Valve Seat Gage

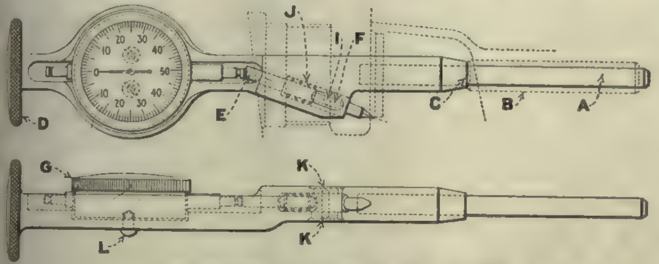
By Charles Kotersall

Chief Tool Designer, Peerless Motor Car Co.

The gage shown and illustrated here may be of interest to the readers of the *American Machinist*. It is used for checking the concentricity and run-out of cylinder valve seats on automobile cylinders.

The stem or plug of the gage at *A* must be a close sliding fit in the valve stem guide bushing *B*. The gage must bear on the shoulder of the guide at C. This is done by pushing down on the knurled knob D. This being done the plunger E works in the slot F and has about $\frac{3}{32}$ in. on both sides of the center, as shown on the gage. The bezel ring *G* of the dial gage is set to zero. The knob is now turned at the same time the stem *A* is at stop *C*. In other words "push down and turn."

If there are any irregularities on the seat of the cylinder the gage will show them. The pin *I* is to prevent the plunger *E* from turning and springing out. The spring *J* is a compression spring compressing on the plunger against the cylinder valve seat. The cover *K* is to prevent dust from getting into the slot *F*. It is held in place by peneing the edge of the opening into which it fits. The screws *L* hold the dial gage in place. The dial gage used is a No. 9, B. C. Ames gage which has a spindle travel of 5/16 inch.



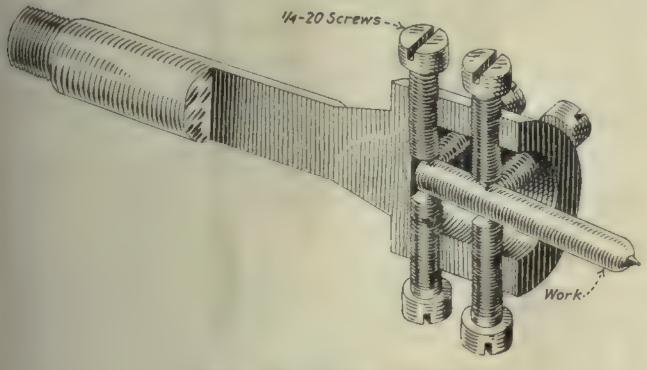
CYLINDER VALVE SEAT GAGE

A Collet Chuck for Truing Up Irregular Work

By Richard B. Hawes

We had occasion to set a number of diamonds in such manner that the points would run absolutely true, and as it was impractical to accomplish this result when brazing the diamonds into the holder, it was necessary to devise some means of truing up the point after setting so as to turn off the outside of the holder. After spending many fruitless hours in trying to do this by means of a four-jawed independent chuck and sundry pieces of blocking, we devised the simple tool shown in the sketch.

The shank of the tool was made to fit the spindle of the bench lathe and the outer end was left 1⅜ in. in diameter by 1 in. long. A ⅞-in. diameter hole was bored ⅞ in. deep into this head, and into the annular wall thus left, holes were drilled and tapped and eight ¼-in. set-screws inserted in rows of two as shown. With this tool it becomes a simple matter to true up the diamond point, irrespective of its position in the holder.



A SIMPLE COLLET CHUCK

The device is useful also for other work beside that for which it was intended.

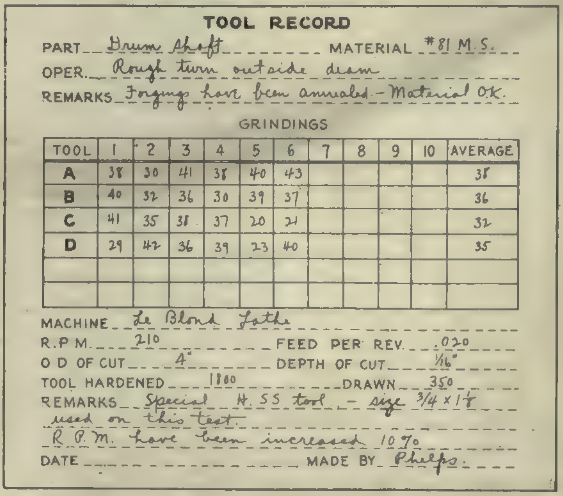
Keeping Records of Tools

By Gene Phelps

An accurate record of what a cutting tool can be expected to do, or has done, is very useful when determining the best tool to use for a certain kind of work or the best speed to produce the most satisfactory results. Many factories run machines at speeds which are not efficient, this being largely due to the use of improper cutting tools. If a certain piece of work is to be done and a record has been kept on something of a similar nature, it is a very easy matter to make a selection of a type of tool which will bring the desired results.

The tool record card shown here has been found exceptionally useful in determining the best tool for cutting a piece of work under a given condition. The correct feed and speed is recorded on the card, and the actual tests shown in the record practically eliminate guess work. Records can be accurately kept on such machining operations as turning, drilling and milling; and a reference to the card enables the engineer to observe past performances.

Very frequently some operation is found to be too slow, and the speed is increased without definite knowledge of what the increase should be. The result will be that the tool does not stand up for the required length of time. If a record is made before the change of speed, a comparison will show whether the increase is profitable or not.



TOOL RECORD

PART Drum Shaft MATERIAL #81 M.S.
OPER. Rough turn outside diam
REMARKS Forgings have been annealed - Material O.K.

GRINDINGS

TOOL	1	2	3	4	5	6	7	8	9	10	AVERAGE
A	38	30	41	38	40	43					38
B	40	32	36	30	39	37					36
C	41	35	38	37	20	21					32
D	29	42	36	39	23	40					35

MACHINE Le Blond Lathe
R.P.M. 210 FEED PER REV. .020
O D OF CUT 4" DEPTH OF CUT 1/16"
TOOL HARDENED 1800 DRAWN 350
REMARKS Special H. SS tool - size 3/4 x 1⅛ used on this test.
R.P.M. have been increased 10%
DATE MADE BY Phelps.

RECORDING WORK DONE BY A TOOL

Another use for a card record of this sort is in comparing such tools as high-speed steel and stellite, in order to find out if the change of tool is warranted by an increase in production. The card record here given shows in the column opposite the various tools the number of pieces which have been machined between each grinding operation. The average is also shown. More than one tool test can be recorded on the same sheet, if desired, and the number of different grinds listed, so that a very good average can easily be obtained. For example, if a lathe tool on a certain job ran for two hours without grinding and required only one minute to set up, it would be seen that the machine could be speeded up or the feed increased until grinding would be required about every hour, when it would be evident that the limit of production had been reached.

Reference to records of this sort could be easily made, the cards being filed and cross-indexed in whatever way may be found most convenient. It is advisable to make the space for remarks as large as the size of the card will permit, in order that a complete record may be kept.

EDITORIALS

Russia Is Retarding the Progress Curve

MANY and conflicting have been the reports from Soviet-Russia. Those from our own correspondent in Riga have given a picture of gloomy conditions in industry. A recent newspaper report on general business conditions as seen by the president of the Amalgamated Clothing Workers of America, stated that Russia is on the eve of vast economic expansion and that there is absolute liberty of speech. A correspondent of the Literary Review of the New York *Evening Post* writes that nothing can be published, except works that express a definite agreement with the policy of the communist party and that there is no literature except the poetry of the "Imaginists." Estimates on the wheat crop show that Russia will have to import instead of having a surplus.

Because of these varied reports we deem the articles by Royal R. Keely, the first of which appears in this issue, to be particularly valuable. Mr. Keely spent a year in studying conditions in Russian industry and another year in prison, because, as he says, he "knew too much."

As he sees conditions, Russian industry is literally paralyzed. The brains of the country are almost wholly devoted to theorizing, accompanied by negligible practice; the Russian workman cannot and will not work; there is nothing for him to eat whether he works or not; and by the existing neglect of schools at least a decade of progress has been lost.

The evidence seems to show that for a long time to come Russia will be an economic drag. With all of her fine natural resources and her vast productive territory she cannot be a real producer for many years. She is handicapped by too much ignorance and too much communism. There remain no rewards for individual accomplishment.

The Industrial Cost Association—An Organization of Practical Men

IT IS in the nature of men to organize themselves into groups for all sorts of purposes, good, bad and indifferent. Some thrive and grow, some merely exist, some soon die out. It is an ancient principle of organizations of men that the individual gets out of them in proportion to what he puts in, from which it might be argued that the association whose members are enthusiastic enough to do the hard work incidental to the preparation of papers and to take active part in the discussions, is likely to be among the thriving class.

Such a body is the Industrial Cost Association whose second conference was briefly described in last week's issue. The membership is not large as yet, but nevertheless most of the papers discussed were written by members. This group of practical men who get together to discuss practical matters and help solve each other's problems, can do much for industry and business and is deserving of wider support.

The Price of Industrial Peace

BOTH Mr. Hoover and Mr. Rowntree, in their addresses before the Academy of Political Science at its recent conference, emphasized the desirability of reaching a condition of economic security for the worker. Such a condition would go a long, long way toward bringing about industrial peace. The scheme of unemployment insurance or its equivalent, referred to by Mr. Rowntree as a constructive measure, is not a new one and it is worthy of wider consideration. That the employer and employee should set aside during prosperity an account for a rainy day seems to offer a simple solution of a very serious problem.

Mr. Rowntree said that to secure industrial peace it will be necessary for the employer to pay the price—commensurate wages, sufficiently short hours, a guaranteed economic security and a proper status of the worker. His conclusions ring true, especially because as the employer of some 7,000 men he has practiced the things he advocates.

We wonder if America has fallen so far short of paying that price. Some figures from the report of the United States Department of Labor on the union scale of wages and hours of labor in effect May 15, 1920, will be enlightening. Wages averaged $48.76 per week in the twenty-one principal trades in the representative city of Chicago. The lowest weekly wage was $37.95 and the highest $55. In eight of the trades the weekly wage was $55. In only three was it below $40. The hours worked per week in these twenty-one trades were 44 in thirteen, 45 in one, 48 in six and 54 in one. These figures would seem to show that the American workman is receiving commensurate wages and sufficiently short hours. We believe that his own evidence will show that his status in society and in the shop is very high and that he doesn't find fault with it. This leaves only the position of economic security for the worker to be attained.

A point that is generally overlooked is that the worker must know that the employer is paying the price. If he once becomes convinced that his wages are a just proportion of the profits of the business, and that shorter hours would be a failure economically, he will be much less inclined to risk his all in a strike. His instruction, of course, implies some very careful work on the part of the employer. Both instructor and pupil would be inclined to proceed warily for a time, but progress would be the more sure therefor. A difficult part of the task would be to overcome the effects of doctrines previously absorbed.

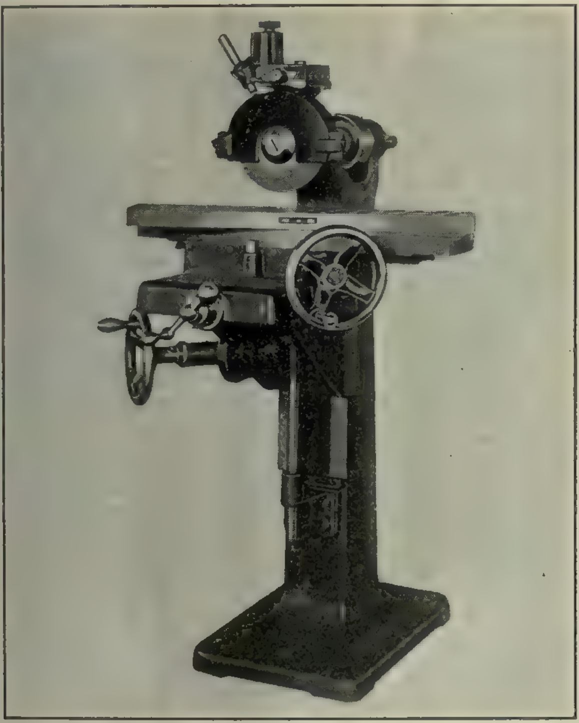
What part can be expected of labor in accomplishing a state of industrial peace? Probably only the indirect one of keeping the employer active. Labor does not possess the broad vision necessary to reach a solution, so the employer and the engineer must consider the problem as their own. The same amount of effort applied toward attaining economic security as is exerted on manufacturing problems would hasten the day of its accomplishment to the benefit of all of us.

Shop Equipment News

Wilmarth & Morman No. 1 Surface-Grinding Machine with Swivel Table

The Wilmarth & Morman Co., Grand Rapids, Mich., has recently fitted its No. 1 surface-grinding machine with an auxiliary swiveling table, as shown in the accompanying illustration. The use of this table adapts the machine to the performing of grinding operations on angular and irregular shapes.

It is not necessary to remove the work from the table and reset it for the angle required; but the auxiliary table can be swung on the sliding table, graduations being provided at one end to facilitate adjustment. The table is provided with T-slots, to accommodate the headstock and tailstock or dividing head. It is not necessary to disturb the work to dress the wheel, as this is accomplished by the built-in wheel-truing device located on the wheelhood. The machine is recommended by the maker for accurate work on gages and dies.

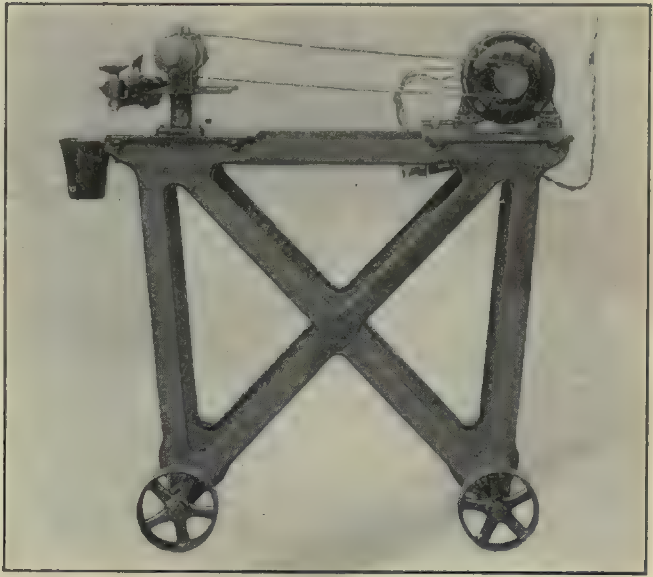


WILMARTH & MORMAN SWIVEL-TABLE GRINDING MACHINE

St. Louis Portable Motor-Driven Grinder

The accompanying illustration shows a type of machine recently developed by the St. Louis Machine Tool Co., 932 Loughborough Ave., St. Louis, Mo., for grinding tools or implements where it is necessary that the machine be easily portable. The machine consists of a large stand mounted on wheels, so that it can be moved over irregular surfaces without danger of tipping, being particularly adapted to the use of contractors doing outside work, or to yard use.

On one end of the stand is mounted a fully inclosed a.c. motor of the induction type. Either a 3-phase squirrel-cage motor for any given voltage can be furnished, or a single-phase motor capable of operation on either 110 or 220 volts with either 1, 2 or 3-phase current. If desired, a compound-wound d.c. motor can be furnished.



ST. LOUIS PORTABLE MOTOR-DRIVEN GRINDER

The wheelhead is mounted at the other end of the stand, and is belted directly to the motor. The arbor carries two wheels, each of which is provided with an adjustable workrest. A water pot is mounted at the front of the machine.

The machine can be furnished with either No. 1, 2, 3 or 4 "Saint Louis" grinder heads, or No. 0, 1, 2 or 3 "Western" heads. Wheels from 6 to 12 in. in diameter can be carried on the arbors, which vary in size from $\frac{3}{4}$ to $1\frac{3}{16}$ in. in diameter in the bearings of the different machines. The weights vary from 200 to 260 pounds.

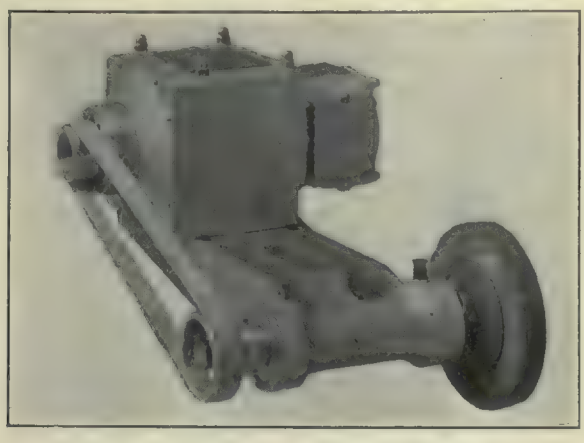
R.V. Portable Electric Grinder

The illustration shows a portable, electric, precision grinder for general use either on a machine tool or held in a vise. It is known as the R.V., and has recently been placed on the market by Arva Stroud, 327 Broadway, New York, N. Y. The machine is made in two sizes, the Type A having a $\frac{1}{2}$-hp. motor, and the Type B a 1-hp. motor. The latter type, having a motor housing of square section, is shown, the smaller machine having a cylindrical motor housing.

The motors used in both types of machine are of the commutator type and operate on either direct or alternating current, being supplied for either 110 or 220 volts. The motor runs at high speed, and is provided with belt drive on two-step pulleys, so as to give spindle speeds of 4,000 and 12,000 r.p.m. under load. The low speed is used for external and the high speed for internal work, spindle extensions being provided for doing the latter work.

The motor is sturdily constructed to withstand the high speed, and the armature is accurately balanced.

The commutator has 32 segments, insulated with mica. The brushes are easily accessible for inspection and renewal. The frame and motor housing are made of a hard aluminum alloy. At the front end of the frame the grinding spindle is held, while the motor is adjustably mounted on the rear, so that the tension of the driving belt can be varied. The device can be secured to a machine tool by means of a bolt through the slot in the center of the frame, as when mounting on the toolpost of a lathe. It can be held in a vise on a machine table, as for sharpening a milling cutter in place.



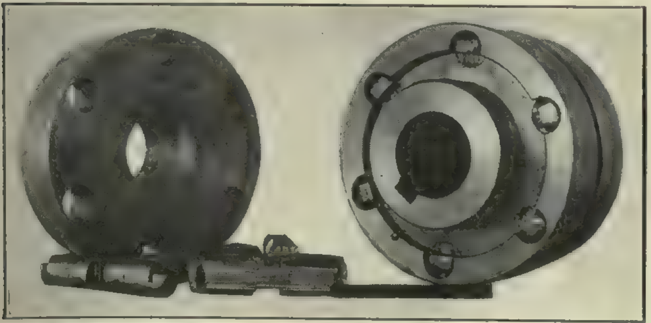
R.V. PORTABLE ELECTRIC GRINDER

The grinding spindle runs on ball bearings. The sleeves and extensions are fastened to it by means of taper fits and a square thread. The machine is equipped with two 5-in. grinding wheels with sleeves and flanges, two spindles and wheels for internal grinding, two belts, an adjustable table for hand grinding, two wrenches, and an electric cord with attachment sockets, all fitted into a wooden case. It weighs 22 lb. net and 37 lb. with the accessories.

Francke Light-Duty Flexible Coupling

Smith & Serrell, Central Ave. at Halsey St., Newark, N. J., have recently placed on the market a light-duty type of the Francke flexible coupling previously described in the *American Machinist* on page 836, Vol. 38. The coupling is intended for use on motor drives up to 50 or 75 hp., and for general use about machinery plants.

It consists of two cast-iron flanges reamed to either the same or to different sizes, and mounted on the shafts to be connected. Both parallel and angular misalignment is corrected by the spring pins connecting the two flanges. At the left of the accompanying illustration can be seen one of the flanges, and also the type of flexible pins employed. As shown on the right, six pins are used in the assembled coupling.



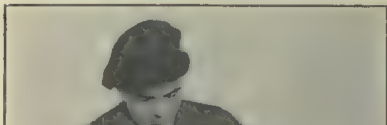
FRANCKE LIGHT-DUTY FLEXIBLE COUPLING

Each pin unit consists of a bundle of thin, flat, steel springs held in keepers at each end. A small pin passing through slots in the springs holds the springs in position in each keeper, but allows movement both lengthwise in the pin and at an angle to it. The keepers do not slide in the flanges, but are locked in position and prevented from turning by means of retainer rings. The springs transmit the driving torque and cushion the shocks that occur, the leaves being so placed that they bend slightly as the load is applied.

The coupling is furnished in eight sizes for bores from ⅝ to 3½ in. in diameter, the bores being furnished in $\frac{1}{16}$-in. steps. The smallest size of coupling is 3¼ in. in diameter, and can be run at a maximum speed of 2,500 r.p.m., while the largest size, which is 8¾ in. in diameter, has a maximum speed of 1,750 r.p.m. The weights vary from 5 to 70 pounds.

Black & Decker "Safety" Cleaning Machine

The device shown in the accompanying illustration has recently been placed on the market by the Black & Decker Manufacturing Co., Baltimore, Md., for the purpose of cleaning small parts with gasoline. The "Safety" cleaning machine consists of a cast-iron pedestal with a bowl at the top, 13 in. in diameter and about 12 in. deep. About 5 in. from the bottom of the bowl, a fine-mesh screen is supported. A plunger pump is cast integral with the bowl at one side. The bowl is provided with a safety cover, arranged so that it cannot be left open when the device is not in use, being controlled by the handle which operates the plunger pump.



BLACK & DECKER CLEANING MACHINE

A gallon of gasoline, kerosene or such liquid cleanser is merely poured into the bowl of the machine, and the operation of the plunger pump forces a stream of this fluid from one side into the center of the bowl. It passes through the screen and returns to the pump, so that the liquid is used over and over. It is merely necessary to hold the part to be cleaned under the stream of liquid, which washes dirt, chips and foreign matter from it, and deposits them on the screen. The machine is particularly adapted to cleaning such small parts as ball and roller bearings, gears, magnetos, drills, milling cutters and tools. It is said to have the approval of the Fire Underwriters, and to be intended to replace the dangerous and wasteful "bucket and brush" method of cleaning.

NEWS SECTION

Organization of Deutsche Werke

Under the above title (German Works) a stock company was formed a year or so ago for the purpose of taking charge and remodeling the former Imperial State Factories in which material for the army and navy had been manufactured. It has not been an easy task to complete this transformation, especially not in view of the fact that gigantic plants with special machinery had, in many instances, to be transformed to the bottom. It was decided that, as a *conditio sine qua non* for the further carrying on of the business of the various enterprises, the latter had to support themselves and to pay interest for the capital invested.

The company took possession of the following State works: Spandau, gun foundries, shrapnel factories, ammunition works, manufacturing of rifles and artillery laboratory, powder factory: Cassel, ammunition works. Erfurt, rifle factory. Amberg, rifle factory. Ingolstadt, gun foundries and shrapnel factories. Munich, plant for artillery. Dachau, powder factories. Hanau, powder factory. Siegburg, shrapnel and artillery material. Lippstadt, artillery material. Rüstringen, undersea-boats and torpedo factories. Kiel, shipbuilding yards. Friedrichsort, torpedo factories. Plaue, powder and ammunition works. Reichertshofen, powder factories.

The capital of the company consists of 100 million marks in shares and 330 million marks in bonds guaranteed by the State. The entire business is now carried on on a commercial basis. The board of administration includes high government officials, representatives of the public diet, and financial and industrial experts. At the present time the German works give employment to about 40,000 men, and the principal articles now turned out by the various works are: Amberg, machine tools, compressed air tools, machine knives and wrenches; Cassel, repair work on locomotives, freight and passenger cars, automobiles, drilling machines, mechanical toys; Erfurt, pocket pistols, hunting rifles, files and rasps, locomotive repair work, etc.; Ingolstadt, metal wares of every description and wood work; Kiel, freight steamers, fishing boats, motor boats, sailing and motor yachts, lighter and bunker ships, ship machinery, turbines, Diesel motors, ship boilers, etc.; Lippstadt, coal mining machinery, mine cars, tip-carts, etc.; Munich, locomotive repair work, agricultural machinery and implements; Spandau, machine shops, repair work on locomotives, freight and passenger cars.

Army Development of High-Powered Guns

A demonstration of the Army's latest achievements in ordnance was staged at the proving ground at Aberdeen, Md., on Nov. 2 for the benefit of members of the Washington Post of the Society of American Military Engineers. The large delegation from the post was accompanied by mechanical engineers from various of the government departments.

The visitors were impressed with the achievement of the Ordnance Department in improving the 75-mm. gun. The French "75" was used by France, England and Italy throughout the war without improvement over the original model brought out in 1897. The ordnance Department has improved the gun until it has a range of 15,000 yards as compared with 8,000 yards, the range of the French gun. Other improvements allow greatly increased elevation and greater ease of manipulation.

It was pointed out to the visitors that while the development of new ideas in ordnance is important function at the proving ground, the real task is the testing of all guns and ammunition made for Army use. Every gun turned out must be tested so as to withstand strains 15 per cent in excess of those of actual service.

Demonstrations also were had of guns on automotive mounts and of the large guns mounted on railway trucks. Numerous improvements have been made since the war in the mounts and in the trucks, since it has been definitely decided to rely largely on this type of artillery for future coast defense.

Aircraft Accidents

A report prepared for the Secretary of Commerce by the information department of the Manufacturers' Aircraft Association states that, based upon the most trustworthy available information, it is estimated that 1,200 aircraft are engaged in commercial flying in the United States today. A conservative estimate places the mileage flown by these craft during the period of January 1 to June 30, 1921, at 3,250,000 miles.

In the first six months of 1921 there were 40 serious accidents in civil flying, not including accidents to government-owned machines, resulting in death of 14 persons and injury, more or less serious, to 52. In 18 instances there were no casualties. The 14 lives were lost in 10 accidents, and injury to the 52 was caused in 20 accidents.

Westinghouse Biography

"The Life of George Westinghouse," by Col. Henry G. Prout, will soon be published by the American Society of Mechanical Engineers for the following committee: Charles A. Perry, chairman; Paul D. Cravath, Alexander C. Humphreys, James H. McGraw, H. G. Prout, Charles F. Scott, L. B. Stillwell, Ambrose Swasey, H. H. Westinghouse.

"To the memory of few other men, if any, do the engineers of America owe so great a debt of gratitude as to that of George Westinghouse, whose inventions and achievements have not only benefited mankind, but have made possible the enterprises in which so many of our members are now engaged," said Calvin W. Rice, secretary of the society, in a statement explaining that "the underlying motive for publishing a biographic series of great American engineers is to inspire others."

British Fairs To Cover Wide Scope

The Third British Industries Fair will be held in Birmingham and London simultaneously during the period from Feb. 27 to March 10, 1922, the Department of Commerce announced today, upon receipt of reports from the American vice consul at Birmingham. The following lines will be represented at the exhibit:

Hardware, metals, engineering trades, power, lighting and heating, brass foundry and ironmongery, engineering in general, agricultural implements and appliances, mining colliery and quarries, brewing, distilling and catering, building and decorating, motors, guns, saddlery and harness and fishing tackle.

Catalogs outlining the scope of the Welsh National Exhibition, to be held at Cardiff, Wales, during the period from May to October, 1922, already have been published, the department declared. The exhibits will include mechanical engineering, electricity, gas-oil, mines and metallurgy, transportation, civil engineering, shipbuilding, motors, aviation, manufactures and varied industries.

Patent Office Salaries

Early consideration of the bill providing for increases in salaries and certain reorganization in the Patent Office is assured. A majority of the Committee on Rules is understood to have agreed to vote for a special rule which will bring that bill before the House for a final vote.

Industrial Situation of Spain

(By Our Spanish Correspondent)

Spain has just been through a terrible convulsion that almost made her lose balance and undermine the foundation of her social structure.

The fabulous profits so easily made by the manufacturers during the World War, filling orders for the Allies and especially for France, made labor ask for higher wages on several occasions, each request being granted.

After some time the workers did not ask, but demanded, increases in wages, giving birth to the syndicalism that has been a constant menace to social organization.

With the termination of the war, orders were canceled, and the manufacturer found himself facing a situation of great expenditure, which he could have easily stood when he was obtaining great profits and his products were being sold at very high prices to the nations at war. But not to-day, when the very little work in hand is done at much lower prices.

This has been the cause of the great industrial crisis through which Spain is passing to-day, made more serious by the fact that the consumer is not buying, knowing that many of the shops are badly equipped with antiquated machinery and that the products are improperly and expensively made. The latter is caused by the reluctance of the manufacturer to lower the prices which he had obtained for his wares during the special situation created by the war.

Germany has taken advantage of these circumstances by sending a great quantity of merchandise into Spain, which finds ready sale on account of the very low prices at which it is sold. Cases are known where steam engines manufactured in Germany have been sold at prices lower than the value of the material of which they were made.

The flooding of the Spanish market with German goods reached to such an enormous proportion that the industrial interests were alarmed and requested the government to take the proper steps to stop the importation of German merchandise into Spain.

In May the government increased, temporarily, all custom duties 100 per cent, and as if this were not enough, in July a new tax of a high percentage was added to the 100 per cent increase already established. This new tax varies according to the quality of the article imported, and the percentage is applied to the currency of the country of origin, at the exchange on the day the custom duties are paid. In this way all merchandise (German, for example), besides paying a double custom duty, must pay the percentage which results from the difference in the currency of the two countries, which is between 86 and 90. Thus a machine of German make pays 40 pesetas in gold for 100 kilos, plus 70 per cent of 86 to 90 for each 100 pesetas, according to the rate of exchange of the day in which payment is made. German exchange being at a discount of 90, 70 per cent × 90 or 63 per cent would be added to the 40 pesetas, making it 65 pesetas. The original rate was 20 pesetas.

By means of this new tariff arrangement the imports from Germany were curtailed, no doubt benefiting the national production, although to a slight extent, since a number of industries require for their development raw material and elements which must be acquired in foreign countries. In this class are the metallurgical and construction industries, which must import the machinery from other countries, principally the United States and Germany.

The Spanish industry is to-day in a very peculiar situation; it is not in a condition to compete with foreign products which threaten to ruin the national production. The only solution the government seems to have found to the problem consists in placing a barrier that hinders the interchange of products with foreign nations. Many believe that it would have been better if the government had protected the industries until they were able to compete with similar foreign producers.

Equipment Used in the Machine Shops

As it has been said, the majority of the Spanish machine shops are badly equipped. The most accepted machinery, due to its economical cost, is the Germany machinery. However, although very cheap, it lacks precision.

The manufacturer in general equips his shops to produce, disregarding the quality of the product. Partly he is right, since very precise work is not especially necessary in this country and consequently is poorly paid. The aim when buying manufactured products is to get them cheap, with no question as to how well they are made.

In this country American machinery is considered the best, and in spite of its high price, to which must be added the great difference in exchange, it is used in a good number of machine shops, most of them of great importance. The import duty would be less than on machinery from countries with depreciated exchange.

American machinery is used in every shop where quality as well as quantity production is required. In general, in the government and in the railroad machine shops only American machinery is used, since it is considered superior to that manufactured in other countries.

Idle Freight Cars Gradually Decreasing

The number of freight cars, idle because of business conditions, totaled 375,370 on Oct. 1, compared with 414,698 on Sept. 23—or a reduction of 39,328, according to reports just received by the Car Service Division from the railroads of the United States. Of the total, 172,420 were freight cars in good condition which could be placed in immediate service if traffic conditions demanded, while 202,950 were in need of repairs.

Reports showed that the number of surplus cars in serviceable condition on Oct. 1 was a reduction of 28,733 compared with the total of the previous date. Surplus box cars in good order numbered 42,093 or a reduction within that period of 13,756; while surplus coal cars totaled 98,048, or a reduction of 12,328 compared with the same previous date. There was also a reduction of 873 in the number of surplus stock cars.

Of the 2,306,036 freight cars on line on Oct. 1, reports showed 364,372 or 15.8 per cent, to be in need of repairs compared with 374,431 or 16.3 per cent on Sept. 15.

Metal Industries of South Show Big Improvement

A steady increase in production at the foundries, machine shops, and iron and steel plants in the southeast during October, especially in Alabama, is reported by William E. Dunn, Jr., of Atlanta, secretary of the Southern Metal Trades Association. The outlook for the future is such as to portend normalcy by the early part of 1922.

Since the recent reductions in the prices of steel rails, production has materially speeded up at the various steel mills, one order being reported by the Tennessee Coal, Iron & Railroad Co. from the Southern Pacific for 44,600 tons of rails for 1922 delivery. It is also reported, unofficially, that the steel corporation plans the establishment of another big industrial plant at Ensley, Ala. Production at the plant of the Chickasaw Shipbuilding & Car Co., at Fairfield, Ala., has increased to twelve or fifteen cars per day.

During the latter part of October the wire mill of the Gulf States Steel Co., at Gadsden, Ala., established a new record in wire production for a single day, producing 737,990 lb. in eight hours, or upwards of 368 tons. The previous daily record was 595,000 lb. in ten hours, or 287 tons. During October the nail mill of the company established a new record, producing 93,000 kegs. The previous best monthly record was 77,000 kegs. With the exception of the blast furnace all departments of the big plant are operating.

Pipe making shops at Anniston, Ala., the largest producer of pipe in the world, are nearly all in steady operation, many of them running at full capacity.

Iron mines in the vicinity of Cedartown, Ga., are in operation again for the first time in many months, shipping the ore to the furnaces at Rock Run.

A new and larger plant will be constructed at Anniston, Ala., by the National Forge Co., to replace the plant recently destroyed by fire. Construction work will begin at once.

A large new foundry and machine shop is to be constructed in the near future at La Grange, Ga., by the J. T. Tice Co. The building will be 175 by 75 ft., and ready for operations by Jan. 1.

SMTA Standards

Gus F. Meehan, of Chattanooga, Tenn., president of the Southern Metal Trades Association, has named the following members of the research committee recently established by the association to set a certain high standard on the products of the foundries and machine shops in the South that are members of this body, and only products measuring up to these standards will be allowed to use the trade name that has been adopted: James R. Hedges, of the Casey-Hedges Co., of Chattanooga, chairman; John S. Schofield, of the Schofield Iron Works, of Macon, Ga.; T. H. Siddall, of the Sumter Machine Co., of Sumter, S. C.; W. W. Storm, of the Wilmington Iron Works, of Wilmington, N. C. All of the members of the committee are recognized as leaders in the metal trades industries of the South, and all are expert metallurgists. The association has adopted an emblem for its products which is known as the SMTA Standard.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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Last week was unusual in that it included two legal holidays and the initial session of the Congress for the reduction of armament of which so much is hoped.

With the convening of this Congress the enthusiasm of the people here and abroad for some agreement that will be a guarantee of peace has become so evident and is so fervently expressed that it is possible that the power of public opinion will compel a millenial meeting of minds between the great nations that are represented at Washington.

If so the effect upon commercial and financial sentiment will be electrical, but it is well not to take too much for granted for "when self the wavering balance shakes it's rarely right adjusted," and it is almost too much to hope that the flare of idealism now apparent will entirely obliterate the racial and national antagonisms that have made Europe an armed camp since the days of the Caesars. This I say because I fear the reaction that would follow if the Conference shall fail in what has now come to be so confidently expected of it.

The tax bill agreed upon by the Senate and the election are the only other political facts in the weeks record that have any direct bearing upon business. Disappointment over the former is possibly responsible for the defeat of the Republican nominees in not a few localities and the effect will be salutary if the House shall be made more considerate of business when it comes to deal with the Senate proposals. In the "Congressional Record" Senator Frelinghuysen is quoted as saying: "I believe this is a political taxation bill, not a scientific taxation bill, and I believe that the burden which it imposes upon business is so great that it means a continuation of business paralysis."

Most men of affairs agree with him, for the only relief that the Senate bill provides is the elimination of the excess profits tax and a graduated reduction in the surtax which leaves the maximum at 50 per cent. The details of the bill are fully set forth in the newspapers and need not be further discussed here.

One gratifying feature of the election returns is the general reduction in the Socialist vote. Last year the New York Assembly contained four Socialists but none was elected this year.

In the security markets the area of buoyancy is extending itself in accordance with precedent. The boom in bonds which has advanced Liberty Bonds still further and made it possible to sell high-grade industrial and railroad bonds on a 6 per cent basis has induced some buying of the preferred and common stocks whose dividends are assured. Unless history shall fail to repeat itself it is only a question of time when the low-priced securities will join in the upward movement, for in the past it has always been true that when loans could be easily and cheaply obtained people would borrow and buy.

That we are entering upon a period of easy money seems to be indubitably indicated by the Federal Reserve statement. The reserve ratio is 71.4 per cent as against 71 per cent at the end of the previous week and the gold reserves have gained another $16,000,000. The gold held by the banks now exceeds the $2,500,000,000 of Federal Reserve notes and bank notes outstanding by $316,000,000 and in these circumstances cheaper money seems to be inevitable. The fact that new bond issues aggregating over $20,000,000 on several days have been absorbed without causing even a ripple in the money market is conclusive evidence of a plethora of investment capital that will sooner or later find speculative employment.

In the commodity markets the sensation of the week has been a sharp drop in the price of cotton following the issuance of a ginning report which showed that the government's earlier crop estimate of 6,537,000 bales is likely to be largely exceeded. But even if this season's crop shall reach 8,000,000 bales, as some now expect, the supply at the end of the season will not be excessive and the decline in prices will probably give impetus to the movement for crop diversification in the South and a still further reduction in cotton acreage next year.

Meantime, with wheat bringing only 75 or 80 cents on the farm while corn is being used for fuel because it cannot be sold and hogs, cattle and cotton selling at less than the cost of production, the farmer's predicament is one that calls for the attention of thoughtful men everywhere.

In the cities there are numberless organizations whose purpose it is to make urban and industrial life more attractive. A hotel boot-black now makes more money and lives with less toil and in greater comfort than the man who owns and cultivates 160 acres of land. Unless some way is speedily found to correct this inequality agriculture will become a lost art for it will be abandoned to the ignorant and unenterprising residuum of the population who haven't the wit or the energy to detach themselves from the land.

I proffer these observations in lieu of my usual review of the commercial movements of the week which have not been otherwise important. Generalizing, it may be said that distributive trade is now normal. A remarkable increase in building operations is noted in nearly all the commercial reports. There is a striking decrease in the number of unemployed and business men throughout the country seem to be more cheerful than at any time this year.

If it were not for the threatened agricultural depression it would be unnecessary to qualify one's optimism and it is to be hoped that some way may soon be found to make the farmer a participant in the prosperity which those who live in the cities enjoy.

The news from overseas has but little of novelty in it. Lloyd George is still struggling with the Irish problem but the indications are that he will solve it. The unrest in India seems to be spreading and silver is lower. British trade is nevertheless improving. The London discount rate is down to $3\frac{11}{16}$ and there seems to be a plethora of loanable capital there as well as here.

German marks are still lower. "Three for a cent" was the price in New York last Wednesday. They subsequently advanced to 40 cents per 100 but their fluctuations have ceased to have any significance except as the bankruptcy of the German government is indicated. Sterling exchange is distinctly firmer and if a substantial reduction in armament is agreed to at Washington it will probably advance still further for in Europe as here the economic future is largely dependent upon the action taken at the most momentous gathering held since the armistice was signed on Nov. 11, 1918.

Tests of Manila Rope

The Bureau of Standards has recently issued Technologic Paper No. 198 on the tests made on manila rope. It is ready for distribution by the Superintendent of Documents, Government Printing Office, Washington, D. C.

The results of the tests discussed in this paper represent some of the data which have been accumulated at the Bureau during the past few years. Most of the specimens were submitted by various rope manufacturers on purchase orders for government departments and a fixed procedure was adopted by the laboratory in testing all of them. The rope ranged in diameter from ½ to 4½ in. inclusive, and consisted of commercial 3-strand, regular lay ropes. The breaking load, weight per linear foot, number of yarns, and the lay of the rope and strands, as well as the elongation, were measured. The average breaking load was found to be approximately a quadratic function of the diameter of the rope. It is expressed quite closely by the equation

$$L = cd(d + 1)$$

in which L is the load in pounds, c is a constant equal to 5,000, and d is the diameter of the rope in inches. The ropes showed a continually varying modulus of elasticity and no well-defined proportional limit. The number of yarns composing a rope may be expressed approximately by the equation

$$N = kd(d + 0.4)$$

where N = the number of yarns, k is a constant equal to 50, and d the diameter of the rope in inches.

The test results cover sufficient range and show such consistency that it is believed that the formulas deduced may be safely used for 3-strand regular lay manila rope of sizes between ½ and 4½ in. in diameter.

Industrial Ills and Their Remedies

Opinions and Advice of Experts on Various Phases of Industrial Management—Better Co-operation Urged—Hoover, Rowntree and Others on Labor Conditions

At the annual convention of the Industrial Relations Association of America, held on Nov. 1, 2, 3 and 4 in New York city, the subjects covered at the open meetings and sectional conferences covered a wide and varied field of industrial subjects. Employment and personnel work received a good share of attention, as did departmental costs, living costs and wages.

It would be impossible for us to cover the entire meeting in a limited space, so we have selected a few of the addresses which we believe have a more intimate relation to our readers. Brief digests of these are presented herewith.

Problems of industrial relations was the subject at the session on Wednesday. S. R. Rectanus, director of employment of the American Rolling Mills Co., spoke on "Sound Employment Practices." Mr. Rectanus said that the greatest and only law governing employment is the Golden Rule—its application in a humanitarian way. He described the practice of co-operative committees as employed at the American Rolling Mills, taking up the organization of workers, community and stockholders, and their share in the settlement of industrial problems. He advocated the filling of higher positions in a firm by promotion of efficient and worthy employees, but admitted that the fresh viewpoint of an outsider was often beneficial to a concern.

Oppression Its Own Enemy

In closing his remarks he said: "Through specialization and realization that manpower is the most important factor in industry, our factories are better than ever before, and any form of oppression or economic condition has in it the seeds of its own destruction, and only those who adapt themselves to changing conditions will survive and develop."

Earl B. Morgan, of the Curtis Publishing Co., led a discussion on the costs of an industrial relations department. He said that the cost of personnel work was entirely up to the management of a concern. He advocated the use of charts in personnel work, classifying the activities and charging the expense of each to its proper account. Thus an efficient and up-to-date record can be at hand for any reference or for learning the personnel costs at a glance. He urged a budget system for personnel managers, basing the expenditures for the various activities on the number of employees, working conditions, community life and other conditions peculiar to the business.

Determination of Wage Rates

On Thursday morning a most interesting study of the relations between living costs and basic wage levels and wage changes was presented by Magnus W. Alexander, managing director of the National Industrial Conference Board.

Mr. Alexander drove his points home by the use of charts which were prominently displayed about the room. He started his discussion with an analysis of the family budget, showing the cost of keeping an average household under present living costs and wages. He divided the budget as follows: Food, 43.1 per cent; clothing, 13.2 per cent; shelter, 17.7 per cent; fuel and light, 5.6 per cent, and sundries, 20.4 per cent.

He also presented a chart showing the percentage increase in the cost of living since 1914. From that time to the peak of high prices in July, 1920, he showed an advance to over 200 per cent, while at the present time this rise has gone down to about 63 per cent. Another interesting chart showed the purchasing power of the dollar from 1914 to the present. Taking 1914 as full value, the dollar is now worth 61 cents—in purchasing value. He declared that it is not the monetary wage but the purchasing power of that wage, that effects our economic condition; his figures showed that workers who have full time employment today are 20 per cent better off than they were in 1914.

The Golden Rule

In the afternoon the convention listened to a discussion of the fundamental principles of human relations in industry by Loyall A. Osborne, president of the Westinghouse International Electric Co. Mr. Osborne divided industrial relations into two categories, economical and ethical, and analyzed these according to his own viewpoint. He made a plea for cordial relations between employer and employee, saying that on no other basis could industry thrive. On the subject of wages he stated as his opinion that wages should be based on production—the ability to produce determining the rate of pay, and not membership in any organization. He branded the closed shop as contrary to American institutions. Wages should not go back to the level of 1914, he said, but should be gradually adjusted with the decline in living costs. He warned against industrial education schemes which make factories the schoolhouses of propaganda.

He closed with the statement that the one fundamental principle of human relations in industry was a generous interpretation and application of the Golden Rule.

Joint Meeting

The joint meeting of the Academy of Political Science and the Industrial Relations Association of America was opened at the Hotel Astor on the morning of Nov. 4. After an introduction by the president of the Academy the meeting was turned over to Sam A. Lewisohn, who presided at the morning session. In his opening remarks Mr. Lewisohn pointed out that while some questioned the relation between political science and industrial relations in reality industrial relations are the politics of industry. Or to raise it to a still higher plane, where it properly belongs, industrial relations should be considered the statesmanship of industry. In opening this conference, devoted to constructive experiments in industrial co-operation between employers and employees, Mr. Lewisohn pointed out the necessity of continuous co-operation and confidence as being necessary to the harmonious conduct of any business. While arbitration is highly desirable when it becomes necessary, it can only act after the disturbing facts have become realities, when in reality the questions at stake should never reach the arbitration stage if it is possible to avoid it.

He pointed out the vital need of proper employment management, or personnel work, as it has come to be called in many cases, and emphasized its importance. He urged employers to consider that it must not be thought of as a side issue to be delegated to some one who could keep peace in the industrial family, but that the employer himself should give as much time and personal attention to questions of personnel and morale as he did to business and mechanics.

Lead—Not Drive

He pointed out the desirability of settling so far as possible all questions within the plant, and gave as his belief that where proper relations were maintained there was very little need for a union among the workers. This however, varies with the nature of the industry, and in such cases as the building trades, where continuous employment with the same employer is almost out of the question, a strong union of the employees became necessary for their own protection. According to his statistics, from 10 to 25 per cent of industrial employers in thi country use advance methods in handling personnel problems. This showed a great need of education among employers, as well as employees, and h expressed the belief that courses in industrial relations must soon become part of the curriculum in our colleges. Summing up, he stated that the under standing of the human element in in dustry was the acid test of manage ment, and he quoted the slogan, "Le Employers Lead and Not Drive."

Charles B. Seger, chairman of th board of directors of the United State Rubber Co., spoke on "Employee Rep resentation and Personnel Work in Large Scale Organization With Man Plants." Mr. Seger has devoted large portion of his time to this wor and is thoroughly convinced that th solution of the problem of harmoniou relations is in establishing comple confidence between the men and th management. This can only com from knowledge and understandin based on truth and honesty of pu pose. Each side must know the oth as thoroughly as possible. Where t organization is so large that it becom physically impossible to know ea man personally, it becomes necessa to choose the representatives of t executives with extreme care, and provide channels whereby the work may secure information and expre his opinion on all matters pertaini to industrial management. Shop cou cils seem to provide the best meth for this, and if both sides make t proper effort no outside interferen will ever be necessary. The init step must come from the employ who must many times undo injusti of the past and establish confidence by methods which are fair in every particular. Each plant should so far as possible be a unit in securing and maintaining the confidence of its men.

PERSONNEL WORK AND CO-OPERATION

Under the title, "Executive Leadership and Personnel Work in Public Service Corporations," E. K. Hall, vice-president, American Telephone and Telegraph Co., told of that concern's work in securing co-operation among its 270,000 employees. Among the advantages are that it is not subject to seasonal fluctuations, nor to competition, but its disadvantage is that being a monopoly which is regulated as to profits it can hardly offer profit sharing as an inducement for co-operation. Then, too, its plant and its employees are so widely scattered that a large supervisory force is necessary. One of the great difficulties of this is that of securing enough minor executives to understand the handling of the human element, and it has been found that most of the friction comes from misunderstandings which occur very close to the working force. Being a 24-hour service makes it extremely difficult to get in personal contact with all the employees or to hold general meetings at which all can be present in any one district.

It is Mr. Hall's belief that one of the causes of industrial unrest is the fact that working men and women feel that they have no standing in the industry, but are simply small cogs in a huge machine. One of the compensations which we all enjoy is that of approval for good work done, and when this is overlooked it adds to the feeling of discontent. It is his belief that means must be found for giving workers a feeling that they have a definite place in the industry. In many cases the average man's connection with the industry is too narrow to give him a feeling of being part of the institution.

Working along this line Mr. Hall has endeavored to promote family feeling and to make people want to work together for a common aim. The company prepares organization charts which include everyone in the central station or district, from the manager down to the janitor, making them all feel that they are part of the family. This is in distinct contrast of the usual organization chart which only shows the heads of various departments and leaves all the rest in an unclassified mass. The result of this change was recently expressed by one of the employees of the company about as follows: "I have been working for this company for seven years, but up to a year and a half ago I felt that I was simply a servant of the family. Today I realize that I am a real, honest-to-goodness member and can sit down at the table with the family."

Fair wages, a status in the industry and opportunity to secure stock at a fair price (65,000 of their employees own $15,000,000 worth of stock) and the real desire for harmony, have done much to promote the best of relations in this company. The desire for harmony and real co-operation, however, must come from those at the top and cannot be successfully played up by anyone in the role of Santa Claus. It requires the highest kind of executive leadership to secure continuous co-operation in any industry.

"Stabilizing of Employment in a Diversified Seasonal Industry," by Henry S. Denison, president, Denison Manufacturing Co., was an extremely valuable contribution to the proceedings. Taking his own business as an example, he told how by co-operating with and directing the sales force the company had distributed its output on some eight thousand items quite evenly throughout the year. This required a careful analysis of the different departments and the working out of a plan for both educating and controlling the selling force.

In his opinion, many experiments which have been called failures at the end of a year or two have eventually worked out satisfactorily when sufficient time has elapsed for all parties to readjust themselves to the new conditions. In the same way betterment of any kind should not be "installed," but should grow from small beginnings with the mutual knowledge and help of all concerned. Mass action, except in the case of mobs, is very slow and if an experiment works out in from seven to ten years we should be perfectly satisfied.

The transfer of operators from one department to another has been found advantageous in maintaining a dependable working force. This, of course, requires training on two or more kinds of work, but the cost of this has been found much less than was anticipated and it has resulted in a more flexible working force as well as securing increased loyalty and co-operation. When an employee knows that should work fall off in one department he or she will be transferred instead of being laid off, there is no tendency to make the job last, and there is also a great increase in the feeling of really belonging to the family. Then, too, the worker is relieved of the monotony of continuous repetitive work, so that this plan has advantages of many kinds. Perhaps one of the worst features of the old method of laying people off was that the best workers rarely came back, as they secured jobs elsewhere leaving only the least desirable to answer the call for renewed activity. Here again it was pointed out that management is to be taxed with new problems and that the responsibilities of conducting business have far outgrown anything which our forefathers dreamed.

THE MYSTERY OF BUSINESS

Unfortunately, Charles R. Hook, vice-president of the American Rolling Mills Co., who was to talk on "Winning the Confidence of Employees by Taking the Mystery Out of Business," was prevented from being present owing to illness in his family. He was, however, ably represented by his personnel director, Mr. Rectanus, who outlined the plans which had been employed by this company since 1904. Advisory committees are elected by secret ballot, the privilege of voting and holding office being confined to employees who have been with the company a year. These committees take up problems of production, working conditions and other matters which affect both the company and the workers. The objects of the company, the way in which it conducts its business, the conditions of the market in general and the economics of business are discussed and made clear so that every man and woman in the plant has, or can have, a clear understanding as to the methods and practices of the company. The questions of investment, surplus, cost and profits are freely discussed, the executives believing that all problems of this kind should be made clear and that there should be no mystery which can harbor distrust and further the belief of exploitation of the workers. In some cases where it is not deemed advisable to make the exact figures public, a small group of workmen who are thoroughly trustworthy have been shown detailed statements before they were given to the directors and stockholders, in order that they might understand the exact conditions, and, without revealing figures, convince the rest of the men that the statements made by the company were absolutely correct. This is simply one of the ways of securing and maintaining confidence, without which real co-operation cannot be secured. It is Mr. Hook's belief that practically all of the mystery which has surrounded business so far as its employees are concerned is not only unnecessary, but is a direct cause of much distrust and misunderstanding.

UNEMPLOYMENT INSURANCE

Insurance against unemployment in a plant was discussed by Harold A. Hatch of Deering, Milliken & Co., the Dutchess Bleachery and the Abbeville Cotton Mills Co. This plan has been in operation for some time at the Dutchess Bleachery and consists briefly, of setting aside a portion of the earnings of the company for an unemployment insurance fund to be used when necessity arises. The employees also contribute to this fund in some cases. The percentages vary according to conditions, but the companies were fortunate in accumulating a sufficient fund so that the unemployment insurance is still in operation as much as necessary. Under this the employees who are laid off through no fault of their own receive half pay during the periods of unemployment. Mr. Hatch pointed out that this, of course, could not be continued indefinitely but that the plan had been of material help during the present depression.

This subject was also discussed by O. D. Young, treasurer, General Electric Company, and others. Some expressed the fear that a plan of this kind might tend to prevent savings on the part of the employees themselves, and it is quite probable that all cases of this kind must go through a preliminary stage during which we must all be educated to the poorer conditions.

The afternoon session was devoted to "Industry-wide Co-operation," with Samuel McCune Lindsay presiding. Under this heading Matthew Woll, president, International Photo-Engravers Union, and F. A. Silcox, director, Department of Industrial Relations, United Typothetae of America, told of standardization and co-operation in the printing industry. Joint relations in an industry without plants were discussed by Ernest Trigg, vice-president, John Lucas & Company. Co-operation within the clothing industry was presented by Earl D. Howard, chairman, National Board of Labor Managers for the Clothing Industry. L. K. Comstock, president, L. K. Comstock & Company, spoke of joint and national counseling in the electrical construction industry, and the development of co-operation in industrial relations within the leather goods industry was presented by S. K. Prokesch, of Robbins & Prokesch. These cover a wide range of industries and it is particularly interesting to note that progress has been made in all these lines.

Hoover Analyzes Labor Unrest

The third session was held in conjunction with a dinner meeting of the Academy of Political Science. Herbert Hoover, presiding officer, in pointing out the value of good will and co-operation in industry, gave a brief analysis of labor conditions as they exsit today.

Mr. Hoover referred to the universal desire for the limitation of armament, not only internationally but industrially, stating that warfare is becoming more destructive year by year. He expressed the idea that there is arising in the community the desire for a better basis of settlement of industrial disputes, referring particularly to transportation and coal, fields in which "two per cent of the population may jeopardize the comfort and security of the other ninety-eight per cent."

A Third Party

In referring to altercations between employee and employer he stated, ". . . . their very discussions now send economic shivers through the whole community, even though they have no intent to engage in battle. The public is coming to believe, whether justifiably or not, that in these mobilizations on both sides there may yet be a tendency to come to terms on such a basis as will pass mutual charges on to the public. As a result of these things we have seen the gradual extension of the arm of the public to these disputes through both administrative and legislative action. We also witness this extension of public interest bitterly resented both by the employers and employees. The thing that must concern us all is that the entrance of the third party into these disputes will be in such form that it does not increase the ill will, that it shall be in such form as will secure justice and that will preserve the very foundations of initiative and that type of American individualism upon which our whole social system is based, and that it will recognize the fundamental necessity to build up good will itself."

Unemployment was given as largely responsible for industrial unrest. "One of the causes of ill will that weighs heavily upon the community," said the speaker, "is the whole problem of unemployment. I know of nothing that more filled the mind of the recent conference, while dealing mainly with emergency matters, than the necessity to develop further remedy, first, for the vast calamities of unemployment in the cyclic periods of depression, and, second, some assurance to the individual of reasonable economic security —to remove the fear of total family disaster in the loss of the job.

There Will Be a Remedy

"I am not one who regards these matters as incurable. Thirty years ago our business community considered the cyclic financial panic as inevitable. We know now we have cured it through the Federal Reserve System. The problem requires study. It, like our banking system, requires a solution consonant with American institutions and thought. Many American industries are themsleves finding solutions. There is a solution somewhere and its working out will be the greatest blessing yet given to our economic system, both to the employer and the employee. There is also in this great question of unemployment the problems of seasonal and intermittent industry; some of them are incurable, but some are not, and every one cured is a contribution to the solution of these matters.

"An exhaustive study of these problems on a national scale is being undertaken by the President's Unemployment Conference and this study will be carried on by men active in industry itself.

"In industry as a whole it seems to me that the industrial conference expresses the key to all advance in these relationships. It is idle wholly to deny the existence of conflicting interests between employers and employees. But there are wide areas of activity in which their interests coincide. It is the part of statesmanship to organize identity of interest where it exists in order to reduce the area of conflict."

A British Point of View

B. Seebohm Rowntree, president Rowntree & Company, Ltd., cocoa works, York, England, spoke on "Conditions Essential to Industrial Co-operation from a British Employer's Point of View." He complimented American business men upon the efficiency with which they have handled their material problems, but stated that the same effort is not being exerted on the human problems. He gave three theoretical ways of solving the problem of industrial unrest, with the qualification that the first two will not work: (1) Capital shall grow so strong that labor will not dare to raise its head; (2) capital might federate on the one side and labor federate on the other, each seeking to become so strong that the other would not dare attempt to destroy the balance of power; (3) both sides may seek out the causes of industrial unrest and attempt to remove them. Industrial unrest is a reflection on the ability and intelligence of the employer. To secure industrial peace, he must pay the price, consisting of commensurate wages, sufficiently short hours, a guaranteed economic security to the worker, and possibly a proper share of the profits of the work.

A Living Wage

Commensurate wages he defined as wages that must be paid to the least skilled worker to enable him to marry, live in a decent house, raise a reasonably large family and have enough left over for necessary recreation. His definition of sufficiently short hours was that the worker must have a long enough period away from the factory to enable him to re-create his powers. Industry will in all probability become more mechanical and the tendency will be for work to become more monotonous, so that there enters not only the question of fatigue, but also the question of renewing mental powers.

The third point was considered by the speaker to be of the greatest importance. The worker must have economic security. The sense of insecurity at present existing is like a dark cloud hanging over his head. "If the proper maintenance, of industry," said Mr. Rowntree, "requires a surplus of men why should not industry contribute to the maintenance of that surplus?" His constructive suggestion was that there be a mutual insurance against unemployment, so arranged that the worker contribute each week from his pay and the employer set aside with it a given amount each week. Such an arrangement would be parallel to that now existing to protect stockholders. The plan could be operated by the State or by the industry as a whole or by the individual employer in his own works.

The fourth point, the status of the worker, is becoming more prominent each year. As the worker becomes educated he is more given to wondering why he sould not have some voice in deciding how he should conduct himself in the shop.

Profit Sharing

Mr. Rowntree expressed himself as a little bit uncertain about the fifth point. He stated that he is inclined to believe that if there is anything left over after a fair profit has been made and capital has been paid enough so that new capital will be attracted, then labor is entitled to a share.

His conclusion was that if the employer will pay the amount specified in the five points referred to the goods will be delivered and that there must be introduced into business the spirit of real sympathy so that employees are led and not driven.

Labor's Point of View

Hugh Frayne, general organizer of the American Federation of Labor, spoke on the subject, "From the Worker's Point of View." He admitted that there exists a lack of co-operation and good will and stated that we cannot go on as we have been, as there must be a limit. "I believe we have almost reached that limit now," he said. He expressed his willingness to welcome any movement which will bring together labor and capital to establish a program of mutual satisfaction and production.

James J. Davis, Secretary of Labor, enumerated various sub-divisions of the department's plans. He stated that he is against what is merely the living wage and that he favors a saving wage, explaining that a lesson thoroughly learned by the working man from the war and from experiences after the war is that he must save.

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Opponents of Metric Bill To Be Heard

Hearings on Senator Ladd's metric system bill are to be resumed, according to present plans, during the latter part of November. At that time the opponents of the measure will present their side of the case and attempt to refute the arguments made in support of the legislation.

There is reason to believe that there will be opposition to this legislation from within the administration if the bill should advance sufficiently far on its legislative course to call for an expression from that quarter. It is known that the official whose opinion would probably govern in such a situation does not believe it is wise to adopt legislation of this sort at this time. He regards the metric system as an ultimate but rather distant ideal. Before attempting to clamp it down on the Nation as a whole, he thinks time should be allowed for a knowledge of metric weights and measures to percolate more thoroughly. Even then he would be opposed to a general application of the system by compulsory methods. He thinks it could be applied first in a limited way and gradually extended.

Air Mail Service Makes High Record

An almost perfect record of performance is reported by the Air Mail Service during July, August and September. The performance of the entire service was as follows:

"Percentage of performance 98 per cent; number of miles flown with mail 391,018; number of letters advanced 10,014,280. The performance by divisions: New York-Chicago 98.5 per cent; Chicago-Rock Springs 97.6 per cent; Rock Springs-San Francisco 98 per cent.

"In addition to the 391,018 miles flown with mail on regular schedule, the records show 49,662 miles of test flights and ferry trips, making a grand total of 440,680 miles flown in the three months.

"During the quarter, we had eleven crashes. In two accidents the ships were completely destroyed. In eleven cases of damage, eight occurred on our fields and three at points of forced landings.

"During the quarter, there were no fatalities or injury to employees on one regular mail trips. However, there was one fatality on a ferry trip. On July 16, 1921, Pilot Howard Smith lost his life in ship No. 222 on the San Francisco field. He was assigned to ferry this ship to Reno and fell from an altitude of 300 ft. on the home field.

"The cost per mile of operation during this period was: July 73 cents, August 71 cents, September 70 cents. This shows an average of 71⅓ cents per mile during this period. The records show that the cost during the same quarter of the year 1920 was 87 cents per mile.

An exceptionally good record is being made on that portion of the transcontinental route between Cleveland, Ohio, and Chicago, Ill. The air distance is 335 miles. The last date on which a mail trip was defaulted was April 29, 1921. We have completed 24 weeks of 100 per cent performance on this leg of the route and we are now on our twenty-fifth week without a break. During the 24 weeks, the mails were flown 96,480 miles without default.

"A record flight was made by mail planes between Salt Lake City and San Francisco on Friday, Oct. 14. The time consumed from take-off at Salt Lake City (5:32) and arrival at San Francisco (11:33) was six hours and one minute. A stop for service of eleven minutes was made at Elko and a twenty-minute service stop was made at Reno; therefore, the actual flying time was five hours and thirty minutes.

"Train No. 9, the fast exclusive mail and express train operated over the Southern Pacific Railroad has a schedule of 24 hours and 15 minutes between Salt Lake City and San Francisco.

Details as to the **accidents are shown** by the following:

Date	Location	Cause	Damage
July 2	Honey Creek, Iowa	Anemometer pump failed	Propeller damaged.
July 11	San Francisco, Cal.	Skid landing	Propeller and radiator.
July 13	Elko, Nev	Pancake landing	Damaged landing gear.
July 13	Cheyenne, Wyo	Wind blew ship over on ground	Propeller, radiator and other slight damage.
July 15	Rock Springs, Wyo.	Hit light and dead air	Propeller, radiator, wings and landing gear.
July 15	Washington, N. J.	Forced down in storm	Broke longerons.
July 16	San Francisco, Cal.	Unable to pull out tail spin.	Ship totally destroyed.
July 20	Bellefonte, Pa	Pancake landing	Broke bottom longerons.
July 27	Chicago, Ill	Broke wheel in landing	Propeller, radiator, lower wing panels.
Aug. 4	Concord, Cal	Out of gas	Broke longerons, damaged wing and landing gear.
Aug. 6	Elko, Nev	Overshot field	Ship entirely destroyed.

Eleven cases of damage, eight occurred on or around fields and only three cases of damage at points of forced landings.

Cushing's Survey of Coal Situation

After personal visits to a number of coal consuming centers, and a telegraphic survey of the situation among wholesalers, George H. Cushing, managing director of the American Wholesale Coal Association, has reached the following conclusions:

(1) The stocks of high-priced goods of all kinds have about been worked off. Manufacturers everywhere are buying raw material only after they have orders for the finished product, manufacturing the raw material into a finished product as quickly as possible and are making shipments almost instantly. Everywhere there is a definite feeling that price liquidation has reached bottom on the present wage scale. Everywhere there is a feeling that business activity is starting to resume and there is an expectation of a price recovery.

(2) That stocks of coal in the hands of retail dealers are equal to November demands for at least two weeks and range in some places as high as three weeks. Almost uniformly public utilities have on hand a thirty-day supply of coal. The householders have taken coal into their own bins to the extent of between 30 and 40 per cent of their winter's requirements. Stocks on hand by industrial plants range from practically nothing at all up to a supply equal to 100 days.

(3) There was no general belief that the railroad strike would occur. There was a little precautionary buying but not much. In one or two places there were slight prices advances. Generally the market was dull.

(4) In Ohio and western West Virginia and eastern Kentucky there is already a shortage of cars. It is rather surprising to see that railroad movings have been for three weeks on the basis of 95,000 cars per week which is about equal to the average of 1918, and is getting close up to what heretofore might be considered prosperous times.

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Kempsmith Co. Makes Film of Milling Machine at Work

Under the supervision of Sumter Calvert, manager of the industrial department of the Society for Visual Education, a moving picture has been taken of a Kempsmith milling machine, manufactured by the Kempsmith Manufacturing Co., Milwaukee, Wis. The film shows the unit assembly of the machine and brings out the accurate building of its component parts. A machine in operation was also photographed, giving close-up views of the cutters and the removing of chips. Another film shows the operation of cutting a gear, bringing out the manner in which a tooth is cut.

The pictures will be used in vocational education work.

America Must Wake Up To Possibilities of Foreign Trade

The following paragraphs are taken from an address by Dr. Frederick Willson, of Reading, Pa., before the Industrial Relations Conference under the auspices of the Pennsylvania State Department of Labor, held at Harrisburg on Oct. 24 to 27:

There was a day when the American business man thought the best way to manage his affairs was to stick closely to his desk at all times and to write a complaining letter to his Congressman once in a while when things did not seem to be going well. However, changed conditions induce new activities and so of late we are finding it advantageous to leave our desks occasionally and visit other countries. The reason for this change of attitude is not far to seek. During the late war, all industries in the United States were stimulated to larger production through increase in their physical equipment and now that the war is over, many factories find they must develop an export outlet for 25 to 35 per cent of their production if plants are to be operated on a profitable basis. It becomes highly important for us to ascertain, therefore, whether it is possible now, or in the near future, to find an export market for our products, while along with this question, and overshadowing it, is the doubt as to the ability of American manufacturers to continue even to hold their domestic market against foreign invasion.

A VITAL QUESTION

With idle factories and millions of workmen deprived of the means of livelihood, these questions are of vital importance. So involved are the fundamental conditions underlying business in these days that it becomes the imperative duty of the live executive to get under the surface of things and to do a little thinking for himself.

The group of nations that were neutral during the war, including Norway, Sweden, Denmark, Holland and Spain, are undoubtedly in better shape in many particulars than the belligerent countries, but they too have their troubles at the present time because of greatly increased commodity prices, a tremendous advance in labor cost, and all the other evils which accompany development of trade and industry under the forced and unnatural conditions induced by the war. Seafaring countries like Denmark and Holland were particularly affected this year by the decrease in shipping. While in Copenhagen I saw literally hundreds of large ocean-going steamers lying at anchor, the condition at that time being more than unusually acute owing to the protracted coal strike in Great Britain.

Industrial conditions in Belgium are very much depressed, owing to lowered consumption at home and inability to meet foreign competition. Belgian Trade Unions reported in February of this year that $22\frac{7}{10}$ per cent of their membership of 621,000 were unemployed; the textile trades, as in France suffering very heavily.

The impression a stranger gets in Great Britain is that there is a woeful lack of mutual confidence and understanding between Capital and Labor, with the unfortunate result that instead of all interests getting together for the common good there is a tendency to lean upon trade organizations formed for purpose of conflict rather than to promote industrial peace. Under such

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Grinding Stand, Tool

Frontier Machine Tool Co., Inc., 128 Lakeview Ave., Buffalo, N. Y.

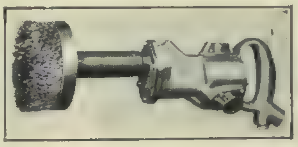
"American Machinist," June 9, 1921.

The machine is of the ordinary wheel-stand type, is belt-driven and carries two wheels. Guards are furnished for the wheels, and rests for the work. A countershaft can be furnished. The wheels are 12 x 2 in. in size and 15 in. apart. The height of the center of the spindle is 39 in. and the floor space required is 18 x 24 in. The machine without the countershaft weighs 195 lb. net, and 215 lb. crated. The countershaft has a length of 24 in., a drop of 7 in., and weighs 58 lb.

Brush, Wire, for "Little David" Air Drill

Ingersoll-Rand Co., 11 Broadway, New York, N. Y.

"American Machinist," June 9, 1921.



The brush is for use with the standard No. 6 "Little David" pneumatic drill, on which it is shown. It has a face diameter of 5 in. and is made of wires of heat-treated steel. It is said to be sturdily constructed, so that it will stand up under severe service. The wire-brush outfit is adapted to the removal of paint, rust, scale and dirt from tanks, steel cars, structural and sheet-metal surfaces, as well as to cleaning iron, steel and aluminum castings. The whole outfit weighs 11¼ lb.

Grinder, Portable, Pneumatic, No. 22-G

Keller Pneumatic Tool Co., Grand Haven, Mich.

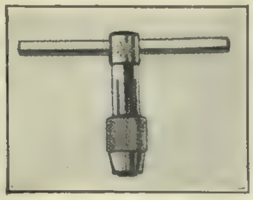
"American Machinist," June 9, 1921.

The motor is of the rotary-piston type and is stated to maintain its speed under load. The construction eliminates crankshaft and connecting-rod thrust, and thus any vibration that might be due to these parts. The object of the design has been to develop a tool that will be both handy and well-balanced, it is said, thus lightening the strain on the operator. The tools are built in two sizes, the smaller weighing 5¾ lb. and the larger, 18 pounds.

Wrench, Tap, Adjustable

Consolidated Tool Works, Inc., 296 Broadway, New York

"American Machinist," June 9, 1921.



The tool is made from solid bar steel, and is ground and polished to a finish. It is said to be a very handy wrench, being quickly and easily adjusted by means of the threaded collar for holding different sizes of taps, drills, reamers, wire and other articles. The wrench is made in two sizes, the No. 70 tool holding taps up to ¼ in. in size, and the No. 80 up to ½-in. taps.

Reamer, Expansion, Pilot-Blade

New Britain Tool and Mfg. Co., New Britain, Conn.

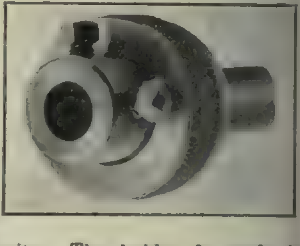
"American Machinist," June 9, 1921.

The reamer is of the six-blade expansion type with the entering ends of the blades reduced in diameter to serve as a pilot, to keep the reamer straight, and to prevent "digging" and chattering. A complete range of sizes from 15-32 in. to $4\frac{1}{16}$ in. is made. The construction is the same as in the standard expansion reamer manufactured by the company. The tool is intended especially for garages.

Holder, Floating, Reamer and Counterbore

Randa Mfg. Co., 1316 E. Jackson St., Muncie, Ind.

"American Machinist," June 9, 1921.



The device is adaptable for use on automatic screw machines, turret lathes and boring mills, to hold reamer shanks of different sizes, either straight or tapered. The driving is accomplished by means of a square block fitting into correspondingly shaped recesses in both the shank and the floating member. The wearing surfaces are hardened and ground. It is stated that the device is very accurate, the reamer being held parallel to the axis of the spindle and that it can work continuously to close limits. The holder is made in three standard sizes, the No. 1 size holding up to ½ in. reamers, the No. 2 size those ½ to 1½ in. in diameter, and the No. 3 size reamers above 1½ in. The two larger sizes are made so as to provide oil feed for the reamer.

File Grip, Outer, Safety

J. L. Osgood Tool Co., 43 Pearl St., Buffalo, N. Y.

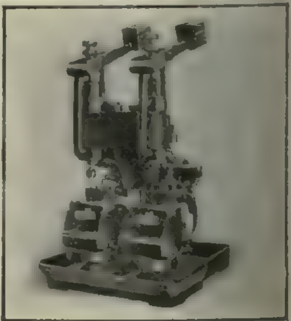
"American Machinist," June 9, 1921.

The grip is intended for use on the outer end of a file, the illustration showing it in place. The device is made of rubber, and is pliable and soft, so that it both holds itself in place when slipped on the end of the file, and also prevents cutting and soreness of the hand which occurs from constant pressure on the file teeth. It is stated that the use of the grip enables the holding of the file flat on the work. The grip can be used as a soft-face mallet for light driving on finished surfaces. In case the file be dropped, the cushioning action of the grip prevents breakage of the file or injury to the work on which it may strike. The grip is made for all sizes and shapes of files.

Jig, Drilling, Pin, Automatic

Kingsbury Manufacturing Co., Keene, N. H.

"American Machinist," June 16, 1921.



This pin-drilling jig is for use with the two-spindle automatic sensitive drilling machine made by the concern and described in the "American Machinist" on page 1066, Vol. 53. The jig operates in conjunction with the drilling machine, so that the operation is completely automatic, the illustration showing the jig adapted to drilling the crossholes in small pins, rivets or screws. When the operator pushes the pin to be drilled in place, the spindle is released from its position at the top of its stroke, the pin is automatically locked in place, and the cycle carried through automatically until the spindle rises and the drilled work is unclamped and ejected. When drilling comparatively deep holes, the drill is raised when it is part way through the work.

Clip, paste on 3 x 5-in. cards and file as desired

conditions it is hardly a matter of surprise that the cost of production of most fabricated articles has risen to such a point in Great Britain that great fear is expressed of her ability to retain either her domestic or foreign trade. In many cases the cost of production of British made goods exceeds the selling price of similar German goods in foreign markets and the effort of the government to control the situation by means of reparation duties and "Anti-Dumping" restrictions apparently has not improved a condition due in so large a part to mal-adjustment at home.

In the opinion of many, Germany is by far the most interesting European country to visit at the present time. A people with many ideals different from our own, traits of character which we may not like and internal problems still awaiting solution, may yet teach us much or at least yield us food for reflection. Considering the difficulties of life, the financial burden, and the internal troubles which Germany is called upon to meet, it is astonishing to see the remarkable progress that is being made. In 1919 there were more than 1,000,000 workers in Germany out of employment but at the present time hardly a quarter of that number are idle. It is said that German industries on an average are working 55 or 60 per cent of full capacity and from personal observation, I know that this degree of activity is even exceeded in certain lines of industry.

Unquestionably in its industrial life Germany is forging ahead and I feel that we need fear German competition more because of the indomitable energy manifested in the country than because of the temporary export advantage which they seem to enjoy through the depression in the value of their currency. Much has been written about the ability of German merchants to undersell us in the American market because of this difference in exchange, but it must not be forgotten that taxes and wages are rising in their country as the purchasing power of the mark falls and consequently the cost of production of fabricated articles expressed in their currency is even from fifteen to twenty-five times greater than before the war—thus neutralizing to a considerable extent the commercial advantage about which we hear so much.

Without dwelling on certain points of difference in our point of view, Germany impressed me as a giant nation temporarily prostrated but vibrant with awakening energy and ambition.

To compete with Germany in staple lines of manufacture will not be an easy thing at best but we cannot too earnestly point out that in attempting to meet this situation we should study to improve methods of production, rather than to depend on tariff protection alone, for permanent relief. The recent report of the Committee on the Elimination of Waste in Industry of the Federated Engineering Societies gives sufficient evidence that we in America have been thoughtlessly wasteful to a degree that imperils our future prosperity. If we do not develop better methods we shall have no one but ourselves to blame if foreign competitors steal our business prestige from us. Particularly in the line of industrial relations is it important that conditions should be stabilized. In 1920 this nation lost through strikes alone a total of over 11,000,000 days of labor. Considering the gigantic task of business defence that confronts us, should not Capital and Labor each undertake its proper and fair part in the readjustment, uniting their forces to help uphold the supremacy of American industry? The present depression and our doubtful future is due to economic causes which cannot be ignored. Entrench ourselves as we may, the fact remains that in industry as in other games of skill, the best man wins. What Capital and Labor in this country need most to take to heart is the naked truth about the foreign situation, so that they may realize we are facing a struggle in which victory and affluence will come only to the nation whose spirit of industry and unselfish co-operation rises supreme over all other considerations.

Business Items

The Runnels-Cummins-Emery Corporation, Milwaukee, Wis., has purchased the Folsom Miller Company's plant at Markesan, Wis. The new owners manufacture electric washing machines, and will continue that work in the new location.

The Westinghouse Electrical and Manufacturing Co. has purchased the plant of the Kilbourne & Clark Manufacturing Co. at Seattle, Wash. The plant will be used as an assembling factory for the Western territory.

The Milwaukee Motor Products, Inc., is the new name assumed by the Milwaukee Auto Engine and Supply Co., of Milwaukee, Wis.

The Arrow Machinery Co. has been organized at Philadelphia, Pa., with salesrooms at 234 N. Third St., where a full line of machine tools and mechanical equipment will be carried. U. A. Heilprin is manager.

The stock, equipment and property of the Globe Metal Products Corporation, Sheboygan, Wis., manufacturer of all metal products, will be sold at public auction soon, to satisfy an execution held by the Citizens State Bank, Sheboygan, Wis.

The Lake Laboratories, Inc., has just been organized at Elkhart, Wis., with George C. Trotter and William H. Burke as incorporators. The new company will manufacture electrical and mechanical devices.

The Pullman Company and the American Car and Foundry Co., at Wilmington, Del., have increased their working force during the past month.

The Liberty branch plant of the Trumbull Steel Co., at Warren, Ohio, has resumed operation in six of its eight mills; about 5,500 men are now employed.

The New Process Gear Plant of the Willys-Overland Co., has contracted to produce the differential gears for the Durant automobiles.

The Associated Motors Industries has taken over the plant and other property of the Jackson Motors Corporation at Detroit, Mich. This new organization is an association of passenger car, truck and accessory manufacturers, combined to meet changed conditions in the industry.

The Gilbert & Barker Manufacturing Co. has opened its latest foundry at West Springfield, Mass. The new building with its equipment is said to have cost approximately $300,000. S. Griffiths is the superintendent.

According to a survey recently completed by George C. Smith, director of the Industrial Bureau of the Board of Trade, Baltimore, Md., there are thirty-four industrial concerns in and near Baltimore which are building new plants or additions to present plants at a total cost of approximately $27,000,000.

With a capital stock of $30,000 the Dixie Tool and Novelty Co. has been organized and incorporated at Charleston, S. C. The following officers are named: V. L. T. Cooper, president; J. H. Roberts, vice-president and general manager; O. J. Muller, secretary and treasurer.

The Bridgeport Motor Truck Co., Inc., Stratford, Conn., has recently moved its plant to Bridgeport, Conn., where it will have more floor space. The company makes the "Bridgeport" motor trucks and was recently incorporated in New Jersey with a capital stock of $1,100,000.

The Kraut, Brenton and Salvucci Co., of Bridgeport, Conn., was recently incorporated to manufacture and deal in reversing devices, turrets, etc. The capital stock of the new company is $20,000. The incorporators are C. F. Kraut, H. J. Brenton and Daniel Salvucci, all of Bridgeport, Conn.

The Hartmann Manufacturing Co., of Hartford, Conn., filed a certificate of incorporation in the State of Connecticut. The company will engage and deal in drill presses, tools, machinery, etc. The capital stock is $25,000, and the incorporators are L. H. Sherwood, R. A. Hartmann and P. W. Porritt, all of Hartford.

The Peerless Die & Tool Co., Cincinnati (Ohio), through its secretary-treasurer. Harry F. Thomas, has admitted the statements of creditors that it is solvent, and is willing to be adjudicated a bankrupt. A majority of the creditors have signified willingness to accept the compromise offered for settlement of their claims and the arrangement is to be given approval in the United States District Court.

The Coats Machine Tool Co., Inc., 110 West 40th St., New York, N. Y., has recently been appointed the sole American agent for the Hirth minimeter and the Fortuna internal and face-grinding spindles, both of which are manufactured by the Fortuna Werke, Connstatt-Stuttgart, Germany. the concern has also taken over the American agency for A. Leonard & Co., Ltd., London, England, and will sell the renewable single- and double-ended plug gages made by that concern, as well its line of plain and universal V blocks, toolmakers' knees, taper test gages, parallels and box parallels.

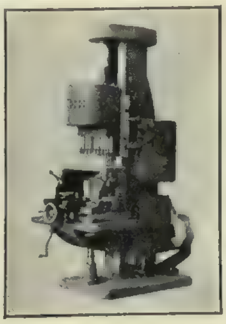
The Cortland Grinding Wheel Corporation has bought from Archie D. Robinson and the Maxf Grinding Wheel Corporation the property of the Hampden Corundum Wheel Co. in Chester, Mass., the purchase price being about $115,000.

United States Hardware and Manufacturing Co., of Pawtucket, R. I., has recently been incorporated to manufacture and deal in hardware, etc. The company was organized under the laws of the State of Rhode Island. The incorporators are John R. White, Providence, R. I., Harry P. Burnham and John D. Sawyer of Pawtucket, R. I.

Condensed-Clipping Index of Equipment

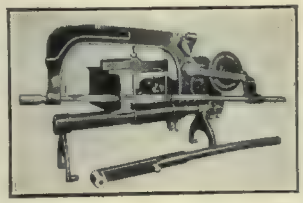
Patented Aug. 20, 1918

Drilling and Tapping Machine, Multiple-spindle, Vertical
Defiance Machine Works, Defiance, O.
"American Machinist," June 16, 1921.



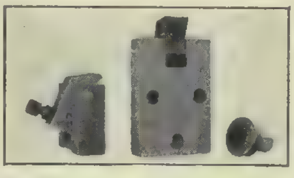
The machine is intended for drilling or tapping a number of holes in a piece simultaneously. The spindles are held in a head with the center distances fixed, so that a different spindle head is required for each part handled. The machine is thus primarily a single-purpose one. The work is held in a quick-clamping fixture either plain or of the tunnel type, and is usually brought to the machine on a conveyor at the height of the fixture. The head feeds down automatically to the work. All moving parts in the head as well as in the other units are oiled either by splash or spray, it being intended to keep a mist of oil in the compartments surrounding the moving parts. The machine can be driven by belt or by individual motor. If desired, two heads can be operated simultaneously, one above and one below. The machine shown is fitted for drilling, although it can be equipped for tapping.

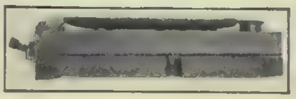
Saw, Hack, Power, High-Speed, "Economy," No. 400
W. Robertson Machine and Foundry Co., 56 Rano St., Buffalo, N. Y.
"American Machinist, June 16, 1921.



The machine can be used as a general utility saw in the shop when fitted with the two legs as shown. By removing the front leg, it is suitable as a rail saw for use on street railways. The electric current is ordinarily taken from a lamp socket, but where it is not available, the machine may be driven by hand by means of the lever shown lying in front of the saw, after connecting the lever to pins on the crank disk and on the frame. The machine has a maximum capacity of 8 in. and uses 17-in blades. The motor is mounted on a bracket supported on the bed and drives the crank disk through worm gears running in oil. Gravity feed is used, and a lever engaging a stud is provided for holding up the saw while clamping the work.

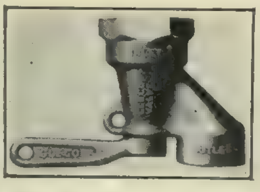
Dogs, Holding, Fixture
Cincinnati Engineering Tool Co., 4659 Spring Grove Ave., Cincinnati, O.
"American Machinist," June 16, 1921





These special dogs are for use on first-operation fixtures. At the top of the illustration are shown two sizes of the adjustable dogs, with one size of the stationary dog at the right. The lower part of the illustration shows the smaller adjustable dog and the stationary dog in position on a fixture, illustrating their use in holding work. The adjustable dogs with their holders are made of case-hardened machine steel and the stationary dogs are made of hardened alloy steel. It is said that the fixture is easily cleaned, as there are no projecting walls which hold chips. The work can be clamped close to the finished surface.

Valve, Air, Pressure-Seated, "Cleco"
Cleveland Pneumatic Tool Co., Cleveland, Ohio.
"American Machinist," June 16, 1921



Packing gaskets, stems and springs are eliminated, there being only three parts to the valve, the body, the plug and the handle. The air does not come in contact with the seat of the valve, which prevents damage to the seat and the necessity of replacing it. The air enters at the top of the valve, passing into the top of the hollow plug, and then out of the side of the plug and into the supply line. The turn in the path of the air is slight, so as not to impede the passage. The conical plug is forced in place on its seat by the air pressure itself. The valve is provided with a waste arrangement, to allow the pressure in the air hose on the outlet side to escape when the valve is shut off.

Drilling and Tapping Machine, Multiple-Spindle, Horizontal, Two-Way
Defiance Machine Works, Defiance, O.
"American Machinist," June 16, 1921.

The machine is intended for drilling or tapping simultaneously a number of holes in parts made in large quantities. It is especially adapted to use in conveyor lines employing vertical-spindle machines also, as it is not necessary to turn over the part to drill holes in the sides. The two heads move forward simultaneously. The spindles in the heads have the center distances fixed, so that a different head is required for each different part. The machine is thus primarily a single-purpose tool. The work is held in a quick-clamping fixture, usually of the tunnel type. The machine can be driven by belt or by an individual motor. Splash or spray lubrication is provided for the running parts. A drilling machine is shown, although the machine can be fitted for tapping.

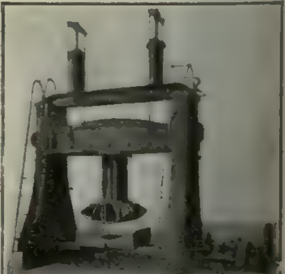
Saw, Hack, Power, High-Speed, "Economy," No. 2
W. Robertson Machine and Foundry Co., 56 Rano St., Buffalo, N. Y.
"American Machinist," June 16, 1921

This is the 1921 model of the No. 2 "Economy" power saw. The machine, which is a draw-cut saw having a capacity of 6 x 6 in., has been equipped with an oil-lift of the type employed on the larger machines made by the concern, and intended for relieving the teeth of the blade from the work on the idle stroke. The oil-lift device consists of a two-cylinder pump submerged in oil contained in the tank shown removed and placed beneath the machine. At the end of the cutting stroke the plunger connected to the crankshaft is on the down stroke, which forces the oil under the plunger connected with the frame, thus raising the saw from the work. It is said that the lift greatly decreases saw breakage. The machine is equipped with a swivel vise for cutting angles up to 45 deg. It is driven through a friction clutch and stops automatically when the cut is completed.

Testing Device, Hardness, Portable
Fritz Werner A.G., Berlin, Germany.
"American Machinist," June 16, 1921.

The portable hardness-testing instrument is operated on the Brinell principle and is not confined in its use to testing rooms, but is intended for workshops and stockrooms and for the small manufacturer. The maker does not claim high accuracy for the device, but that it fulfills all practical requirements. The tool is of simple design, making its handling easy and fool-proof. It can be used for testing stock in place, or set in the machine, not needing special test pieces. When the tool is used, it is held in the hands and the ball end is pressed against the piece to be tested. A piston moves forward, producing an impact of the ball against the piece under test. For ascertaining the hardness of the material, a transparent rule is supplied, showing two lines at a very acute angle and used to measure the size of the ball impression, as shown at the bottom of the figure.

Bulldozer, Vertical
Beatty Machine and Mfg. Co., Hammond, Ind.
"American Machinist," June 23, 1921.



The principal features of the machine are claimed to be the simplicity of construction and the location of the driving parts. The main shaft is mounted through the lower bed instead of overhead, and the main side gears are enclosed in the box-type housing, with all intermediate gears fully enclosed. Clutches and high-speed bearings are easily accessible. Air cylinders are used for counterbalancing the weight of the ram. The bulldozer is especially adapted to work on steel cars. The machine is built in sizes up to and including 500 tons ram pressure. The distance between the housings ranges from 8 to 12 ft. The stroke varies from 18 to 24 in.; and the weight from 12,000 to 24,000 lb.

Clip, paste on 3 x 5-in. cards and file as desired

The New Process Cutlery Co., of New Haven, Conn., has been incorporated under the laws of the State of Connecticut to engage in the manufacture of cutlery, etc. The capital stock is $50,000, and the incorporators are G. F. Hemming, B. W. Hemming and W. H. Hurley, all of New Haven.

Bateman, Inc., which operates the Belcher & Taylor Agricultural Tool Co. works at Chicopee Falls, Mass., along with plants in New York and New Jersey, has filed in the registry of deeds in Springfield, Mass., a mortgage for $700,000 to the Equitable Trust Co., of New York to secure an issue of 8 per cent five-year gold bonds.

The new foundry being constructed by the Clearfield Machine Shop Co. on South Fourth and Spruce Sts., Clearfield, Pa., is nearing completion; the firm is ready to install the equipment. A siding has been built from the Pennsylvania Railroad lines.

The Standard Bolt Corporation, a Delaware corporation, with headquarters in Columbus, Ohio, has taken over the plant and assets of the Standard Bolt Co. The new concern has been organized by the election of Justin C. Burns, president; and Harley E. Burns, vice president and secretary.

The Detroit Seamless Steel Tubes Co., of Detroit, Mich., for over twenty years manufacturer of seamless steel tubing, has found it necessary to increase the sales staff. The position newly created is that of assistant general manager of sales and C. C. Rosser, head of the department, has announced the appointment of C. H. Hobbs for this position. For fourteen years Mr. Hobbs has been with the Lackawanna Steel Co. and for the last five years been the district representative in charge of the Detroit Office.

The Hodes Zinc Manufacturing Co., Fremont, Ohio, manufacturer of fabric accessories for automobiles, has announced the purchase of the factory building of the Shelby Sales Book Co., in that city.

Personals

L. B. THOMPSON, formerly a buyer and salesman for the Simmonds Machine Co., Albany, N. Y., has resigned his position. He is now engaged in private business as a dealer in machinery and equipment.

CLYDE E. DICKEY, Woolworth Bldg., New York, has been appointed sales representative for the metropolitan district for the Peerless Drawn Steel Co., manufacturer of cold-drawn stock, shafting and alloy steels.

W. J. L. BANHAM, of the Otis Elevator Co., has been appointed commander of the manufacturing engineers division in the mobilization of New York business men in the "Budget Guard," under the supervision of Sam A. Lewishon. The movement is for national economy and lower taxes.

ARTHUR L. WALKER, professor of metallurgy in the School of Mines, Columbia University, New York, has been appointed a member of the board of Engineering Foundation. Prof. Walker succeeds Dr. J. W. Richards, of Lehigh University, who died recently.

J. M. DILLON, formerly New England representative of the Detroit Twist Drill Co., Detroit, Mich., is now in charge of the New York territory as district manager. His office is located at 45 Warren St.

SIDNEY M. HENRY, formerly a captain in the U. S. Navy and assistant to Admiral Taylor in the Bureau of Construction and Repair, has become commercial manager of the Emergency Fleet Corporation. His special work is the disposal of the surplus property of the Fleet Corporation.

L. E. COLLINGS, who was with the Gilbert & Barker Manufacturing Co., of West Springfield, Mass., a few years ago, has recently returned as sales representative of that company in the State of Michigan.

J. S. KENNY has recently joined the Los Angeles sales division of the Gilbert & Barker Manufacturing Co., of West Springfield, Mass.

N. A. HODGE has reecntly joined the general sales department of the Gilbert & Barker Manufacturing Co., West Springfield, Mass. Mr. Hodge will be located in the Des Moines, Ia., territory.

F. R. CROSIER, of the general sales department of the Gilbert & Barker Manufacturing Co., of West Springfield, Mass., has recently been transferred from the Los Angeles to the Chicago office of the company.

REUBEN T. COMER has recently joined the sales department of the Whitin Machine Works, Whitinsville, Mass. Mr. Comer was at one time associated with the Lowell Machine Shops and with the Anglo-American Textile Machinery Co.

ANTHONY F. HOLTMEIER, formerly in the sales department of the Hisey Wolf Machine Co., Cincinnati, Ohio, manufacturers of grinding tools, recently has been appointed district sales manager of that concern in the Pittsburg territory.

MORGAN OLCOTT, previously connected with Griggs & Myers, New York, is now with William T. Donnelly, consulting engineer of New York.

WARREN G. C. THOMPSON is assistant professor of mechanical engineering at Pennsylvania State College, having resigned his position as chief engineer for D. G. Dery, Inc., Allentown, Pa.

FRED W. RABE, formerly engineer for Westinghouse Electric and Manufacturing Co., Philadelphia, Pa., is now instructor in the mechanical engineering department of Sheffield Scientific School, Yale University.

H. R. BLAKESLEE has left the employ of C. F. Kenworthy, Inc., of Waterbury, Conn., and entered the engineering department of the Hendry Machine Co., of Torrington, Conn.

HARRY ROSS JONES, for eighteen years president of the United Alloy Steel Corporation, Canton, Ohio, and E. L. Hang, vice-president and secretary of the same concern, have tendered their resignations, effective Dec. 31. Both men will continue to serve on the board of directors, and Mr. Jones will continue to serve on the executive committee of the corporation until the next annual meeting.

CHARLES E. COATS, treasurer, Coats Machine Tool Co., Inc., 110 West 40th St., New York, N. Y., has recently returned from a four-month trip to England, France and Germany.

Obituary

HARTLEY HOWARD, JR., vice-president and general manager of the Packard Motor Car Co., died suddenly on Nov. 6 at his home near Pittsburgh, Pa.

HENRY S. REGESTER, Sr., aged 69 years, for many years secretary of J. Regester Sons Co., brass founders and bell manufacturers, Baltimore, Md., died on Oct. 31 at the home of his son, Henry S. Regester, Jr., Baltimore. Death was due to paralysis. Mr. Regester was born in Baltimore and when a young man became connected with the business which was established by his father, the late Joshua Regester. When the firm was dissolved about fifteen years ago he became a manufacturers' agent.

JAMES BROWN RIDER, aged 42, vice-president and general manager of the Pressed Steel Car Co., Pittsburgh, Pa., died at his home in that city on Nov. 3. He was ill two months. He began work with the Pressed Steel Car Co. in 1899 as a stenographer to James V. Maher and advanced by steps to the post as general manager.

Trade Catalogs

Francke Flexible Couplings. Smith & Serrel, general agents for the Francke Co., Newark, N. J. Bulletin No. 32, describing a line of flexible couplings and parts, for direct-connected machines. Tables of specifications giving complete data as to use and capacity are included.

Tube Welding Machinery. Davis-Bournonville Co., Jersey City, N. J. Catalog describing a line of welding and fabricating equipment, including slitters, forming machines, straighteners, seam grinders, swagers, cutting-off machines, benders and draw-benches.

Philadelphia Worm Gear Drives. Philadelphia Gear Co., Philadelphia, Pa. Circular describing modern speed-reducing units which feature these worm gear drives.

Ignition, Starting and Lighting Systems. Gilfillan Bros., Inc., Los Angeles, Cal. A catalog giving much valuable information and data for those interested in automotive equipment. The booklet is replete with charts, guides and full specifications for all the products described.

Dexter Chuck. The Levitt Machine Co., Orange, Mass. Circular "C" describing the latest perfected chuck as produced by this company, for use on foot and light power lathes. Lists of sizes and prices are included.

Ingersoll Milling Machines. Ingersoll Milling Machine Co., Rockford, Ill. Bulletin No. 41; a well-prepared and beautifully illustrated catalog, describing the latest drum-type, continuous milling machine. This machine is to mill grey iron castings and steel forgings of any weight or size. Each model is fully specified.

Industrial Furnaces. W. S. Rockwell Co., 50 Church St., New York City. Bulletin No. 234, the fourth of a series illustrating the practical applications of the principles of heat-treating, dealing briefly with the fundamentals that influence the quality and cost of heated products.

Forthcoming Meetings

The annual meeting of the Taylor Society will be held in the Engineering Societies Building, New York City, on Dec. 1, 2 and 3.

The annual meeting of the American Society of Mechanical Engineers will be held in the Engineering Societies Building, New York City, on Dec. 5 to 9.

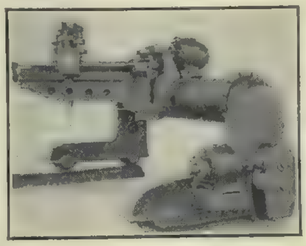
A dinner-meeting of the Metropolitan section of the S. A. E. will be held at the Automobile Club, New York City, on Dec. 15.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Drilling Machine, Gantry

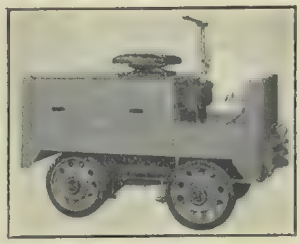
William K. Stamets, Jenkins Arcade Bldg., Pittsburgh, Pa
"American Machinist," June 23, 1921.



The machine is mounted on a track, the gage of which is broad enough to accommodate the plate to be drilled. The machine is traversed on the track by means of a separate motor. The drilling head is mounted on the radial arm which swings on a support attached to the cylindrical crossbeam. Machines having several heads and arms can be furnished. Arms can be mounted on each side of the cylindrical crossbeams, and more than one head can be mounted if desired. The drive is by an electric motor mounted on the crossbeam. The machine is adapted to the requirements of manufacturers of steel cars, tanks, boilers, or of any product where holes are to be drilled in plants.

Tractor, Industrial, Electric, Four-Wheel-Steer,

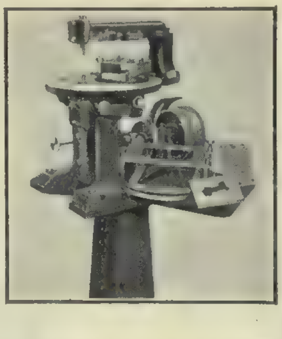
Atlas Car and Mfg. Co., 1130 Ivanhoe Rd., Cleveland, Ohio.
"American Machinist," June 23, 1921.



The principal feature of the tractor is the four-wheel-steering apparatus. The tractor can be furnished with either two- or four-wheel drive. It can also be supplied as a four-wheel-drive rail locomotive by substituting flanged steel wheels for the rubber-tired ones and omitting the steering mechanism. The driving axles are of the full-floating type with removable drive shafts. The controller is of the drum type, entirely enclosed, giving three speeds in either direction. The circuit breaker is integral, operated by means of a pedal. A "Powerlock" differential is used. The tractive effort is, under normal conditions, 400 lb. The speed is 6 miles per hour without load. Weight: with Edison battery, 3,700 lb.; with lead battery, 3,950 lb.

Die- and Templet-Making Machine

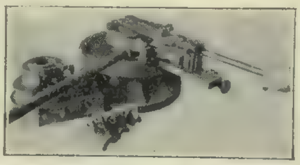
R. L. Hawkes, 212 Niagara St., St. Catherines, Ontario, Can.
"American Machinist," June 23, 1921.



The machine is intended for the production of dies, punches, templets, and similar tools at a lower cost and in less time than is possible with hand work. It is stated that an unskilled operator can, with a few instructions, make accurate tools, ready to be hardened. To operate, the die blank or templet is roughed out, and then placed in the fixture shown on the table of the machine. Then the guiding finger, which projects downward from the overhanging arm, is set to follow the outline of a design or similar templet on the top of the fixture, the cutting tool, which is a file, following the design and thus shaping the work in the fixture. Various shapes of files can be used, according to the profile of the work.

Bending Machine, Pipe

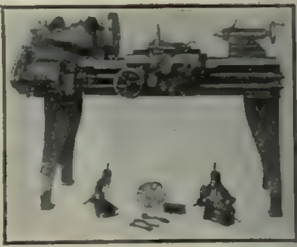
Leonard Machine Works, 1023-27 Race St., Philadelphia, Pa.
"American Machinist." June 23, 1921.



This machine is made in three sizes, No. 1, which bends pipe from 0 to $\frac{1}{2}$ in., No. 2 from 1 to 2 in., and the No. 3 from 2 to 4 in. The No. 1 machine, which is shown, can be furnished with or without a floor pedestal, while the Nos. 2 and 3 sizes are furnished with the floor pedestal as regular equipment. Each machine is equipped with four forming heads and four bending shoes, and special shoes can be furnished for handling unusual work. To operate, the pipe is slipped through the guard that protrudes from the forming head, and then the small pinion is rotated until the shoe is in contact with the pipe. As the hand lever is swung around, the pipe is bent at the forming head. The machine with forms for 1, $\frac{3}{4}$, $\frac{1}{2}$ and $\frac{3}{8}$-in. pipe weighs 115 lb., and with a stand, 225 lb.

Lathe, Quick-Change, 12-Inch, "Economy"

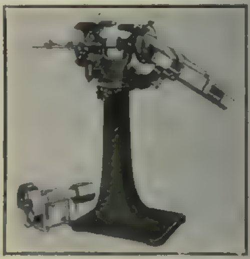
Rockford Lathe and Drill Co., Rockford, Ill.
"American Machinist," June 23, 1921.



A four-step cone pulley is provided for the drive, and is connected with back gears of a ratio of 8.06 to 1. The spindle has a $1\frac{1}{16}$ in. hole through it, permitting the use of draw-in collets up to $\frac{5}{8}$ in. capacity. The tailstock is offset to allow the compound slide to set parallel with the bed, and it is provided with a set-over for turning tapers. The carriage is provided with a thread indicator which can be disengaged when not in use. All feeds are reversed in the apron, and their controls interlock with the bronze lead-screw nut. A redesigned quick-change gear box provides thirty-two changes of feed, obtained through sliding steel gears and hardened steel clutches. The lead-screw rotates only when in use for thread cutting. Net weight, with 5-ft. bed, 1,300 lb.

Grinding Machine, Tap and Drill, Combination

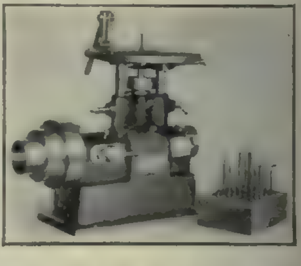
Grand Rapids Grinding Machine Co., Grand Rapids, Mich.
"American Machinist," June 23, 1921.



The machine is designed for shops having need for correctly ground drills and taps, and is said to combine all the advantages of single-purpose machines. The machine automatically grinds the same taper and clearance on every flute of a tap. The drill-grinding side of the machine is equipped with a holder stop, which, working in connection with the base of the diamond truing device, automatically places the drill holder in proper relation to the face of the grinding wheel. With the No. 10-A and 10-B machines, two types of wheel-truing devices are furnished, one for truing the periphery of the tap grinding wheel, the other for truing the face of the drill grinding wheel. Diamonds of approximately one-half carat are furnished for each wheel. The machine is made in two sizes, having net weights of 385 and 400 lb., respectively.

Filing Machine, Bench, Universal

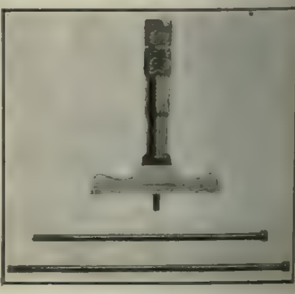
Boston Tool & Mfg. Co., 262 Dover St., Boston, Mass
"American Machinist," June 23, 1921.



This bench filing machine has both a reciprocating movement for using ordinary files and a rotary motion for round files or special milling cutters. The table can be tilted to any desired angle for the purpose of giving the requisite draft to the dies. An arm is bolted to the table, so as to furnish a rigid support to the upper end of the file. The reciprocating files are made parallel, so that the angle of clearance on the work is determined wholly by the angular setting of the table. The rotary files are tapered to suit the angle of clearance, the table being set square with the axis of the spindle. The machine occupies a bench space of about 9 x 12 in. and stands 11 in. high. The chuck is adapted to hold file shanks $\frac{1}{4}$ in. in diameter. The circular table is 7 in. in diameter and the stroke is sufficient to finish dies $1\frac{3}{8}$ in. in thickness.

Gage, Depth, Micrometer, B & S

Brown & Sharpe Mfg. Co., Providence, R. I.
"American Machinist," June 23, 1921.



The latest micrometer depth gage made by the concern is obtainable with either a $2\frac{1}{2}$ or 4 in. base. It is furnished complete with three measuring rods which enable readings from 0 to 3 in. to be taken by thousandths of an inch, the micrometer screw having a movement of 1 inch. The selected rod can be placed in position by removing the cap, which when replaced brings the nut on the rod against the seat. Using the nut as a shoulder permits individual adjustment of the rod. Adjustment is provided for wear of the threads on the micrometer screw.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

N. H., Berlin—The Berlin High School, D. W. MacLean, Headmaster—$25,000 worth machine shop equipment for new high school shops.

N. Y., New York—The Erie R. R., 50 Church St., Mechanical Dept.—sxity-four items machine tools and machinery for various shops. We have wired for confirmation but no reply received.

N. Y., New York—The Miller Brass Fitting Co., 33 Bleeker St.—No. 22 or 23 New Britain automatic chucking machine, (used).

Pa., Philadelphia—Arnold & Co., 1019 Cherry St., M. E. Arnold, Purch. Agt.—one 12 in. machine lathe, 5 ft. bed, and one 20 in. hand or power feed drill press.

Pa., Pittsburgh—The West Penn Power Co., West Penn Power Bldg.—three 28-in. drill presses, 3 grinders, three 24-in. shapers, 3 hack saws, 2 pipe machines, 2 hammers, one 24-in. drill, one 18-in. lathe and one 3-ft. radial drill.

Ala., Anniston—The National Forge Co.—
One lathe, 20 in. x 10 ft. bed.
Two motor driven blowers.
One 1 in. automatic upsetting or forging machine.

Ala., Birmingham—G. R. Mueller Co., Brown-Marx Bldg., G. R. Mueller, Purch. Agt.—

One 1½ in. capacity bolt threading machine, belt or motor driven.

One bevel shear, Lennox preferred, ⅝ in. to ½ in. steel plate, capacity, belt or motor driven.

One 3 ton capacity electric hoist, standard lift, 220 volt. 3 phase, 60 cycle current available, or one 3 ton capacity air hoist. (used if in good condition).

La., New Orleans—The Commercial Garage, and Auto Service Specialists, 915-23 Conti St.,—double end grinder, drill press and lathe (new or used.)

La., New Orleans—J. S. Grego, 3435 Dryades St., auto equipment, adjusting and socket wrenches, medium size reamers, etc.

La., New Orleans—The Orleans Steel Products Co., Inc., 1021-25 Bienville St., **W. Holzer, Mgr.**—One cylinder grinding machine for grinding automobile cylinder block.

One G. A. Ohl, ⅛ in. capacity power cornice press brake.

One 36 in. Niagara power gang slinging machine.

One 10 ft. G. A. Ohl or equal, power squaring or gap shear to cut 3/16 material. (used).

La., New Orleans—Rabito, Lind & Kraft, 1818 Carondelet St., (auto repair shop)—small Dalton lathe, (used), also automobile wrecking outfit.

La., New Orleans—Toulouse Auto Repair Shop, 825 Toulouse St.—small lathe, Dalton or equal, also drill press, auto jack and auto equipment.

W. Va., Charleston—The Nitro Mfg. Mine Supply Co., P. O. Box 1494, P. J. Rowan, Purch. Agt.—machinery and equipment for proposed machine shop and foundry.

Ill., Aurora—The Walker Laundry Co.—one 8 to 10 ft. lathe.

Ill., Chicago—The Amer. Metal Co., 2801 South Kedzie Ave.—one square shear, 136 in.

Ill., Chicago—The N. S. Ball Bearing Co., 4538 Palmer St., S. R. Schubert, Purch. Agt.—one bar shear and 5-in. roll bar.

Ill., Chicago—F. W. Mateer & Co., 230 West Ontario St., manufacturer of laundry equipment—one 8 in. jointer.

Ill., Chicago—The Reliance Iron & Steel Co., 2141 South Sawyer Ave.—power shear to cut up scrap.

Ind., Muncie—The Warner Corp., Clerk and Penn Sts., J. F. Warner, Purch. Agt.—two No. 12 Barber-Colman gear hobbing machines and one No. 13 Watco Multi drill with rectangular head, (used).

Mich., Detroit—The Dept. of Purchases and Supplies, 710 Marquette Bldg., G. J. Finn. Purch. Agt. one pipe and bolt threading machine also one set extra pipe dies.

Mich., Detroit—The Federal Motor Truck Co., 5780 Federal St., H. E. Snyder, Gen'l Supt.—forming or upsetting machine.

Mich., Homer—W. E. Dryer & Sons, 601 South Sophia St., E. W. Dryer, Mgr.—
One 36 in. lathe, 12 ft. bed.
One 18 in. lathe, 10 ft. bed.
One 24 in. or 30 in. shaper.
One 3 ft. or 4 ft. radial drill.

Set of high speed drills, size from ½ in. to 2 in., drills must be 32nds. over size.

One 12 x 14 hack saw or larger, also 24 saw blades to fit same.

One 36 in. band saw tilting table, also one extra saw.

One wood lathe, 36 in. capt.

One ¾ x ¾ in. power punch and shears combined.

One Emery arbor with 16 in. wheels.

One threading machine for bolts size ½ to 2 in. with taps and dies.

Two vices, one 8 in. Black Smith and one 8 in. Bench.

One air hammer.

One 40 ft. line shaft, pulley, hangers, belts, line shaft speed 200 R.P.M.

O., Cleveland—The Manual Training School, 2122 Prospect Ave.—No. 2 or 3 punch press (used).

O., Cleveland—The Perfection Auto Parts Co., 400 Lakeside Ave.—machine for maching connecting rods.

Wis., Cedar Grove—Lemke & Hesselink Co., H. Lemke, Purch. Agt.—equipment for auto repairing including lathe, 1 ton press, etc.

Wis., Fond-du-lac—B. F. Sheridan, Route 6—drill press and air compressor for auto repairs.

Wis., Kenosha—The Winther Motor Co., North Shore Rd., W. F. Swift, Purch. Agt. —machine tools and power machinery for proposed factory.

Wis., Madison—J. W. Pepper, 310 East Wilson St.—machinery for plumbing and millworking shops.

Wis., Manitowoc—K. O. Muehlberg Co., 209 North 9th St.—special machinery for proposed machine shop on 9th St.

Wis., Milwaukee—The Badger Beet Topper Co., 963 Mitchell St. manufacturer sugar beet topping machines. S. F. Parker, Purch. Agt.—lathe and drill press.

Wis., Milwaukee—Jack's Garage, 691 Mitchell St.—one lathe for auto repair shop.

Wis., Sheldon—L. A. Cox—equipment and machinery for auto repairing.

Wis., Milwaukee—J. Madis, 1184 24th St. —sheet metal manufacturer—square shears and brake.

Wis., Milwaukee—K. O. Muehlberg Co., 209 North 9th St.—tool room lathe.

Wis., Milwaukee—The Pauly Garage, 24th St. and 9th Ave. L. C. Pauly, Purch. Agt. —lathe suitable for auto repair duty.

Wis., Milwaukee—A. Schier, 728 Pearl St.—additional sheet metal working machinery.

Wis., Wauwatosa—G. Hummel, 2500 North Ave.—one machine lathe for auto repairs.

Mo., Lamar—The Osage Power Site Co., W. E. Banks, Mgr.—machinery for machine shop and power plant.

Ont., Windsor—Colonial Motors, Ltd., Exchange Bldg., J. O'Brien, Purch, Agt.—lathes, drills, presses and general equipment for the manufacture of autos.

Que., Montreal—C. Lapierre, 1611 Cadieux St.—full equipment for auto repair shop.

N. Y., Rochester—The Syracuse Supply Co., 306 Arlington Bldg., manufacturers of oak tanned leather belting, D. R. Clarkson, Mgr.—machine for straightening and taking kinks out of tubing from 2 to 4 in. in diameter and up to 25 ft. long, also a 36 in. squaring shear to take metal up to No. 14 gage.

Pa., Norristown—The Norristown Hosiery Mills—knitting machines for proposed mill in Lansdale.

Pa., Pittsburgh—The Standard Underground Cable Co., 15th St.—2 cranes one 5-ton, other 10-ton, floor operated, for new plant in Pittsburgh, also 2 cranes, one 5-ton and other 15-ton for St. Louis plant.

Fla., Daytona—C. M. Randall, 40 Orange St.—stump pullers, portable saw mills, cutting-off saws, wood splitters, tractors, heavy service plows, etc.

Ga., Savannah—W. J. Walker, Hicks Hotel —machinery and other equipment to manufacture cane syrup.

La., New Orleans—W. Ball, Purch. Agt., City Hall, is receiving bids for the installation of a 21 ton refrigerator plant to be installed in the Poydras St. Market.

S. C., Florence—The Hotel Florence, J. W. Heaps, Purch. Agt.—complete machinery for laundry.

W. Va., Clarksburg—The Imperial Ice Cream Co.—refrigerator machinery and equipment for ice cream plants. following capacities and locations, 100 ton at Huntington; 40 ton, Ashland, Ky.; 40 ton, Steubenville, O.; 40 ton, Staunton, Va.; 30 ton, Winchester, Va., and 30 ton, Harrisonburg, Va.

W. Va., Huntington—The H. T. Lambert Co., 1018 1st Natl. Bank Bldg.—manufacturers of railway equipment—15-ton overhead crane.

W. Va., Romney—Tas-Te Fruit & Canning Co., Inc., of Romney and 191 Market St., Paterson, N. J., P. O. Box 1454, P. R. Fredricks, Pres.—box and crate making machinery. Apple parers and corers also peach and cherry pitters. Six cast aluminum tanks, inside dimensions, 7 x 3 ft. and 1 ft. deep, walls ⅜ or ½ in. thick, reinforced top edge, rounded inside corners, no sharp creases or seams, reinforced bottom with ribs at least 1 in. high, running lengthwise on bottom of tanks, 9 in. apart, 4 in all. Heating apparatus for use with tanks, underneath, burning either oil or gasoline. Will consider electric equipment. Must be capable of bringing cold water up to boiling point and hold it at that point for one hour or more.

The Weekly Price Guide

This Week's Market

Pittsburgh mills continue to quote structural steel shapes, plates and bars at $1.50@$1.65 per 100 lb. Bars are easily obtainable at $1.50; but $1.60 constitutes the minimum on shapes and plates, with small tonnages selling at $1.65. Mill shipments, New York, continue at $1.88@$2.03; bars at $1.80@$1.88 per 100 lb. Steel warehouse prices remain firm in New York and Cleveland. Chicago quotes hoop steel at $3.28 as against $3.48 per 100 lb.; also general decreases in shop supplies and a slight advance in old metals.

Cleveland quotes solder at 21c. as compared with 23½c. per lb., formerly.

Linseed oil declines 3c. in Cleveland and advances 2c. per gal. in Chicago.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$24.50
Northern Basic	22.52
Southern Ohio No. 2	23.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	30.26
BIRMINGHAM	
No. 2 Foundry	20.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	22.75
Virginia No. 2	28.74
Basic	20.75
Grey Forge	21.75
CHICAGO	
No. 2 Foundry local	22.70
No. 2 Foundry, Southern, sil 2.25@2.75	26.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	22.96
Basic	21.96
Bessemer	21.96

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50	3.53	3.10	3.38
No. 12	2.55	3.58	3.15	3.43
No. 14	2.60	3.63	3.20	3.48
No. 16	2.80	3.73	3.30	3.58
Black				
Nos. 17 and 21.	2.85	3.80	3.55	3.95
Nos. 22 and 24.	2.90	3.85	3.60	4.00
Nos. 25 and 26.	2.95	3.90	3.65	4.05
No. 28	3.00	4.00	3.75	4.15
Galvanized				
Nos. 10 and 11.	3.00	4.00	3.75	4.15
Nos. 12 and 14.	3.10	4.10	3.85	4.25
Nos. 17 and 21.	3.40	4.40	4.15	4.55
Nos. 22 and 24.	3.55	4.55	4.30	4.70
No. 26	3.70	4.70	4.55	4.85
No. 28	4.00	5.00	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	68½	56	¾ to 1½	44½	29½
LAP WELD					
2	61½	49	2	39½	25½
2½ to 6	65½	53	2¼ to 4	42½	29½
7 to 8	62½	49	4½ to 6	42½	29½
9 to 12	62½	49	7 to 12	40½	27½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66½	55	1 to 1½	44½	30½
2 to 3	68½	56			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59½	48	2	40½	27½
2½ to 4	63½	52	2½ to 4	43½	31½
4½ to 6	62½	51	4½ to 6	42½	30½
7 to 8	58½	45	7 to 8	35½	23½
9 to 12	52½	39	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded.	60%	46%	60½%	47½%	60%	46%
3½ to 6 in. steel lap welded.	51%	37%	58½%	44½%	57%	43%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	5.00	6.00	*3.78
Spring steel (light) (base)	6.00	6.00	*2.93
Coppered Bessemer rods (base)	8.00	8.00	*6.03
Hoop steel	3.88	3.29	3.28
Cold rolled strip steel	7.50	8.25	6.75
Floor plates	4.85	....	5.23
Cold finished shafting or screw	3.88	3.50	3.83
Cold finished flats, squares	4.38	4.00	4.35
Structural shapes (base)	2.88	2.74	2.88
Soft steel bars (base)	2.78	2.64	2.78
Soft steel bar shapes (base)	2.78	2.64	2.78
Soft steel bands (base)	3.43	....	3.48
Tank plates (base)	2.88	2.92½	2.88
Bar iron (2.15@2.25 at mill)	2.78	3.52	2.78
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
$\frac{3}{32}$	8.50		12@13
$\frac{1}{8}$	7.15		11@12
$\frac{5}{32}$ to $\frac{1}{4}$	6.75		10@11

* Price to Dealers.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	13.62½
Tin, 5-ton lots, New York	28.50
Lead (up to carlots), St. Louis, 4.60; New York	5.00
Zinc (up to carlots), St. Louis, 4.97½; New York	5.37½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.00	20.00	20.00
Antimony (Chinese), ton spot	5.50	6.50	6.00
Copper sheets, base	20.75	21.50	22.50
Copper wire (carlots)	16.50	16.50	15.75
Copper bars (ton lots)	19.00	23.00	19.00
Copper tubing (100-lb. lots)	20.50	23.00	22.50
Brass sheets (100-lb. lots)	16.25	17.00	18.25
Brass tubing (100-lb. lots)	18.00	19.00	20.00
Brass rods (1,000-lb. lots)	14.25	16.00	15.25
Zinc sheets (casks), (8% dis. carlots)	11.00	11.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ½), (case lots)	19.50	21.00	18.00
Babbitt metal (best grade)	70.00	39.00	34.00
Babbitt metal (commercial)	30.00	13.50	8.00

—Shop Materials and Supplies

MONEL METAL—Base price in cents per lb., f.o.b. Bayonne, N.J.:

Shot	35.00	Hot rolled machined rods (base)	53.00
Blocks	35.00	Hot rolled rods (base)	42.00
Ingots	38.00	Cold drawn rods (base)	56.00
Sheet bars	40.00	Hot rolled sheets (base)	55.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grades "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

OLD METALS--Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.50	10.25
Copper, heavy, and wire	9.50	10.50	9.50
Copper, light, and bottoms	8.00	8.00	8.25
Lead, heavy	4.00	3.75	3.75
Lead, tea	3.00	2.75	3.00
Brass, heavy	6.50	6.00	8.00
Brass, light	5.00	4.00	5.50
No. 1 yellow brass turnings	5.25	4.50	5.25
Zinc	3.00	2.00	2.75

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

	New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade.			
IC, 20x28, 112 sheets	21.50	......	....
IX, 20x28, 112 sheets	24.00	......	....
"A" Charcoal Allaways Grade:			
IC, 20x28, 112 sheets	18.50	......	....
IX, 20x28, 112 sheets	21.50	......	....
Coke Plates, Bright			
Prime, 20x28 in.:			
100-lb., 112 sheets	14.00	13.00	14.50
IC, 112 sheets	14.30	13.30	14.80
Terne Plate			
Small lots, 8-lb. Coating:			
100-lb., 14x20	7.50	6.25	7.25
IC, 14x20	7.75	6.50	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb	\$0.07½@\$0.10	\$0.12	\$0.12
Cotton waste, mixed, per lb	.055@.09	.09	.10
Wiping cloths per M., 13¼x13¼	....	55.00	55.00
Wiping cloths per M., 13¼x20½	....	65.00	65.00
Sal soda, 100 lbs	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb	2.55	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.72	.77	.74
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 75 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville	per ton	\$3.25@3.35	
Coke, prompt foundry, Connellsville	per ton	4.25@4.75	

SHOP SUPPLIES

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	—50%	—60%	60-10-10%
1⅛ and 1¼x3 in. up to 12 in.	—40%	-60-10-10%	-60-10%
With cold punched sq. nuts	—30%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	—40%	.....	..\$4.00 off
Button head bolts, with hex. nuts	—20%	\$3.90 net	.....
Hex. head and hex. nut bolts	—20%	....	-65-5%
Lag screws, coach screws	—50-10%	....	—60%
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	—50-10-10%	50-5%
Bolt ends, with hot pressed nuts	—50%	....	—55%
Tap bolts, hex. heads	—20%	....	.....
Semi-finished nuts all sizes	—70%	—75%	—80%
Case-hardened nuts	—60%	....	.....
Washers, cast iron, ½ in., per 100 lb. Off list	\$5.00	\$5.50	\$3.50 net
Washers, cast iron, ⅝ in. per 100 lb. Off list	4.25	3.75	3.50 net
Washers, round plate, per 100 lb. Off list	3.00	....	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	2.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	2.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.50	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.50	3.00	4.00
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	-50-10%	60-10-10%	-65-5%
Rivets, tinned	-50-10%	60-10-10%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	\$3.70	3.50	3.43
Cone heads, ditto (net)	3.80	3.60	3.53
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅞ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	\$4.03 base
Copper rivets	—50-10%	—40-10%	—50-10%
Copper burs	—25-10%	—15%	—10%

Lard oil, pure, (50 gal. bbl.) per gal.	0.95	......	.....
Lard cutting oil (50 gal. bbl.) per gal.	0.60	......	.....
Machine oil, lubricating, per gal.	0.40	... ..	.....
Belting—Present discounts from list in fair quantities (½ doz. rolls)			
Leather:			
Light grade	50-5%	.....	50-5%
Medium grade	45%	.....	.....
Heavy grade	40%	.....	.....
Rubber and duck:			
First grade	50-10%	.....	.....
Second grade	60-5%	.....	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	\$9.00 less 20-10-5%	....	-20-10%
Emery paper	11.00 less 20%	.. ..	-20%
Emery cloth	32.75 less 10%	.....	-10%
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll	\$4.50 net	....	list+10%
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	\$1.65 less 20%	.....	-10%
Cloth	\$3.55 less 10%	....	-10%

O., Cleveland—The Zerk Lubricator Co. has taken over the plant of the Ri-Chard Automobile Co. at 7800 Finney Ave.—additional equipment.

O., Salem—The Church-Budget Envelope Co.—several small lathes, 24 in. between centers, 12 in. swing (used).

O., Winton Place (Cincinnati P. O.)—The Cincinnati Car Co., J. H. Elliott, Wks. Mgr. —one 2 stage, motor driven, 400 ft. air compressor, (used).

Wis., Appleton—The Standard Mfg. Co., 934 Lawe St.—millers, planers and other woodworking machinery also steam power machinery for saw mill.

Wis., Cedarburg—J. J. Wittenberg—two shaping machines, etc., for proposed tire factory on Main St.

Wis., Milwaukee—C. Kronis, 860 Teutonia Ave.—band saw for cabinet maker.

Wis., Eden—The Nast Bottling Co., W. J. Nast, Purch. Agt.—motor or belt driven filling machine, sealing machine, washers, and carbonator.

Wis., Milwaukee—The Caldick Furniture Co., 136 3rd St., C. Luhrsen, Purch. Agt.—one planer.

Wis., Milwaukee—The Milwaukee Electrical Wks., 315 Mineral St.—one complete welding outfit.

Wis., Milwaukee—Milwaukee Washing Machine Co., 3928 Vliet St., W. Erni, Pres. —wood working machinery and special machinery for Clinton factory.

Wis., Milwaukee—The Reliable Photo Service Co., 907 3rd St., A. Grosswitz, Purch. Agt.—one power paper cutting machine.

Wis., Milwaukee—J. Wilging & Co., 1612 Teutonia Ave., J. Wilgin, Purch. Agt.—one 12 or 16 in. jointer and a 7 in. sticker for mill work.

Wis., Milwaukee—J. Zapf, 1341 40th St. (woodworker)—one 6-in. sticker.

Wis., Monroe—J. Gempeler—ice cream making machinery with electric motor, also refrigerating equipment.

Wis., New Lisbon—Genl. Device Corp., F. W. Bolzendahl, Purch. Agt.—rubber working machinery for the manufacture of rubber specialties.

Wis., Beaver Dam—R. Christian—air compressor, gasoline tank and pumps.

Mo., Cape Girardeau—C. Wielpuetz Bakery Co.—machinery for proposed bakery at Poplar Bluff.

Mo., Jefferson City—The Central Missouri Coal & Mining Co., Suite 314 Central Trust Bldg., J. McManus, Secy.-Treas.—coal mining machinery and equipment.

Ont., Milverton—J. Boshart—machinery and equipment for the manufacture of heavy shoes.

Que., Montreal—I. Paquin, 962 Dorion St. —embossing machine capable of printing on brass plate, dimensions from 3 in. sq. to 2 ft. sq., the letters to be from ¼ in. to 3 in.

Metal Working Shops

NEW ENGLAND STATES

Mass., Charlestown—D. J. Kane, 73 Tremont St., Boston, has awarded the contract for the construction of a 1 story, 115 x 120 ft. garage on Warren St. Estimated cost, $50,000.

Mass., Dorchester—W. Baker & Co., Ltd., Pierce Sq., has awarded the contract for the construction of a 3 story, 40 x 100 ft. storehouse and garage. Estimated cost, $50,000.

Mass., Rutland—Treasury Dept., J. A. Wetmore, Supervising Archt., Washington, D. C., will receive bids until Nov. 22 for the construction of various buildings including a 1 stcry, 36 x 91 ft. laundry and garage. Total cost, $500,000.

Mass., Springfield—The Readio Co., 62 Yale St., has awarded the contract for the construction of a 1 story, 54 x 130 ft. auto repair shop on Magazine St. E. C. Spear, Pres. Private plans.

MIDDLE ATLANTIC STATES

N. J., Mt. Holly—W. A. Jones, Washington and King Sts., has awarded the contract for the construction of a 1 story, 100 x 200 ft. garage and service station. Estimated cost, $60,000. Noted Oct. 6.

N. Y., Kellogg (Buffalo P. O.)—The Electro Refractory Co., Ellicott Sq. Bldg., Buffalo, plans to construct a 50 x 300 ft. factory and a 30 x 75 ft. machine shop, on Town Line Rd. Estimated cost, $100,000.

Pa., Mifflinburg—The Mifflin Auto Body Co. is having plans prepared and soon receives bids for the construction of a 2 story, 40 x 100 ft. factory. Estimated cost, $45,000. R. R. Markley, Spooner Bldg., Harrisburg, Archt.

Pa., Philadelphia—The Union Transfer Co., 1004 Spring Garden St., has had plans prepared for the construction of a 1 story, 150 x 165 ft. garage. Estimated cost $40,000. C. T. Mitchell, 129 South 5th St., archt.

SOUTHERN STATES

Ky., Louisville—Gray-Von Allmen Milk Co., 1143-45 Garvin Pl., is receiving bids for the construction of a 2 story, 93 x 122 ft. garage on 5th and Oak Sts. Estimated cost, $60,000. F. Erhart, Norton Bldg., Archt.

W. Va., Brocious—The Hancock Steel Co., Hancock, Md., is receiving bids for the construction of the 1st unit of its plant, here, a 1 story, 130 x 200 ft. machine shop and foundry. Total cost, $3,500,000. E. McGeorge, 1900 Euclid Bldg., Cleveland, O., Archt.

MIDDLE WEST STATES

Ill., Chicago—The Austin Machinery Co., 865-79 Sangamon St., is having plans prepared for the construction of a 4 story, 80 x 160 ft. factory on North Sangamon St. Estimated cost, $80.000. Fox & Fox, 38 South Dearborn St., Archts.

Ill., Chicago—The Newberry Library, c/o Mundie & Jensen, Archts., 39 South La Salle St., is having plans prepared and soon receives bids for the construction of a 1 story, 75 x 100 ft. garage at 215-19 West Erie St. Estimated cost, $40,000.

O., Cleveland—The Assn. for Crippled and Disabled, 2233 East 55th St., has awarded the contract for the construction of a 2 story, 40 x 80 ft. brace factory and garage. Estimated cost, $40,000.

O., Cleveland—T. B. Foley, 5716 Franklin Ave., is having plans prepared for the construction of a 1 story, 69 x 80 ft. garage at 1445 West 58th St. Estimated cost, $40,000. Private plans.

O., Cleveland—Greenwald, Stecker & Wallach, 535 Society for Savings Bldg., are receiving bids for the construction of a 2 story, 67 x 268 ft. garage and commercial building, at 1934 East 105th St. Estimated cost, $60,000. N. Petti, 1526 Williamson Bldg., Archt.

O., Cleveland—J. M. Sands, Sweeney Ave., manufacturer of water heaters, has awarded the contract for the construction of a 1 story, 37 x 100 ft. forge shop at 10300 Harvard Ave. Estimated cost, $40,000. Noted Nov. 3.

O., Cleveland—The Speck Baking Co., 3310 Central Ave., has awarded the contract for the construction of a 2 story, 40 x 80 ft. garage at 3330 Central Ave. Estimated cost, $40,000.

O., Cleveland—The Stone Improvement Co., Kirby Bldg., is having plans prepared for the construction of a 1 story, 100 x 150 ft. garage and commercial building, on East 83rd St., and Carnegie Ave. Estimated cost, $75,000. P. Matzinger & Co., Caxton Bldg., Archts.

O., Cleveland Heights (Warrensville P. O.)—H. Wagner Garage, 1162 Addison Rd., Cleveland, has had plans prepared for the construction of a 1 story, 51 x 84 ft. garage at 1817 Coventry Road here. Estimated cost, $40,000. Private plans.

O., Columbus—The Carroll Chain Co., 63 Smith Pl., is having plans prepared for the construction of a 1 story, 50 x 150 ft. factory on South High St. Estimated cost, $25,000. D. Carroll, 63 Smith Pl., Archt.

Wis., Beaver Dam—R. Christian plans to build a 1 story, 60 x 120 ft. garage. Estimated cost, $40,000. Architect not selected.

Wis., Clinton—The Milwaukee Washing Machine Co., 155 West Water St., Milwaukee, plans to build a 1 story, 40 x 180 ft. factory. Estimated cost, $50,000. Private plans.

Wis., Hingham—P. Ernissee & Co. has awarded the contract for the construction of a 2 story, 50 x 95 ft. garage and machine shop. Estimated cost, $45,000. Noted Nov. 3.

Wis., Hurley—L. Santini is having plans prepared for the construction of a 1 story, 50 x 95 ft. garage and machine shop on Main St. Estimated cost, $42.000. Private plans.

Wis., Kenosha—The Winther Motor Co., North Shore Rd., has awarded the contract for the construction of a 1 story, 61 x 386 ft. factory. Estimated cost, $250,000.

Wis., LaCross—The Nat'l Refining Co., 7th and Wall Sts., Dubuque, Ia., is receiving bids for the construction of a 1 story, 40 x 100 ft. warehouse and 40 x 50 ft. garage on 12th St., here. Estimated cost, $40,000. Private plans.

Wis., Manitowoc—K. O. Muehlberg Co., 209 North 9th St., has purchased a site and plans to build a 1 story, 60 x 125 ft. machine shop on 9th St. Estimated cost, $55,000. Architect not selected.

Wis., New Lisbon—The General Device Corp., F. W. Bolzendohl, Pres., plans to construct a 1½ story, 50 x 120 ft. factory on Main St. Estimated cost, $85,000. Architect not selected.

Wis., West Allis—The Kroening Constr. Co., 68th and Greenfield Aves., will build a warehouse and garage on 39th Ave. Estimated cost, $40,000.

WEST OF THE MISSISSIPPI

Kan., Wichita—F. L. Wright, 310 Schweiter Bldg., will build a 1 story, 75 x 130 ft. garage at 137-41 North Water St. Estimated cost, $40,000.

Minn., Duluth—The Duluth Auto Exchange Co., J. A. Kohn, Mgr., 201 East 1st St., has awarded the contract for the construction of a 2 story, 100 x 140 ft. garage on East 1st St. Estimated cost, $60,000. Noted Aug. 11.

Mo., St. Louis—Hall & Brown Woodworking Machine Co., 1913 North Bway., will soon award the contract for the construction of a 2 story factory at 1900 North Bway. Estimated cost, $50,000. P. J. Bradshaw, International Life Bldg., Archt.

Mo., St. Louis—C. Lischer, 4247a Grace Ave., will build a 1 story, 75 x 125 ft. garage. Estimated cost, $45,000.

Mo., St. Louis—The Missouri Pacific R. R., Ry. Exch. Bldg., will soon award the contract for the construction of a 1 story, 46 x 500 ft. car repair shop. Estimated cost, $125,000. E. A. Hadley, Ry. Exch. Bldg., Archt.

CANADA

Ont., Windsor—The Colonial Motors, Ltd., L. A. McCalla Genl. Mgr., Exchange Bldg., plans to remodel factory for the manufacture of automobiles.

General Manufacturing

NEW ENGLAND STATES

Mass., Haverhill—C. M. Kelley will soon award the contract for the construction of a 7 story shoe factory on Water, School and Chestnut Sts. Estimated cost, $500,000. Private plans.

MIDDLE ATLANTIC STATES

D. C., Washington—Wise Bros., 3206 N. St., N. W., will soon award the contract for the construction of a dairy building. Estimated cost, $75,000. A. P. Clark, Jr., 816 14th St., Archt.

Md., Baltimore—The Maryland State Dairymens Assn., Inc., Fidelity Bldg., has awarded the contract for the construction of a 2 story, 32 x 58 x 68 ft. plant at 1421-25 Aisquith St., for the marufacture of various products from surplus milk products. Estimated cost, $20,000.

N. Y., Brooklyn—The Graselli Chemical Co., 347 Madison Ave., New York City, has awarded the contract for the construction of an addition, consisting of 4 buildings, to its chemical plant along Newtown Creek here. Estimated cost, $100,000.

N. Y., Syracuse—Gaylord Bros., 506 South Clinton St., have awarded the contract for the construction of a 3 story, 65 x 100 ft. factory on Gifford and Granger Sts. for the manufacture of paper supplies. Estimated cost, $60,000. M. L. King, Snow Bldg., Archt.

Pa., Berlin—The Eclipse Wood Pulley Co. plans to rebuild its plant which was recently destroyed by fire. Estimated loss, $50,000. G. T. Brubaker, Pres.

Pa., Dorranceton—(Kingston P. O.)—M F. Fadden has awarded the contract for th construction of a 2 story 58 x 91 ft. ic cream plant. Estimated cost, $90,000 Noted Nov. 10.

Pa., Lansdale—The Norristown Hosier Mills, Norristown, has awarded the contract for the construction of a 2 story, 4 x 162 ft. factory. Estimated cost, $50,000

Pa., Philadelphia—J. M. Kennedy, 40 South Van Pelt St., has awarded the contract for the construction of a hosiery factory on B. and Allegheny Aves. Estimate cost, $33,600.

Pa., Philadelphia—L. J. Priestley, Jr 1312 Sansom St., is havnig preliminar plans prepared for the construction of a story printing factory on 5th and Butler St Estimated cost, $75,000. H. Reinhold, 151 Walnut St., Archt.

American Machinist

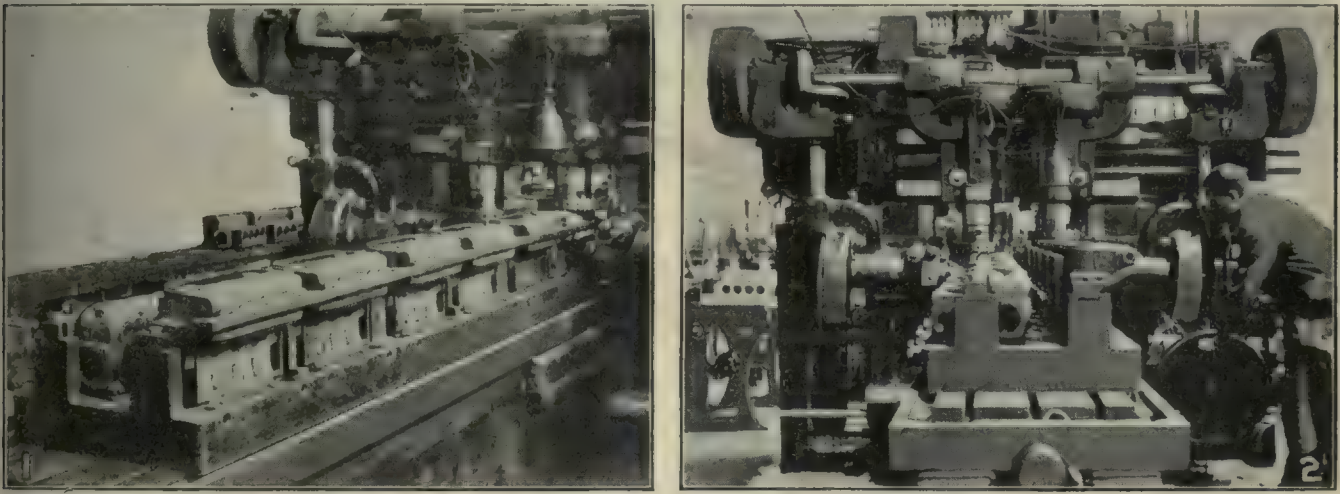
Volume 55 NEW YORK, NOVEMBER 24, 1921 Number 21

Machining the "Bean" Motor Cylinders

Methods Used in a Well Equipped English Motor Plant—Cylinders Produced on American Machine Tools—A Power Washing Machine

BY I. WILLIAM CHUBB
Editor, European Edition, *American Machinist*

PROBABLY the most completely equipped factory in Great Britain for the production of motor car chassis is that at Tipton belonging to A. Harper Sons & Bean, Ltd., a group which has its own iron foundry adjoining, with body-building factory at Dudley arranged on much the same general plan, a stamping works at Smethwick, while the steel needed, the aluminum, radiators, etc., are provided by associated firms. The factory at Tipton has an area of about 1,231,000 sq.ft., the adjoining iron foundry adding 68,000 sq.ft. covered, with yards making a total of 122,000 sq.ft. while the body factory at Dudley has a site of about 682,000 sq.ft. At Tipton are the administrative offices in a two-story building 225 x 44 ft. Everywhere in the works roller conveyors and moving trucks are used, from the taking in of supplies to the complete assembling of the chassis in a shop which is 450 ft. long by 90 ft. wide. Even the messenger lads have been provided with roller skates. In fact, generally speaking, in mechanical means employed the Tipton factory is almost unique in England.



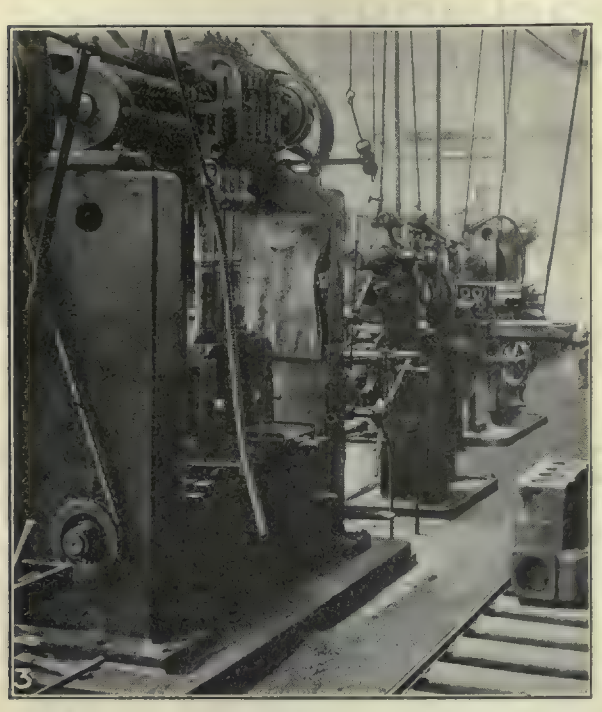
FIGS. 1 AND 2. GANG MILLING ON AN INGERSOLL MACHINE

In the machine shop the line system of grouping tools has been very extensively—in fact almost exclusively—followed, but in the present article only the cylinder-production methods are dealt with, and almost the complete line of machines for this, is shown in the illustrations. The cylinders are of cast iron, the bores being 69 millimeters.

The first operation on the cylinder blocks is that of milling on an Ingersoll milling machine, as illustrated in Figs. 1 and 2, twelve blocks being milled simultaneously in two rows each of six components. In this way after the first loading six cylinder sets are completed on each pass of the table. On the left-hand side the set of castings, as dressed, lying on their backs, are located on pegs bearing rough facings. Machined on the crankcase and inlet and exhaust manifold faces, they are then turned over to the other side of the machine table to deal with the top, the inspection cover and valve spring faces, the faces produced in the first half of the operation acting as registers. Thus four milling cutters are used (three with inserted blades,) to produce four faces, two on a side. Three cutters are of face form and one is a left-hand spiral, left-hand cutting end-and-face mill. Fixed setting stops are provided on the jigs as shown, and 0.01-in. feelers are used for all setting points. The cylinder then goes to a Milwaukee milling machine for machining the fan bracket and the accelerating pedal bracket faces, the fixture employed indexing around on a vertical axis for this purpose, the pedal bracket face being done first. A cut straight across is taken in each case by means of an inserted-tooth side and face cutter. Next held in a vise the job is taken to a Le Blond milling machine to deal with the plug hole faces by means of an end mill with right-hand cutting, right-hand spiral teeth. The process may be gathered from Fig. 3.

For rough-boring a Moline No. 5-D machine (see also Fig. 3) is employed, the casting being located against the crankcase face throughout, with datum positions from one end and one face against stops.

The casting is slipped on a special fixture which, by a compensating link motion acting on plungers, lifts six plungers independently until all have forced the cylinder into place, its crankcase face bearing under the bridge piece of the fixture and the job being clipped



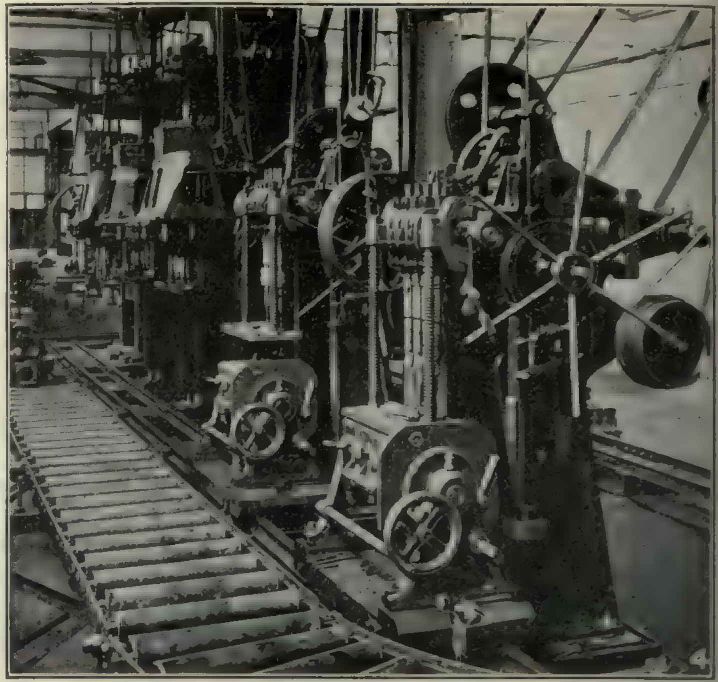


FIG. 3. ROUGH BORING CYLINDERS. FIG. 4. JIGS ON THE TRUCK LINE

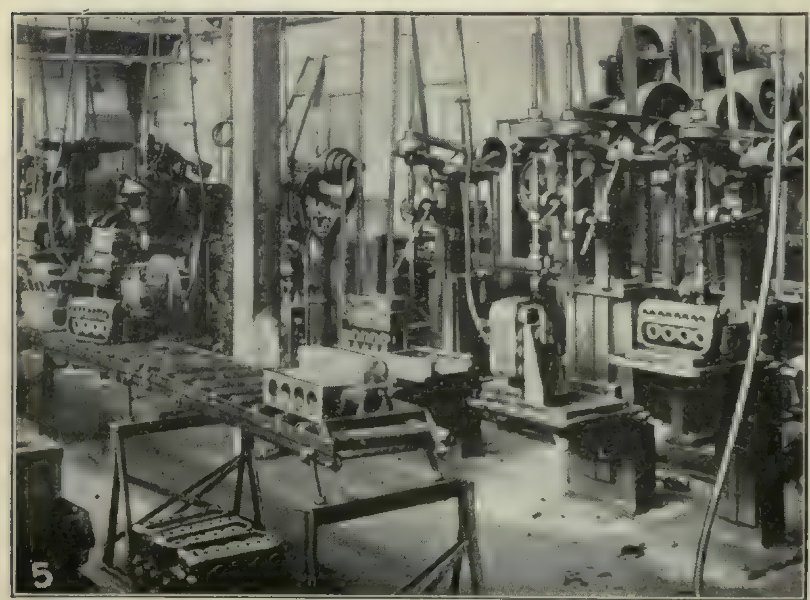
sideways and also from the front. To this device is applied an air blast which blows into the exhaust parts and forces chips, etc., out of the cylinder plug holes. This type of jig is also used for the semi-finish reaming. For boring and facing the top of the cylinder bores three cutters are employed, let into the bottom of a bar and adjusted for diameter by the cone head of a screw which expands the set, each cutter being locked in position by a grub screw at the side. The toolholder itself is tenoned into the end of the boring bar and secured by a screw, and the boring bar is driven from the machine spindle by keys, one on each side. The table of the machine rises and falls and in one cut the rough-boring takes the holes from the cored stage to within 0.045 in. of finished size.

The water test follows, the pressure employed being up to 100 lb. This test takes place immediately after rough-boring to save machining leaky cylinders.

The water plug holes are then bored and tapped in a Sibley machine, a shell cutter and arbor being employed for the boring. The work drops over four plugs which have bushed holes into which the pilot of the cutter enters. Here again for the locating positions, the exhaust manifold faces and accelerating pedal bracket faces are used and it may be added that all cutters are secured by bayonet slots and are therefore easily removed.

The cylinder bores are then chamfered in a Sibley geared-head machine. The work is clipped on the fixture, dropping on two bungs in the cylinder plug holes, the jig sliding in ways on rollers.

Up to this point the cylinder has been moved from machine to machine along the roller line, but in subsequent operations it is secured in a truck jig on rollers, which runs on a rail system and is illustrated in Fig. 4. With the cylinder in a trunnion jig, loaded square with



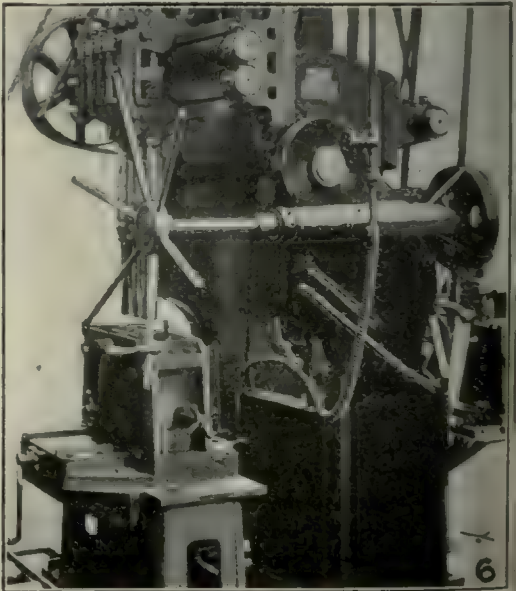


FIG. 5. MISCELLANEOUS DRILLING OPERATIONS. FIG. 6. SEMI-FINISH AND FINISH BORING CYLINDERS

the line, the truck is pushed from machine to machine along the rails, turntables being provided at ends of track for return of trucks via the back of machines. The first of these operations is boring the inlet and exhaust valve holes, counterboring and recessing in a Moline machine No. 61, combination shell cutters being used. The truck jig floats on ball races and the truck itself is roughly located by means of pedal catch to within say $\frac{1}{16}$ in. Then heavily tapered dowels in the jig enter dowel holes in the bush plate, which is carried on the machine and held down by springs on to the jig for final position. In this machine two sets of cutters are used, roughing and finishing, slipped on and off four spindles and producing holes for eight valves for the two positions of the truck, four alternates being dealt with at a time. The truck is then moved to Natco machines No. 13 for drilling inlet and exhaust manifold faces and three inspection cover stud holes, thirteen holes in all, the job being located as before, in the jig, which revolves on the trunnions to the required position. Next, under a Natco No. 13 machine, the five bolt holes are drilled for securing to the crankcase, and under a Moline No. 5 tapping machine, inlet and exhaust valve holes are tapped for the plugs. Inserted blades are used, and the taps float, lead being provided on top of the spindle, which is reversed by belt motion. This is the last operation on the truck line, which is fairly completely illustrated in Fig. 5, the job moving from right to left.

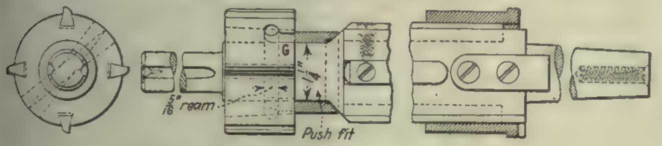


FIG. 7. SEMI-FINISHING REAMER

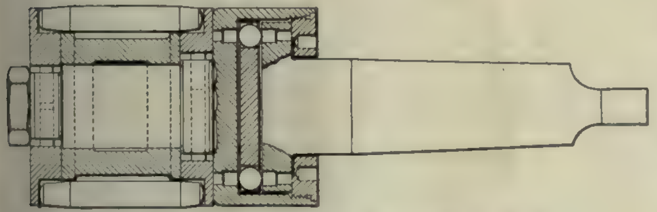


FIG. 9. DETAILS OF THE ROLLING TOOL

A number of minor operations follow, including tapping the inlet and exhaust manifold faces and the inspection cover stud holes in a single-spindle Herbert drilling machine, this operation being the first of those illustrated in Fig. 5, where the cylinder is shown lying on the table of the machine at the extreme right-hand side. The cylinder then passes to a two-spindle Herbert machine where, mounted in the jig shown, the water plug holes are drilled and tapped, a three-lipped core drill being employed for the drilling. A single spindle Herbert upright drilling machine then drills and reams the valve stem holes, the tools being held in a Gronkvist chuck, a pilot bush inserted in the plug hole being employed. The work then passes to a Barnes drilling machine with four-spindle head, where it is drilled for the accelerator pedal and fan faces, the work being slipped on the jig and located in the cylinder bolt holes which have already been drilled. The two ends are drilled with the work in the same jig, which swings, as illustrated, on a horizontal axis. The holes in these faces are then tapped in a Garvin machine, being held exactly as for drilling. Then valve stem guides are broached by means of an arbor press on a stand, 0.002 in., being left in by reamer for broaching, the job being dropped on the bolt hole face for the eight positions. For facing the valve seats the cutter locates itself in the bore already put in as the first of the truck operations, and the cylinder plug holes inside the bores are countersunk by an ordinary cutter, this operation being followed by spot-facing the bolt holes in a Herbert vertical drilling machine.

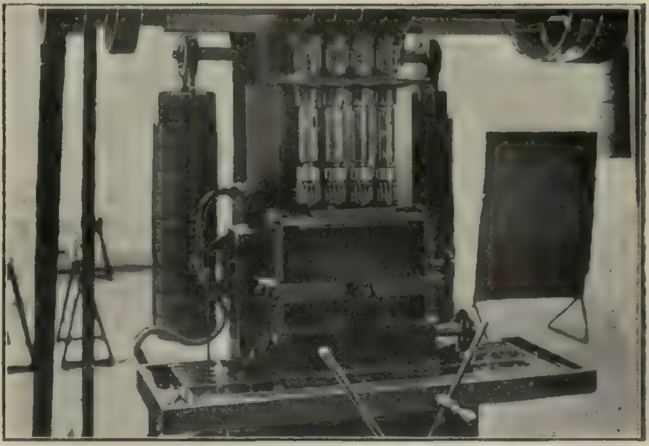


FIG. 8. ROLLING THE CYLINDER BORES

The semi-finish reaming for cylinder bores (Fig. 6) which follows, is done on a Moline machine No. 66-D, using piloted bars and a jig similar to that used for the rough-boring. To prevent seizing only four bearing strips, two long and two short, are employed on the bar held by screws. Further, under the pilot plate is a cavity into which air is blown from the back of the machine inwards to keep the dust away from the bar. A four-bladed reamer is employed, the blades being a tight fit in dove-tails which are taper 3 deg. at the back for adjustment (see Fig. 7). Eight thousandths of an inch is left for the finish-reaming, which follows by means of a six-bladed reamer. This is not piloted in the jig but permitted to float, leaving 0.0005 to 0.001 in. for the rolling, which is also done in a Moline machine, type 2-D.

The drive to the finish reamer is much as described later in relation to the roller head. Made from $\frac{3}{8}$ x $\frac{1}{2}$-in. steel, the actual cutters are each 1$\frac{3}{8}$ in. long, with a rounded front or entering end and a slight cutting lip. The land is $\frac{5}{64}$ in., clearance for the center being stoned

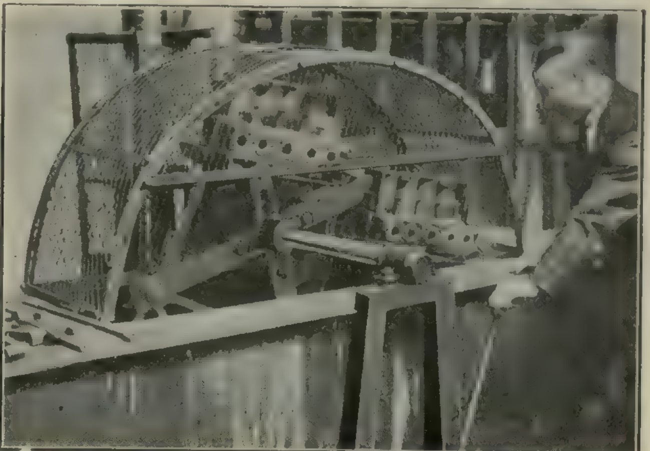


FIG. 10. WASHING THE CYLINDER BLOCKS

off. Each set of blades is good for sixty bores, allowing plus or minus one half-thousandth.

For the final burnishing operation (Fig. 8) on the cylinder bore the roller head shown in Fig. 9 is employed. At the lower end will be seen a set of ⅜-in. cast steel rollers, hardened and ground, fourteen in number, carried between two hardened and ground rings which are slightly recessed for the ends of the rollers; the latter having spherical seats and being barreled by about 0.015 in. in diameter on the operative length of 1⅝ in. The roller end is carried on a body piece from which it is driven by means of two cross pegs at each end. The central bush on which the two rings supporting the rollers are carried is a running fit on the body piece, but the end rings have some play. Between the latter and the flanged end of the shank entering the machine spindle is a set of eight balls to take the end thrust, and the drive between the shank and body is by means of an Oldham coupling device, 1/16 in. of flat, not wobble, float being permitted. The rollers are arranged to have 3-deg. left-hand spiral lead when assembled. This system has displaced grinding.

Two minor milling operations follow, namely, milling the connecting-rod clearance, the cylinder being held in an index fixture which gives four positions, the corners of the clearances being milled in a Milwaukee machine. Finally the cylinder is washed (see Fig. 10) in a tank of soda water, heated by burners, cradles for the cylinders being carried through the bath on four arms driven by worm gearing.

Economic Conditions in Switzerland

Unfortunate Situation of a Small Neutral Country Surrounded by Belligerents—Exchange and Dumping Difficulties—Labor, Raw Material and Food Problems

By Dr. WALTER E. BOVERI
Brown, Boveri et Cie., Switzerland

MUCH has been said and written about the economic troubles of the belligerent nations, but little is heard of the almost equally hard position of some of the neutrals, particularly Switzerland. The Swiss Republic, bounded by four big nations all of which have been engaged in the war, with insufficient resources to produce her own food supply, besides having no raw materials of her own, depends for her existence entirely upon foreign trade. Under the circumstances, free trade is the only feasible commercial policy; but at the same time it is obvious that a country entirely dependent on its foreign trade is bound to be severely affected by the depreciation of the currency of its former customers, as well as by the high tariff walls by which even the strong commercial nations have surrounded themselves recently. As a result, business conditions are very bad in Switzerland, two of the most important industries, the watch and the lace industries being entirely shut down. Huge sums have to be paid by the government to support the ever increasing number of unemployed.

The depreciation of foreign currency produces similar effects to those created by high tariffs, only in a much stronger degree. There are two sides to the matter; the first and more important is, that the manufacturer cannot compete any more with countries with a low exchange, and it is evident that a country that lives by foreign trade, like Switzerland, is bound to be very much affected by this situation. On the other hand, the Swiss market becomes flooded by foreign products which can be sold at a much lower price than the home-made articles, so that the Swiss manufacturer has even to fight for the home market.

It has, therefore, been suggested several times to depreciate the value of the Swiss franc by issuing a larger number of bank notes. Fortunately, the advocates of this scheme have not been successful. One has to bear in mind that the effects of a low exchange are caused by the difference between the purchasing power of the depreciated currency at home, and the rate at which this currency is exchanged for other currencies abroad. As soon as these two valuations are equal all bad effects upon foreign trade will disappear. It is obvious that the smaller the country in question and the more intensely it is engaged in foreign trade, the more rapid will be the adjustment. Switzerland has nothing to hope from a depreciation of its currency as the only effect this could bring about would be a raising of the cost of living and wages, without giving any stimulus to the exporting manufacturer.

Speculative Investments

The depreciation of the currency of our neighboring countries has had other effects, too. To create an outlet for the national products, Swiss bankers and manufacturers have invested their capital in foreign countries and these investments were made in the form of pa value. With the decrease of the value of the foreig exchanges, some of these investments were partly, other (as in the case of Russia, Austria and Germany) almos entirely lost. As long as the political and economica uncertainty prevails it is not likely that Swiss capitalist will re-invest their money in foreign countries, though before the war this had proved to be a most efficien means to stimulate foreign trade.

Another very bad effect of the exchange situation ha been the inducement it created to speculate in foreig money. Unlike the speculative fever in Germany an Austria (which is founded on a more or less soun argument, namely, to invest liquid funds in shares whic are backed by some real value not effected by exchang fluctuation, and which has driven the prices of stock to an unprecedented level at which they hardly yield any thing), the speculation which we encounter in Switzer land merely rests on the feeling that one day th foreign exchanges will have to come back to their pa level. Chiefly, people with insufficient knowledge of th underlying principles, as for instance the small en ployees and peasants, have engaged in these speculatio and the sums they and the country lost ran into man millions.

It may be asked why under all these unfavorable co ditions the value of the Swiss franc never more ser ously depreciated. Besides a 60 to 70 per cent cov of gold for the outstanding notes, this can only be accounted for by the fact that Switzerland has a very favorable balance of payments. When during the war the Swiss franc always kept its high level (even the dollar toward the close of the war sank for a time to about 75 per cent of its par value in Switzerland), many foreigners thought it advisable to open accounts with Swiss banks. This was also done to avoid taxation, and since then a steady influx of money into Switzerland has taken place. For some reason or other, however, these large sums may be called back at any moment and therein lies the danger of the present situation.

As far as labor troubles are concerned, it may be said that the recent period has brought very satisfactory changes. The revolutionary wave of 1918 has entirely passed owing to the energetic opposition it found from the peasants who all own the land they cultivate. Besides, the working man realized that under the unfavorable industrial conditions, the times for wage increases have passed and that all he can hope for is not to lose his job. However, there have not been any substantial wage reductions due to the fact that wages of the men employed by the state and the federal railways are fixed by law and can only be altered by legislative action, a very remote possibility. The same applies to the eight-hour day which is also a legal standard, and from which productivity has immensely suffered.

SWITZERLAND AND AMERICAN MARKETS

During the war, when Russia stopped supplying us with grain and not sufficient coal and iron could be obtained from Germany, we turned for these supplies toward the United States. However, these trade relations did not develop as we hoped they would. Switzerland cannot buy here unless she has a chance of selling her products in this country. The United States is commercially the strongest nation today and could accordingly adopt a free trade policy without the slightest risk, in my opinion. The American manufacturer would be sufficiently protected by freight charges and by the fact that a foreign product always encounters a stronger resistance. The present tariff laws, however, prevent our products from finding a market here and, therefore, it is not likely that we shall be in a position to buy large quantities of American goods.

Though in general our economic situation may be subject to some fluctuations, no recovery is possible while the causes of the crisis remain. Russian food supplies and purchasing power, which went far to support the people and factories of Europe, are gone not to return for many years. It took France a decade to recover from her revolution. Will it take less for Russia to come back?

The dismemberment of the Austro-Hungary empire, while it may have been expedient politically, was an economic crime which will bring its retribution on the countries that formerly traded with Austria. Small countries, economically unsound, always cause many troubles.

The German reparations will never be paid; it is economically impossible to do so. Some of the wiser heads predicted the situation which is now upon us, but no one yet seems to have found a cure. Over everything broods the spectre of uncertainty, in politics as in trade, and while it lasts recovery will be very slow.

A Letter From Chile

By Harry S. Thomas

Why is the United States machinery trade with South America, particularly Chile, declining? A major cause is that representation is left to the people here, who are more interested in selling a case of salmon, tea, sugar, or some such commodity, than in talking about the advantages of buying mechanical contrivances. Nor are they properly prepared to sell machinery, because they are purely office people. Other causes are neglect in dispatching orders, and the substitution of inferior articles. Again, one is visited by a traveling salesman who cannot speak Spanish, and who knows nothing of the people who handle his goods, nor of the transportation difficulties.

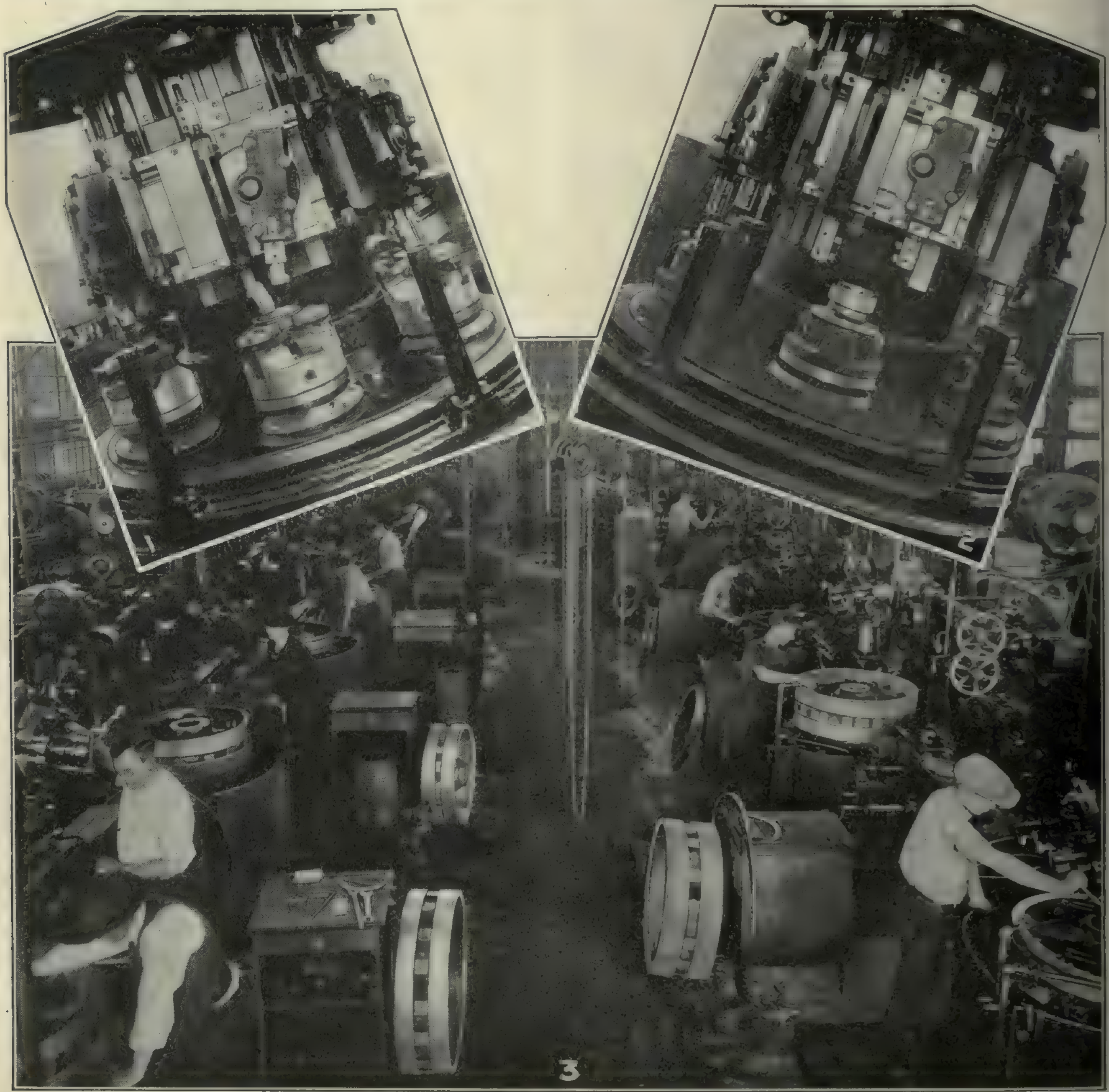
To my mind what is wanted, and I speak from a master mechanic's viewpoint of 20 years' experience, is representation by master mechanics who know, and who are known to, all the people here. That would go a long way in recommending machinery and requisite accessories. Powerhouse specialties, mining equipment, railroad accessories, water line fittings, shop tools and machines, oil burning equipment, hardware—in fact all things pertaining to the metal trades where a mechanical working knowledge is necessary, should be represented by the class of men spoken of. One man could represent a small group.

The usual method followed here is for some house, upon request, to become an agent. However, no push is put in and one has to be a miner to dig down and find out who has the machinery he wants. Advertising is not practiced except by a few of the largest concerns.

Care should be taken to give the representative a good salary, office quarters in the right spot, traveling expenses and the usual out-of-pocket. Men can be found right here who are in touch with the buying people, through social intercourse and who can give every attention to the article sold.

Think what it means to a man stuck away up on the mountains to find it necessary to make a week's trip when he wants a spare part. Conditions should be such that a telegram to his distributors would get it in half the time.

PRODUCTION



Figs. 1 and 2. Two operations on part of a roller bearing for a Timken axle are shown while being done on 8-in. Bullard mult-au-matics. This installation is a good example of high efficiency in all factors of cost. The machine on the first operation was in production 92 per cent, and the one on the second operation 93 per cent of the possible total time. On a 30-day run, no machine adjustments were made on the second machine. Careful inspection showed 100 per cent perfection of the work from the first machine and 99.86 per cent perfection from the second machine. To fully appreciate the vast strides made in production by this type of machine, one must see it in actual operation.

Fig. 3. In this illustration there is shown a large battery of Bullard vertical turret-lathes in the machine department of a steel foundry. The wheels shown, both on the floor in the foreground and in process on the machines, are regularly finished at the rate of 36 per day per machine.

IN PICTURES

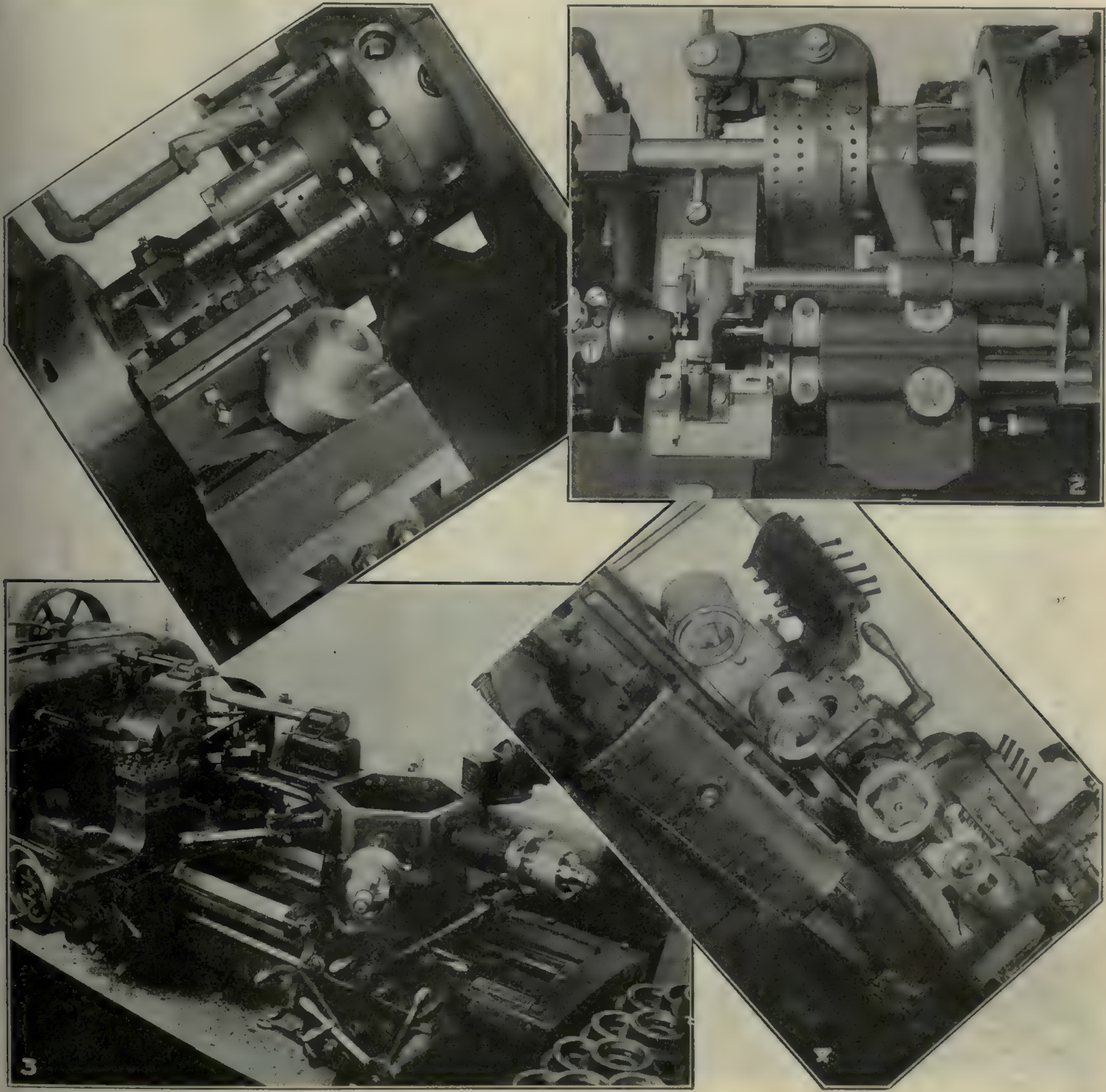


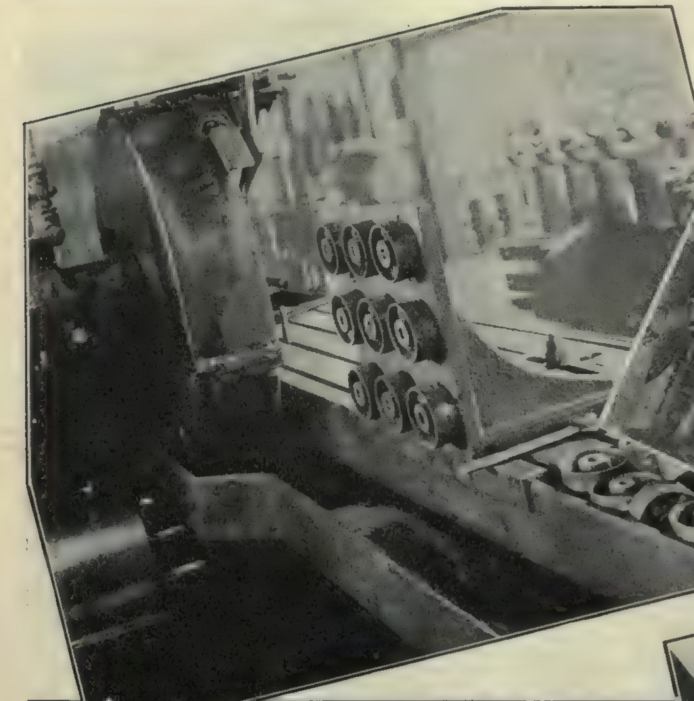
Fig. 1. Producing bevel-gear blanks from a 6-in. bar of steel is a husky job for an automatic screw machine. The motor-driven Cleveland automatic shown herewith turns out such blanks in 22½ min. each. If made under older methods the time required would be very materially increased.

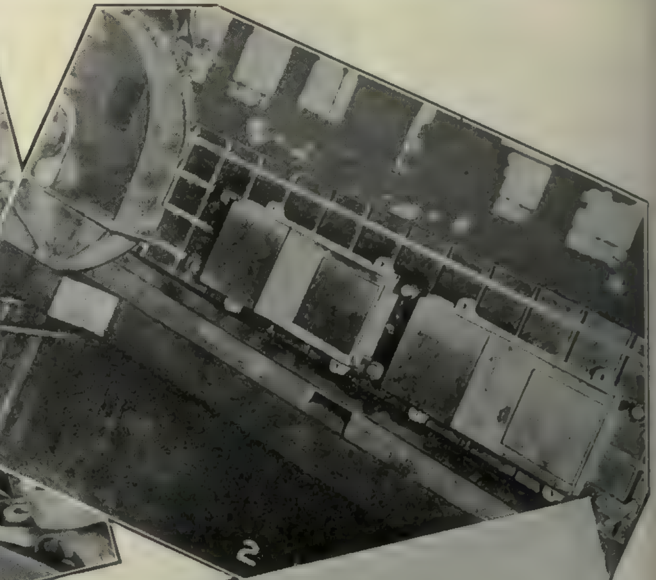
Fig. 2. Here is a Cleveland automatic of a smaller size turning out 800 pieces per hour. The material is brass rod and the product is spark-plug nuts. A much smaller quantity would be considered fast production on a hand-operated machine.

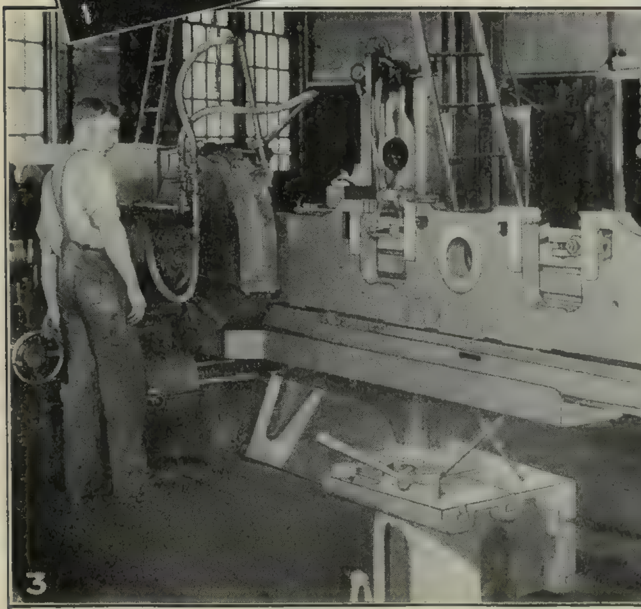
Fig. 3. Differential housings for automobiles require several operations for completion. The illustration shows a Foster universal turret-lathe machining housings in 2½ min. each. The modern turret lathe has made possible the production of such work in very brief time.

Fig. 4. The screw machine of today with its automatic selective-stops and its multiple tooled carriage is a hog for work. Here is shown a Foster screw machine turning out patented aluminum pistons at an up-to-the-minute quantity rate.

PRODUCTION







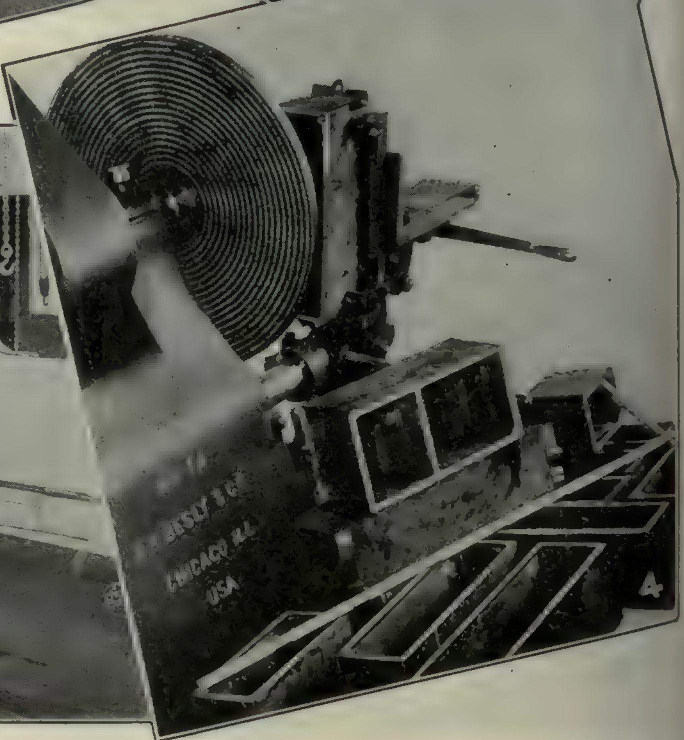


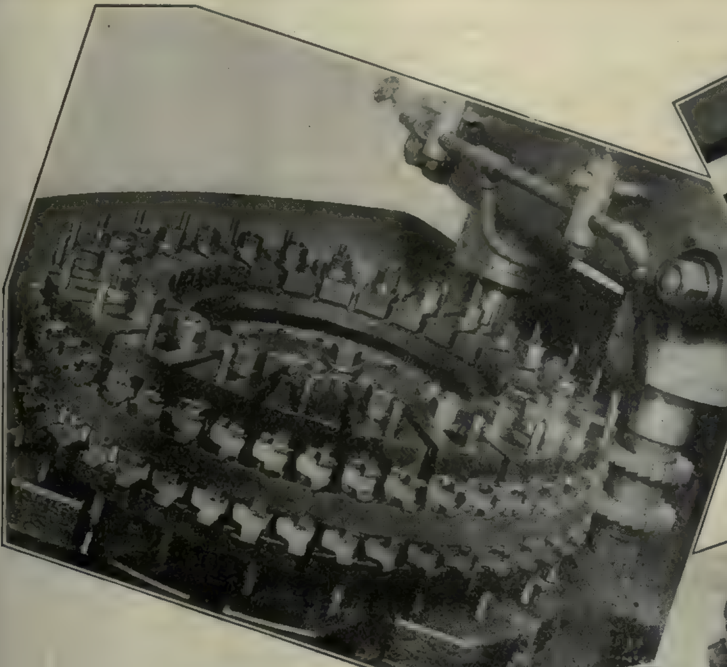
Fig. 1. Surface grinding as a production machining operation is of comparatively recent date. The illustration herewith shows the sides of pulleys being ground on a Diamond heavy-duty face-grinding machine in batches of nine. One-sixteenth inch of metal is removed from each side of the pulleys and the time from floor to floor is 5 min. for the lot.

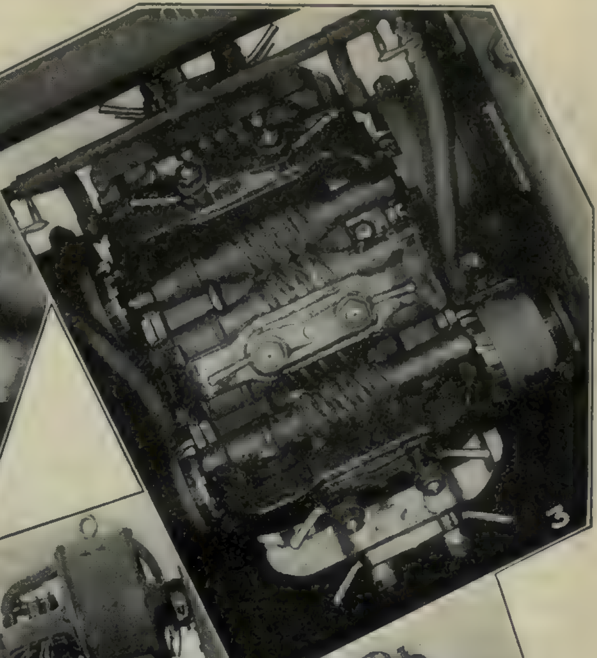
Fig. 2. Bases for centrifugal pumps are being ground on this Diamond heavy-duty machine in 5 min. each. The material is cast iron and the amount of metal removed is ⅛ in. The planer must take a back seat on quantity work of this character.

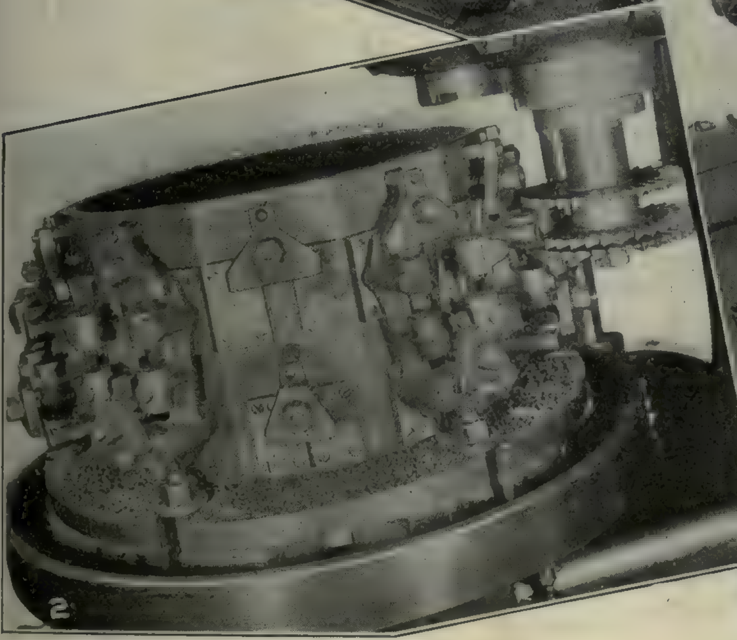
Fig. 3. Here a real planer job is being done on a Diamond heavy-duty grinding machine. Notwithstanding that ⅛ in. of metal must be removed from each side, the floor to floor time for grinding a pair of these frames on both sides is 2½ hr. This work was formerly done on a planer and required 6¼ hr. per pair.

Fig. 4. Comparatively large work is being machined on the Besly disk grinding-machine shown in the illustration. The castings are held so as to float against the disk and are finished by unskilled labor at the rate of 50 per hr. or eight times faster than the previous time on a milling machine.

IN PICTURES







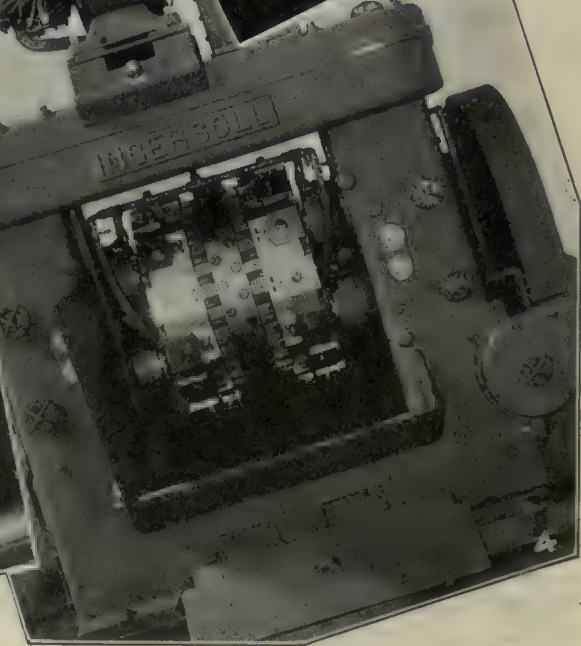


Fig. 1. The use of a revolving table provided with multiple fixtures has greatly increased the production capacity of the milling machine. As some of the fixtures can be loaded and unloaded while work in others is being operated on, the production is practically continuous. This illustration shows a Newton vertical double-spindle continuous milling machine roughing and finishing gear shifter forks. The fixtures hold 100 pieces and the production is 240 pieces per hour.

Fig. 2. The fixtures on this Newton machine hold 22 brackets for valve rocker-arms in which three bosses on each are to be faced on both sides. As the bosses are not all in alignment, two operations are necessary. Three faces are machined in one operation and the work is then reversed for milling the other three faces in a second operation. The production is 35 pieces per hour.

Fig. 3. The drum-type machine with horizontal spindles is particularly adapted for milling both ends of pieces too long to be straddle milled. The Ingersoll drum-type machine with its four spindles is here shown roughing and finishing both ends of worm shafts at the rate of 75 per hour.

Fig. 4. In addition to milling long work in both ends, the drum-type machine is well adapted to milling shorter work on one end by double ganging as shown in this illustration. Here an Ingersoll machine is milling the ends of 376 connecting rods per hour.

Magnetic Analysis of Steel

Uses of Electric Current for Inspection—Apparatus and Method of Operation—Relation of Magnetic to Mechanical Properties of Steel—Advantages and Difficulties

BY R. L. SANFORD
Physicist, National Bureau of Standards, Washington, D. C.

MANY physical and chemical methods for testing steel and steel products destroy the sample or render it unfit for the use for which it was originally intended. This fact has made necessary our present methods of vicarious testing. It is plainly evident, therefore, that any satisfactory non-destructive method which makes possible the comparison of each individual piece with one whose performance has been carefully determined and which thus serves as a standard of equality will have great commercial value.

Various non-destructive methods have been investigated by physicists and engineers, but none give greater promise of ultimate success than those of magnetic analysis. So great are the apparent possibilities in this direction that the United States government, through the National Bureau of Standards, is making as thorough a study of the subject as the present limited appropriations of the Bureau will permit, and the American Society for Testing Materials through its committee on magnetic analysis is co-operating with various industrial concerns and educational institutions in the development of this type of testing.

RELATION OF MECHANICAL TO MAGNETIC PROPERTIES OF METALS

The mechanical properties of steel are functions of its chemical composition, its micro-structure, and its mechanical condition. The micro-structure and mechanical condition, such as internal strain, etc., are determined by the thermal history and the amount and kind of mechanical work that has been done on the piece. The magnetic properties of steel are likewise functions of the same variables and any change produced in one set of properties is accompanied by a corresponding, though not necessarily proportional, change in the other. These facts constitute the fundamental basis upon which the science of magnetic analysis is being developed. Magnetic analysis may be defined then, as the utilization of magnetic methods for the study of the internal structure and mechanical condition of magnetic materials, particularly of iron and steel. The methods of magnetic analysis may also be used to detect internal changes on heating or cooling or even as an indication of mechanical properties.

MAGNETIC PROPERTIES OF STEEL

Whenever a piece of steel is subjected to the influence of a magnetic field, such as exists within a coil of wire, or solenoid, carrying current or between the poles of an electromagnet, it becomes magnetized and the degree of magnetization varies according to the strength of the magnetizing field. Although the mode of variation of this magnetization with the magnetizing force is regular and characteristic, still no satisfactory mathematical relationship between them has yet been established.

The characteristic relationship between the magnetization of steel and the magnetizing force producing it is shown graphically in Fig. 1. If a previously neutral or demagnetized sample of steel is subjected to a magnetizing force continuously increasing in magnitude, the resulting magnetization will increase at varying rates as indicated by the curve *O T D*. If this curve is determined in a certain definite manner, so that it is reproducible for a given sample, it is called the curve of "normal induction." The unit of magnetizing force (H) and the unit of magnetization or magnetic induction (B) are called the "gilbert per centimeter" and the "gauss" respectively. The ratio of corresponding values of magnetic induction and the magnetizing force, $\frac{B}{H}$, is called the magnetic "permeability."

SECRET OF PERMANENT MAGNETIZATION

If from some point on the induction curve, such as *T* in the figure, the magnetizing force is decreased, the induction does not follow the curve *O T D* in the reverse direction but "lags" behind as indicated by the curve *T R C*. This lagging of the induction behind the magnetizing force is called ***hysteresis***. When the magnetizing force has been reduced to zero there remains a certain induction as at point *R* on the curve. This is called the "residual induction" (B_r). It is the existence of this residual induction, or the phenomenon of hysteresis, which makes permanent magnets possible.

In order to reduce the magnetic induction to zero it is necessary to apply a magnetizing force in the reverse direction. The value of the reversed magnetizing force required to bring the induction down to zero, i.e. to the point *C* on the curve, is called the "coercive force" (*HC*). If the magnetizing force is varied continuously from a maximum positive value to an equal negative

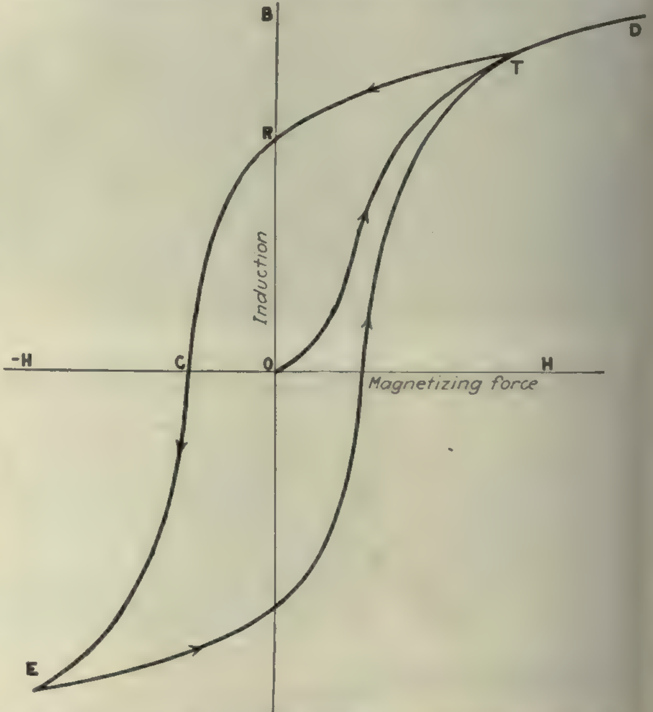


FIG. 1. RELATION BETWEEN MAGNETIZING FORCE AND MAGNETIZATION

value and back again to the same maximum positive value a closed loop (*T R C E T*) is obtained which is called a hysteresis loop. The point *T* whose co-ordinates are the corresponding values of maximum magnetizing force (H_m) and maximum induction (B_m) is called the "tip" of the loop. In giving values of B_r and H_c for any given material either the H_m or the B_m from which they were determined should always be specified.

These magnetic relations are definite and characteristic for the various compositions and kinds of metals; thus their measurement is of importance.

The photograph Fig. 2 shows the standard permeameter of the Bureau of Standards with which precision measurements of these magnetic properties of samples of iron and steel are made.

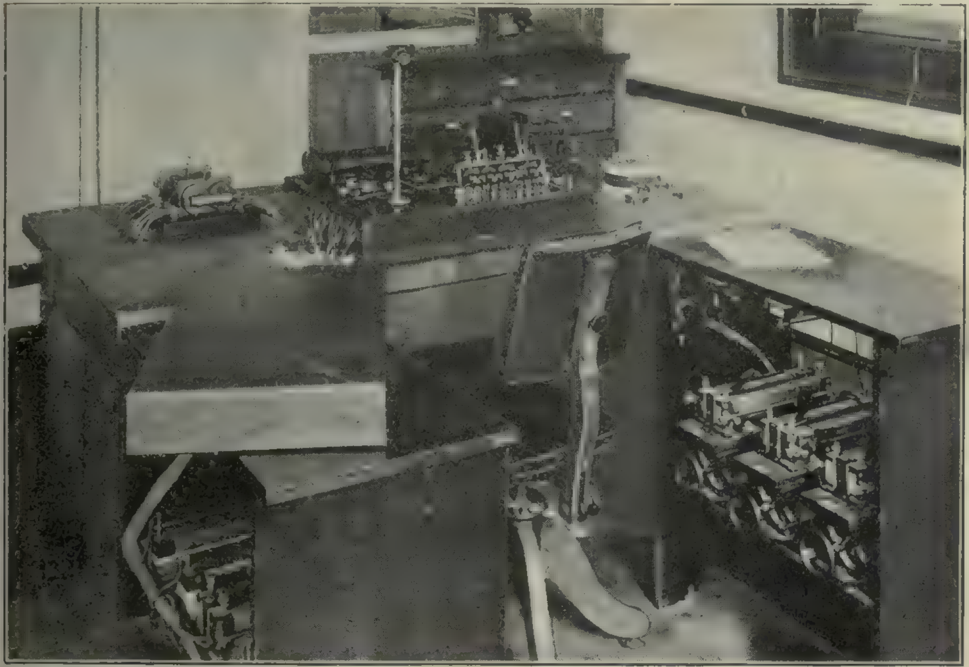


FIG. 2. BUREAU OF STANDARDS PERMEAMETER

The methods of magnetic analysis may be employed either by the investigator, as an aid in the solution of theoretical problems such as those arising in the study of the phenomena involved in the hardening of steel, or by the testing engineer as a non-destructive method of test to supplement the methods now in use for many iron and steel products. However, many fundamental investigations are still necessary before the methods can be fully used either for the study of various changes occurring during the heat-treatment of steel or for the collection of data on the relation between the magnetic and other physical properties of steel.

Any such study of the relation of the various properties is usually best carried on with specially prepared samples upon which accurate measurements of both mechanical and magnetic properties can be made. This is especially important in order that the work of various investigators can be compared. An example of this type of work is an investigation carried out some time ago at the Bureau of Standards on the properties of a 1 per cent carbon steel such as that sometimes used for springs. A description of this work is not necessary, but the curves of normal induction shown in Fig. 3 as taken from the report of this investigation are interesting to give some idea of how clearly the effect of variations in heat treatment were shown by the magnetic properties of steel of this composition. A still better idea of the abrupt changes in magnetic properties due to variations in heat treatment is given in the curves of Fig. 4 which show some results obtained on steel of slightly lower carbon content (0.85C). It is not difficult to see how such striking results can be used to distinguish between metals which have been differently treated.

Data of the type just described show the conditions existing *after* the sample under investigation has been cooled to room temperature. It is possible that much more information could have been gained as to the changes which took place during the heating or cooling if observations on the magnetic properties had been taken while the temperature changes were taking place. Some work of this kind has been done in other countries, but little if any in the United States. As can well be understood, such tests are difficult to make.

The results of investigations of the kinds just described are susceptible to many methods of interpretation and one of the problems as yet unsolved is to find the best methods of expressing the results so as to indicate most clearly the relationship between the various properties. While the evidence already at hand is sufficient to demonstrate that there is a very strict correspondence between the magnetic and mechanical properties of steel, these relationships are so complex that up to the present time no definite laws have been worked out. Indeed it may prove extremely difficult, if not impossible, to completely define in terms of the magnetic properties of a substance all of its other physical properties or vice versa. In spite of this apparently discouraging fact, we need not wait for the complete working out of all the correlations before applying magnetic analysis in a practical way.

For practical purposes, magnetic analysis has as its

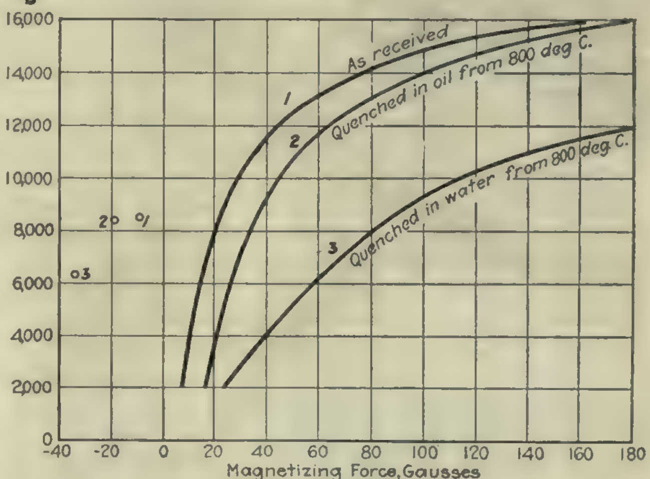


FIG. 3. EFFECT OF VARIATIONS IN HEAT TREATMENT

ultimate object the development of methods and instruments which can be used in the shop for the purpose of comparing the factory product with specimens which have been selected as standards of quality. At the present stage of development, each application must first be the subject of an individual investigation. The properties of the material must be studied, the magnetic criteria for quality must be determined upon and apparatus must be built for making the magnetic measurements quickly and accurately under shop conditions. After these steps have been completed, the final step is trial under actual service conditions to demonstrate whether the method is sufficiently rapid, accurate and reliable to warrant its commercial use.

For the examination of fabricated articles many different types of apparatus will be required. Odd shapes give extreme difficulty in the accurate determination of their magnetic properties. Fortunately, however, for purposes of comparison and routine testing, very accurate values are not necessary. Apparatus which is capable of yielding reproducable results with good comparative accuracy should be entirely satisfactory for this purpose.

PRACTICAL APPLICATION OF THEORY

One method which has been applied to the study of ball bearing rings is illustrated in Fig. 5. The ring is mounted on a table free to rotate and magnetized between the poles of an electromagnet which also rotates about the same axis. The rotation of the ring is opposed by a spiral spring. By means of a pointer and scale the torque exerted on the ring by reason of the rotation of the electromagnet can be measured. This torque is proportional to the energy required to carry the direction of magnetization of the ring through one complete revolution. It seems probable that this value may be used as an index in testing the rings. If the needle jumps during the rotation a crack or soft spot is indicated. The cracks shown by the pieces of a broken ring in Fig. 6 were detected in this manner. Unfortunately this investigation was interrupted by the war and has not been carried on to a practical conclusion, but very promising results may ultimately be expected.

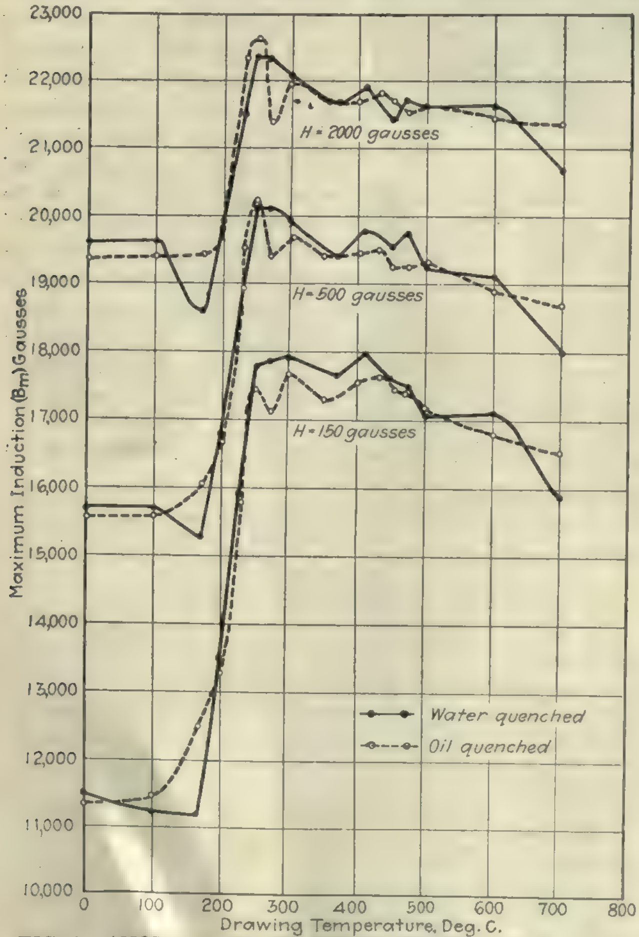


FIG. 4. ANOTHER GRAPH SHOWING EFFECT OF HEAT TREATMENT

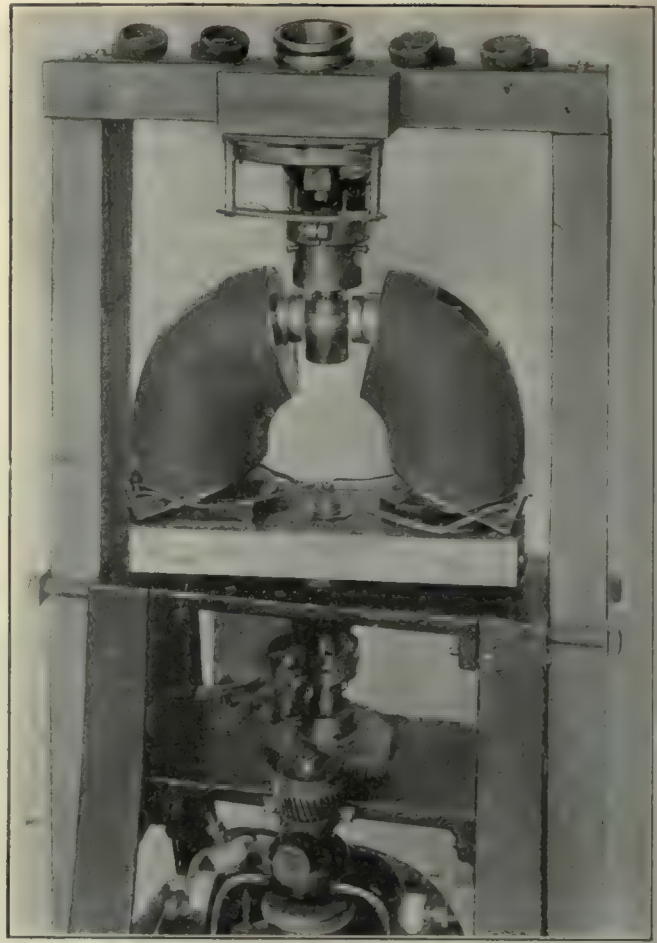


FIG. 5. METHOD OF STUDYING BALL RACES

Various investigations are now under way on the practical application of magnetic analysis to the testing and study of various products such as twist drills, chain, welded pipe and raw materials. Besides the testing of such materials for their general properties it is possible in some cases, such as the ball bearing rings just mentioned, to detect the presence of hidden flaws and imperfections as evidenced by variations in magnetic permeability.

This requires the method which has been developed for determining the degree of magnetic uniformity along the length of a specimen of a substantially uniform cross-section.

The apparatus for this test is shown in Fig. 7. It consists of a magnetizing coil through which the bar to be tested is driven by means of a set of rollers. Within the solenoid are mounted test coils which are connected to a sensitive electrical instrument. If the bar is uniform there will be no deflection of the instrument when the bar is moved through the coil. Any variation from uniformity, however, causes a deflection of the instrument. These variations in magnetic properties

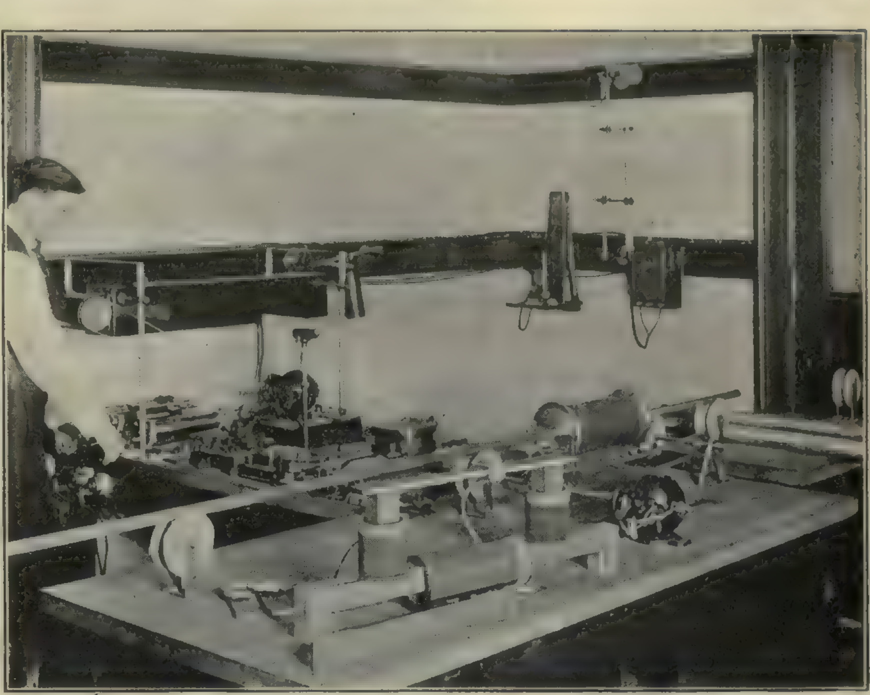


FIG. 7. APPARATUS FOR TESTING BARS OR PIPES

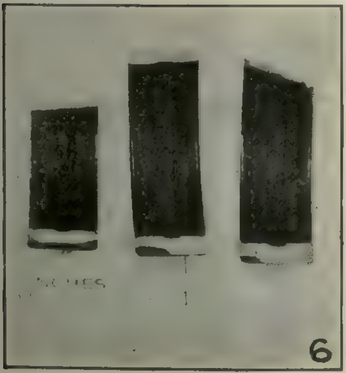
may be the result of any one of a number of causes. There may be chemical segregation in the bar; there may be mechanical strains; or there may be flaws or other mechanical imperfections. Any one of these conditions will be indicated by the apparatus. It is possible by moving a photographic film in front of a spot of light reflected from the mirror of the instrument to obtain a photographic record showing the degree of uniformity of the bar. Fig. 8 shows one example of the kind of flaw that may exist in the interior of a bar of steel. This flaw was detected by means of a magnetic test.

The greatest difficulty in this line of investigation lies in the interpretation of the results. This is due to the fact that there are many causes which may produce magnetic inhomogeneity, such as chemical segregation, strains and flaws, and it is difficult to differentiate between them. The conclusions so far warranted are: (1) A bar which is magnetically uniform along its length is also mechanically uniform; (2) a bar which is mechanically non-uniform along its length is also magnetically non-uniform and this non-uniformity will be surely indicated by the test; (3) bars which are magnetically non-uniform may or may not be seriously defective from the mechanical point of view.

Investigations are now being carried out with the end in view of distinguishing if possible between the effects of various conditions in the bar which give magnetic differences so as to avoid the acceptance of material which is really faulty, or the rejection of material which is for all practical purposes entirely satisfactory.

LIMITATIONS OF MAGNETIC TESTING SHOW NEED OF RESEARCH

The foregoing rather brief discussion of magnetic analysis is not presented as a comprehensive treatment of the subject. It is hoped, however, that enough of an idea has been given to show that magnetic analysis has great promise and should develop into a powerful tool in the hands of the metallographer for the solution of many of the complex problems encountered in the study of iron and steel, as well as a nondestructive testing method of great utility. It will not be possible to utilize this method to the fullest extent until a great deal of research work has been done, both in the collection of fundamental data on the correlation of properties and also in the development of methods and apparatus by means of which magnetic tests on various manufactured articles can be made. The development must necessarily be a gradual one and will require the closest of co-operation between investigators skilled in magnetic measurements and metallographers and testing engineers. It is not to be expected that magnetic analysis will prove to be a "cure all" for all the troubles encountered in the study of steel nor a universal testing method which will displace other existing methods. It is not too much to expect, however, that it will take its place among the recognized methods and that through its use much valuable information will be gained which could not be obtained by any other means.



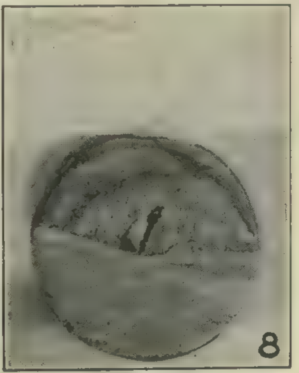


FIG. 6. RESULT OF CRACKS DETECTED BY MAGNETIC ANALYSIS. FIG. 8. AN INTERIOR FLAW DETECTED MAGNETICALLY

Airplane Service in Europe

The airplane service in Europe is not yet on a remunerative basis, according to a recent report from Consul Frank W. Mahin, of Amsterdam. Government subsidies are needed to keep it alive.

The Netherlands government estimates 370,000 florins ($148,740 at the normal exchange rate) as a subsidy, for the year 1922, for the service between Amsterdam and London, which is operated by a Dutch company. England plans to subsidize the English air service from London to Paris, Belgium, and Amsterdam, which seems to mean that a British company will compete with the Dutch between Amsterdam and London. France and Belgium grant varying sums toward payment of pilots, cost of benzine, etc. Germany gives a premium on the number of kilometers flown.

In spite of subsidies, however, it was decided to discontinue the air service between Amsterdam and German cities from Oct. 1 until next spring. The service between Amsterdam and London, and Amsterdam and Paris will, however, be continued without interruption during the winter.

The Deplorable Condition of Russian Industry

Most of the Men in Power Are Without Experience or Technical Education—The Russian Workman Cannot and Will Not Work

BY ROYAL R. KEELY

THOSE Americans who have come out of Russia with the statement that the industries and transport are operating with any degree of success are either ignorant or malicious, or both. It appears to me that some of them must have been bribed by the Bolsheviki to bring an optimistic report—either by a direct money bribe or indirectly in the form of profits on contracts awarded. I must say that there is shrewdness displayed in covering up the dirty work, but there is much evidence on close examination which leads one to certain definite conclusions. For the present, just one example to illustrate what I mean:

Since leaving Russia I met a big importer in the Baltic provinces, who began his quoting to the Soviet government by letter but was requested to quote only by phone in order to leave open the opportunity to put in a higher price to the Moscow government. When seed rye was quoted at about $55 per ton privately, the Bolsheviki were paying about $90. But the importer got only the market price and it is easy to guess where the difference went.

Of all the industries of Russia I found just one that had never been nationalized, in other words one of which the owners had not been robbed by the aid of the automatic and the machine gun. Another surprise came to me when I learned that this was one of the best, if not the best, factory in Soviet Russia. The owner was the International Harvester Company of America. The distinctive feature of the factory was that the old manager was left in control and was allowed to manage as best he could under the tremendous difficulty of government control of all labor, fuel, food, clothing, raw material, etc., without means of allotting an adequate supply. In addition, the transport and ways of communication were most deplorably bad. The manager, who was of German education and training, had succeeded in maintaining technical control of the plant, and while his production was infinitesimally low it was not so bad compared with other Russian plants.

MARTENS HEADS THE METAL DEPARTMENT

All means of production and ways of communication are controlled from the centralized Moscow office, known in English as the "Supreme Council of National Economy," of which Rikoff is head. Of this, the most important department industrially, and perhaps economically, is the "Metal Department," of which Ludwig Martens is now the head. Martens is (or was) a German subject; he was the official Bolshevik representative in New York, who was deported some months ago by the United States Government. The most competent two men among all the high government officials are Krassin, formerly head of the railway department and now head of the department of foreign trade, and Martens, both said to be of German origin, and to have German tendencies and German sympathies. People who have the interests of Russia at heart are grieved to think that these two, the only ones with technical, executive or business ability to bring anything better into Bolshevism, have degraded themselves by affiliation with this villany. It is said by those who know them that they abandoned their old system of morals and ethics for those of the Bolsheviki.

In June or July of this year, in a conversation with Martens, I was astounded at his admission that they had "discovered that *the Russian workman could not and would not work.*" In the past four years many have been sent to prison for statements of this character. During the last months of my stay, I was surprised at the openness of the criticisms and expressions of discontent among not only workmen, peasants and office clerks, but also among high officials. In a talk with Martens' chief assistant, a fairly able Finnish engineer, his secretary and another able engineer, the latter said, "When you first came to Russia there was still some hope of saving the industries or some remnant of them, but now it is absolutely lost and we must begin over from the beginning." To hear such statements from prisoners, or from open counter-revolutionaries would not be surprising; but from such high officials it sets one thinking, to say the least.

RISING GENERATION LACKING IN MORALS AND EDUCATION

Recently, while walking through the big Amo automobile factory in Moscow, with Martens, I wanted to hear his opinion, so I suggested that the buildings were new and of the finest, and completely equipped with the finest new American machine tools. He replied, "Yes, but dead, absolutely dead." This of course was evident, but still I was pleased to have his opinion. The plant should have had over 6,000 workmen, stores filled with raw materials, work in process and completed product. As it was, there was no material, and only about 1,200 poor, dirty, ragged workers, a considerable portion of whom were working on their new dining room. The mere detail that they had no production and almost no food was a trifling negligible detail to these wonderful Bolshevik managers.

On my arrival in Moscow, Lenin had given me liberty to travel, to see and to understand the production and transport system. In return for this opportunity to get acquainted with labor under Bolshevism, he asked me to tell him when I saw conditions not in accordance with American practice. I wrote him a personal letter dated Dec. 13, 1919, in which I said, "The Red Army has won at the expense of the industries—the bone and sinew of our modern life. The result is almost complete exhaustion of the ways of communication and production. Most of your men in power in the industries are without experience or technical education. It is hard for me to see how it is possible for them to succeed." The reasons were obvious: A painful shortage of trained workmen, raw material and fuel, clothing and food for the workers and transport. I also pointed out to him that equally serious was the fact that the few remaining workmen were spoiled. During the three years of the revolution, the propagandists had been preaching to them that now they were the owners and proprietors and that in the future they were to live in luxury and idleness as they were told the previous owners had done. This is a serious problem for future Russia. The present generation is so demoralized that there is no hope of its ever doing any satisfactory work. But that is not all, for the educational system has completely broken down under the Bolsheviki. The moral foundation also is destroyed, so that no one in the rising generation is being prepared for the rebuilding of destroyed Russia.

I was then asked to spend some time with Krassin, at that time Commissar, Department of Ways and Communication. I found conditions in the railway shops, locomotive and car shops no better than in the other factories, although a greater effort was being made to keep the railroads running. Krassin saw and understood the situation, yet he continued to support his Bolsheviki. It can only be assumed that he has motives. It gives him power and a good position, and he is in a position to direct the affairs of Russia into German hands. Of one thing I am sure; he is no Bolshevik. He is in the game, like most of the others, for the power and influence which it brings. He is a business man and an executive. Before the revolution he was manager of the big German Sieman-Halske factories in Russia, employing 40,000 men.

By this time I had come to the conclusion that there was nothing in Russia but the destruction of what had been, and I determined to leave. But the gates of Russia open only inward. The Bolsheviki have a dread of letting anyone get out who has any real knowledge of the destruction wrought, the atrocities committed in the name of Socialism or the hopelessness of the situation. I told Lenin that anybody with any education, ability or experience wanted to leave Russia and would at the first opportunity, and that while he might prevent them from going and force them into service, a nation of slaves and prisoners would not make a prosperous or wholesome country.

In Petrograd I found so much of interest that I remained until the last of February, 1920. The factories I found even more dead than in Moscow. The big Tregolnik Rubber Co., with fine buildings and equipment, and employing before the revolution some 38,000 men, was idle. I spent my whole time interviewing former bankers, economists, engineers and factory managers, and in inspecting the important factories, and talking with the factory executives and workmen. What impressed me most strongly was that they were all of the opinion that there was no possible hope of reconstruction or life under Bolshevism.

A VISIONARY FOREIGN TRADE DEPARTMENT

I was advised to visit the newly organized department of Foreign Trade. Since I had convinced myself that there was no prospect of rebuilding Russia or even of supplying the common necessities at home, I turned with some enthusiasm to the Foreign Trade Department, hoping that I might find there a carefully worked out plan for saving the Russian situation through trade—export and import. I spent almost the whole day with the manager. He outlined to me at considerable length the whole Bolshevik industrial plan. He told me that the spirit of the industrial workers was fine; that they had in their central labor union hall the secretaries of all the various unions (about thirty in all I think) who could be called at a moment's notice on any important question and immediate action secured. He outlined at length their plan for moving the basic heavy industries to the iron and coal fields of the Ural mountains in the west, or the Ukriena in the south. The lighter factories, requiring much highly skilled labor, would remain in Petrograd. And so they had an elaborate plan for the complete rearrangement and rebuilding of the entire manufacturing system of Russia.

When I asked him if he thought Russia could accomplish all this without the aid of foreign capital he said, "No." Then I asked, "How will you enlist this aid?" He replied, "By exports." Then I asked him what they would export. He began with timber and wood, but I asked him, "How is it possible for you to consider exporting wood when your people are living in great distress in houses improperly heated, and your factories are, in many cases, idle because of lack of wood fuel?" (Coal and oil are at present out of the question.)

Then he said they would export flax, but I told him that from my own knowledge there was no appreciable quantity of flax in the country and there was no transport to take it to the ports, and beside, the small quantities which they had would be required for home consumption. Next was gold, but I remarked that while no doubt there was plenty of it in the Ural Mountains, they had no capital, no transport, no organization and no trained workers to produce it. Then he mentioned irrigation in Turkestan, a country that has ideal conditions for cotton. But Turkestan requires irrigation costing millions of dollars, colonization and years of time. He next referred to hides and leather, but I told him the leather industries of Russia could not run because of the shortage of hides. During the long war horses and cattle were destroyed more rapidly than they were reared. The peasants were away in the army and the farming was neglected. Since the revolution the Bolsheviki have systematically robbed the farmers of their stock. If a peasant had more than one cow or horse the Red Guard took away the surplus, either giving to the neighbor who had none, or appropriating for the army or city population. Many hides were lost because of lack of salt and preservatives and improper care. He also referred to grain, but the present hungering proves the absurdity of such a suggestion.

Finally he was forced to admit that I knew the facts and that there was no prospect or hope of help from exports. Then he said that they were accustomed to very little. They would, rather, he said, get along without the modern things and be free from capitalism; they would build from the beginning and very slowly. Then he told me of a plan they had for buying a few locomotives on credit against gold deposits which they would make in foreign banks. They would send the locomotives into the interior of Russia, bring out raw products and sell them for enough to buy other locomotives, and so on. More than a year has passed since that interview and no progress has been made in either production, exports or purchases. In fact there is far less prospect now than then. Some very small purchases have been made, of most necessary things, but only with gold payments in advance. There is no possibility of credit or business except on a strictly cash in advance basis with a government which has no sense of obligation to written contracts.

Early this year I met in prison the head of the timber concessions and export department. I said to him, "Yours is an interesting department, for on the forests Russia can realize more easily and quickly than on any other of her natural resources. What is being done in this department?" "Oh," he said, "we have elaborate plans and many inquiries from the outside on timber concessions." He had divided the vast timbered area of Russia into small blocks, one or more of which would be given to each concessionaire, but always with a string attached, i.e., each must build certain permanent improvements, such as waterways, railways, saw mills, pulp mills, etc. But I said, "Just what timber concessions have been actually given?" He reluctantly admitted that at that time none had been given. "But," I said, "you certainly must have exported some timber." He replied, "Yes, we have exported some veneer lumber (thin, three-ply lumber used for making packing cases), but that went to the John McDougal Lumber Co., in England, and applied on an old contract for which payment had already been made.

Plans For an International Hotel

This summer there was a proposed "concession" for an international hotel in Moscow. A great lot of time was spent in perfecting details. The Bolsheviki were to put the hotel in first-class repair and then turn it over to the concessionaires who would have the right to secure their help and provisions from abroad and charge their guests in foreign currency. The plan seemed to have a prospect of success, but the project failed and no concession was given.

I not only saw the industries and transport methods in Moscow, and Petrograd and surrounding districts, but I talked with hundreds of men from all over Russia, including Siberia, so that I got an understanding of the national economic situation. The conditions in Moscow and Petrograd are undoubtedly the best in all Russia, everything considered.

Friction and Carrying Capacity of Ball and Roller Bearings*

Experiments were undertaken by the Bureau of Standards at the suggestion of the Navy Department to determine the maximum safe load and the static friction under load of ball and flexible roller bearings.

Tests were made on balls of 1.00, 1.25 and 1.50 in. diameter in grooved straight races with the ratio of groove and ball radii 1.03 and 1.10; 1.04 and 1.12; 1.04 and 1.12 respectively.

The rollers 1.25 in. in diameter and 5.25 in. long were tested in flat and cylindrical races; the inner cylindrical races having radii 3.5 and 10 in. and those of the outer races 4.75 and 11.25 in. respectively.

The scleroscope hardness of balls and ball races was about 65, that of rollers 70 and of the roller races 97.

Method of Test

Friction Test. Two balls were used in the static friction test to secure stability in the loaded condition. The test was made in a 50,000 lb. Riehle machine; the starting effort was determined with a spring balance. One of the two races was movable and rested on rollers, whose friction was determined separately. No lubricant was used during the test.

Similar tests were made on the rollers, using steel plates. In addition, the cylindrical races were fitted to a 230,000-lb. Emery testing machine. Two rollers diametrically opposite were used being held in position by retainers having the same axis of rotation as the inner race.

The torque necessary to rotate the system was determined by a spring balance acting on a lever attached to the inner race.

Compression Test

Compression Test: To measure the total deformation of a ball (or roller) and two races, an apparatus was designed consisting of a simple lever system. The relative displacement of the longer arms which was proportional to the total deformation of the races and the ball was measured by micrometer microscopes. A deformation of 0.00001 in. could be measured. A similar device was used in determining the deformation of rollers.

To determine the contact area between the race and the ball (or roller) an extremely thin film of lubricating oil was applied to the surface of the race, while the ball was dry. The contact surface was distinctly visible as it appeared darker than the surrounding surface. Its diameters were measured by a micrometer microscope.

Conclusions

Friction Test: (1) The starting friction is nearly the same for both sizes of groove. The groove having the larger radius gave the lowest value.

(2) The ratio of starting friction to load (0.00055) is nearly the same for all three sizes of balls and increases slowly with the load (more rapidly for small size ball) until the "critical" load is reached, when the increase becomes rapid. The critical load varies with the diameter of ball, 1,300 lb. for 1.00-in.; 1,700 lb. for 1.25-in. and 2,200 lb. for 1.50-in. balls.

(3) A similar "critical" load, 25,000 lb. was found for the larger roller bearings with a ratio of friction to load equal to 0.00075.

(4) This "critical" load at which the friction began to increase more rapidly was in all cases lower than the safe load as determined by permanent deformation and calculated from Stribeck's law.

Compression Test: (5) The results of compression tests of balls and rollers agree roughly with the Hertz's theory. The differences are ascribable to inhomogeneity of the material. The total deformation of ball (or roller) and races follows pretty closely the law of a straight line. The smaller diameter of contact area agrees with that given by Hertz's theory, the other diameter differs considerably. This is due to the fact that the major diameter of the arc of contact is not as assumed by the theory, very small in comparison with the diameter of the ball.

(6) The permanent set of a ball is quite negligible even for very high loads (10,000—30,000 lb.) which produce large permanent sets in the races.

(7) The permanent set of the ball races increases very gradually; there is no indication of a load below which no set occurs. With a sufficiently accurate measuring device, the permanent set of races may be discovered at a very low load, below that used in actual practice. The load limit depending upon permanent set of races may be arbitrarily assumed.

(8) A flexible roller does not produce any appreciable permanent set of races unless stressed beyond its proportional limit, which is about 130,000 lb. This limit tends to decrease as the radius of race increases. The breaking load of the rollers was about 190,000 pounds.

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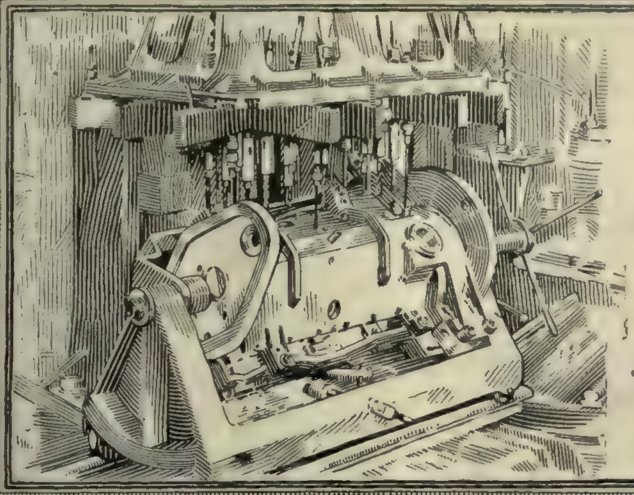
*Abstract of Technologic Paper of the Bureau of Standards, No 201, by H. L. Whittemore and S. N. Petrenko.



Tool Engineering

By

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Special Work-Holding Fixtures for Lathe Use Continued—Closing-in Devices for Outside Holding —Special Faceplate Tooling—Outside-Holding Fixtures for Threaded Work

In Fig. 260 is shown an example of a piece of work *A* which has been previously machined at *B* and *C*, and must be held for the operation indicated by means of the previously machined surfaces. A special form of closing-in device is used for the purpose. The end of the spindle is furnished with a nosepiece *D*, this being made of steel hardened and ground. The work is to be machined on an angular surface and at the end *A* in this operation, so that it is necessary to make the holding device in such a way that it will not interfere with the cutting action of the tools.

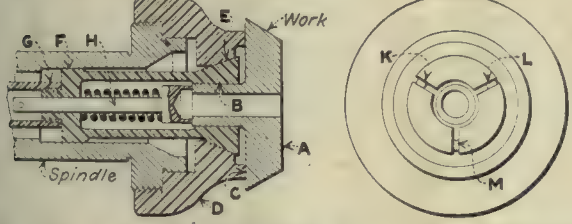

FIG. 260. CLOSING-IN DEVICE FOR OUTSIDE HOLDING

A special spring collet *F* is ground to fit the portion *B* and to a taper corresponding with the angular surface *E* in the nosepiece. This collet is split in three places, as shown in the end view at *K*, *L* and *M*. It is operated by means of the lever at the end of the machine through the sleeve *G*, which connects with the collet mechanism. The device is provided with a knockout *H* which operates automatically by means of the coil spring shown. In setting up this piece of work, a plug is placed in the turret of the machine, and is brought up against the end of the work until it strikes the end of the nosepiece at *C*. The operator holds it there while operating the collet mechanism, after which the turret is indexed and the cutting tools are brought up as needed.

A knockout device such as that shown may be found very convenient for any work which cannot be easily removed from the fixture, and numerous applications of a principle similar to this can be used on various types of fixtures. It is usually necessary when a fixture is equipped with a spring knock-out to use the turret to hold the work in place, so that the spring will not tend to force it out of position while chucking.

In holding a long piece of work having a finished surface of considerable length on which it is necessary to grip it during the holding operation, a somewhat different method may be necessary from those that have been previously shown. An example of this sort is shown in Fig. 261, in which the work *A* is a projectile on which the outside work has been done in a previous setting. The work must be located by the outside finished surface for the operation of boring the inside *B*. Furthermore, the concentricity of the outside and inside is important, so that the closing-in device must be very accurately made.

The fixture *E* is so made that it fits an adapter at the point *F* and is secured to it by means of four screws as shown. An end stop for the projectile is provided by boring out the inside surface *K* to the same form as that of the end of the work. In placing the piece in position in the chuck, it is held back against this seat while tightening the collar *G*. This collar is ground to a taper on the inside, so that it fits the corresponding taper *D* on a spring collet of special form. The other end of this collet at *C* fits a tapered portion in the inside of the holding device. The collet is made of tool steel and split in six places, three from each end, so that it will expand and contract evenly. A special device of this kind is useful when a piece of thin work is to be handled, as it does not distort the work, yet it holds it with sufficient pressure to enable the machining work to be done.

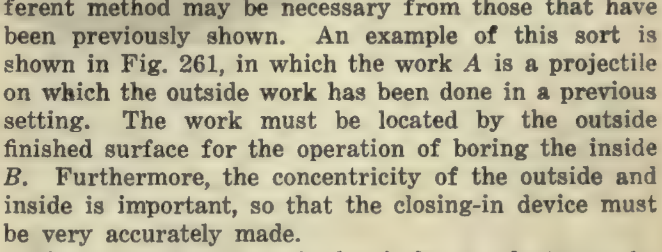

FIG. 261. DOUBLE-END CLOSING-IN DEVICE FOR PROJECTILE

We have dealt largely in the previous descriptions with the location of work from surfaces more or less

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concentric with those which are to be machined. The example shown in Fig. 262 is a radical departure from those mentioned in that the work *A* is a drop-forged lever which has been previously bored and reamed at *B*, and which has to be milled on the surfaces *C* and *D*. The fixture shown was designed for the boring, reaming and facing of the large hole. The requirements of the work are that the distance between the hole *B* and the large hole in the hub shall be held closely to size and that they shall be parallel to each other. The fixture *E* is a casting, which is recessed at *G* so that it can be fastened to an adapter, as indicated by the dotted lines. The work is located on a hardended plug having a shoulder at *F*, this end of it being held down by means of a nut and washer as indicated.

The large hub locates on a hardened bushing *H*, which also acts as a pilot bushing for the tools used in generating the hole. In order to locate this end of the work centrally, two swinging arms *L* and *M* are used, being cut away where they come in contact with the work, so as to form a "V." The two members *L* and *M* are so positioned on the fixture that they come above the parting line of the forging and are in contact with a slightly angular surface on the hub, which tends not only to locate the hub but to hold it down slightly against the surface of the bushing *H*. The two arms are operated by means of a plunger *P* which is set up by means of a cam at *Q*. There are two plungers *O* and *N* controlled by coil springs behind them, and these plungers throw the arms *L* and *M* out away from the work when the cam is released.

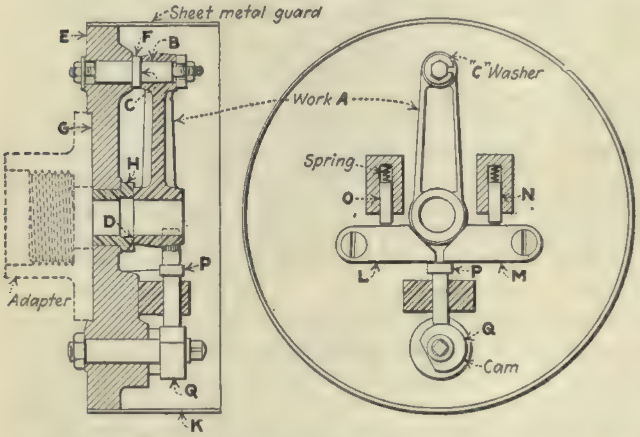


FIG. 262. FACEPLATE FOR SECOND OPERATION ON DROP-FORGED LEVER

This fixture is of clean design and there are several good points in its construction. The type of V-block used has been described in a previous article. Due to the fact that protection is required for the outside of the fixture, a sheet-metal guard *K* is applied, so that it surrounds the entire fixture and guards the workman from injury. An additional advantage in this guard is that it prevents the lubricant from flying on the operator, as it might otherwise do if no protection were provided.

Holding a Thin Casting

In Fig. 263 is shown a condition somewhat out of the ordinary. The work *A* is a thin casting which is to be machined in the central tapered hole and on the outside diameter; and also an annular groove is to be cut at the back of the flange as shown by the *f* mark. The work is set up for the operation on three washers *E*, these being so arranged that they will rock on the spherical surfaces *H* so as to equalize any roughness in the casting at the points where they come in contact with it. Similar washers are provided at *F* for the same purpose.

In locating the work, the turret is furnished with a special locating bushing, as indicated at *C*, this bushing being brought up before the bolts are tightened so that it receives the end of the taper hub *B* in the center of the work. The turret is held in place in this position while the bolts are being tightened. A simple type of face plate *D* is used for this fixture. Additional support is given to the work by means of a spring bushing *G* having three points which come in contact with the work opposite to the center hub. This bushing is allowed to spring into place, after which it is held by means of the screw and plug at *J*. This work is a rough casting on which no previous machining work has been done, yet the fixture is so much out of the ordinary that it was thought best to include it here.

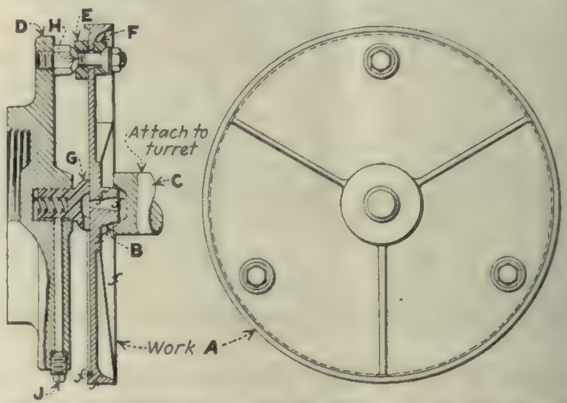


FIG. 263. FACEPLATE FOR HOLDING A THIN CASTING

Work which has been threaded on the outside and on which other operations are to be performed in concentricity with the thread must be carefully held in a special fixture if work is to be done with precision and speed. It may be thought that the only provision necessary for work of this kind would be to screw the piece into a threaded bushing, letting it bear up against a shoulder of some sort, according to the nature of the work. This method might be all right in some cases if

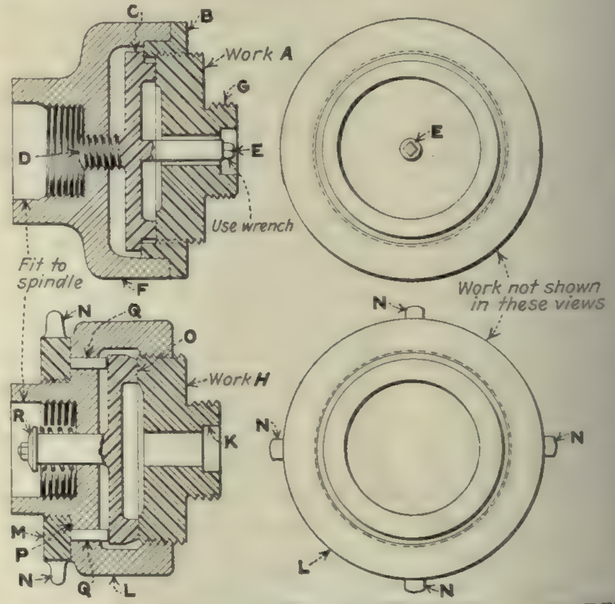


FIG. 264. OUTSIDE-HOLDING DEVICES FOR THREADED WORK

only a few pieces were to be machined, but it should be remembered that the pressure of the cut would naturally tend to tighten the work in the bushing, so that it might be very difficult to remove after the operation. Provision should, therefore, be made against this tendency by designing a special holding device.

An example of this sort is shown in Fig. 264 at *A*. The work shown here has been threaded on the outside of the large end and has been faced on one side and the center hole drilled. The work to be accomplished is the threading of the small hub *G* and facing the end. The threaded portion *G* must be concentric with the large end. A special nosepiece *F* is fitted with a hardened bushing *B*, which is threaded on the inside. The nosepiece is fitted to the end of the spindle. A flanged plug *C* is turned down at *D* and threaded with a left-handed, coarse-pitch thread. The flanged portion of this piece strikes against the inside end of the bushing *B*. When the work is screwed into the bushing it seats against a portion of the flanged member, as indicated. This acts as an end stop for the work. After the machining has been done, a socket wrench is applied to the end at *E* so that the pressure on the work is relieved, thus permitting it to be readily unscrewed.

Another type of chuck for the same piece of work is shown in the same illustration. The work *H* is screwed into a nosepiece *L*, so that it rests against a flanged member *O*. This member has two pins in it at *Q* extending through to the back of the chuck and bearing against the knock-off ring *M*. When the work is being placed in position, this knock-off ring is screwed up against the back face of the chuck at *P*, thus positioning the locating flange. After the work has been machined, the lugs *N* are struck a sharp blow with a lead hammer, which releases the work and allows it to be unscrewed from the chuck. The flanged member is provided with a stem on the end of which a nut and washer at *R* holds the coil spring in such a position that it keeps pressure against the knock-off member. The member *M* is threaded with a coarse-pitch, left-hand thread, in order to facilitate loosening it and also to make the movement more rapid.

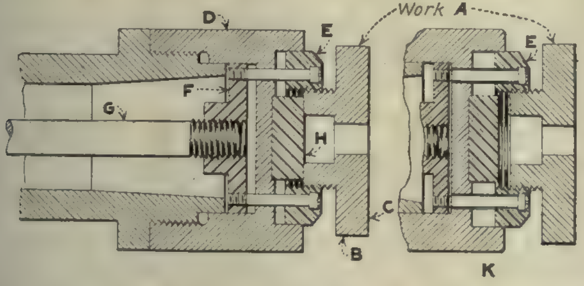


FIG. 265. OUTSIDE-HOLDING DEVICE FOR THREADED FLANGE

Either of the two designs used in this illustration can be used for work of this kind, but in all probability the latter will be found more adaptable for the general run of work. It is important in any device into which a threaded piece is to be screwed to make sure that the end position of the work is positive.

Outside Holding Device

Another example of an outside holding device for a threaded member is shown in Fig. 265. The work *A* is a flanged member which has been threaded on the hub as shown. It is to be machined on portions *B* and *C* in this operation. A nosepiece *D* is screwed to the end of the spindle and is fitted with a threaded ring *E*. Two screws pass through this ring and enter a disk *F*, into which is screwed a draw rod *G* extending through to the rear end of the spindle and connected to the collet mechanism. When the work is placed in position in the bushing *E* it is screwed up against the hardened disk *H*, which gives it the end location. After the work has been done on the piece, a movement of the collet closing lever carries the bushing *E* forward, as indicated at *K*. This action removes all the strains on the work and allows it to be unscrewed very readily. It would be possible to use a device of this sort on a lathe not equipped with collet mechanism, by using a handwheel at the end of the spindle to operate the rod *G*. For small parts which have been threaded, a device of this kind can be used to advantage.

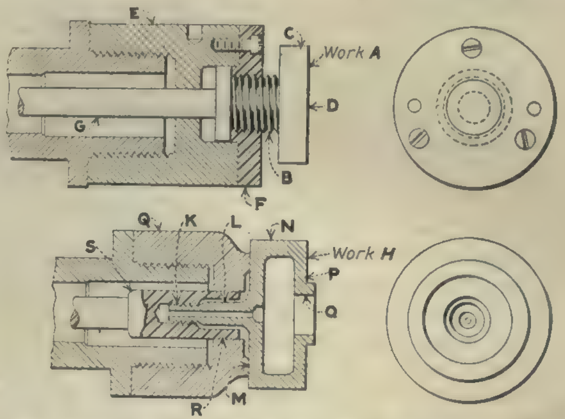


FIG. 266. TWO SPECIAL CHUCKS FOR THREADED WORK

Chucks for Threaded Work

In Fig. 266 are shown two other examples of chucks designed for holding threaded work. The piece shown at *A* has been threaded at *B*, and is to be machined in this operation at *C* and *D*, so that it will be square with the threaded portion. The nosepiece *E* is fitted with a hardened threaded ring *F*, into which the work is screwed until it rests against the end of the plunger *G* that acts as an end stop. This plunger can be operated by a handwheel or by means of the collet mechanism, depending upon conditions. This particular design is so simple that it needs no further description, the working of it being very apparent from the illustration.

A piece of work shown at *H* has been threaded at *K*, turned at *L* and faced at *M* in a previous operation. The outside portion *N*, the hole *O* and the face *P* are all to be machined square and concentric with the threaded portion. The nosepiece *Q* is of hardened steel ground at *R* to fit the sleeve *S*. When the work is placed in position in the chuck, it is screwed into the member *S*.

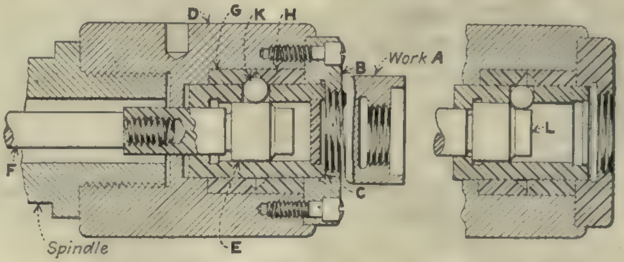


FIG. 267. QUICK-OPERATING THREADED CHUCK

which is operated by a handwheel at the end of the spindle. Considerable pressure is necessary in order to make sure that the work will not slip when the outside *N* is being turned. The method of releasing the work is obvious.

QUICK-OPERATING THREADED CHUCK

In Fig. 267 is shown a design of a quick-operating chuck for holding threaded work. The piece *A* is screwed in to a hardened threaded ring *B*, and its endwise location determined by its contact with the end of the sleeve *C*. This sleeve is contained in a nosepiece *D* screwed to the end of the spindle, and it is operated by means of the shouldered member *E* attached to the operating rod *F*. The inside of the nosepiece is fitted with two hardened bushings *G* and *H*, chamfered where they come together so that they form an angular internal groove. The sleeve *C* has a hole in it slightly larger than the ball *K*, so that the latter will work freely in it. In operating the device, the rod *F* is pulled back until the shoulder of the member *E* strikes the end of the inside of the bushing *C*, at which time the rod takes the position shown at *L* in the other detail. The ball is constrained to travel toward the center on account of its contact with the angular groove. This releases the whole mechanism and allows the work to be removed easily.

The advantage of an arrangement of this sort is in the positive lock which is provided for the bushing *C*, so that it is not necessary to keep a strain on any of the members. The ball secures the bushing in an accurate and positive manner, giving it at the same time correct end location.

Co-operation in Foreign Trade

BY W. C. ANDERSON

The business of the United States in foreign countries is still approximately 50 per cent greater than it was before the war. Lower prices have much to do with the general apparent depression compared with our foreign trade during the war. Other countries found it necessary then to force their orders upon us and we took the orders and filled them any old way. Confirmed Bankers Letters of Credit were surely worthwhile documents, but most of these attractive assurances of payment stopped when the war stopped. Many of the shipments to foreign ports stopped also.

Those manufacturers who still have a good foreign business are the ones who filled their orders with some degree of conscientiousness. Those who lost their business were the ones who filled the orders with any old thing and raced to the bank with the invoices and bills of lading, cashed in and waited for another victim. The successful American manufacturers are those who worked with an eye to the future and built up a foreign business based upon honest dealing and fair treatment. They were the ones who adjusted claims promptly and gave their customers the consideration to which a good customer is usually entitled.

WHAT CONSTITUTES FOREIGN BUSINESS

Foreign business, now and from now on, is the learning of just what the foreign customers want and complying with their wants. Up to the present time we have had no co-operation in these matters; that is, to any great extent. Our consular service has no appropriations for the purpose of acquiring information relative to the needs of foreign buyers. The United States Consuls in foreign countries have no means of gathering information for the American manufacturers. What is needed by the Department of Domestic and Foreign Trade is a staff of men who know how to go into foreign markets and gather detailed information as to requirements. Sending excursionists and sightseeing delegations under the nom de plume of trade investigators doesn't result in information that is practical to the manufacturer. What the American manufacturer wants to know is what kinds of goods are used and what prices are paid and how he should pack the goods. He wants to know how to meet English and German competition, and above all he wants to know how to overcome the restrictions Great Britain has put upon other nations, including ourselves, in order to make our foreign trade an entanglement of detail. He wants to know why everything he sends out has to be marked "Made in the U. S. A." He wants to know whether he has to put this on goods when no English words appear on the shipment.

If all manufacturers would appeal to their representatives in Washington through their various manufacturers' associations it might be possible to have appropriations made that would enable our consular service abroad to gather the vital detailed information.

If every manufacturer would demand action in the matter it wouldn't be long until all manufacturers would have a good working knowledge of foreign trade requirements—and that is the co-operation which is needed.

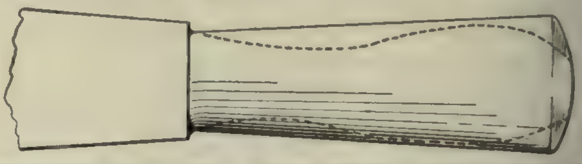
Write today to your representative in Washington and ask him to support a movement for appropriations which will enable our consular service abroad to gather foreign trade information.

Make your appeal through your "Manufacturers' Associations" and build upon a substantial foreign trade foundation.

Are Hollows Worn in Hammer Handles?

BY R. G. MCDOWELL

In the columns of the *American Machinist* of recent issues, numerous articles have appeared under the above title. For the information of the younger machinists the writer can say that he has known for forty years that hollows are worn in hammer handles. When I was an apprentice I used the same hammers that my father had used and the handles were worn when I got them.

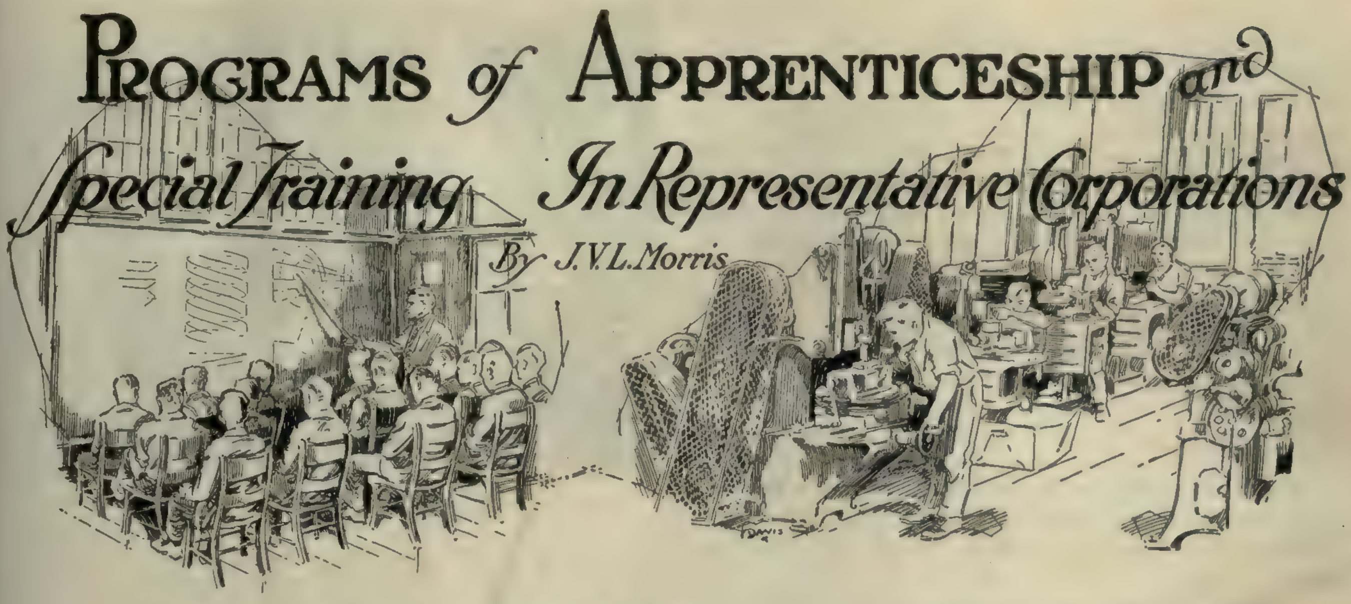

SHOWING WEAR ON A MILD STEEL LEVER-HANDLE

The handles of hammers used by diamond setters in setting diamonds in rock drills are generally worn though used with dry, clean hands.

The other day I noticed that the handles on some of the levers used in mine operation were badly worn. The levers are of mild steel, and are shifted about one thousand times in twenty-four hours. The accompanying sketch shows in full lines the original shape of the handles, and the dotted lines indicate the average shape to which they have been worn in 23 years of service.

Programs of Apprenticeship and Special Training In Representative Corporations

By J.V.L.Morris



XVI. The Watervliet Arsenal, Watervliet, N. Y.

Separate Department for Apprentice Training—Evening Classes for Improvement and Trade Extension —Training of Foremen—Well-Rounded Plan of Employee Instruction

THE Watervliet Arsenal has long been maintained by the Ordnance Department of the United States Army. For ten or twelve years apprentices have been employed, but, owing to the relatively small number of employees previous to the late war, not more than ten or twelve were taken on each year. As a result, however, of the increased production stimulated by the war and an awakened interest in apprenticeship there were at the time this survey was made seventy-six apprentices, all being in the machinist's trade. In this connection it should be noted that there were 475 all-around machinists and toolmakers employed in the arsenal, and about the same number of operatives and skilled specialists.

The plan of organization for training is of interest. In general charge of all educational activities in the works is a superintendent of education. These activities embrace apprenticeship, intensive study, visual instruction, mass education, a vestibule school, and foreman training.

APPRENTICE TRAINING

In charge of apprenticeship under the direction of the superintendent already mentioned is a supervisor, who is a machinist of long experience and apprentice trained, who previous to the expansion of the apprentice department gave all the supplementary instruction. He is now assisted by an instructor in shop mathematics and applied science, formerly an assistant professor in Rennsalaer Polytechnic Institute, who is devoting all his time to this instruction; and for the work in drawing by a professor of design from the same institution who is employed on a part-time basis.

The first year of apprenticeship is spent in the training department, which is a separate and distinct section of the plant with a generous equipment of all the standard types of machine tools and with facilities for twenty-five boys. A view in this department is shown in Fig. 66. In charge of this section is the supervisor, who is assisted by two experienced mechanics to act as subforemen in training at regular production jobs. For the remainder of the term of apprenticeship the boys are transferred for further experience about the plant but always under the friendly direction of the supervisor. A boy at work on a job in the plant can be seen in Fig. 67.

Supplementary instruction is provided for six hours a week, so arranged as to be about equally divided between the employer's and the apprentice's own time. This is accomplished by requiring them to work until six o'clock instead of five on the two days a week in which they receive their instruction. The adherence of the apprentices to this arrangement is secured by their signing a special agreement upon indenture to put in one hour of study on mathematics and drawing for each hour of instruction given in place of work during regular employment hours. In Fig. 68 can be seen a class in mechanical drawing.

The instruction is divided into six terms of twenty-one weeks each, as follows:

Term I.	Arithmetic	2 periods of 1½ hours each per week
	Algebra	2 periods of ¾ hours each per week
	English	2 periods of ½ hour each per week
	Practical Talks	2 periods of ½ hour each per week
Term II.	Arithmetic	2 periods of 1½ hours each per week
	Algebra	2 periods of ¾ hour each per week
	English	1 period of ½ hour each per week
	Practical Talks	1 period of ½ hour each per week
	Mechanical Drawing	1 period of 1 hour each per week
Term III.	Mechanical Drawing	2 periods of 1½ hours each per week
	Mensuration and Geometry	2 periods of 1½ hours each per week
	Practical Talks	1 period of ½ hour each per week
	Industrial History	1 period of ½ hour each per week
Term IV.	Trigonometry	2 periods of 1½ hours each per week
	Mechanism	1 period of 1 hour each per week
	Mechanical Drawing	2 periods of 1½ hours each per week
Term V.	Tool Design	2 periods of 1½ hours each per week
	Strength of Materials	2 periods of 1 hour each per week
	Mechanics	1 period of 1 hour each per week
	Practical Talks	1 period of ½ hour each per week
Term VI.	Tool Design	2 periods of 1½ hours each per week
	Practical Science	2 periods of 1 hour each per week
	Mechanics	1 period of 1 hour each per week
	Shop Economics	1 period of ½ hour each per week

Boys fifteen to eighteen years of age are eligible for apprenticeship, those with at least one year of high school being preferred. The candidates must pass a civil service examination which is given twice a year, and from the eligible list thus established selections are made at such times as needed. In an endeavor to assure that the boys thus selected will be "A" grade, a weight chart, Fig. 69, is used.

The remunerative returns for apprenticeship in this arsenal seem more generous than would be possible for a private concern to offer. The indenture calls for six whole terms of 1,250 hours each, which works out as about three and one-half years, since the boys are granted a thirty-day vacation each year and the working week is forty-four hours in length. Upon this basis the apprentice pay is as follows:

1st period	25c. an hour or $11.00 a week
2nd period	27c. an hour or $11.88 a week
3rd period	30c. an hour or $13.20 a week
4th period	32c. an hour or $14.08 a week
5th period	35c. an hour or $15.40 a week
6th period	40c. an hour or $17.60 a week

In addition to this, after the first six months $20 per month bonus is paid by the government, which brings the apprentice's pay up to what seems generous proportions.

EVENING IMPROVEMENT AND TRADE EXTENSION CLASSES

"Intensive study" is the caption under which evening classes were during the past winter organized in the plant. Merely the fact that a night school is provided is, of course, of no great significance beyond the plant; but that the classes were planned and promoted by a committee of employees does seem of some importance as suggesting an essential form of procedure to insure their success. The year was divided into two terms of twenty weeks each, with two lessons a week. The cost of registration was placed at $5 per term for adults and $2.50 for employees under twenty years of age. There was said to be an average enrollment of eighty-four altogether in the following eight courses:

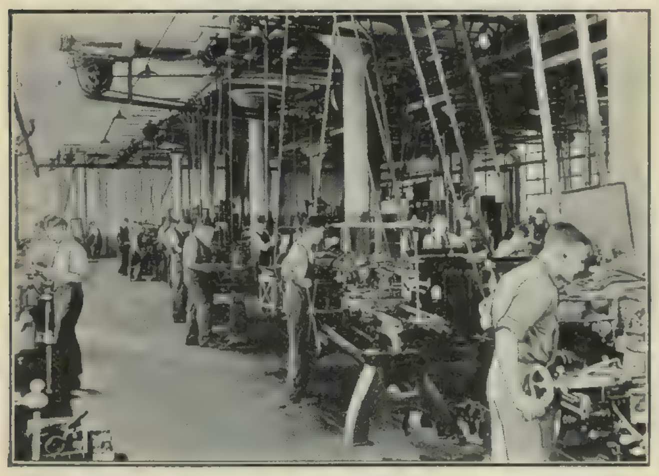


FIG. 66. VIEW IN APPRENTICE-TRAINING SHOP

English and Current Events
Elemenetary Mathematics
Advanced Mathematics
Strength of Materials
Drafting
Elementary Electricity
Commercial Arithmetic, Cost Keeping and Stock Keeping
Penmanship, Stenography, and Typewriting.

Some of the classes were held from 5 to 6 p.m., while others were from 7:30 to 9 p.m., so as to be at times most convenient to the students.

"Visual Instruction" seems to be merely a title under which "industrial and entertaining movies" are being provided. It is not believed that much was expected of them as an effective means of education in the industry, but rather that they were intended to provide innocent diversion which might not otherwise be available. Such a provision is, of course, to be recommended, more especially in industries located at points not readily accessible and where the plant seems the natural center for such activities.

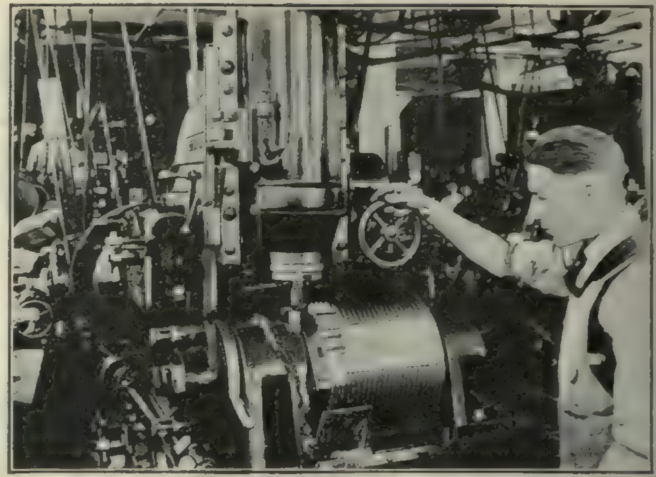


FIG. 67. APPRENTICE MILLING A BREECH BLOCK IN THE PLANT

The employee's committee on "Mass Education" has provided a series of noon-hour lectures twice a week. The lecturers seem to be in the main nearby clergymen and educators. The idea actuating the movement is evidently to enlist inspirationally the best efforts of the working force toward co-operation in production and enlightened community activity. How effective this movement will be undoubtedly depends on its permanency and its effectiveness in reaching the bulk of the workers. If the lectures are patronized only by those habituated to church, Young Men's Christian Associations and lecture forum it is reasonable to assume that the movement will not function beyond the circles already reached by those community agencies.

VESTIBULE SCHOOL

In the "Vestibule School" it was stated that there were now three ex-service men being given training for rehabilitation. Their first period of training is for six months and if they are not proficient at the end of that time they are to be given one or even two more similar periods of training.

A "Foreman's School" is also maintained, meeting

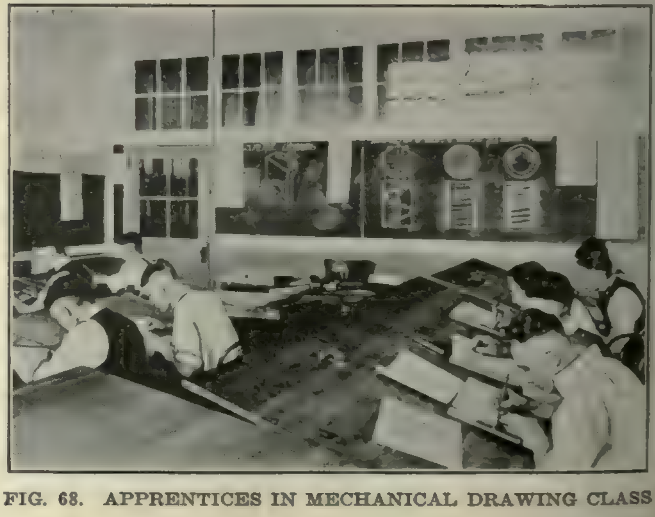


FIG. 68. APPRENTICES IN MECHANICAL DRAWING CLASS

fortnightly in lunch sessions in the plant's cafeteria. This effort toward improvement of the working force at a vital point seems to be favorably considered and to be developing toward more intensive utilization.

"Apprenticeship," "Intensive Study," i.e., night school trade extension as a co-operative movement of employees and management, and foreman training all seem measures favorably received and developing as useful expedients toward improving the plant's working force. Particularly to be commended seems the apprentice system, where the equipment of the training department, the quality of the teaching staff, and the plans for related-work instruction with that for systematic training in practice, all seem eminently satisfactory. This condition is reflected in the apparent high quality of the young men undergoing apprenticeship, and their satisfaction expressed to the writer as to the conditions.

	Weight		
Mental			
(*a*) Education not less than 8th grade at 16	5	( )	
(*b*) Observation	5	( )	
(*c*) General knowledge	5	( )	
(*d*) Attitude	5	( )	
(*e*) Self-reliance	5	( )	
Total	25		( )
Moral			
(*a*) Manners and habits	5	( )	
(*b*) Character	10	( )	
Total	15		( )
Physical			
(*a*) Appearances	5	( )	
(*b*) Activity	5	( )	
(*c*) Health	10	( )	
Total	20		( )
General Impression			
(*a*) Tact	5	( )	
(*b*) Common sense	10	( )	
(*c*) Mechanical aptitude	5	( )	
(*d*) Future ambitions	5	( )	
Total	25		( )
Mathematics	10	( )	
Reference	5	( )	
Total	15		( )
Grand Total	100%		( )

Applicant..........................
Course..........................
Accepted..........................
Reported..........................
Date..........................
Interviewer..........................
1 Comm. check..........................
2 Comm. check..........................
3 Comm. check..........................
Agreement signed..........................

FIG. 69. WEIGHT CHART FOR SELECTION OF APPRENTICES

Cut the Force or Reduce Working Hours?

By S. N. Bacon

On page 375 of the *American Machinist*, A. W. Forbes, in discussing the unemployment situation, inquires why the unemployed do not apply for work. In his discussion he makes the surprising statement that he has actually received less applications than a year ago. It is evident to the writer, who is a mechanical engineer and shop foreman, that Mr. Forbes is not familiar with the situation in various cities and in a variety of manufacturing plants.

There is a very good reason why there are not more applications made, at least at the large plants, and that is the almost universal practice of hanging out a sign "No Help Wanted" which confronts laborers, skilled help, engineer draftsmen, and office employees alike. It is almost useless to apply at a small shop unless it advertises, because one is very apt to be interviewed by a clerk in the office.

In regard to filling out applications, the skilled workman has learned through experience that it is a waste of time because they are invariably filed away and become stale after a few weeks or months have passed and the employer feels that the applicant has either secured a position or left for parts unknown; so he inserts an advertisement and receives a large number of fresh applicants, perhaps a few of whom are already employed.

It seems to the writer that it would be far better to have a system whereby the applicant could qualify for a position which is sure to open up in the near future, and in the meantime keep in touch with the would-be employer by means of return mailing cards which the former would receive periodically.

Referring to the second paragraph in the above mentioned article, if the men who were let go were not good enough for future prosperity, then they should have been dispensed with before the lean years came on; which proves to a certain extent that with a well-balanced organization of good workmen the best and fairest policy is to cut the force.

Metallurgy in India

By L. Becker

Chief, Iron and Steel Division, Department of Commerce

India, during the next five years, will witness considerable development and growth in its metallurgical industries, particularly those of iron and steel, in the opinion of S. M. Marshall, consulting engineer for the Tata Iron and Steel Co., who has recently made a study and survey of railway traffic as relating to these industries. Plans have been drawn up for extensions to existing mills and new plant construction, all for completion and operation during this period.

At the present time there are only three industries of this kind in operation: The Bengal Iron Co., at Kulti on the East Indian Railway, the Tata Iron and Steel Co., at Tatanagar on the Bengal-Nagpur Railway, and the Cape Copper Co., at Rakha Mines on the same railway. There are, however, three large new plants under construction or in serious contemplation. These are the Indian Iron and Steel Co. near Asansol, the Eastern Iron Co., whose plant will probably be located near Chandil on the Bengal-Nagpur line from Sini to Adra, and a third company whose plant will probably be at Manharpur on the same railway.

In addition to these, the three existing plants have extensions under way or planned. Furthermore, a number of similar industries are locating near the works of the Tata Iron and Steel Co. At the present time eight of these subsidiaries are proceeding with their construction, and several others are under immediate contemplation.

The iron ore and coal come from the same districts for all the iron and steel companies. The two main coal fields are located east and west of the Bengal-Nagpur line to Asansol. The iron ores are located in Manbhum, Singhbhum, Keonjhar, and Bonai States and lie immediately south of the main line for a distance of about 100 miles from Tatanagar to beyond Manharpore. The flux for the companies comes largely from points on the same railway west of Manharpore, although a small quantity is secured on the East Indian Railway near the Sono River.

The Indian Iron and Steel Co.'s plant will be ready for operation in a year, and the extensions of the Tata Iron and Steel Co. will start progressively within the next two years.

Transfer Dies for a Shallow Cup

The Construction of a Combination Die—How a Transfer Mechanism Is Designed—Blanking, Piercing, Forming, and Swaging, in One Operation

BY FRANK A. STANLEY

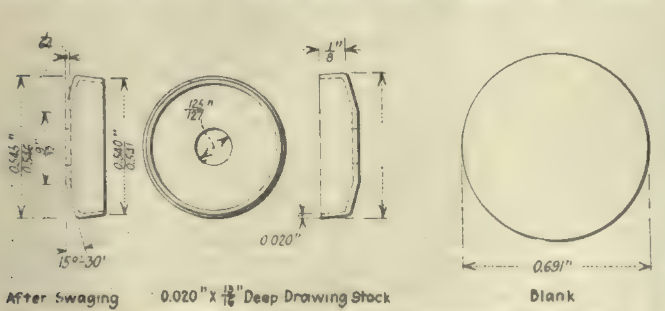
THE accompanying line drawings illustrate a set of compound dies for blanking, piercing and forming a shallow cup and for swaging the cup to the form shown in Fig. 1. The blank is shown at the right in the drawing; the shape to which it is drawn or formed at the same stroke as the blank is cut is shown at the center, and the tapered form as swaged is seen at the left. Combined with the compound construction of the dies is an auxiliary device which automatically transfers the straight drawn cup from the drawing die to a swaging die in front, so that after the first stroke of the press, each down movement produces a plain cup and at the same time completes the swaging of the preceding cup, each stroke thus discharging a completed piece from the press.

The blank is punched out 0.691 in. in diameter in the compound die and the continued downward stroke of the press pierces the ⅛-in. hole at the center and forms the cup to a depth of ⅛ in. The transfer then carries the piece to the swaging die at the front where the cup is tapered and the open end made 0.005 in. smaller than the bottom of the cup. The dimensions of the swaged cup will be seen at the left in Fig. 1.

The press tools as assembled are illustrated in Fig. 2, the die base being shown at *A* and the punch head at *B*. Both are of cast iron and both are bored for two ¾-in. guide pins or pillars.

The blanking die is shown at *C*, Fig. 2. This die is a piece of tool steel finished to rectangular form, 3 in. long by 1⅞ in. wide, and 3/16 in. thick. The die opening is 0.692 in. in diameter. It is secured by fillister head screws and dowels to the die block. It is also drilled and tapped for screws and dowels for carrying the stock guide and stock stripper *D*. This plate has a guide channel for 13/16-in. stock, the thickness of the stock being 0.020 inch.

The blanking die *C* is counterbored at the underside to fit over the projecting end of tool steel member *E*, which is pressed into the die base and is drilled at four points longitudinally to receive the four shedder pins *F*, which are of 0.187-in. drill rod hardened. These pins are 1 7/16 in. long. They act upon the underside of shedder *G*, and are themselves acted upon by the rubber pad *H* underneath the die base. The combined blanking punch and drawing die *I*, in descending, blanks out the disk, 0.691 in. in diameter, and continuing downward forces the work and member *G*, which acts as a pressure pad, down into the die against the pressure of rubber spring and shedder pins *F*. At the same time the blank is drawn into a shell inside the drawing die *I* and on the drawing punch *J*, the latter fitting nicely inside of drawing ring or pad *G*. The same action causes the shell to be pierced by piercing punch *K* carried inside of drawing die *I*.



After Swaging 0.020" X 13/16" Deep Drawing Stock Blank

FIG. 1. FINGER KEY CUP AT DIFFERENT STAGES IN PROCESS OF MAKING

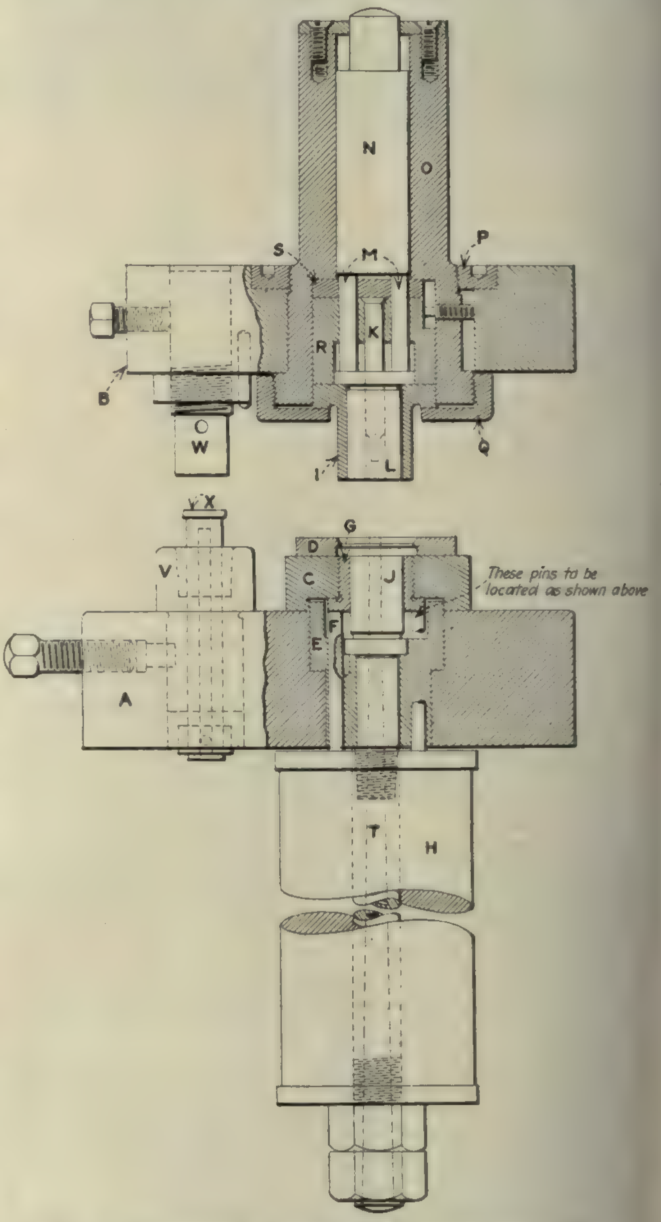


FIG. 2. SECTIONAL VIEW OF COMBINATION DIE ASSEMBLY

On the up stroke, ring *G*, forced upward by pressure pins *F*, strips the work from the punch *J*, and ejector *L*, acted upon by knock-out pins *M* and plunger *N*, ejects the cup from the drawing die inside of blanking punch *I*.

The blanking punch *I*, which also contains the drawing die, is provided with a collar or head which fits inside tool steel shank *O*. This shank is threaded to receive a locking nut *P* at the back, and its lower end is also threaded for ring nut *Q*. The shank fits snugly in a hole bored in the punch head casting and is fastened in place between its shoulder at the bottom and ring nut *P* at the top. It is also keyed in place. Nut *Q* when screwed on secures punch and die *I* firmly against the bottom end of knock-out carrier *R*. Piercing punch *K* fits nicely in *L* and *R* and its enlarged head abuts against a steel plate *S* at the top of the recessed chamber in the lower end of the punch holder shank *O*.

Drawing punch *J* is shouldered, and this shoulder rests upon a seat formed in the center of *E*. A hole is formed in this to serve as a piercing die. The lower end of part *J* is threaded to fit a tapped hole in the upper end of stud *T*, which carries at its lower end nuts for holding and compressing the rubber spring *H*, which is confined between two steel washers at the top and bottom of the stud.

Referring now to the transfer feature of these dies, Fig. 3, when the punch rises and the upper knock-out comes into action, it forces the cupped work into the transfer chuck *U*. When the press is at the top of its stroke, the transfer chuck stands in central position, where it receives the work. When the press ram starts to descend, the transfer chuck and arm *U* also descend and at the same time they swing forward to carry the work over the swaging die at the front of the die block proper.

Punch *W* (Fig. 2) then forces the work into die *V* and the tapered swaging effect is produced on the shell.

On the up stroke, the swaged cup is ejected from die *V* by the knock out *X*, and the transfer arm *U* returns to central position as shown in Fig. 3.

This transfer member *U* is pivoted on a vertical post *Y* which is one of a pair of studs passing down through the die base and through a strap *Z* which is secured to the bottom of studs *Y* by nuts as indicated. The upper ends of studs *Y* are passed through punch holder *B* and secured by nuts at the top. The pair of rods *Y* thus act in conjunction with strap *Z* as a positive knock out, so that as they ascend on the up stroke of the press, they cause knock out *X* to rise and eject the work from the swaging die *V*.

Referring again to the method of pivoting the transfer chuck and arm *U* on post or stud *Y*, it will be noted in Fig. 3 that the part *U* is mounted on the stud so as to rest against the shoulder *M*, and while free to swing about on this stud, it is held from independent up and down movement and must travel up and down with the stud through the controlling action of a hooked member *BB*. This member is threaded at the end and passes through the die base, the upper end then projecting over the hub of arm *U* so that it confines the top of that member by the action of spring *CC* at the under side of the die base. Now as the punch head descends, the spring *CC* draws down the transfer member *U*, and upon the up stroke the punch head causes stud *Y* to lift the transfer member positively to normal position.

The downward movement of transfer arm *U* is accompanied by a swinging movement to carry the work forward over swaging die *V* through the medium of a cam slot in plate *DD*. The slot as there represented is $\frac{5}{8}$ in. wide and receives a cam roll *EE* which is mounted upon a reduced bearing provided at the outer end of transfer arm *U*. Here the cam roll is retained in place by means of a small fillister headscrew.

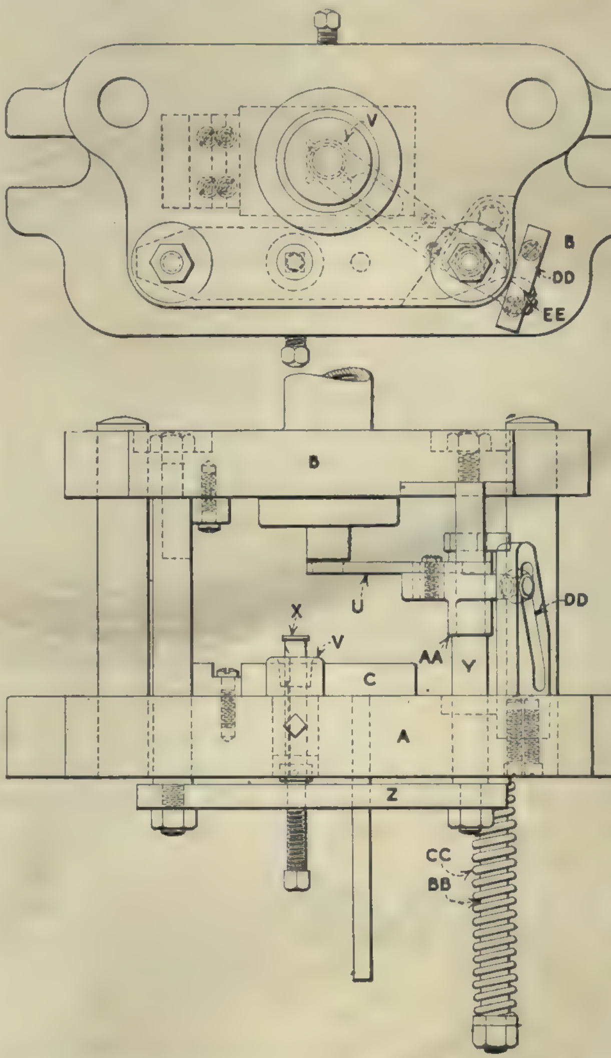


FIG. 3. VIEW SHOWING DETAILS OF TRANSFER ARM

It is evident that with the punch and die in the position shown in Fig. 3, when the punch starts to descend, the action of the cam slot *DD* is to throw the rear end of the transfer arm around toward the back and thus cause the front end with the work to swing forward over the swaging die. As it reaches a central position over that die, the punch *W* forces the cup out of the transfer chuck and down into the die. The up stroke carries the transfer back to its starting point ready to receive another piece of work and the knock out below ejects the swaged piece from the swaging die *V*.

These tools were made at the shops of the Smith Premier Typewriter Company, Syracuse, N. Y.

The End of British Preference in India

British Engineering Firms Not to Receive Preferential Treatment—German Artificial Prices Condemned—A Market for American Machinery

BY F. C. CHAPPELL

READERS of this journal may not be aware that the British government has granted a very full measure of fiscal autonomy to India. There has been a persistent demand of late years among almost every class of educated East Indians for a larger share in the management of the country. The great assistance which India gave to the British Empire during the late war has been acknowledged by a very liberal grant of self-government, including, as I say, the control of import and export duties. When we remember that India is an enormous buyer of machinery and engineering manufactures of all kinds from Europe, and to some extent from U. S. A., we should at once see the importance of a measure that puts Britain on exactly the same plane as other nations in the competition for orders. To all intents and purposes British exporters of iron and steel goods, especially railroad plants of all kinds, have received a preference over their competitors, but all this is now abolished. The immediate effect of this is seen in a resolution just passed by the Indian Legislative Assembly recommending that all stores be purchased in the cheapest market, consistent with the requisite quality being obtained. It has frequently been alleged that the East Indian Railroad Corporation, run by the Indian government, gave preference to English contractors, although material and equipment might be bought cheaper and equally well in the United States or in Germany.

FAVORS SHOWN BRITISH

The position of British and foreign purchasers was recently very clearly explained by the director-general of stores to a committee of inquiry which has lately been sitting. He said: "I have a great deal of pressure put on me at various times in England to deal with British firms. They say it is very hard that they should be penalized by the abnormal advantages obtained by Germany through the exchange," etc. The principle he has followed is that if the lowest British tender is within 10 per cent, say of the German or Belgian tender, the contract goes to the British firm. Another point is that the British firm may be able to turn out the goods in much quicker time; while another consideration is that of the much higher cost of the work of skilled inspection to insure adhesion to the standards laid down when contracts are executed abroad. The director-general told the committee that on occasions if the lowest German tender is considerably lower than the lowest British tender, he has communicated confidentially the terms of the German tender to the British, and asked him if he will come down. "Sometimes he comes down to an extent that justifies one in giving the business to him; sometimes he does not. The following are some recent examples: Wheels and axles, German price, £45; British price, £83 15s., subsequently reduced to £67. Rails, foreign price, £10 10s.; British price, £17, subsequently reduced to £11 10s. In the former case the reduction was insufficient; it is understood that in the latter case the revised British tender was accepted." The director states that he would not adopt such a system under normal conditions. "The Germans," he said, "are simply putting up an artificial price; and we don't want to see British firms ruined by such prices." The result would probably mean a German monopoly, and he adopted a moderate amount of preference for British firms to last while the present abnormal conditions exist.

To give you an idea of the value of this trade I may say that the value of stores purchased by the state-owned Indian railroads for the ten years prior to 1919 was 486 lakhs of rupees, while the purchase of private-owned companies was double that of the state-owned corporation. The Indian government has just raised a loan in London for seven and one-half millions to be spent on the purchase of railroad materials for the state lines alone, and a good deal of this will be supplied by British firms, while seven more millions will also be spent this year on the same objects.

BRITISH MONOPOLY GONE

But India has ceased to be a monopoly or close preserve for the benefit of the English manufacturer. It will be many years before all the parts of a locomotive can be made in Indian machine shops and until that time comes India must continue to be a splendid market for European and North American machinery exporters. The railroads have fallen into a deplorable condition and it will need the expenditure of vast sums to bring existing lines up-to-date. As I stated there is to be an immediate outlay of seven and one-half millions and United States firms may expect notices of tender before long. Several new lines are also under consideration and will be proceeded with as soon as circumstances permit.

In view of the growth of protectionist feeling in India, British manufacturers are establishing themselves in the country. United States makers of machine tools should find India a really excellent market and one that will last for many years to come. In addition to this there is a ready sale for simple soap-boiling plants, including pan, boilers and vacuum glycerine apparatus. Makers of machines for milling rice and wheat would do well to investigate the market. Ice making and refrigerating machines are badly needed. It is certainly worth noting that special attention is being given in the United Provinces to fruit preserving, pulping and canning, as well as jam making. Cream separators are also being employed in the manufacture of ghee and sales can be increased. In the United Provinces there is also an opening for furnaces and bottle blowing machines for the glassware trade.

The market has been kept short of electrical machinery and supplies since the war, but these will be in increased demand as soon as manufacturers can ship the same. The share of the United States in the electrical trade of India has doubled since 1914. British makers take the view that United States exporters will not be able to increase their hold on this market for electrical goods. Japan is making much headway with fittings and accessories.

The Indian government is anxious to foster industry and especially wants the community to utilize within the country itself all products of the sort to a greater extent than in the past. There is bound to be a demand for every item of cotton mill equipment including renewals for jute spinning and weaving machinery. The government has sanctioned extensive schemes in connection with the further exploitation of state collieries. This will involve the purchase of various plants and general engineering material. The use of coal mining machinery is largely extending in India. Tea garden machinery is also wanted as little machinery of this kind has been imported lately. Saw mills and portable timber felling machines are needed; also a plant for paper pulp manufacture, match-making machines, and a plant for the production of tanning extract. An increasing market exists for crosscut saws, axes and adzes.

There are excellent possibilities for the sale, in connection with the existing installations, of motors, cable and wire, fans, lamps and other apparatus.

Kinks From Far-Western Railroad Shops

SPECIAL CORRESPONDENCE

Although much of the work in railroad shops in various parts of the country is very similar, it often happens that different methods are devised for handling the same kind of a job. The interesting device shown in Fig. 1, is from the Hillyard shops of the Great Northern Railway, just outside of Spokane, Washington, and is for setting the valve motion crank, often known as the half-crank, used on locomotives having a Walschaert valve gear.

Instead of waiting until the wheels are under the locomotive and the valve mechanism is in place before setting these cranks, general foreman A. B. Colville made the device shown. It consists of a light but rigid tripod with the legs suitably placed and a main central tube which carries a center that fits into the center of the locomotive axle. On the outer end of the central tube *A* is an arm *B*, carrying a pointer *C*. The rod *B* is graduated so as to allow the pointer *C* to be easily set.

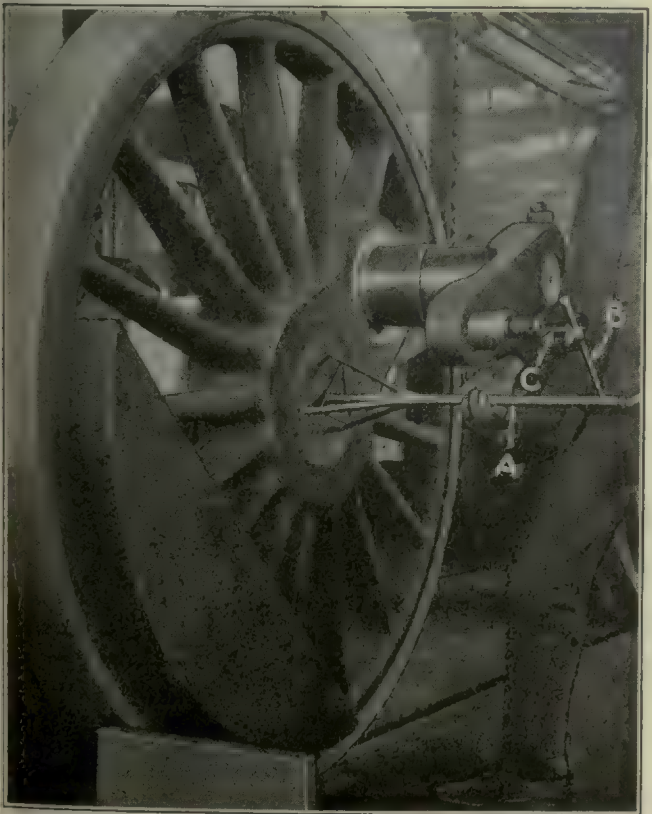


FIG. 1. SETTING WALSCHAERT VALVE CRANKS

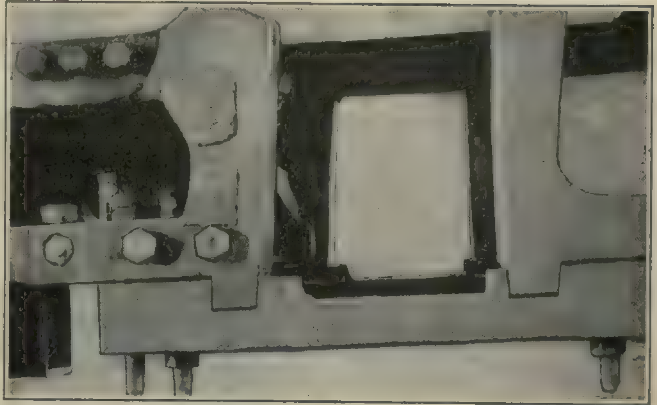


FIG. 2. A WELDED FRAME

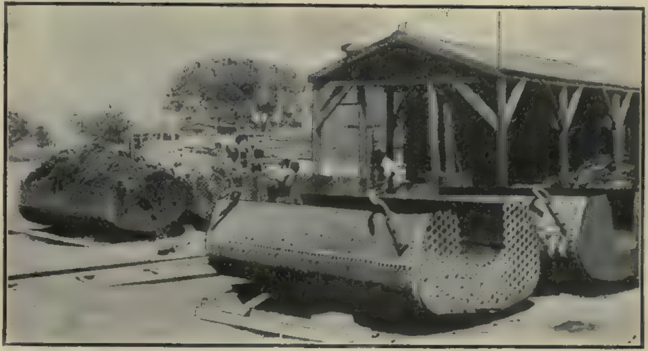


FIG. 3. UTILIZING OLD FIREBOXES

Each kind of locomotive has a different setting and a small blueprint table shows the proper distance between the central tube *A* and the pointer *C*. Setting the pointer to the proper position, it is only necessary to place the tripod in position and swing the half crank until its center coincides with the pointer *C*. This enables the crank to be quickly set and removes the necessity for any further adjustments after the wheels are placed in position on the locomotive.

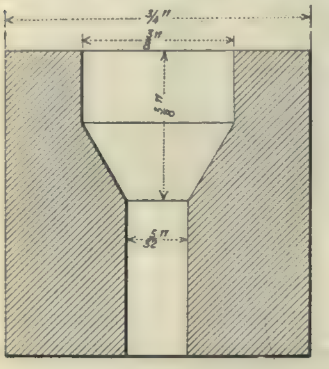
A good example of frame welding is shown in Fig. 2, which also comes from the Great Northern shop at Hillyard. Two rather bad cracks developed beside the pedestal jaws and were welded by oxy-acetylene as shown, without removing the frame from the locomotive.

THE DENVER & RIO GRANDE

Fig. 3 shows how the Denver & Rio Grande shop at Salt Lake City utilizes old fireboxes for handling turnings and other waste material. With the lower part of the side sheets cut off and suitable hooks or eyes riveted into place, they make substantial and convenient holders that can be readily handled by the crane.

A device in the shop of the Denver & Rio Grande at Burnham, which is really a part of Denver, Colorado, is for turning grinding wheels used in sharpening the formed tool for finishing tire flanges. The truing device consists of a stand carrying a series of levers on the top which control the path of the diamond tool used for truing. These levers are so proportioned and arranged that they outline the correct shape of the wheel. This arrangement was devised by H. G. Strong, general foreman of the shop.

This shop is also putting in grooved piston rings as shown in Fig. 4. The drawing shows a cross section of the ring which is grooved for approximately half its depth and has $\frac{5}{32}$-in. holes drilled through at about every 6 in. of the circumference. Two or three rings are used to each piston, enough being cut out to allow the ends to open over a $\frac{3}{8}$-in. dowel, the dowels being so placed as to bring the gaps about 6 in. apart.



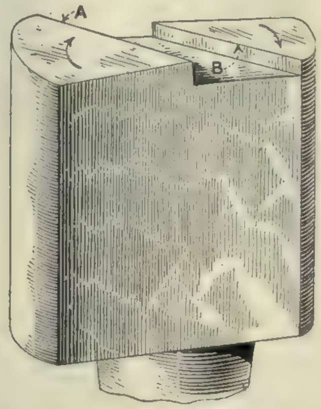


FIG. 4. GROOVED PISTON RINGS. FIG. 5. A NOVEL KEYWAY CUTTER

Northern Pacific Shop

A keyway or splining cutter which gives good satisfaction in the Northern Pacific shop at South Tacoma, Wash., is shown in Fig. 5. This cutter was used on an old Bement splining machine. The cutter is flat with the center about $\frac{1}{64}$ in. lower than the outside cutting edges. A diagonal slot was cut across the face of the cutter as shown, and the angular faces are of course backed off, so as to give the cutting edges *A* and *B* a little rake. This form of cutting edge gives a shearing cut which is very satisfactory. The tool runs in the direction of the arrows.

The link grinder shown in Fig. 6 is not new, but on the other hand is not particularly common. It consists of a grinding machine made on the order of an old style horizontal milling machine with its spindle adjustable vertically. This necessitates the arrangement of the idler pulleys shown at *A* for preserving the belt tension at different heights of the spindle.

The truck *B* is mounted on four wheels with V-grooves which run on the track *C*. It is of suitable size to handle all the links to be ground and has handles at each end for conveniently moving it from one end to the other.

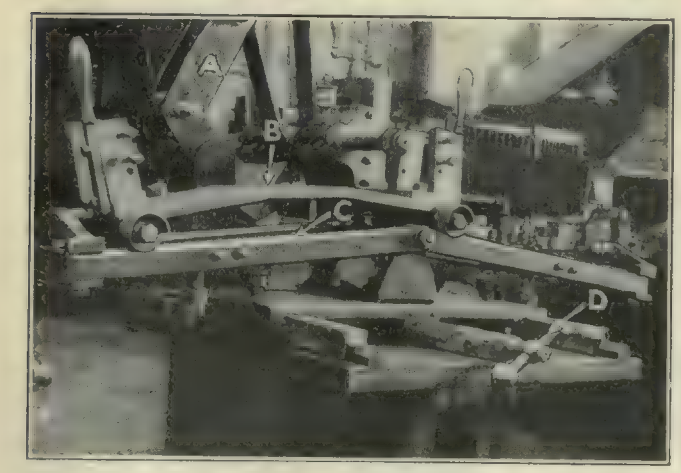


FIG. 6. A LINK GRINDER

The track *C* is hinged in the center and adjustable at the ends in order to secure the different radii in the various links. The method of adjustment is easily seen. Spring bumpers are provided at each end of the track. The whole work-carrying unit can be moved to and from the grinding wheel by means of the crank *D*, so as to cover any part of the surface with the grinding wheel. This device is in the shop of the Northern Pacific Railway at South Tacoma, Washington.

Drafting Room Notes

By F. C. Edwards

On page 17 of the *American Machinist*, John S. Watts makes some pertinent remarks under the above heading. There are, indeed, very few firms engaged in engineering production in which an appreciable leakage is not constantly taking place through failure on the part of the drafting room to clearly realize the requirements of the shops for economical manufacture.

No disparagement of the drafting room, however, is intended in this article, which aims at suggesting an effective remedy for the ills referred to.

It is not so uncommon as it ought to be to find on the arrival of drawings in the shops that one or two slight alterations in design (quite immaterial, perhaps so far as the finished article is concerned) make all the difference between cheap and costly production. It may be that a component is perfectly designed so far as its ultimate purpose is concerned, yet, from the point of view of its manufacture it would deserve to be termed execrable.

The Evils of Specialization

Since specialization is a necessity of the age we live in, this common complaint, as we may call it, naturally tends to become more and more aggravated. The designer of today is fully occupied in dealing with the technicalities of his own special line of business in order to keep abreast of competitors. At the best, he can obtain only a comparatively meager insight into up-to-date practice in pattern shop, foundry, jig and tool work, machining and assembling. For it is not humanly possible for any one man to become really proficient in all these branches, as each branch demands constant and unremitting study for its efficient pursuit. Nevertheless, perfection in engineering design obviously hinges upon a clear conception of its several requirements.

What, then, is the remedy? It logically follows, that, in all but the simplest of new designs, the various departments affected should contribute their quota of suggestions and criticisms, and, so far as practicable, each phase of manufacture should be decided by its own expert. Each departmental chief, being *au fait* in the latest practice in his particular line and fully cognizant of the possibilities and limitations of his own shop, should be consulted before the drawings are issued to the works, or preferably, while they are still in the unfinished stage. Adjustment can then be easily made and possible conflicting requirements of the various shops harmoniously settled. The chief designer, being, of course, responsible, will have the final word on contested points.

Finally, the design will actually be the collective embodiment of all available individual experience, and its transition to the finished article by the path of least resistance will be insured.

Ideas From Practical Men

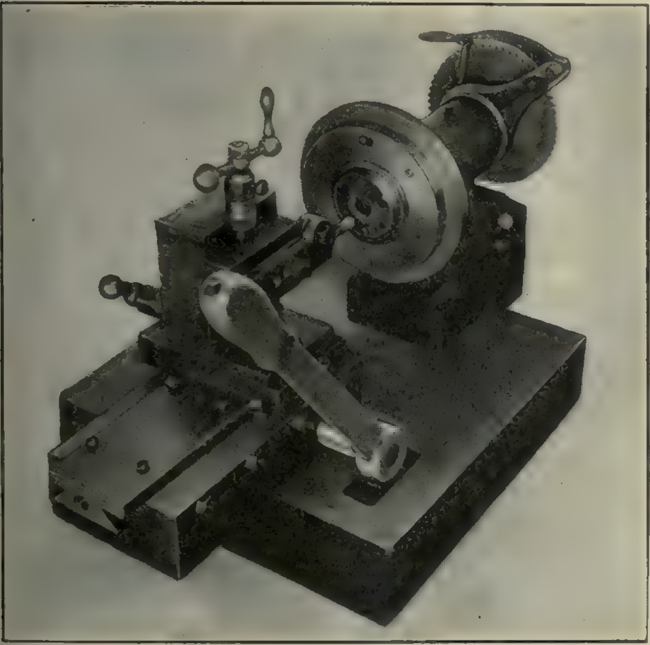
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Device for Cutting Teeth in Dies for Clock Wheels

By Amos Ferber

The small subpress dies for blanking and shaving the gear wheels for clocks are of necessity made very accurately with respect to tooth contour and spacing, and it would be impractical to follow the usual method of filing to line; therefore, broaching is the method not infrequently used to make them.

A master broach is an expensive proposition in itself and to justify its cost there must be demand for many dies of one size and shape. In some cases, as in special and experimental work, this demand does not exist, and to make such dies quickly and accurately, Fred Lux, of the Lux Clock Co., Waterbury, Conn., devised the little machine shown in the illustration.



DEVICE FOR SPACING TEETH IN CLOCK WHEEL DIES

The rotating member is built very much like the headstock of a standard bench lathe except that it has no pulley for driving it, and is made to fit the bed of such a lathe; the center line of the spindle coinciding with that of the bench lathe and being driven from it by means of a wire held in the collet chuck of the latter. The die holder is located upon the faceplate of the device by dowels and a die may thus be set in place, bored and faced in the bench lathe, and then the head transferred to the base upon which it is shown for cutting the teeth.

The spindle takes various index plates for spacing different numbers of teeth and the toolslide has movement in three directions so that plain, spur or ratchet teeth may be cut by adjusting the position of the tool sidewise, and any diameter of die within its range may be accommodated by the up and down movement. Adjustable stops limit all movements so that the tool may be displaced if necessary and returned to position with certainty. The stop on the longitudinal movement prevents overrunning and possible breakage of the cutting tool.

Cutting a Keyway in a Large Pulley

By H. Beard

We recently had occasion to cut a keyway 2 in. wide by 20 in. long in the hub of a pulley 6 ft. 6 in. in diameter with a 7-in. bore.

There was no machine in our town big enough to do the job in any ordinary way, so we dug a hole in the ground in front of a small planer and, by means of bolts, jacks and straps, fastened the pulley to the legs of the planer in such a position that the bore was in line with and just above the level of the table.

A crosshole was made near the end of a short length of 3 15/16-in. shaft to take the cutter, this hole being fitted to the cutter for a distance of a little over 3 in. of its length, while the remainder was tapped for a 1-in. setscrew with which to feed the cutter. A 5/8-in. setscrew tapped into the end of the shaft was made to bear upon the cutter hard enough to hold it in place, but was not set up so tightly as to prevent it from moving when the 1-in. feed screw was turned.

The shaft was then clamped to the table of the planer with the end carrying the cutter projecting through the bore of the pulley. Putting plenty of scrap iron on the back end of the table to keep it from tilting up, and arming the operator with a wrench to fit the 1-in. screw, we were ready for business.

The cutter was set to cut upward at the top of the bore, and faced toward the planer to cut on the forward stroke. We thus had a regular "draw-cut" shaper. Each time the end of the bar came through the bore on the return stroke the operator would take a turn on the feed screw.

By using several cutters we were able to do a good smooth job. The time consumed was six hours, more than half of which was consumed in the setting up. But we had the satisfaction of doing a better job in less time than could have been done with hammer and chisel.

Cap Bulging Tools

By S. A. McDonald

The accompanying drawings illustrate a rather unusual die for forming a bead on the neck of the tin cap shown.

In Fig. 1 *A* is a holder containing the knockout *B*. The cast-iron shoe *C* is formed so that the hardened tool steel die center *D*, the tool steel stripper ring *E* and the cast-iron retaining ring *F* are all concentric. The spring *G* fits in a seat turned in both the ring and shoe to centralize the pressure. A rubber collar *H*, held in place by the center bolt *I*, is made a little smaller in diameter than the die center.

The die operates as follows: The cap is set in the stripping ring *E*, as shown. When the punch descends the knockout *B* comes down on the cap and through the cap forces the stripper ring down, thus forcing the inside of the cap on the head of the center bolt *I*. As the punch continues to descend the underside of the bolt head compresses the rubber collar so that it bulges out the cap, as shown in Fig. 2. The stripping ring holds the bottom of the cap from spreading. When the punch ascends the cap stays in the punch until near the end of the stroke, when the knockout forces it out.

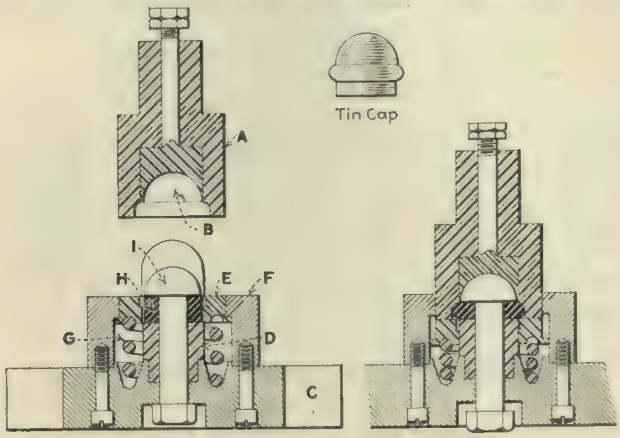


FIG.1 FIG.2

FIG. 1. THE CAP BULGING TOOLS. FIG. 2. TOOLS AT END OF STROKE SHOWING BULGING ACTION OF RUBBER RING

The dies are run practically dry, as any oil on the rubber collar would decompose it.

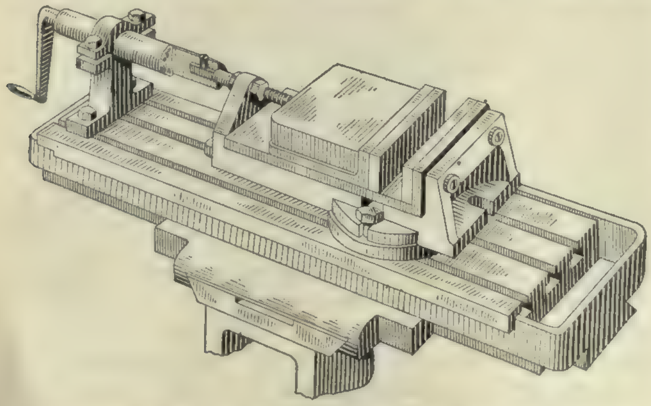
The rubber collar must be changed occasionally on account of being spread from continued use.

Extension for Screw of Milling Machine Vise

By R. Grant

In the article on tool engineering, page 801 of *American Machinist* under the heading "Quick Removal of Work," appears this statement. "When the regular type of milling machine vise is used, every half revolution of the screw means that the operator is obliged to remove his wrench and replace it again. This takes time and is a decided objection, if the jaws need to be opened rapidly."

The above objection to the regular type of milling machine vise, so commonly used, is removed by the use of a simple device that I made for myself during the war-time rush to meet this same condition. It consists merely of an extension piece, as shown in the sketch, broached at one end to fit the squared end of the vise-screw and squared at the other end to take the regular wrench, or crank handle.



EXTENSION FOR SCREW OF MILLING MACHINE VISE

The extension is long enough to reach out over the end of the milling machine table, is supported near the end of the table by a suitable bracket casting, and is retained in place by a headless setscrew which tightens against the flats of the vise-screw. This device permits the vise to be opened as rapidly as may be desired.

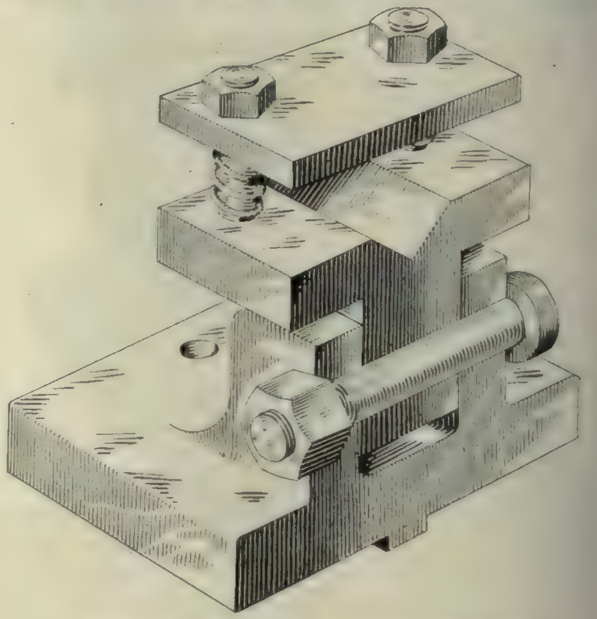
Adjustable V-Block for the Milling Machine

By Richard H. Kiddles

A handy V-block for holding pieces at an angle upon the table of the milling machine is shown in the illustration.

The tongue and groove that hold the block in angular position should be of ample proportions and nicely fitted, so that the position will not be changed by the action of the cutter, and to secure a firm grip the holding bolt should be of generous size.

A taper pin may be added, if desired, to obtain the setting for various angles quickly, and to make certain that the work will not move under the cut, but this is not absolutely necessary as the friction should be sufficient.



ADJUSTABLE V-BLOCK FOR THE MILLING MACHINE

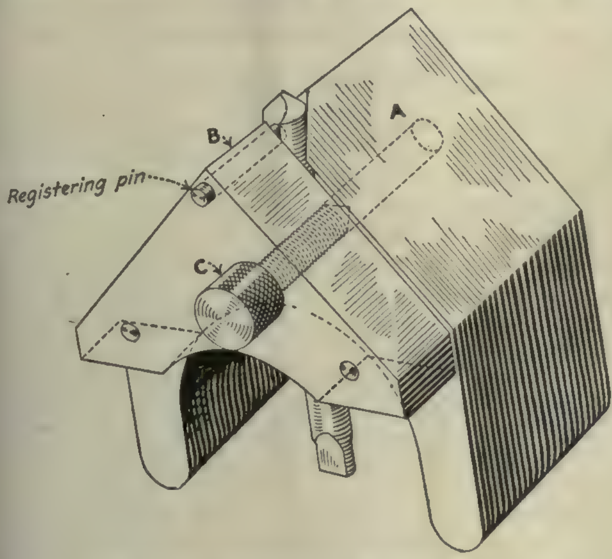
Jig for Resharpening Small Drills

By Richard F. Moore

In the shop where I am employed there are a very large number of small twist drills used, ranging from number 75 to 70, and the resharpening of these drills constituted a considerable item of expense; besides which, if the resharpening was not done exactly right, the drills would not cut to size.

After some experimenting, the device shown in the illustration was made to facilitate this work, and now the resharpening is not only rapidly done, but almost anybody can do it without risk of error.

The block *A* was made with a small V-groove to suit the size of the drill, and the cover plate *B* fitted to it with dowels so that when the screw *C* was tightened the cover would just clamp the drill in the *V* and keep it from turning. A register pin in the cover plate, made to fit the flute, located the drill in the right position, and it was necessary only to put the drill in the device, tighten the screw, and pass an oil stone over the beveled surfaces until the lips of the drill, which were set to protrude slightly, were stoned down flush with the hardened surfaces.



JIG FOR RESHARPENING SMALL DRILLS

It required skillful work, of course, to get the registering pin in exactly the right position with reference to the beveled surfaces, but when finished, anybody could use the tool.

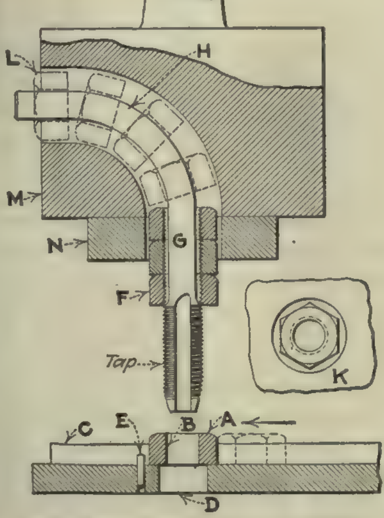
Tapping With a Bent Tap

By C. W. Frank

A time saving tap, driver and chuck which avoids the necessity for backing the tap out of the work is shown herewith. The pieces being tapped are cold-drawn nuts, but it is possible to apply this method to various kinds of work providing the outside is of uniform shape.

The feature of this tap is that the work passes over its entire length and, at the same time acts as a holder and driver allowing sufficient float.

The illustration shows a nut *A* which is to be tapped at *B*. The nut is fed in the direction indicated by the arrow between two guides *C*, which prevent it from turning while the tap is passing through it. A clearance hole is provided in the plate *D* and a stop pin *E* is used to give the work an approximate location. The tap is brought down through the work until it has reached the position *F* at which time it is free to float on the shank. It is necessary to have the shank of the tap *G* smaller than the root diameter of the thread in order that the work will not bind. The shank of the tap is curved as at *H* to suit the size of the work and the body of the chuck has a hole with a similar curve allowing ample clearance as shown at *K*. It is necessary to have a number of pieces of work on the shank of the tap in order to form a positive drive. Each time a nut reaches the position *F*, a previously tapped one drops out at *L*.



HOW THE BENT TAP WORKS

In making the body *M* it is advisable to use two pieces of stock, machining half of the curved hole in each piece. A plate *N* is used in order to allow the first or second piece of work to steady the tap.

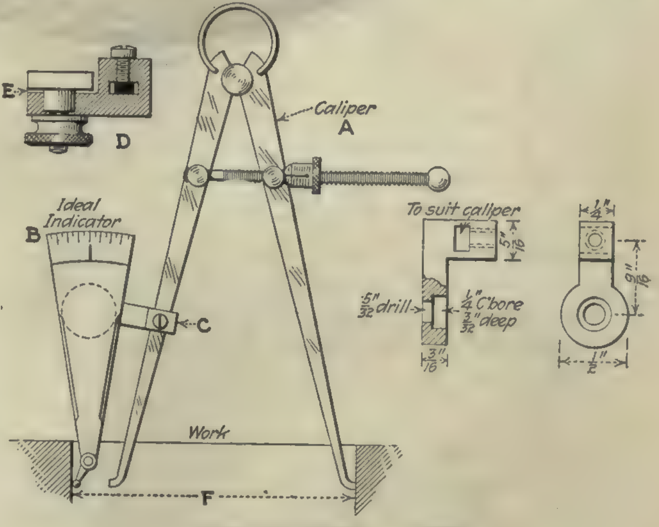
A pulley tap with a shank the right length for this kind of chuck can sometimes be bought, but if it cannot be obtained an additional shank must be welded on the end of the tap.

This method of tapping has been used on work ranging from $\frac{3}{16}$ to $\frac{5}{8}$ in. and the results obtained are surprising.

An Indicating Caliper

By Gene Phelps

The art of calipering a hole correctly requires considerable skill and experience. Very often, two men will obtain different dimensions due to the individual sense of touch. Devices have been brought out which involve a direct reading caliper having pointers or dials built directly on the caliper, but very few have been brought out for using standard indicators and calipers for correct measurements of holes.



AN INDICATING CALIPER

A very simple arrangement which has been used by the writer with considerable success is shown in the illustration. The caliper *A* and the indicator *B* are standard products and are connected with each other by the bracket *C*. A detail of this bracket is shown in the lower portion of the drawing, and at *D* in the upper part is shown a section through the arm with the caliper and indicator in place. Note that the caliper has clearance, as shown at *E*, in order to prevent cramping. In measuring the diameter of a hole as shown at *F*, the caliper is put in the hole and adjusted until the indicator reads zero. The same reading is then taken across the points of the indicator and caliper by using a micrometer, which gives the diameter.

The bracket is a simple piece to make and will prove to be a very useful device for the toolmaker's kit.

EDITORIALS

Forty-Four Years of Usefulness

PERHAPS there is a lack of due modesty in the head we have picked for these remarks on the occasion of our birthday anniversary, but the feeling that our forty-four years of existence have been well spent, in the main, is encouraged by certain letters written to us and about us by our friends. One says, and his opinion on any point is one that we value highly, "We have learned to love the *American Machinist* because of its close intimacy with the machine tool industry. It has become a permanent adjunct to our business and we would be lost without it."

Forty-four years, measured in terms of modern industrial development, is a very long time. The old timers who have followed the *American Machinist* throughout its career, which began in November, 1877, have seen revolutionary changes in machinery and in the ideas of those who use it. The modern machine has greatly lightened the burden of human toil, not only in quality but in quantity as well. The hours which constitute a day's work now would have been looked upon with scorn by the early readers of the paper, but the output of each man would have excited wonder if not awe.

It may be, as some claim, that the workman of today has too much time on his hands in which to get into trouble, as the result of producing enough in eight hours to provide for himself and his family a comfortable living. But if such is the case, isn't it the duty of those who have had advantages to educate him in the use of his leisure hours for the improvement of his mental and spiritual equipment? We believe so and we feel that assisting in such education is part of our job.

It would be pleasant to be able to chronicle an equal advance in the science of business, but unfortunately we are still in the grip of the business cycle with its wild upward surges and calamitous declines. Without our background of alternate depression and prosperity the present outlook from the bottom of the deepest depression of all would be very black, but the *American Machinist* has lived through other depressions in its forty-four years, doing its best at all stages of the game to help the players to success. So now that we are beginning the climb of the next upward slope the future looks ever brighter and we have only the hardships of the last few months to warn us that unless we study the principles underlying the conduct of business with more care than we have before, the coming period of prosperity will be followed by another depression. Here again we stand ready to help in the economic education of our industry.

Forty-four strenuous years have seen the coming and going of many editors and business managers. Each has done his part and passed out of the immediate service of the paper, but the *American Machinist* has gone on to carry the word of progress and achievement to the men of the machinery industry everywhere. Much has been accomplished but there is much more ahead. Who shall say what marvels can be looked back upon when another forty-four-year period has passed?

Genuine Open Diplomacy

THERE has been much talk about open diplomacy and some hope that it would be employed in the conference now sitting in Washington, but nobody had the faintest idea that it would get such an airing as Secretary Hughes gave it in his opening address. Mr. Hughes has scored heavily in the first round and is in a strong position to put over any other plans he may have in readiness for settling the other controversies to be discussed.

It is our feeling that the United States will be met halfway by England and Japan in the matter of naval armament. Their people are at least as anxious as ours to reduce the tax burden imposed by the construction and maintenance of dreadnoughts and battle cruisers and here is a chance to accomplish it. Then, too, it is gradually coming home to people that the capital ship is an obsolete weapon where the opponent is possessed of airplanes and chemicals. This question has not yet been settled by the naval expert but its answer is quite evident to the man who pays the bills. As we pointed out in these columns some weeks ago, the tests on the Alabama were about as conclusive as tests can ever be.

Even the most belligerent nation could afford to give up its battleships so long as it was allowed to keep its airplane factories and chemical works. Potentially military aviation and chemical warfare are far more deadly than naval conflicts and there is no practical way of limiting the preparation for them. The airplane factory will produce more and more commercial airplanes of improved design as time goes on and this means of transportation comes into its own and the chemical works will turn out its nitrates for the farmer and its dyes for the textile makers. Either can be turned to military use at short notice. Mr. Hughes wisely said nothing about either in his address.

From the militaristic point of view, then, there can be little opposition to the secretary's proposal. What of the economist?

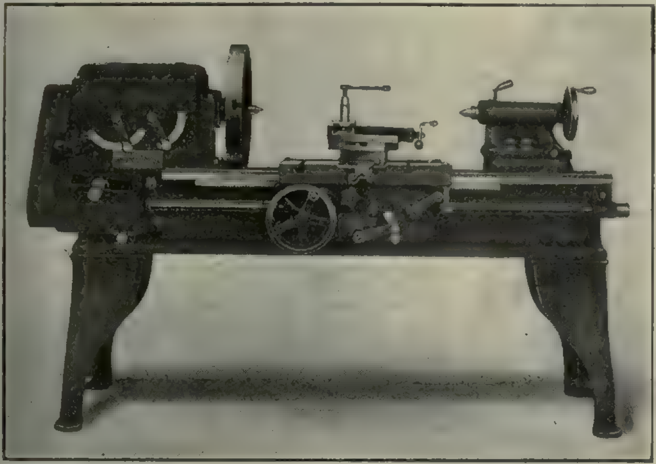
Some writers have already gone so far as to estimate in dollars and cents the savings that will result from the American armament reduction program. They run into the hundreds of millions in direct taxes which can be eliminated, but who can estimate the amount to be earned by the capital that will be released for the industry of the world? There is even a fair chance that it would be possible to wipe out the world debts if this capital were used to good account. It seems useless to carry the economic argument further, it is far too one-sided.

We have given rather materialistic reasons here for the success of the administration plan, not because they are the only ones but just to add the substantial backing of cold facts to our heart-felt sympathy with the President and Mr. Hughes in their stand for reducing the chances for future wars. We speak for ourselves and for the American machinery industry when we say that we are solidly behind them in their endeavor and confident of their success.

Shop Equipment News

Sebastian Type-S Lathes

The Sebastian Lathe Co., Cincinnati, Ohio, is placing on the market a line of lathes designated as the Type S, the machines being particularly intended for heavy production work. The lathe is of the quick-change type, and is made in swings of 13, 15 and 18 in. It can be furnished in either the geared-head or cone type, the former being illustrated.


SEBASTIAN 18-IN. GEARED-HEAD TYPE-S LATHE

The bed has four V-ways in the 13- and 15-in. sizes and 2 V-ways and two flat ways in the 18-in. size. The bed can be furnished in lengths from 5 to 14 ft. in the two smaller sizes of machines and from 6 to 14 ft. in the largest size. The cone type of headstock is semi-inclosed, so as to increase rigidity. The cone pulley is turned on both the inside and outside. The spindle is hollow. All of the gears are covered. The back gear can be thrown in and out of engagement by means of a cam operated by a handle at the back of the machine. Lubricating facilities are provided both on the spindle and on the back gear shaft.

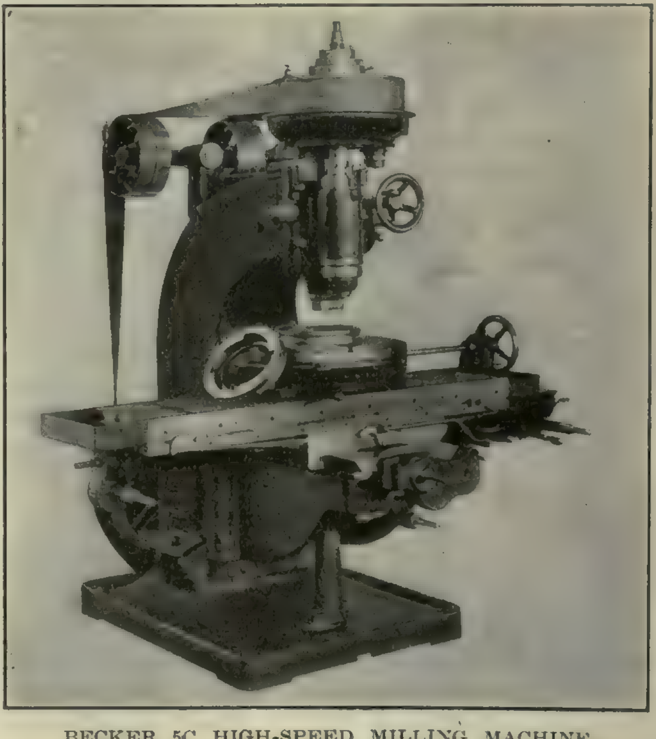
The geared headstock provides speeds from 19½ to 487 r.p.m. for the 13- and 15-in. sizes, and from 14 to 350 r.p.m. for the 18-in. size. All of the gears in the headstock are made of steel, are fully inclosed and run in lubricant. The geared headstock can be used with a double, friction countershaft or with a motor drive, the motor being mounted on the top of the headstock. In this latter arrangement, the motor is ordinarily connected to the spindle by means of silent chain, although a belt tightened by means of an idler can be employed. The tailstock is of the open-side pattern, allowing the compound rest to swing parallel over the ways and over the base of the tailstock. It has an adjustable side movement for taper turning.

The carriage is provided with T-slots on both the front and rear wings. The carriage and the apron are so joined by means of a long key as to provide accuracy of alignment and rigidity. The power crossfeed is of the pull type, and engages the gears from the side. A thread chasing dial is regularly furnished. The mechanism in the apron is strongly built, and is provided with facilities for lubrication. A safety device prevents the simultaneous engagement of both feeds. In doing plain turning, the half-nut is not engaged, but the motion is derived from the lead screw by means of a key running in a spline. The threads of the lead screw are used only when cutting threads on the work. The lead screw is 1⅜ in. in diameter, and a cast-iron clamp nut is used to engage the feed. The compound rest is graduated on the base, being provided with a guard on the rear to prevent chips from accumulating. A European style of toolpost can be furnished instead of the standard toolpost, if desired.

The quick-change box provides for the cutting of threads from 3 to 48 per in., and gives feeds from 6 to 96 per inch. All of the gears in the box are made of steel, and there is provision made for easy oiling. The lathe is ordinarily equipped with a quick-change box, compound rest, large and small faceplates, center rest, centers, as well as the necessary wrenches. Any special attachments that are ordinarily applied to a lathe can be furnished. The countershaft furnished ordinarily provides one speed forward and reverse, although it can be utilized to provide two speeds in one direction, in case the reverse is not necessary.

Becker No. 5C High-Speed Vertical Milling Machine

The Becker Milling Machine Co., of Hyde Park, Mass., has recently arranged its No. 5C vertical milling machine so that, on special order, spindle speeds up to 1,400 r.p.m. may be obtained and cutters as small as $\frac{7}{32}$ in. may be successfully used. The normal range of speeds for this machine is from 13 to 500 r.p.m., the


BECKER 5C HIGH-SPEED MILLING MACHINE

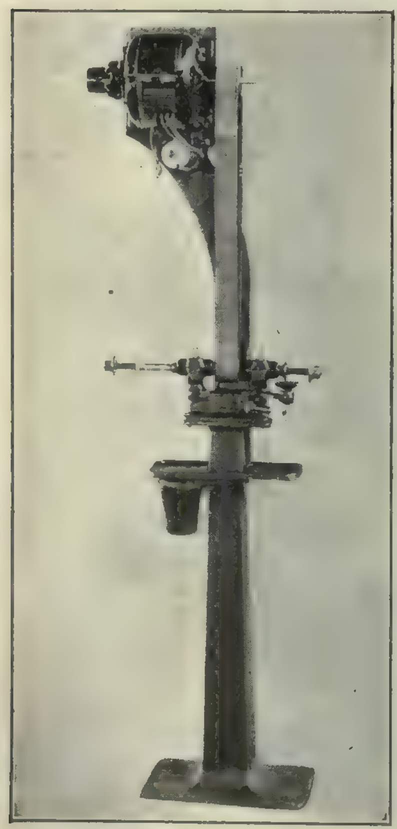
high speeds added not interfering with them, so that the machine may be used for all usual jobs and also be promptly available for the high-speed work. This feature is added because it is sometimes necessary to do light milling on pieces of work so large as to require a large size of machine merely to accommodate them. Large table dimensions and throat clearance may be desirable, although a smaller machine would be preferable because of the higher spindle speeds required for small cutters.

A special three-speed countershaft is furnished, with one shipper for obtaining the regular speeds, and another for the high speeds. A special composition drive belt is used, and sight-feed oilers are placed at bearings.

In the work shown in the illustration, a groove $\frac{7}{32}$ in. wide x $\frac{1}{4}$ in. deep is milled tangent to the circular wall previously milled, and about 1 in. below the top face of the work. Because of the necessary extension of this frail cutter from the spindle face, a special bracket is bolted to the spindle head, to which bracket is attached a bushing for supporting the cutter close to the surface being milled. The job as shown does not require a large throat clearance, but a larger size of this diehead cam 30 in. in diameter requires nearly the maximum clearance, which is 18 in. from the center of the spindle to the frame.

St. Louis Belted Motor-Driven Grinders

The St. Louis Machine Tool Co., 932 Loughborough Ave., St. Louis, Mo., has recently adapted its line of floor grinders and polishing machines to belted drive by means of individual overhead electric motors. The accompanying illustration shows the arrangement of the motor, it being carried on a heavy arm fastened to the rear of the pedestal. It is claimed for this arrangement that the driving motor is protected from the dust and dirt that ordinarily accumulates on a motor mounted on the floor, as well as from the action of grit that is apt to find its way into a motor mounted directly on the spindle of the machine. The addition of the motor does not increase the floor space required by the machine, and does not interfere with the operator. The motor and its supporting arm are, of course, easily removable. The motor is of the fully inclosed dust-proof type, and ordinarily furnished for alternating current. A 3-phase, squirrel-cage motor can be furnished, or else a single-phase motor capable of operating on either 1, 2 or 3-phase current, and at either 110 or 220 volts. Where necessary, direct current motors can be furnished. The starting switch is mounted directly beneath the motor.

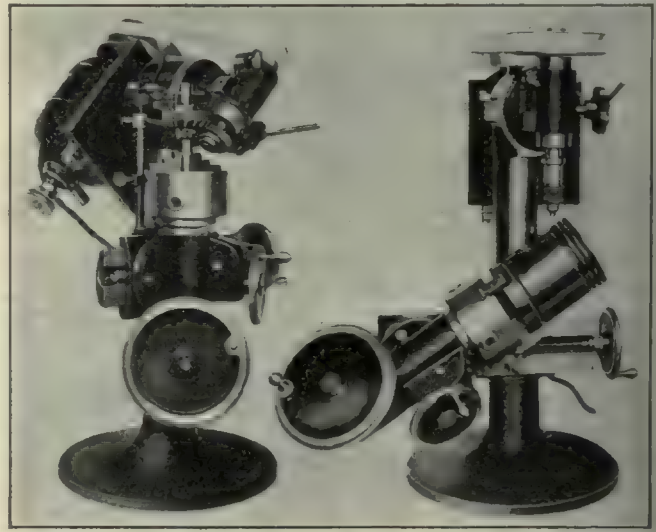


ST. LOUIS MOTOR-DRIVEN GRINDER

The machine can be furnished with practically any type of head used on the regular line of grinders and polishers made by the concern. It is ordinarily arranged to run the grinding wheels at 5,000 and the polishing wheels at 7,500 ft. per minute. The machine shown in the accompanying illustration is a combination type, having one grinding and one polishing wheel. All sizes of heads made by the concern under the trade names of "Saint Louis" and "Western" can be furnished, so as to provide the length of arbor and the style of head suited to any particular work. The maximum sizes of the wheels that can be carried vary from 6 x $1\frac{1}{2}$ in. on the smallest machine to 12 x 2 in. on the largest machine. The complete machines range in weight from 150 to 345 pounds.

Parker Grinding, Drilling and Turning Machine

The Ex-Cell-O Tool and Manufacturing Co., 1214 Beaubien St., Detroit, Mich., has recently placed on the market a fully universal bench machine, under the name of the Parker grinding, drilling and turning machine. The upper spindle head can be set at any angle about a horizontal axis, being directly connected to the $\frac{1}{4}$-hp. motor, which latter can be furnished to run from the lighting circuit. The lower spindle can also be set at any desired angle.



PARKER UNIVERSAL MACHINE GRINDING A CUTTER AND DRILLING A HOLE

The lower spindle can be driven by belt from a small pulley on the lower end of the motor, the belt running on a double idler pulley fastened to a spring on an adjustable shaft so as to give the proper belt tension in any position. This shaft and idlers are not mounted in the views shown. The upper spindle has $1\frac{1}{2}$ in. travel; the lower spindle has $2\frac{1}{2}$ in. vertical travel, $8\frac{3}{4}$ in. vertical adjustment and 7 in. horizontal travel. The upper, or grinding spindle, is equipped with ball bearings. The lower spindle has a full-length straight bearing, with a 45-deg. taper head providing $\frac{1}{2}$ in. bearing for thrust. The lower spindle is equipped with a 4-in. universal scroll chuck, and also with a 6-in. faceplate. The machine weighs 135 lb., and is 24 in. high.

Both external and internal grinding operations can be performed, as well as any class of cutter grinding. An idea of the grinding range of the machine can be obtained from the fact that it is used for grinding the outside diameters of automobile pistons, and also for grinding holes as small as $\frac{5}{16}$ in. in diameter. It is adapted to grinding automotive valves. On the left of the accompanying illustration it is shown grinding a cutter for refinishing the valve seats on cylinder castings.

By inserting a tool in the lug to the left of the upper spindle, small turning operations, such as regrooving pistons and turning small armatures, can be handled. An overhanging center bracket can be furnished with the machine.

By placing a drill chuck on the upper spindle instead of the abrasive wheel, small drilling or milling operations can be performed, as shown on the right of the illustration. A large pulley to reduce the speed for this purpose is furnished. The high speed possible with the machine is said to make it a very sensitive drill press.

Hirth Minimeter

The Coats Machine Tool Co., Inc., of 110 West 40th St., New York, N. Y., is placing on the market a complete line of the original Hirth minimeters suited to various applications in the ball-bearing, automobile, typewriter and sewing-machine industries. Recent additions to the line are shown in the illustrations.

The minimeter proper, to be seen at the right of Fig. 1, consists of a lever having unequal arms and resting on two knife edges. A series of levers with their bearings is not employed, thereby avoiding the play due to the presence of a film of oil or to movement on dead centers, which might affect the precision of the instrument. The arc described by the pointer attached to the longer lever arm depends upon the distance between the two bearing points of the knife edges. The ratio may, therefore, be adjusted as desired. The lever is held on the knife edges by means of a spring, which brings the pointer back to the normal position after the reading has been taken. A uniform contact pressure is thus assured.

The entire mechanism is protected from dust by a steel tube, and the upper part is provided with an opening that permits the graduated scale over which the pointer moves to be seen. The ratio of amplification is 1:50, 1:100, 1:200, 1:500 or 1:1,000, depending on the accuracy to which it is desired to gage. The upper measuring anvil of the minimeter is provided with a trip lever which, on being lightly pressed with the finger, permits free entrance of the piece to be gaged, thus avoiding considerable wear on the contact points.

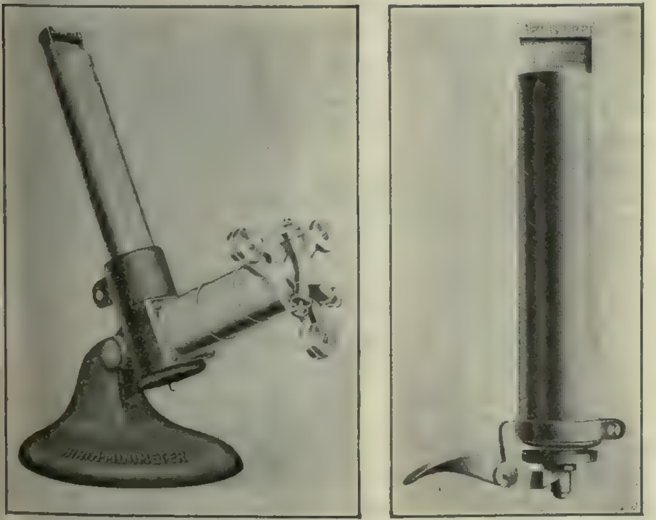


FIG. 1. HIRTH MINIMETER AND MOUNTING FOR BORE TESTING

The measuring instrument proper can be mounted in different types of holders. In one adaptation, in which the minimeter is held on a column over a small table, an instantaneous raising of the minimeter of about $\frac{3}{8}$ in. is effected by means of a lever. This arrangement permits the gaging of grooved and slotted parts, as, for instance, the circular grooves of end-thrust bearings, the depth of the groove being quickly checked at any point.

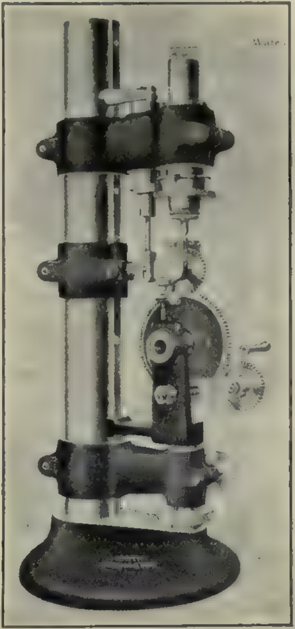


FIG. 2. MINIMETER FOR GEAR TESTING

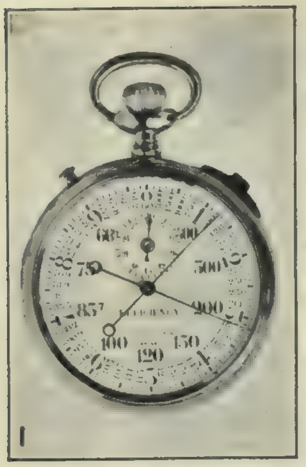
Another application of the minimeter is the inspection of balls requiring high accuracy. The housing of the minimeter forms a clamp which facilitates the setting. Fine adjustment is obtained by means of a micrometer screw below, while the back-stop, also movable, serves as a guide for the ball to be measured. Holders can be furnished which may be bolted either directly to the machine or to the wall.

The type shown on the left of Fig. 1 is intended for measuring holes up to $1\frac{15}{16}$ in. in depth and from $\frac{3}{4}$ to $2\frac{3}{4}$ in. in diameter. This instrument is equipped with a telescopic sleeve, interchangeable three-point gaging head and three back-stops. The other recent model, shown in Fig. 2, is suited to the field of gear inspection. The instrument is intended for checking the pitch and the tooth flanks of spur gears. There are three sizes ranging from $\frac{3}{4}$ to $8\frac{5}{8}$ in. in the diameter of the gear measured, and from $\frac{3}{8}$ to $1\frac{3}{16}$ in. width of tooth.

Silberberg Time-Study Watches

The Mortimer J. Silberberg Co., Peoples Gas Bldg., Chicago, Ill., has recently placed on the market a decimal-graduated, two-handed, computing, time-study watch, shown in Fig. 1. The dial of the watch is graduated in tenths and hundredths of minutes, and contains figures, spaced 0.02 min. apart and distinctly legible, that indicate at any point of elapsed time exactly what the output per hour totals on the work in process.

A sliding stop is provided by which the watch may be started, stopped and started again without returning the hands to the zero position; an additional "plug" on the left side of the case makes it possible to stop one hand without interfering with the other. The time required for multiple operations and portions of operations can be determined by operating the two hands in sequence without at any time returning the hands to zero. The hand on the small dial records the total elapsed time up to 30 minutes.



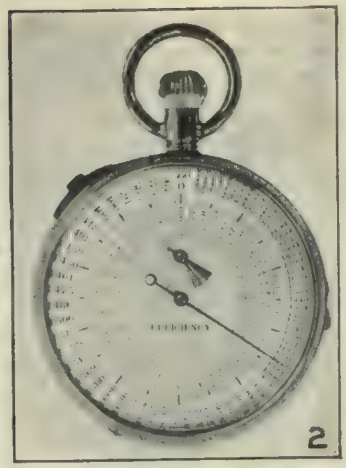


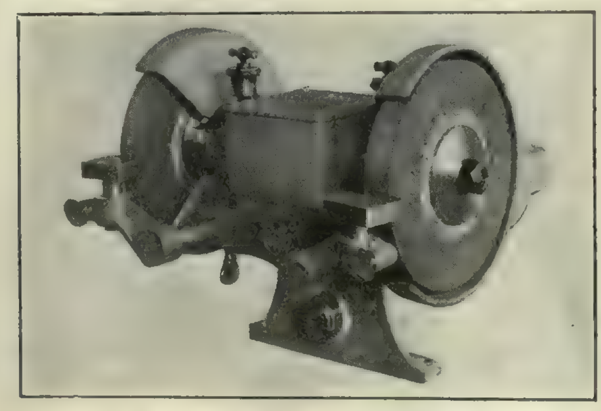
FIG. 1. SILBERBERG SPLIT-HAND TIME-STUDY WATCH.
FIG. 2. "DECIMAL, DURATION" WATCH

The watch shown in Fig. 2 is known as the "decimal duration" type. The dial is graduated in tenths and hundredths of minutes and contains figures that indicate at any point of elapsed time what the corresponding output per hour is. The outside circle on the dial is colored in red and the figures thereon denote production per hour for any observation up to and including one minute. The central circle is colored in black, and the figures thereon denote production per hour for any operation of longer duration than one minute, but not exceeding two minutes. The inner circle, which is colored in blue, contains figures denoting production per hour for any operation of longer duration than two minutes, but not exceeding three minutes.

The small sector of a circle on the upper central portion of the face contains a small hand, which records the revolutions of the large hand up to and including 30 minutes. A sliding control button on the side of the case allows the observer to start the watch, stop it, and start it again without returning the hand to the zero position. This makes it possible to eliminate from the total the time consumed in delays on the work, so that when the operation is completed, the time shown will be the net time of the operation. Pressing down the crown brings both hands back to zero.

Black & Decker 8-In. Electric Bench Grinder

The Black & Decker Manufacturing Co., Baltimore, Md., has just brought out the 8-in. electric bench grinder shown in the illustration. The machine carries two wheels, and has a $\frac{3}{4}$-hp. universal motor, capable of operation on either alternating or direct current. The motor is air cooled, and arranged so that the cooling-air intake is located 12 in. from the grinding wheels, in order to reduce the possibility of grit being drawn into the machine. The machine is grease lubricated throughout.

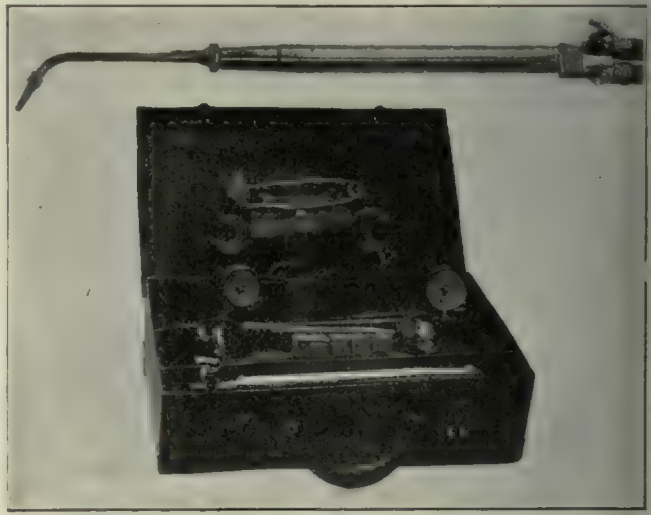


BLACK & DECKER 8-IN. ELECTRIC GRINDER

The grinding wheels, which are set well forward of the motor casing, are arranged so that they overhang the bench. This makes it possible to grind long pieces and odd shapes without interference from the casing, and also to wear the grinding wheels down to the clamp washers before discarding them. The machine is equipped with two 8 x $\frac{3}{4}$-in. grinding wheels, one coarse and one fine, two wheel guards, two adjustable toolrests, and an electric cable fitted with an attachment plug and switch.

Davis-Bournonville Garage Welding-Torch Outfit

The Davis-Bournonville Co., Jersey City, N. J., has recently placed on the market an oxy-acetylene welding torch and carrying outfit, especially for use in garages and small machine shops. The outfit is intended for repairing broken metal parts of all sorts, and is said to be capable of handling the usual types and sizes of welding work encountered in the small shop.



D-B GARAGE WELDING OUTFIT

The accompanying illustration shows the case open and illustrates the manner of packing the apparatus. The case is made of fiber and is provided with partitions for holding the various units of the outfit. The outfit consists of a welding torch, with three extension tubes, one decarbonizing tube and five tips; an oxygen and a hydrogen regulator, with hose and connections; a spark lighter; colored glasses, and a torch wrench and regulator wrench. Various types of rods and fluxes can be furnished for use with the torch.

The torch is of the concern's No. 7000 style. It is shown assembled in the illustration. The extension tubes furnished are 5, 10 and 15 in. in length, and are made of drawn copper. The tips are made of copper although brass is used for the smaller sizes. They are secured to the head by means of a fine-thread nut which is said to provide a gas-tight connection. The mixing chamber is in the head of the torch, and is stated to be so constructed as to give a perfectly mixed gas. The gas tubes are silver soldered in position in both the head and rear ends of the body, and the needle valves, which are quick-opening, are also silver soldered in place. The regulators are of the standard type, one being for the oxygen and the other for the acetylene. If desired, regulators having two gages can be furnished, one gage indicating the working pressure and the other the tank pressure.

Bausch & Lomb Thickness Caliper

The Bausch & Lomb Optical Co., Rochester, N. Y., has recently placed on the market the thickness caliper shown in the illustration. The device is intended to give a means of easily measuring diameters or thicknesses, being originally developed for determining the thickness of lenses. The two legs of the device are of U-form, to give strength. The pivot is provided with a bronze bearing adjustable for wear.

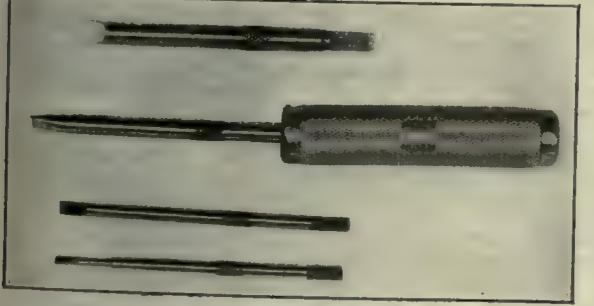
BAUSCH & LOMB THICKNESS CALIPER

The measuring points are made of hardened steel, the ends being given a spherical form. A locking screw adjustment is provided at each point. The scale fastened to one of the legs is made of German silver, and can be supplied with two different styles of graduation. The caliper illustrated is graduated to read in thousandths of an inch. It can be graduated to read in tenths of a millimeter, if desired. The maximum capacity is 12 mm. or $\frac{1}{2}$ in.

Consolidated Tool Works Screwdriver Set

The Consolidated Tool Works, Inc., 296 Broadway, New York, N. Y., has recently placed on the market the No. 60 screwdriver set shown in the illustration. The tool is intended for heavy work and is strongly made. Four hardened and ground tool-steel blades are provided, the widths being $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$ and $\frac{5}{16}$ inch. The handle is turned from a solid bar of cold-rolled steel, being knurled to provide a grip.

The blades are interchangeable in the handle, the two smaller blades being fitted at one end and the two larger ones at the other. They are secured without the use of any moving jaws, being merely pushed in place and withdrawn by pulling them outward. The blade is prevented from turning in the handle by a stop which bears against the flat surface on the tang. The method of gripping is positive and permanent, but permits of very quick changing of the blades. The assembled tool is $6\frac{1}{2}$ in. long; the blades themselves are $3\frac{1}{8}$ in. in length. Each set is packed in a brown canvas bag, so that it can be conveniently carried.

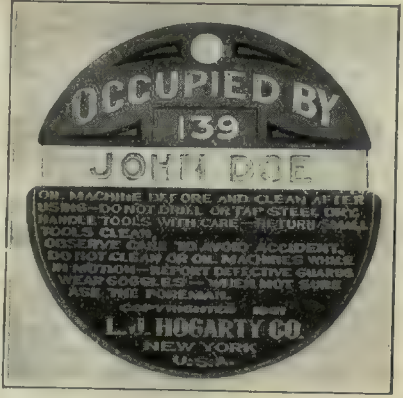


CONSOLIDATED NO. 60 SCREWDRIVER SET

Hogarty Identification Tag

The L. J. Hogarty Co., 5 Beekman St., New York, N. Y., has recently placed on the market the identification tag shown in the accompanying illustration. The device is intended for use by toolmakers and machinists in general, where one man is not assigned permanently to one machine.

Each operator has one tag. The tag bears the name and check number of the man, the former being stamped on a metal band so fastened on the tag that it can be easily removed and replaced by another band in case an employee leaves the concern and is replaced by another. When an operator starts to use any machine in the shop, he attaches to it his identification tag, which indicates that the machine is occupied. This method is intended to displace the more common one of putting a tool or cutter in a machine to show that the latter is in use, or else being held for future use. Since each man has but one identification tag, it is not possible for an operator to reserve more than one machine at a time. In case that it is necessary for him to temporarily proceed with other work, such as at a bench, the tag indicates that the machine is in use. The display of the tag on the machine assists timekeepers, foremen and inspectors in checking up the operations and the work of the men. It is stated that the displaying of the operator's name gives him a greater sense of responsibility regarding the machine. On the face of the tag are printed some rules regarding the care and operation of machine tools. It is made of brass and is $2\frac{1}{4}$ in. in diameter.


OCCUPIED BY
139
JOHN DOE
OIL MACHINE BEFORE AND CLEAN AFTER USING—DO NOT DRILL OR TAP STEEL DRY. HANDLE TOOLS WITH CARE—RETURN SMALL TOOLS CLEAN.
OBSERVE CARE TO AVOID ACCIDENT. DO NOT CLEAN OR OIL MACHINES WHILE IN MOTION—REPORT DEFECTIVE GUARDS WEAR GOGGLES!—WHEN NOT SURE ASK THE FOREMAN.
L. J. HOGARTY CO.
NEW YORK
U.S.A.

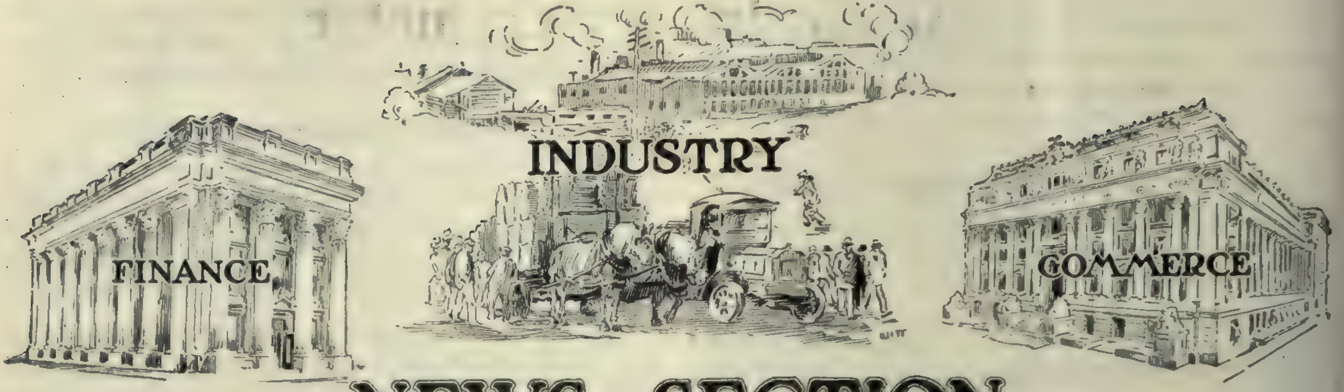
HOGARTY IDENTIFICATION TAG

Erratum

On page 695 of the *American Machinist*, under the title of "Critchley Expansion Reamer with Adjustable Pilot," the maximum size of a reamer recently placed on the market by Chadwick & Trefethen is given as $\frac{17}{32}$ in. This is a typographical error, and should be $1\frac{7}{32}$ in.

Manganese Ore Deposits in Chile

There are numerous deposits of manganese in the Coquimbo and Atacama districts, according to Consular agent Edwin Salz. Years ago they were important sources of the world's demand for this ore, but due to competition from Brazil, their exploitation ceased entirely. During the three years previous to 1921 occasional shipments aggregating about 15,000 tons were made, but even these were discontinued because of the high ocean freight rates prevailing in 1920.



NEWS SECTION

Foundrymen's Exhibit at Cleveland Next Year

The next convention and exhibit of the American Foundrymen's Association will be held during the week of April 24, 1922. The association headquarters and exhibits will be in the new Cleveland Public Hall, which is rapidly nearing completion. The Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers has announced that it will hold joint convention with the foundrymen, as has been the custom in years past.

Following an interval of eighteen months the next meeting promises to be of unusual interest and profit. The papers committee advises that manuscript copies are being received and that the first advance copies of papers to be presented at the convention will be mailed out in January.

At the coming exhibit will be displayed all the latest improvements and inventions in foundry equipment. Full detailed announcements with hotel and railroad rates will be made later.

◆

Southern Railway to Reduce Freight Rates to Aid Iron Industry

Announcement by officials of the Southern Railway Co. that application has been made to the Interstate Commerce Commission for a 25 per cent freight rate reduction on iron ore and fluxing stone, applying to interstate commerce and intrastate transportation in Georgia and Tennessee, is regarded by the metal trades industries of the two states named as one of the most important rate reductions undertaken by any Southern road in some time. The reason for this lies in the fact that the present rates, which are regarded as unusually high, have been one of the main factors contributing to the decline in furnace operations in the South, and if the new rate becomes effective many of the plants that have stood idle for several months are expected to resume operations immediately.

If the application is granted by the I. C. C., rates in force will be the same as those of August, 1920, during which month the new higher rate went into effect which served to make furnace operation unprofitable. Shortly after that furnaces began to shut down and they have, in a large measure, since remained inactive. A great boom is expected if the cut is allowed.

Opening of a School for Time Study

The announcement of the Taylor Institute, 122 South Michigan Blvd., Chicago, Ill., that a course in time and motion study has been instituted under the direction and with the collaboration of several of the country's experts along this line, will be received favorably by production engineers throughout the country.

Although the application of time and motion study has become an important factor in modern production, the variations in the applications of these studies is well known. However, the need for men trained in this work is said to be greater than visible supply, and the means whereby the engineer can perfect himself in this work under the direction of able time study experts will be welcomed by every branch of manufacturing industry. The course of instruction, conducted by correspondence, covers ten lessons at intervals of one week each, and embraces such features as piece work, rate setting, accurate computation, production control, formulas and methods of figuring. The methods and formulas are in operation in some of the largest and best known industries in the country, and are the result of years of experience in this work.

◆

Road Building Machinery at Good Roads Show in Chicago

An exposition that will embrace $1,500,000 worth of labor-saving road machinery will comprise the coming Thirteenth National Good Roads Show, at the Coliseum, Chicago, Ill., Jan. 17 to 20, next, to be held in conjunction with the twelfth American Good Roads Congress and nineteenth annual convention of the American Road Builders' Association. The exposition will demonstrate the marvelous growth that has characterized the American road building industry in the past decade. At a drawing for space on Oct. 29 more than 95 per cent of the 40,000 sq.ft. of space available for exhibits was taken, necessitating the rental of additional buildings to accommodate exhibitors now applying for space.

The program committee is now drawing up a strong program for the technical sessions of the congress and many road builders from all parts of the country will be asked to discuss matters of vital interest to contractors and to machinery manufacturers.

To Memorialize DeLamater-Ericsson Anniversary

March 9, 1922, will be the sixtieth anniversary of the battle of the "Monitor" and "Merrimac" at Hampton Roads, Va., which demonstrated the merits of the turreted battleship. That has been the date selected by the DeLamater-Ericsson Tablet Committee to memorialize the services of Cornelius H. DeLamater and Capt. John Ericsson, who for 50 years, 1839-1889, were pioneers in developing the naval, marine and industrial interests of this country, and who at the time of the civil war, without thought of personal reward, turned their mental and financial resources to account and applied their knowledge and experience to accomplish what the Government had failed to do.

The Government has appropriated $35,000, and private individuals have subscribed a larger sum for a memorial to Captain Ericsson in Washington adjacent to the Lincoln Memorial, and $5,000 is being raised by private subscription among engineering and marine interests to erect bronze tablets on four sites of buildings in New York City with which the lives and work of the two men were identified.

Mr. Isidore Konti is the sculptor, the Municipal Art Commission has accepted the design and the American Scenic and Historic Preservation Society will serve as guardian of the tablets.

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Muscle Shoals to Supply Power for South

In order to relieve to some extent the shortage of hydro-electric power in Georgia, Alabama, Tennessee and North and South Carolina, the Alabama Power Co. will operate Dam No. 2 and the power plant in connection with it at the Muscle Shoals nitrate plant, leasing the property from the Federal Government. Shortage of power in the five Southeastern states named has been caused by the long dry spell which has lowered the rivers and streams to far below their normal marks, has resulted in the shutting down of a number of industrial plants operated by hydro-electric power and the curtailment of operations at many others.

By connections with the Alabama Power Co. and the Georgia Railway and Power Co. hydro-electric power is supplied to industries in the five states. and the situation will be somewhat relieved by operation of the Muscle Shoals plant, which has 90,000 hp.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
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It is an old maxim in Wall Street that "the ticker tells the truth however others may prevaricate." If this be so then the record of the Disarmament Congress thus far should be regarded as encouraging, for nearly all the speculative markets showed an improving tendency and had a better tone last week.

While the rise in prices actually established is but small and is in most cases related to some particular trade factor previously unnoticed, it is plain that speculative readiness to take account of the hopeful has been greatly increased by the happenings at Washington.

As far as one can trace the processes of the collective mind this is due to the fact that it has become plain that public opinion throughout a war weary world will compel the acceptance of the proposals made by Secretary Hughes in fact as well as "in principle," and that despite diplomatic maneuvering over the difficulties of the Eastern question a reduction in naval armament sufficient to permit of a substantial reduction in taxes will be agreed upon.

As to whether war will thereby be really made more remote seems to be rather a question of the sentiment expressed than of the vessels that are to be scrapped or abandoned, for even if they are all irrecoverably surrendered there is doubt whether the aggregate tonnage of the "capital war ships" of Great Britain, Japan and the United States will be much smaller than it was in 1914, just before the outbreak of the recent struggle.

The important thing is that civilization has declared itself as opposed to war for the present at least, and is determined to devote its activities to the constructive arts of peace. What this implies in the possible increase of wealth and purchasing power can be partially glimpsed from the recently published statement that through the invention of power producing and labor saving machinery the effective physical energy of the American people is now multiplied by 31, and that one half of this increase is attributable to the development of the present century.

This calculation is based upon the assumption that one "horsepower" is equal to the energy of seven and two thirds men. Put another way for the sake of clarity, it means that with the aid of water power, electricity, steam, gasoline and kerosene the machines and machinery now available in this country can do the work that would otherwise have required the unaided strength and labor of over 3,000,000,000 men. In other parts of the world the use of power and labor saving machinery in multiplying the efficiency of the individual has not advanced as rapidly as in America, but what has been achieved here can be approximated elsewhere and the figures will give an idea of how much more renowned than the victories of war the victories of peace may be, if the world is left free to fight for them.

It is a subconscious appreciation of these possibilities which have not previously, as far as I know, been so circumstantially set forth, that is responsible for the ground swell of optimism that is now noticeable everywhere.

Sterling exchange has advanced to $4 upon the belief that the economies that will follow disarmament will ultimately enable Great Britain to recover her financial equipoise. Cotton, wheat and our other exportable commodities, including copper, have advanced slightly in the expectation of an improved export demand.

Bonds are higher and a fifty million dollar issue offered by the New York Telephone Co. was enormously oversubscribed because the prospect of lower taxes, remote as it seems to be, assures an ultimate abundance of capital for private enterprise. Money is meantime still lower. The weekly statement of the Federal Reserve System shows a reserve ratio of 71.8 per cent a week previous, and a further gain of $7,000,000 in gold. The best commercial paper can be sold at 5 per cent and the call rate has fallen to 4 per cent.

The same conditions exist in London. The reserve ratio of the Bank of England is rising and the market rate for short time bills has fallen to 3⅝ per cent.

The ease of money and the renascence of hope are, as I expected, gradually inducing the purchase of other securities than bonds. A prominent New York banking firm is now advertising the attractiveness of preferred stocks, and shrewd speculators are in a quiet way buying the low-priced common stocks that are to be picked up on the Stock Exchange and elsewhere. The railway shares that pay no dividends are, however, still neglected, and it is in this quarter that the greatest opportunity of profit is probably to be found for it is plain that the position of the American transportation industry is rapidly improving now that the managers are tardily coming to realize 'that high rates work a reduction of both traffic and profits. Their recognition of this truth is evidenced by the reduction of 10 per cent in the rates on farm products outside of New England, and while the permanence of this reduction for more than six months is made contingent upon an order from the Labor Board that will permit of an equal reduction in wages within the same period, it is a safe bet that the old rate will not be reestablished. The next step ought to be a reduction in passenger and Pullman rates. There are intimations that it is being considered.

There are many other indications that commerce and industry are once more upon an even keel. Bank clearings for October were $30,263,000,000, as against $38,768,000,000 last year, the difference being more than accounted for by the decline in prices.

Distributive trade is normal, though not booming. There is every prospect of a good Christmas business. It is said that the winter residents are already on their way to Florida in large numbers and that over 10,000 people have already arrived at St. Petersburg. Bradstreet reports that building permits issued in 157 cities during October call for an expenditure of $167,000,000. This compares with $152,000,000 for 163 cities in September and $92,000,000 a year ago. These figures afford a partial explanation of the more cheerful reports that come from the steel industry, though they are also attributable to increased buying by the railways.

The foreign trade statement for October shows that our exports are holding up marvellously well considering the impecuniosity of Europe. They were $346,000,000. Imports were $183,000,000, leaving a balance of $163,000,000 in our favor, as against $146,000,000 in September. A balance of $2,000,000,000 is indicated for the calendar year. It is, however, unnecessary to adduce more statistics to prove that we are on the way to normal activity and prosperity. The barometer is rising and the glass seems set for fair weather unless either the Disarmament Congress or the Congress of the United States do something that will cause misgiving or doubt. Incidentally it is encouraging that the tax bill, such as it is, seems near its final passage. The House has accepted the Senate amendment fixing the maximum supertax at 50 per cent.

In Europe the Irish question and the probable insolvency of Germany, as indicated by the fact that marks are still selling at 39 cents per hundred in New York, still remain to trouble the foreign statesmen and financiers but these conditions have become chronic and like all chronic disorders they will ultimately become unbearable. There is, however, reason to hope that the rigidity of Ulster will shortly yield to the massage of Lloyd George and that he may be released to visit this country, where a warm welcome awaits him.

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Obituary

Chester L. Lucas, advertising manager of *Machinery* for the Central West, died on Nov. 3, in Syracuse, N. Y. Mr. Lucas was born in Middleboro, Mass., in 1881. He learned the trade of engraving and die-sinking with the Schwerdtle Stamp Co., of Bridgeport, Conn., and was later connected with the John Robbins Manufacturing Co., Boston, and then with the General Electric Co., at Lynn, Mass. He joined the editorial staff of *Machinery* in 1911 and in 1918 took up the advertising work in which he was engaged at the time of his death. The machinery industry has lost a good friend and loyal supporter.

Business Conditions in England

By Our London Correspondent

Perhaps the best method of indicating the present industrial and commercial conditions is to examine briefly one or two company reports and similar documents that have recently been made public. The figures naturally relate to the workings of the past, but it is the immediate past and a pointer is shown as to the present direction of movement. In regard to shipping, one steamship company which had been in the habit of paying 10 or, more frequently, 15 per cent and even 20 per cent, now has to state that the bankers holding mortgages on the vessels covering an overdraft have declined to carry it longer, with the result that a new company is proposed, capital £100,000, to purchase the fleet of eight vessels at present prices. The overdraft is of £400,000. Then again in the case of another company which bought up a line at high prices, the chairman reported that debenture holders have taken possession and decided to sell the 15 ships. Here the loss is due not to trading, which has been profitable, but to the fall in the value of the vessels. The holders however find that, sold at current rates, the ships would not cover half the amount of debentures. It is stated that £450,000 will buy the boats, which cost the company a year or two ago more than £2,000,000. Another steam shipping company has written down the value of its fleet from £1,149,000 to £1,032,000, despite the fact that, owing to the acquisition of two new steamers, the tonnage has increased from 49,664 to 59,248. The net profits, at £176,266, show a decline of nearly $60,000 in the year. Further, the firm of Swan, Hunter & Wigham Richardson, Wallsend, recently published a statement that since the beginning of the year no new order had been received for ships, while the position was very nearly the same at associated yards at Walker, Glasgow and Sunderland, one vessel completed in the last yard having been sold at half the cost of building. Reference is made to a Cunarder finished in 1911 and another launched in 1921. At the former date the cost per ton of steel was £3.58 and the weight of steel worked per iron worker per week was 9.91 cwt. Ten years later the cost per ton was £11.73, and still rising, while the weight worked was 7.35 cwt.; in fact it is asserted that wages paid now amount to between three and three-and-a-half times the wages paid in 1911—compared with work done.

The shipbuilding decline is shown in the annual report just issued by Lloyd's Register. Here the new tonnage classed for the year ending with June last was 3,245,130, a reduction of 25 per cent compared with the preceding twelve months. While tonnage under construction was rather more than this, there has been a definite falling-off in new orders; in fact the reduction of late has been "so extensive as to indicate a slump in orders for new tonnage without precedent." The tonnage registered included productions of the United States, Japan, Holland, and the British Dominions, that of America (1,219,270) being slightly in excess of the British (1,163,590). Vessels representing 58 per cent of the total tonnage classed during the year were fitted for burning oil.

Coming a little nearer to engineering, Kayser, Ellison & Co., Sheffield, steel makers, show in their report for 1920-1921 a net profit of £14.375 as compared with £26,310 the year before. The net profits have in fact declined since 1916-1917. In the year 1917-1918 one hundred per cent in bonus shares was added to the 20 per cent dividend. This year the distribution is at the rate of 5 per cent. The net profits mentioned include the amount received by way of return of excess profits duty; despite this, the directors regard the report as not unsatisfactory. Yates & Thom, the Blackburn steam engine makers, appear to have done well, for they paid 5 per cent, put £10,000 to reserve and carried forward £15,084 as against £10,580 last year, when 10 per cent was paid.

Gwynne's Engineering Co., Hammer smith and Chiswick, in the west of London, the successors of the firm who for many years manufactured centrifugal pumps, etc., to which of late they added motor cars, was registered in 1920. It was stated on the certificate that the profits had been £243,447 for 11 months of 1917 and the first month of 1918, £141,982 for the following twelve months and £164,297 for the last 11 months of 1919. The report issued relating to the period ending with August last shows a loss of £103,164, this being raised to £351,887 by various payments, allowances for depreciation, writing-off formation expenses, and so on.

The Automotive Field

With reference to motor cars, the Austin Motor Co., being re-financed, is being taken out of the hands of the receiver and a scheme of arrangement for the reconstruction of Harper, Sons & Bean has been sanctioned by the courts. It may be added that both the commercial vehicle and pleasure vehicle shows held this year in London could not be fully representative of the industry, as the promoters of the show decided that firms against whom receiving orders had been made or who were in liquidation troubles could not partake. The pleasure car exhibition opened on Nov. 3, with 571 exhibitors, including makers of motor-boats, etc. Low price, with light cars, was the prevailing note.

Herbert Morris, Ltd., crane makers, Loughborough, show a trading profit, after payment of taxes, etc., of £70,878, comparing with £121,266 previously. The dividend is 10 per cent and it is pointed out that two years ago a bonus of 175 per cent in the form of ordinary shares was given to shareholders.

The latest machine tool firm to report, namely, Kendall & Gent, Ltd., Manchester, shows a debit balance of £5,030, despite the fact that £2,514 had been carried forward. The capital of the company is £130,000, £90,000 of which is held publicly.

Finally as regards companies, E. G. Wrigley & Co., Ltd., Birmingham, manufacturers of small tools and also motor car transmission gears, showed a loss during the year ending with April 30, the latest date available of £124,884. They had to carry forward from the previous year a debit balance of £67,021, and capital losses on investments in certain motor car companies and loans in connection with a steel foundry make a total loss of £548,330. To meet this the capital reserve is drawn on and the ordinary shares of the nominal value of 20s are to be written down by 12s, leaving the value at 8s, subsequently to be split into two shares each of 4s. Indeed it is now confidently anticipated that a number of industrial companies will have to reduce their capital accounts. Capital was inflated during the war and in the hectic period following. It is being recognized that much has disappeared and that in the future dividends can be paid only on reduced capital. People seem to be selling out of the companies for fear of the necessity of re-construction on a smaller basis.

There are some industries which, it is thought, have reached the bottom and are on the up-grade. This anticipation applies, not for the first time by any means, to the cotton trade where in some directions notice has been given of advance of retail prices. The coal industry is in a critical position and though drastic cuts have been made in the prices of iron and steel, at present they have not resulted in the closing of many orders. Pig iron prices as last reported are below the cost of production, but nothing in the way of forward buying can be reported. At the last meeting of the London iron and steel exchange it was stated that only one-third of the Sheffield steel furnaces are working. But, so as not to paint too dark a picture, good business was reported by black sheet makers and an improved demand by manufacturers of galvanized corrugated sheets, a steady influx of orders from India and the Far East being mentioned. A steel works in Wigan which had been shut for nearly a year has re-commenced operations, and the pressure of foreign competition in steels has lessened. An order worth one-and-a-half million pounds for water pipes received from Bombay is reported by a Birmingham firm.

Of the engineering industry nothing fresh can be said and, putting it roughly, with some exceptions the machine tool industry appears to be working say one-and-a-half days a week. India in certain directions has been a good friend to engineers, particularly in regard to the supply of iron and steel foundry plants. Developments of a competitive character in this direction are anticipated in the East. Then, too, judging by official reports, Australia has made up her mind to have her own manufacturing industries, and a Yorkshire woolen firm recently arranged to make a start there. But according to the commissioner reporting, Australia will need further capital and, in addition, will have to import specialized knowledge and ability to organize.

The problem of unemployment has led to special efforts by the government, including the allocation of £26,000,000 in connection with export credits and £25,000,000 by way of guaranteed loans; that is, the state will guarantee payment of principal and interest up to that extent of approved loans. In view of the volume of trade the sum is not particularly large, as can be gathered from calculations recently made of new capital subscribed even during the current year. In the 10 months this has amounted to more than £183,000,000, compared with £342,000,000 during the same period of last year. After a very large falling off during the summer, the figures show for October a very definite advance, due to cheaper money. The government is also devoting £12,000,000 directly to the unemployment problem, including funds for emigration facilities, contributions to dependents' funds, and grants for loans for relief work. A number of schemes designed to absorb the unemployed have been proposed and discussed, including the making of arterial roads and the extension of the London tube system. These however will not extend the overseas trade, on which Great Britain so largely depends.

Hoover and Feiker Champion Cause of Trade Associations

Despite the criticisms that have been heaped upon the trade associations and the disinclination on the part of the Department of Justice to attempt to clarify the situation prior to the decision of the Supreme Court in the hardwood lumber case, the Department of Commerce is actively championing the trade association idea. Secretary Hoover and members of his staff are taking pains in their utterances to show that the questionable conduct of a very few trade associations, or aggregations calling themselves trade associations, has resulted in uncharitable criticism of all trade organizations. Mr. Hoover has expressed himself so definitely on the subject that there can be no doubt that he believes trade associations are necessary to the maximum progress of industry. The rapid multiplication of trade associations until they number nearly 3,000 is interpreted by Mr. Hoover to indicate "a great and vital movement and something permanent in our economic system. The coming together of manufacturers and producers in the different trades for the purpose of the advancement of their industries as a whole, is a profound step toward co-operation in the whole business world. Out of it will be gained tremendous benefits for the business public as well as the particular industries.

F. M. Feiker, assistant to the Secretary of Commerce, in a recent public address said:

"The trade association is the natural organization functioning in the establishment of contacts between the government and industry. It is indispensable in such matters as the collection of statistics, the detailed promotion of foreign trade and in the elimination of excess variety. It is the only avenue that the Department of Commerce sees by which the Government can establish contact with a trade to the mutual advancement of fundamental interests.

Founders Celebrate Silver Jubilee in New York

National Association Discusses Questions of Moment—Gov. Allen, of Kansas, Scores Labor Leaders—Barr Re-elected President

With its usual frank and open discussions of the open shop movement of which it is one of the most prominent exponents, the National Founders Association held its twenty-fifth annual meeting at the Hotel Astor, New York, on Nov. 16 and 17. Over four hundred members attended. William H. Barr, the president, made the opening address and presided over each of the sessions.

Mr. Barr covered several topics in his address, but his definition of the causes for our present industrial ills was particularly well received. He said: "In searching for a simple explanation of the basic fault of the industrial situation both before and after the war, I can only sum it up in the two words, "politics" and "unionism."

"The hope today is that we are gradually purging industry of politics and unionism and the after effects of war. We are bringing to this contest the grim resolution of American business men to see the thing through, and we are mightily set upon correcting the conditions which have brought about the present situation. Let us not be too analytical as to the causes which promoted the present business conditions. Rather, let us accept the situation as it is and continue to work for normalcy. It is not an impossible fight and we possess everything that tends to make for victory. We have courage, a clean record, patriotism and the will to win."

An unexpected and unannounced speaker on Wednesday was Governor Henry Allen, of Kansas, who is best known for his establishment of the Court of Industrial Relations in that state, and who is a thorn in the side of every labor leader in the coal mining districts. The Governor, who was attending another conference in New York, was invited to address the Founders. He spoke extemporaneously, giving a brief history of the work of the court, the events leading up to its formation and the results so far attained by this unique tribunal. He said that twenty-nine out of the thirty cases which the court has decided, have been satisfactory to both litigants. He added that the popularity of the movement was evidenced by the fact that he has twice faced the people in general elections, and has been vindicated on each occasion by re-election. He praised the women of this state as the stabilizers of society and the greatest influence for good against the power of the radical element of union leadership.

A very interesting analysis of wage rates and living costs was presented by Magnus W. Alexander, managing director of the Industrial Conference Board. Mr. Alexander illustrated his remarks with charts showing the rise and fall of wages as related to the cost of living. His figures, taken from a survey of machine shops and foundries in the United States, showed that the average hourly wage rate in July, 1914, was 27.4 cents; in 1920, 63 cents; and in 1921, 56.1 cents. He also showed a decline of 13½ per cent in hourly earnings, 26.8 per cent in weekly earnings and 44.5 per cent in employment. He predicted a return to normal by the end of this winter and declared that the proper relation between money wages and cost of living was the only criterion of the economic status of the workers.

A most instructive paper on foundry costs was presented on Thursday by Robert E. Belt, secretary of the American Malleable Castings Association. Mr. Belt gave a thorough analysis of foundry costs as related to selling prices. In impressing his audience with the great value of proper cost supervision, he said that no matter how highly efficient was the technical administration of the product, the business could not be successful unless the cost of production is properly regulated. He urged the foundry-men to pay more attention to their cost systems.

At the conclusion of this program the convention passed a resolution urging better supervision of national transportation lines by the Government. The resolution suggested the appointment of a public tribunal before which all disputes on railroad matters, between employers and workmen, should be heard.

The election of officers resulted in the unanimous re-election of Mr. Barr as president. Mathew Griswold, of the General Electric Co., Erie, Pa., was chosen vice-president and J. M. Taylor, of Chicago, secretary. A. E. McLintock continues as commissioner.

Steel Treaters Meetings

The Board of Directors of the American Society for Steel Treating held an important meeting in the executive offices at Cleveland, Ohio, last week.

It was decided to hold two sectional meetings of the society during the coming year in addition to the regular annual convention. One meeting will be held in New York during January or February, and the other in Pittsburgh in May. These meetings will serve the members of all of the chapters located in that particular section and will continue for one or two days, at which a few well chosen pre-printed papers will be presented. There will be no exhibits at the sectional meetings.

The board further unanimously selected Detroit as the city in which to hold the next annual convention and exposition, on Sept. 25 to 30, 1922.

Manufacturers To Urge "American Valuation"

At a conference in New York City on Nov. 17, which was attended by over 200 manufacturers, plans were formulated for an organized fight to secure the passage of the American Valuation plan, as included in the Fordney Tariff Bill now pending in Congress. Among the speakers were John E. Edgerton, president of the National Association of Manufacturers, and George L. Markland, Jr., of the Philadelphia Gear Works.

It was decided to hold a monster convention, sponsored by the National association, in the Middle West. The date and other particulars will be announced later. At this meeting representatives from all elements favoring the plan will be asked to co-operate in crystallizing a strong sentiment.

"Industrial Waste" Theme of A.S.M.E. Annual Meeting Next Month

Announcing that a five-day annual meeting, which will bring together more than 2,000 engineers, educators, technologists and manufacturers from all over the country, will be held in this city Dec. 5 to 9, the American Society of Mechanical Engineers made public a statement by Herbert Hoover saying that the investigation of industrial waste recently completed by the American Engineering Council, of the Federated American Engineering Socities, has paved the way for an advance in American industry.

The findings of this council's Committee on Elimination of Waste in Industry, which was appointed by Secretary Hoover before he entered the Cabinet, will form the leading topic of discussion at the meeting of the mechanical engineers, who are arranging a national forum, at which Mr. Hoover has been invited to preside. Speakers from many cities will participate in a program embracing a wide range of subjects of public, technical, and social import. Education will be the theme of special sessions.

The leading session of the meeting will be held Monday afternoon, Dec. 5, at the Engineering Societies Building, 29 West 39th St. Conditions in five basic industries "assayed"—to use Mr. Hoover's favorite description—by the American Engineering Council's committee, headed by J. Parke Channing of New York, will be discussed. The industries include the metal trades, printing, clothing, boots and shoes and building. Health of industrial workers, stressing the importance of care of the eyes, now made a national safety movement under the guidance of the Eyesight Conservation Council of America (of which L. W. Wallace, executive secretary of the American Engineering Council, is president), will be a principal feature of the waste discussion.

On Monday evening the society will hold a session on education and training in the industries. Among the speakers will be Prof. R. L. Sackett, dean of engineering at Pennsylvania State College. Tuesday morning, Dec. 6, simultaneous sessions on railroads, power, and machine shop practice will be held. At the power session the speakers will include C. H. Berry and F. E. Moreton, of Detroit; C. W. E. Clarke, of New York; Ernest L. Hopping, of Philadelphia; and J. H. Lawrence and W. M. Keenan, of New York.

At the session on railroads addresses will be delivered by James Partington of the American Locomotive Co., New York; Walter C. Sanders of the Equipment Engineering Department, New York Central Lines; and William Elmer, of Altoona, Pa. Speakers at the machine shop session will include Prof. John Airey of the University of Michigan, and J. A. Smith of the General Electric Company, Schenectady, N. Y. Mr. Smith, with J. J. Callahan, of Worcester, Mass., will speak on "Waste in Machine Industry." Prof. Airey will discuss "The Art of Milling."

On Tuesday afternoon, Dec. 6, there will be sessions on management and gas power. At the management session Walter N. Polakov, of New York, will speak on "Making Work Fascinating." Another speaker will be F. B. Gilbreth, of Montclair, N. J. At the gas power session addresses will be made by Elmer A. Sperry, of Brooklyn, member of the Board of Engineering Foundation and inventer of the gyroscope. Louis Illmer, of Lansdowne, Pa., will also address this session.

On Tuesday evening the presidential address will be delivered by the retiring president of the society, Edwin S. Carman, of Cleveland. Following this address, honorary memberships will be conferred upon Henry H. Towne and N. G. Herreshoff, yacht designer and builder.

Sessions of the fuel and material handling divisions and of the student branches of the society will be held Thursday morning, Dec. 8. The society, it is announced, now maintains branches in fifty-nine colleges and universities with a membership of 2,220. The total membership of the society was given as 15,353, a marked increase being recorded in the past year.

Speakers at the fuel session will include D. E. Jacobus and W. B. Chapman, of New York; Joseph Harrington, of Chicago, and Victor J. Azbe, of St. Louis. At the material handling session the question of co-operating with the state and national governments, with the Engineering Foundation, the National Research Council and other agencies in spending $1,000,000,000, will be discussed.

On Thursday afternoon a joint session with the Society for the Promotion of Engineering Education will be held on "Professional Engineering Education for the Industries." The speakers will be F. C. Pratt, vice-president of the General Electric Company and president of the Yale Engineering Society; J. E. Otterson, president of the Winchester Repeating Arms Co., New Haven; Dexter S. Kimball, president-elect of the American Society of Mechanical Engineers, vice-president the American Engineering Council and dean of engineering at Cornell; A. G. Christie, professor of mechanical engineering at Johns Hopkins. A general session of the society on Thursday will be addressed by Maj. Gilbert D. Fitch, of New York, and Robert F. Wood, of Bayonne, N. J.

On Thursday evening the society will give a dinner and dance at the Hotel Astor. On Friday morning sessions of the textile, ordnance and aeronautic sections will be held. The program for the ordnance sessions will take up the recent army demonstrations at Aberdeen, Md., in which the mechanical engineers co-operated. Among the speakers at the aeronautic session will be R. R. Moore, chief of the Physical Testing Branch, Engineering Division, Air Service, McCook Field, Dayton, Ohio. Orville Wright and other leading aviation authorities are members of the society's aeronautic division.

At the textile session Charles T. Main, of Boston, one of the deputation of thirteen engineers who went abroad recently in the interests of international engineering unity, will make a report on the second World Cotton Conference held in Manchester, England. B. R. Andrews of Boston will discuss "Economy in Textile Drying" and Thayer A. Gates, Providence, R. I., will take up "Hidden Wastes in Textile Mills." On Friday general sessions of the society will be addressed by F. N. Dean, of Boston; L. A. Quayle, of Cleveland, and Paul A. Bancel, of New York.

"Perfect Packages" for Shipping Machinery

Nation-wide interest in careful and secure packing of shipments has been stimulated by the activities of the carriers of the country in the recent "Perfect Package Campaign." The railroads, steamship lines and express companies, and the Post Office Department joined in the movement. The purpose of the drive was to bring the shipping methods of the American commerce to such a high standard that hereafter the huge economic losses, due in part to careless packing by shippers, will soon be a negligible factor in the transportation industry.

Before the recent "Perfect Package Campaign," the transportation lines suffered losses in excess of $150,000,000 a year, and a great deal more, during and immediately after the war.

The carriers take the stand that they do not wish to dictate to shippers just how they shall pack their commodities. In fact, they do not consider themselves expert in packing, and feel that the shippers know more about the packing of their own goods than any of the carriers. But the carriers do believe that they are expert on imperfect packages, for they can see for themselves when shipments break down. The question of just what a "perfect package" is for various commodities shipped by rail is a debatable one, but generally speaking, the carriers ask that "shipments be so prepared or packed as to insure safe transportation, with ordinary care on the part of the carrier."

A recent study by transportation men of the packing methods of machinery has developed the following suggestions:

The proper preparation of machinery and machine parts for shipment by express is a task usually assigned to an experienced mechanic, except, of course, when the shipment consists of a standard article for which a standard package has been adopted and which may be put together by an inexperienced person. In this latter class may be included sewing machines, washing machines, churning machines, etc.

When the article is small and properly braced in its own case, such as check writers, typewriters (portable) and talking machines (small), corrugated and fiber board give satisfaction as outside containers. When packed in wooden boxes or crates all fragile parts should be protected from direct contact with cleats, etc., and all loose parts secured to prevent shifting and possible damage. Wooden cleats covered at point of contact with pads of felt, in addition to securing the stand of the machine to the bottom of the box by means of screws, offer protection against damage in transit and possible damage by consignee in removing the article from the case.

Large machines and parts of same are frequently secured to skids or a platform, which will not withstand the strain caused by the weight of a machine being stressed on center when ends only are supported, as for instance when a shipment is being transferred from a car to a truck. Frequently the bearings or cast-iron frames are not covered to prevent injury from hard knocks incident to handling unwieldy objects of this kind in the limited time allowed at small stations.

Business Items

The Clearfield Machine Co., Clearfield, Pa., is preparing to move into its new foundry now completed at South Fourth and Spruce Sts. The foundry is connected with a Pennsylvania Railroad siding and gives the Clearfield firm the largest advantage of this kind in this section of the state.

The Schmick Gear and Screw Co., which will manufacture a new worm driven screw automobile jack, invented by E. E. Schmick, has been incorporated under the laws of the State of Delaware. The firm manufactures both at Reading and Williamsport, Pa.

The Wayne Oil Tank and Pump Co., Ft. Wayne, Ind., has issued its ninety-first consecutive common stock dividend.

The Clark Tool Works, Inc., Belmont, N. Y., is the new name assumed by the former Clark Machine Works. The new organization will manufacture a complete line of metal-cutting band-saws.

The Wetmore Mechanical Laboratory Co., of Milwaukee, Wis., has been reorganized and is now engaged in general engineering and manufacturing work, specializing in the production of the Wetmore inserted blade expanding reamer. The company will also develop a line of fixtures, jigs and tools, dies and screw machines.

The Rusfal Manufacturing Co., Philadelphia, Pa., has purchased the machine shop and equipment of the James Carr Co., also of that city. With the added facilities the former company will continue to manufacture grinding lathes and tools for opticians, and special machinery.

Rogers, Brown & Co., of New York, have undertaken the distribution of Noral virgin aluminum in the United States. The firm has arranged with producers in Norway to handle the metal exclusively in this country.

The Newcomb Spring Corporation, Brooklyn, N. Y., has acquired the rights, good-will and title of the Reliance Spring and Manufacturing Co. E. L. Newcomb has assumed the presidency of the new company. Present officers are located at 238 West 40th St., Brooklyn, N. Y.

The Ames Shovel and Tool Works, at Elwood, Ind., closed since the middle of June, recently opened the factory in full operation. About 150 men will be employed at the start. The American Sheet and Tinplate Co. has started all of its twenty mills, the capacity of the plant. This means employment for 1,500 persons.

The W. K. Milholland Machine Co., of Indianapolis, Ind., has filed a final certificate of dissolution with the secretary of state.

For the purpose of manufacturing automobile accessories and tools the Poole-Wetz Manufacturing Co. has been organized at Columbus, Ind. The organizers are C. E. Poole, J. D. Wetz and D. A. Wetz.

The Symplex Lock Rim Co., of Petersburg, Ind., which is engaged in manufacturing luggage holders for automobiles, will add new machinery to its plant and expand the business of the concern.

The Hare's Motors of Connecticut, Inc., of Hartford, Conn., recently filed a voluntary petition in bankruptcy. The Hare's Motors, up until last September, had charge of the Locomobile Company of America, of Bridgeport, Conn.

The Morris Metal Products Corporation, with a plant in Bridgeport, Conn., has recently voted to change the name of the company to the Bridgeport Company, and a certificate of change has been filed with the Secretary of State. The Morris Metal Products Co. sometime ago bought the old Bridgeport Projectile Co.'s plant which was operated by them previous to the entry of the United States in the World War, and after that by the American Can Company.

The Plainville Castings Co. of Plainville, Conn., is having an addition of brick, concrete and steel construction put on its castings shop plant. It is expected that the new building will greatly enlarge the facilities of the company.

The Quinnipiac Foundry, Inc., of New Haven, Conn., has recently been incorporated to engage in the manufacture of brass, bronze, etc., castings. The incorporators are Arthur B. O'Keefe, L. J. Clawson and W. M. Higgins.

Engineers have recently been making surveys at Bessemer, Ala., for the new half-million dollar plant it is reported the Tennessee Coal, Iron and Railroad Co. plans to construct there for the manufacture of construction bars and shapes. While no definite announcement regarding the project has been made by officials of the company, it is reported that the plant is a virtual certainty and will include several units, representing an investment said to be approximately $500,000. It will be almost as large as the company's present rolling mill at Bessemer.

Preparations are being made to rebuild the plant of the Bowie Stove Works, at Rome, Ga., recently destroyed by fire, it is announced by J. M. Berry, an official of the company. The new foundries and shops will be larger than the former plant. The name of the concern will be changed to the Rome Range and Stove Co.

The Machinery Supply Co., of San Diego, Cal., which has been doing business for four years under a copartnership consisting of Harold Scott and W. H. Fraser, has been incorporated under the name of the Machinery Pipe and Supply Co., with a capitalization of $100,000, with Mr. Scott as president and Mr. Fraser as secretary and general manager. The company will move from its present location, 340 7th St., to a new plant which is being specially constructed with side-track facilities and occupying 10,000 sq.ft. of ground space. A year and a half ago Paul O. Vance and Charles B. Wincote, formerly with the Western Metal Supply Co., joined the Machinery Supply Co., and are now taking an active part in its business. The company at present is doing a business reported at $30,000 a month. Marion B. Hart, formerly with the Western Metal Supply Co., is now the corporation salesman. Three other salesmen are kept in the field all the time, the company covering the territory south of Los Angeles.

Personals

WALTER C. REED, has recently been chosen general manager of the Pittsfield Machine and Tool Co., Pittsfield, Mass.

FRED ATWATER, secretary-treasurer of the Columbia Nut and Bolt Co., Bridgeport, Conn., was elected mayor of that city, at the November election. Mr. Atwater, a Democrat, went in with a majority of over 4,000 votes over the republican nominee, Mayor Clifford B. Wilson, who has held the office for the past ten years.

JOHN PARKER, has recently been elected treasurer of the Pittsfield Machine and Tool Co., of Pittsfield, Mass.

FRED E. HOLTZ has been appointed representative in the Milwaukee district for the W. A. Jones Foundry and Machine Co., of Chicago, Ill. Mr. Holtz has been general sales representative for the company for the past two years.

EARL G. GUNN, of Detroit, formerly of the Packard Motor Car Co., has been appointed designer of Colonial Motors, Inc., Windsor, Ontario, Canada. Mr. Gunn is an executive of the Society of Automotive Engineers.

ALBERT G. FLAGSTAD, sales engineer of the McDonough Manufacturing Co., Eau Claire, Wis., has been transferred to Alexandria, La., where he will handle the line of McDonough heavy-duty saw machinery.

FRANK M. GERMANE, for many years associated with automotive industries, has resigned as director and sales manager of the Morlin-Rockwell group of ball bearing manufacturers. Mr. Germane's plans for the future have not been announced.

A. C. BISGOOD, formerly with Purinton & Smith, Hartford, Conn., has been appointed sales manager of the Standard Machinery Co., New Haven, Conn.

LOUIS R. KRUGER, previously with the E. E. Fulton Co., Chicago, Ill., has been appointed mechanical engineer and general superintendent of the Angsten-Kox Co., Michigan City, Ind.

Obituary

FREDERICK E. SMITH, partner in the firm of Barney & Smith, car builders, of Dayton, Ohio, died on Nov. 7 at Pasadena, Cal. He was 77 years old.

JOHN SHIELDS, 64 years old, president of the Atlantic Basin Iron Works, Brooklyn, N. Y., died on Nov. 1 in a New York hospital.

Forthcoming Meetings

The annual meeting of the Taylor Society will be held in the Engineering Societies Building, New York City, on Dec. 1, 2 and 3.

The annual meeting of the American Society of Mechanical Engineers will be held in the Engineering Societies Building, New York City, on Dec. 5 to 9.

A dinner-meeting of the Metropolitan section of the S. A. E. will be held at the Automobile Club, New York City, on Dec. 15.

The Weekly Price Guide

This Week's Market

The minimum on structural steel shapes, plates and bars at the Pittsburgh mills continues to be quoted at $1.50 per 100 lb. for large tonnages. Steel shapes are quoted at $1.55@$1.60; plates at $1.65 and bars at $1.60 per 100 lb. in small tonnages. Mill shipment quotations remain unchanged. New York warehouse prices on structural shapes and plates are quoted at $2.78 as against $2.88; bars at $2.68 as compared with $2.78 per 100 lb., formerly.

Electrolytic copper is quoted at 14c. as against 13⅝c. and tin at 29½c. as compared with 28½c. per lb., previously. Brass and copper tubing and brass sheets and rods have advanced ½c. per lb. Long terne plates have dropped ½c.; charcoal-plates 1c. and coke-plates 1½c. per lb. in New York warehouses. Zinc sheets have dropped 1c. per lb. in Cleveland and linseed oil has advanced 2c. per gal. in Chicago.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI

No. 2 Southern	$22.50
Northern Basic	22.02
Southern Ohio No. 2	23.52

NEW YORK—Tidewater Delivery

Southern No. 2 (Silicon 2.25 to 2.75)	28.50

BIRMINGHAM

No. 2 Foundry	18.00

PHILADELPHIA

Eastern Pa., No. 2x, 2.25-2.75 sil	23.26
Virginia No. 2	28.74
Basic	20.75
Grey Forge	22.50

CHICAGO

No. 2 Foundry local	21.70
No. 2 Foundry, Southern, sil 2.25@2.75	24.66

PITTSBURGH, including freight charge from Valley

No. 2 Foundry	22.46
Basic	20.96
Bessemer	21.96

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.25@2.50	3.53	3.10	3.38
No. 12	2.30@2.55	3.58	3.15	3.43
No. 14	2.35@2.60	3.63	3.20	3.48
No. 16	2.55@2.80	3.73	3.30	3.58
Black				
Nos. 17 and 21.	2.75@2.85	3.80	3.55	3.95
Nos. 22 and 24.	2.80@2.90	3.85	3.60	4.00
Nos. 25 and 26.	2.85@2.95	3.90	3.65	4.05
No. 28	2.90@3.00	4.00	3.75	4.15
Galvanized				
Nos. 10 and 11.	2.90@3.00	4.00	3.75	4.15
Nos. 12 and 14.	3.00@3.10	4.10	3.85	4.25
Nos. 17 and 21.	3.30@3.40	4.40	4.15	4.55
Nos. 22 and 24.	3.45@3.55	4.55	4.30	4.70
No. 26	3.60@3.70	4.70	4.55	4.85
No. 28	3.90@4.00	5.00	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel			Iron		
Inches	Black	Galv.	Inches	Black	Galv.
BUTT WELD					
1 to 3	68½	56	¾ to 1½	44½	29½
LAP WELD					
2	61½	49	2	39½	25½
2½ to 6	65½	53	2¼ to 4	42½	29½
7 to 8	62½	49	4½ to 6	42½	29½
9 to 12	62½	49	7 to 12	40½	27½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66½	55	1 to 1½	44½	30½
2 to 3	68½	56			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59½	48	2	40½	27½
2½ to 4	63½	52	2½ to 4	43½	31½
4½ to 6	62½	51	4½ to 6	42½	30½
7 to 8	58½	45	7 to 8	35½	23½
9 to 12	52½	39	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded.	60%	46%	60½%	47½%	60%	46%
3½ to 6 in. steel lap welded.	51%	37%	58½%	44½%	57%	43%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	5.00	6.00	4.28
Spring steel (light) (base)	6.00	6.00	3.68
Coppered Bessemer rods (base)	8.00	8.00	6.03
Hoop steel	3.53	3.14	3.28
Cold rolled strip steel	6.25	8.25	6.75
Floor plates	4.85	2.64@2.80	5.23
Cold finished shafting or screw	3.88	3.50	3.83
Cold finished flats, squares	4.38	4.00	4.35
Structural shapes (base)	2.78	2.64	2.88
Soft steel bars (base)	2.68	2.54	2.78
Soft steel bar shapes (base)	2.68	2.54	2.78
Soft steel bands (base)	3.28	....	3.48
Tank plates (base)	2.78	2.92½	2.88
Bar iron (2.00@2.25 at mill)	2.68	3.52	2.78
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
3/32	8.50		12@13
⅛	7.15		11@12
5/32 to ¼	6.75		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.00
Tin, 5-ton lots, New York	29.50
Lead (up to carlots), St. Louis, 4.60; New York	5.00
Zinc (up to carlots), St. Louis, 4.97½; New York	5.37½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.00	20.00	20.00
Antimony (Chinese), ton spot	5.50	6.50	6.00
Copper sheets, base	20.75	21.50	22.50
Copper wire (carlots)	16.50	16.50	15.75
Copper bars (ton lots)	19.00	23.00	19.00
Copper tubing (100-lb. lots)	21.00	23.00	22.50
Brass sheets (100-lb. lots)	16.75	17.00	18.25
Brass tubing (100-lb. lots)	18.50	19.00	20.00
Brass rods (1,000-lb. lots)	14.75	16.00	15.25
Zinc sheets (casks), (8% dis. carlots)	11.00	10.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ½), (case lots)	19.50	21.00	18.00
Babbitt metal (best grade)	27@30	39.00	34.00
Babbitt metal (commercial)	9.50	13.50	8.00

—Shop Materials and Supplies

MONEL METAL—Base price in cents per lb., f.o.b. Bayonne, N.J.:

Shot	35.00	Hot rolled machined rods (base)	53.00
Blocks	35.00	Hot rolled rods (base)	42.00
Ingots	38.00	Cold drawn rods (base)	56.00
Sheet bars	40.00	Hot rolled sheets (base)	55.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grades "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

OLD METALS--Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.50	10.25
Copper, heavy, and wire	9.50	10.50	9.50
Copper, light, and bottoms	8.00	8.00	8.25
Lead, heavy	4.00	3.75	3.75
Lead, tea	3.00	2.75	3.00
Brass, heavy	6.50	6.00	8.00
Brass, light	5.00	4.00	5.50
No. 1 yellow brass turnings	5.25	5.00	5.25
Zinc	3.00	2.00	2.75

TIN PLATES—American Charcoal Plates—Bright—Cents per lb

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	20.50	19.00	18.50
IX,	20x28, 112 sheets	23.00	21.50	20.90
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	17.50	16.75	17.00
IX,	20x28, 112 sheets	20.50	19.50	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	13.00	14.50
IC,	112 sheets	12.80	13.30	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	6.25	7.25
IC,	14x20	7.25	6.50	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb	.055@.09	.09	.10
Wiping cloths per M., 13¼x13¼	....	55.00	55.00
Wiping cloths per M., 13¼x20½	....	65.00	65.00
Sal soda, 100 lbs	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb	2.55	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.72	.77	.76
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 75 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville	per ton	$3.00@3.25	
Coke, prompt foundry, Connellsville	per ton	4.25@4.75	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in	—50%	—60%	60-10-10%
1⅛ and 1¼x3 in. up to 12 in	—40%	-60-10-10%	-60-10%
With cold punched sq. nuts	—30%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	—40%	....	$4.00 off
Button head bolts, with hex. nuts	—20%	$3.90 net	.....
Hex. head and hex. nut bolts	—20%	....	-65-5%
Lag screws, coach screws	—50–10%	....	—60%
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	—50-10-10%	50-5%
Bolt ends, with hot pressed nuts	—50%	....	—55%
Tap bolts, hex. heads	—20%	....	.....
Semi-finished nuts all sizes	—70%	—75%	—80%
Case-hardened nuts	—60%	....	.....
Washers, cast iron, ½ in., per 100 lb. Off list	$5.00	$5.50	$3.50 net
Washers, cast iron, ⅝ in. per 100 lb. Off list	4.25	3.75	3.50 net
Washers, round plate, per 100 lb. Off list	3.00	....	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	2.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	2.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.50	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.50	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	-50-10%	60-10-10%	-65-5%
Rivets, tinned	-50-10%	60-10-10%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$3.70	3.50	3.43
Cone heads, ditto (net)	3.80	3.60	3.53
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅞ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in *EXTRA*	0.25	....	0.25
Less than 200 lb *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$4.03 base
Copper rivets	—50-10%	—40-10%	—50-10%
Copper burs	—25-10%	—15%	—10%
Lard oil, pure, (50 gal. bbl.) per gal	$0.90	$0.85	$0.90
Lard cutting oil (50 gal. bbl.) per gal.	0.60	0.50	0.55
Machine oil, lubricating, per gal.	0.45	0.35	.....
Belting—Present discounts from list in fair quantities (½ doz. rolls)			
Leather:			
Light grade	50–5%	50–5%	50–5%
Medium grade	45%	40–10–2½%	.....
Heavy grade	40%	40%	....
Rubber and duck:			
First grade	50–10%	50–10%	.....
Second grade	60–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	List $9.00 less 20-10-5%	50–10–5%	–20-10%
Emery paper	List 11.00 less 20%	$11.00 net	–20%
Emery cloth	List 32.75 less 10%	32.75 net	–10%
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll	$4.50 net	....	list+10%
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	List $1.65 less 20%	.....	–10%
Cloth	List $3.55 less 10%	.....	–10%

NEW *and* ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Conn., Bridgeport—The Genl. Mach. & Mfg. Co., 544 Irnstn Ave., J. Wilson, Purch. Agt.,—manufacturer of jigs, dies, metal stamping equipment—one No. 3 Waterbury Farrel Foundry Mach. Co. press.

N. Y., Cohoes—Cohoes High School, Dept. of Industrial Arts,—one engine lathe about 15 in. x 5 ft., one 2 hp. motor, 110 volt, 40 cycle, single phase, 1200 R. P. M., shafting, pulleys, hangers, belting, drills, reamers, taps and miscellaneous supplies.

Pa., Ellwood City—The Standard Eng. Co., 2nd St.—equipment including lathe, milling machine, shaper, grinder, etc.

Pa., Pittsburgh—The Western Penn. Penitentiary, Woods Run, N. S.—machine shop equipment, carpenter shop equipment, motors, shafting, etc.

La., New Orleans—The Janssens Auto Service, 3139 St. Claude St., E. Janssen, Prop.—auto repair shop equipment including jack, small auto lathe, small drill press, etc.

La., New Orleans—J. E. Lejeune, 3711 St. Claude St.—equipment for autc repair shop including drill press, small lathe, jack for hoisting autos, etc.

La., New Orleans—W. Reuther, 5305 St. Claude St.—auto repair and vulcanizing equipment, (new or used).

O., Galion—The Galion Iron Wks. & Mfg. Co., C. L. Flowers, Purch. Agt.—one 10 in. squaring shear to cut $\frac{3}{16}$ in.

Wis., Fond-du-lac—B. F. Sheridan, R. F. D. No. 6—auto repair shop equipment including lathe, press, etc.

Wis., Madison—The Bd. of Regents, University of Wisconsin, Administration Bldg., M. E. McCaffery, Secy.—equipment for machine and forge shops including lathes, presses, dies, etc.

Wis., Manitowoc—K. O. Muehlberg Co., 209 North 9th St.—lathes, punches, hammers, etc., for proposed machine shop.

Wis., Milwaukee—The Golden Electric Mfg. Co., 148 Reed St.—one 30 ton forcing press.

Wis., Neenah—The Tri-City Nash Co., 526 South Commercial St.—equipment for proposed garage on North Commercial St.

Ia., Davenport—The Nicholas Wire & Sheet Co., 1724 Rockingham Rd., H. Bourscheidt, Purch. Agt.—one wire straightener to cut and straighten rods up to and including $\frac{3}{8}$ in. diameter.

Mo., Sedalia—C. M. Byrd, 2319 South Ohio St.—machine tools including lathes, drill presses, motors, reamers, belts, pulleys, etc. for proposed lawn mower factory.

Pa., Philadelphia—The Corrugated Container Co., Trenton Ave. and Venango St., manufacturer of boxes and containers—one cut-off saw with table.

Pa., Philadelphia—F. L. Schlichinmoyer, 4810 North Broad St.—mixers, conveyors, etc. for proposed bakery.

Pa., Philadelphia—Wittman-Moriarity Co., Inc. Ontario Ave. and C St.—cutters, sewing machines, stamps, etc., for leather factory.

Pa., Philadelphia—The York Mfg. Co., (contractors,) 2222 Arch St.—general ice manufacturing machinery including ice crushers, grinders, etc. for the Franklinville Ice Co., 5166 Jefferson St.

Pa., Pottstown—Lockman & Murphy, Engrs., Drexel Bldg., Phila.,—ice manufacturing machinery for Burdan Bros., on 2nd St., here.

La., New Orleans—P. Forschler, Wagon and Mfg. Co., 2831 Burgunday St.—woodworking machinery and equipment including floor and post drills (about 20 in.), also bolt cutters up to $1\frac{1}{2}$ inches, emery wheels, etc.

Tenn., Knoxville—The Sanford-Day Iron Wks., Inc., Dale Ave.—one No. 4 or 5 Nazal air hammer.

W. Va., Wheeling—C. L. Hills, 403 Natl. Bank Bldg.—arc welding outfit for tank construction up to $\frac{5}{16}$ in. plate.

O., Columbus—W. L. Lillie Co., Sycamore St.—woodworking machinery for proposed factory.

O., Columbus—The State Dept. Pub. Welfare, Oak and 9th Sts.—will receive bids until Nov. 30 for an air compressor to be installed in the State Hospital at Massellon. Estimated cost, $6,000.

Wis., Madison—The F. F. F. Laundry Co., 731 East Dayton St., F. J. Lee, Secy. —laundry machinery and equipment.

Wis., Sheboygan—The Wisconsin Mirror Plate Co., 20th and Maryland St.—A. Hoenisberg, Pres.—special machinery for the manufacture of mirror plate.

Kan., Leavenworth—The Bd. Educ., c/o M. E. Moore, Supt.—manual training equipment for proposed junior high school.

Minn., St. Paul—The city will receive bids until Nov. 27 for an air compressor, gas engine driven, 140 cu.ft. per min., per 2 ton displacement.

Mo., Clinton—The Coco Cola Bottling Co., J. C. Marshall, Mgr.—bottling machinery for its plant near Public Sq.

Mo., Shelbina—B. G. Litly & Son—ice making machinery and ice tools.

Mo., Springfield—The Mapo Products Co. —machinery for canning and making candy.

S. D., Canton—The Bd. Educ., c/o C. Sandvig, Pres.—manual training equipment for proposed high school.

Ont., Chatham—Silverwoods, Ltd., A. E. Silverwood, Mgr.—ice cream and refrigeration equipment.

Metal Working Shops

NEW ENGLAND STATES

Conn., Bridgeport—The Crane Co., South Ave., manufacturer of valves, etc., is receiving bids for the construction of a 1 story, 75 x 175 ft. addition to its plant. Private plans.

Mass., Brockton—McRae, Ouderkirk & Hallamore Co., 159 North Montello St., has awarded the contract for the construction of a 1 story, 100 x 100 ft. garage on North Montello St. Estimated cost, $40,000.

Mass., Cambridge—C. N. James, 139 Brookline St., has awarded the contract for the construction of a 1 story, 99 x 122 ft. addition to his factory on Decatur St., for the manufacture of auto wheels. Estimated cost, $45,000.

Mass., Willimansett—The Hampden Motor Truck Co., Holyoke, will soon award the contract for the construction of a 1 story, 60 x 630 ft. motor truck factory along the tracks of the Boston & Maine R.R., here.

Mass., Worcester—T. O. Flynn & Sons, 8 Green St., are having plans prepared for the construction of a 2 story, 40 x 90 ft. garage on Green St. Estimated cost, $40,000. E. T. Chapin, 340 Main St., Archt.

MIDDLE ATLANTIC STATES

Pa., Clarion—L. A. Leathers, Brookville, has awarded the contract for the construction of a 1 story, 60 x 110 ft. garage here. Estimated cost, $50,000.

Pa., Ellwood City—The Ellwood City Forge Co., 10th St., has had plans prepared for the construction of a forge plant.

Pa., Ellwood City—The Pittsburgh Malleable Iron Co., 34th and Smallman Sts., Pittsburgh, plans to build a 1 story plant, here. Architect not selected.

Pa., Indiana—Raylo Co., 1228 Fulton Bldg., Pittsburgh, will soon receive bids for the construction of a 4 story, 50 x 120 ft. factory on Philadelphia St. here, for the manufacture of mechanical specialties. Estimated cost, $85,000. Private plans.

Pa., Philadelphia—J. E. Fieldstein, Archt., Penfield Bldg., will receive bids until Dec. 1 for the construction of a 3 story, 89 x 100 ft. garage and service station on Broad St. and Bainbridge Ave., for the Walton Auto Supplies Co., Inc.

SOUTHERN STATES

W. Va., Huntington—The Chesapeake & Ohio R.R. plans to build an addition to its car and locomotive shops, here. Estimated cost, $65,000. H. Frazier, Richmond, Va., Consul. Engr.

W. Va., Huntington—H. T. Lambert Co., 718 1st Natl. Bank Bldg., recently incorporated with $200,000 capital stock, plans to construct plant for the manufacture of frogs, switches and other rail equipment. Estimated cost, $45,000. A. E. Thomas, Treas.

W. Va., Nitro—E. P. Bailey Co. has had plans prepared for the construction of a 1 story foundry and machine shop. Estimated cost, including machinery, $100,000. Private plans.

W. Va., Point Pleasant—The Auto Motive Mfg. Co., Dunbar, has awarded the contract for the construction of a 1 story, 80 x 250 ft. plant here. Estimated cost, $90,000.

MIDDLE WEST STATES

Ill., Chicago—H. E. Forke, 3261 Fullerton Ave., has awarded the contract for the construction of a 1 story, 50 x 125 ft. garage and auto repair shop on Milwaukee St. near Logan Square. Estimated cost, $40,000.

Ill., Chicago—Mandel Bros., State and Madison Sts., have awarded the contract for the construction of a 1 story, 125 x 191 ft. garage at 2641-59 North Crawford St. Estimated cost, $75,000.

Ill., Chicago—The Rienzi Garage Co., 554 Diversey Ave., is having plans prepared for the construction of a 1 story, 117 x 230 ft. garage on Dole Ave. and Lehmann Court. Estimated cost, $100,000. W. W. Ahlschlager, 65 East Huron St., Archt.

Ill., Elgin—The Duty Motor Corp., c/o W. H. Reuther, Pres., 19 North Spring St., has awarded the contract for the construction of a 1 story, 250 x 250 ft. factory for the manufacture of auto trucks. Estimated cost, $80,000.

Ill., Elgin—Woodruff & Edwards will soon award the contract for the construction of a 3 story, 50 x 100 ft. foundry. Estimated cost, $51,000. Private plans.

O., Cleveland—Lamson & Sessions Co., 2188 Scranton Rd., manufacturer of nuts and bolts, has awarded the contract for the construction of a 2 story, 64 x 110 ft. factory on Scranton Rd. Estimated cost, $60,000.

O., Cleveland—J. C. Lincoln. Pres. of the Lincoln Electric Co., East 38th St. and Kelly Ave., plans to build a 1 story, 60 x 110 ft. garage at 1627 Superior Ave. Estimated cost, $50,000. Architect not selected.

O., Cleveland—W. Rosenzweig, Society for Savings Bldg., plans to build a 1 story garage at the rear of 6535 Carnegie Ave. Estimated cost, $50,000. Private plans.

O., Minerva—The Lewis Electric Co. has awarded the contract for the construction of a 1 story, 90 x 200 ft. factory. Estimated cost, $100,000.

Wis., Appleton—The West End Auto Co., 476 South St., has awarded the contract for the construction of a 1 story, 42 x 120 ft. garage on College Ave. Estimated cost, $40,000.

Wis., Burlington—M. F. White, Archt., 68 Wisconsin St., Milwaukee, is receiving bids for the construction of a 1 story, 68 x 134 ft. garage, for J. A. Luke, Burlington. Estimated cost, $40,000.

Wis., Manitowoc—K. O. Muehlberg Co., 209 North 9th St. has awarded the contract for the construction of a 2 story, 65 x 95 ft. machine shop. Estimated cost, $50,000.

Wis., Milwaukee—The Alliance Investment Co., 115 Wisconsin Ct., is having plans prepared for the construction of a 1 story, 60 x 120 ft. garage on Broadway. Estimated cost, $40,000. M. Tullgren & Sons, 425 East Water St., Archts.

Wis., Neenah—The Tri-City Nash Co., 526 South Commercial St., purchased a site and plans to build a 2 story, 55 x 150 ft. garage on North Commercial St. Estimated cost, $60,000. Architect not selected.

Wis., Platteville—B. A. Doescher plans to build a 2 story, 60 x 150 ft. factory for the manufacture of electrically operated lantern for advertising purposes. Estimated cost, $50,000. Architect not selected.

Wis., Prairie du Sac — Schmalz Bros. have awarded the contract for the construction of a 1 story, 60 x 106 ft. garage. Estimated cost, $40,000.

WEST OF THE MISSISSIPPI

Kan., Columbus—C. & A. Motor Car Co., c/o F. Hart, Mgr., plans to build a 2 story garage. Estimated cost, $50,000. Architect not selected.

Kan., Wichita—The Legeli Engine Co., c/o L. Legeli El Reno, Okla., plans to construct a 2 story factory here. Estimated cost, $50,000. Architect not selected.

Mo., Sedalia—C. M. Byrd, 2319 South Ohio St., plans to build a 1 story factory for the manufacture of lawn mowers. Architect not selected.

Mo., St. Louis—The Adalil Realty Co., c/o P. H. Bierman, 1609 Ry. Exch. Bldg., is having plans prepared for the construction of a 1 story, 50 x 234 ft. garage on Spring and Washington Sts. Estimated cost, $55,000. O. J. Popp, Odd Fellows Bldg., Archt.

Mo., St. Louis—The Automobile Garage Co. has awarded the contract for the construction of a 1 story, 100 x 129 ft. garage on Easton and Valle Aves. Estimated cost, $40,000.

Mo., St. Louis—The Haynes Langenberg Mfg. Co., c/o G. Langenberg, plans to construct a 2 story factory on Forest Park Terrace, for the manufacture of furnaces. Estimated cost, $125,000. Architect not selected.

Mo., St. Louis—The Missouri Pacific R.R., c/o B. F. Bush, Pres., Exch. Bldg., has awarded the contract for the construction of a 1 story, 46 x 500 ft. car repair shop on 21st St. Estimated cost, $125,000. Noted Nov. 17.

Mo., St. Louis—The Walsh Motor Car Co., 4919 Delmar St., is having plans prepared for the construction of a 2 story garage. Estimated cost, $75,000. W. D. Walsh, Pres. Cornet & Casey, Chemical Bldg., St. Louis, Mo., Archt. Noted May 5.

Okla., Cordell—C. H. Murdock is receiving bids for the construction of a 2 story, 50 x 130 ft. garage. Estimated cost, $45,000. Layton, Smith & Forsyth, 701 Majestic Bldg., Oklahoma City, archts.

WESTERN STATES

Cal., Irvington—Reid Bros., 105 Montgomery St., San Francisco, manufacturers of surgical supplies, are having plans prepared for the construction of a 1 story factory here. Estimated cost, $100,000. Sutton & Whitney, Lewis Bldg., Portland, Ore., Archts.

Cal., Long Beach—The Kimball Motor Truck Co., 1700 East 9th St., is having plans prepared for the construction of a 3 story auto truck factory on West Aneheim Blvd. Estimated cost, $350,000. Private plans.

Cal., Los Angeles—The Kittle Mfg. Co., 643 Santa Fe Ave., has awarded the contract for the construction of a 1 story, 140 x 160 ft. factory for the manufacture of auto accessories. Estimated cost, $40,000.

Ore., Scappoose—The Oregon Charcoal Iron Co., 412-13 Corbett Bldg., Portland, is having plans prepared for the construction of a 50-ton charcoal blast furnace supplied by a by-products plant, 1½ mi. west of here. C. I. Calkins, Pres.

Wash., Seattle—E. Goldberg, 615 Boren Ave., is having plans prepared for the construction of a 2 story, 138 x 160 ft. industrial building. Estimated cost, $60,000. Kilbourne-Clark Mfg. Co., Spokane and East Marginal Way, manufacturers of electrical apparatus, including wireless sets, etc., lessee.

CANADA

Ont., Brockville—The J. R. Baxter Co., Ltd., 102 St. Antoine St., is having plans prepared for the construction of a 50 x 200 ft. grinding wheel factory on Pearl St., E. Estimated cost, $25,000. J. A. Johnston, Brockville, archt.

Ont., Toronto — The Gotfredson-Joyce Corp., Ltd., Walkerville, plans to build a 2 story garage and service station, etc., on Spadina Ave. here. Estimated cost, $100,000. W. H. Leishman, 106 Jarves St., Toronto mgr.

General Manufacturing

NEW ENGLAND STATES

Conn., Hartford—The Frisbie Pie Co., Kossuth and Burroughs Sts., Bridgeport, is receiving bids for the construction of a 2 story, 100 x 100 ft. bakery, etc., including a warehouse, on Prospect St., here. Private plans.

Conn., Hartford—St. Francis Hospital, Farmington Ave., has awarded the contract for the construction of a 1 story, 80 x 90 ft. laundry on Ashley St. Estimated cost, $40,000.

Conn., Stamford—The Vogue Publishing Co., 19 West 44th St., New York, is having sketches made for the construction of a 3 story, 75 x 100 ft. printing plant, on Boston Post Rd., here. Estimated cost, $85,000. W. Higginson, 18 East 41st St., New York, Archt. and Engr.

Mass., Walpole — Bird & Son have awarded the contract for the construction of a 1 story, 65 x 210 ft. addition to their paper factory. Estimated cost, $60,000.

R. I., Pawtucket—J. and P. Coats, Inc., 366 Pine St., plan to build an addition to their thread mill. Architect not announced.

MIDDLE ATLANTIC STATES

D. C., Washington—Fleishmann Yeast Co., Longdon, has awarded the contract for altering and building an addition to its yeast plant. Estimated cost, $50,000.

N. J., El Moro (Elizabeth P. O.)—The Amer. Type Fdry. Co., Communipaw Ave., Jersey City, plans to build a type foundry here. W. Kelly, Westfield, Mgr.

N. Y., Mt. Vernon—The Willow Brook Dairy Co., 5 South Fulton Ave., has awarded the contract for the construction of a 1 and 2 story, dairy and garage. Estimated cost, $300,000. Noted June 23.

Pa., Philadelphia—The Franklinville Ice Co. has awarded the contract for the construction of an addition to its ice factory at 5166 Jefferson St. Estimated cost, $38,000.

Pa., Philadelphia—The Producers' Cold Storage Co., c/o W. C. Benkert, is having preliminary plans prepared for the construction of a 10 story, 90x275 ft. cold storage plant on South and Bainbridge Sts. Estimated cost, $2,000,000. A. J. Sauer & Co., Denkla Bldg., Engrs.

Pa., Philadelphia—F. L. Schlichinmoyer, 4810 North Broad St., has awarded the contract for the construction of a 2 story, 40 x 84 ft. bakery on Courtland Ave. and 15th St. Estimated cost, $18,000.

Pa., Philadelphia — Wittman-Moriarity Co., Inc., has awarded the contract for the construction of a 2 story, 77 x 195 ft. and a 1 story, 72 x 111 ft. additions to leather factory on Ontario Ave. and C St. Estimated cost, $100,000.

Pa., Pittsburgh—H. J. Heinz Co. (pickling and preserving plant), is having plans prepared for the construction of a 6 story, 92 x 150 ft. manufacturing and storage building on Progress St. R. M. Trimble, Ferguson Bldg., Archt.

Pa., Pottstown—Burdan Bros., 2nd St., will soon award the contract for the construction of a 4 story, 100 x 260 ft. ice cream factory. Estimated cost, $125,000. Lockman & Murphy, Drexel Bldg., Phila., Archts. and Engrs.

SOUTHERN STATES

Ky., Ashland—The Imperial Ice Cream Co., Parkersburg, has awarded the contract for the construction of a 1 story, 46 x 166 ft. ice cream plant here. Estimated cost, $90,000.

Ky., Louisville—The Van Camp Packing Co., 1303 South Shelby St., has awarded the contract for the construction of 2 canned food product factories, each 2 story, 102 x 275 ft., on Shelby St. and Goss Ave. Estimated cost, $400,000.

Ky., Louisville—The Standard Sanitary Mfg. Co. is having plans prepared for the construction of a 1 story, 53 x 404 ft. enameling plant on 6th and A Sts. Estimated cost, $80,000. O. P. Ward, Lincoln Bldg., Archt.

N. C., Gastonia—The Loray Mills, Jenckes Spinning Co., has awarded the contract for the construction of a 1 story addition to its mill. Estimated cost, $50,000.

La., New Orleans—P. Forschler Wagon & Mfg. Co. plans to build and equip a temporary plant at 2831 Burgundy St. The old plant at 610 Montegut St., which was destroyed by fire will be rebuilt. J. A. Maschek, Mgr.

N. C., Gastonia—The Spencer Mountain Mills will soon award the contract for the construction of a 1 story, 56 x 64 ft. addition to cotton mill. Lockwood, Greene & Co., Charlotte, Archts.

W. Va., Huntington—The Imperial Ice Cream Co., Parkersburg, has awarded the contract for the construction of a 2 story, 45 x 83 ft., and a 1 story, 40 x 60 ft., ice cream plant, here. Estimated cost, $75,000.

MIDDLE WEST STATES

Ill., Canton—The Canton Ledger Newspaper, c/o H. Owen, Mgr., is having plans prepared for the construction of a 2 story printing shop. Estimated cost, $50,000. Reeves & Ballie, Arcade Bldg., Peoria, Archts.

Ill., Chicago—The Vienna Model Bakery, 1040 Vernon Park, will soon award the contract for the construction of a 3 story bakery. Estimated cost, $150,000. The McCormick Co., Century Bldg., Pittsburgh, Pa., Archts.

Ill., Jacksonville—The International Shoe Co., 1505 Washington St., St. Louis, Mo., is having plans prepared for the construction of a 3 story factory here. Estimated cost, $50,000.

Ill., Joliet—The Suburban Ice Co., c/o L. E. Stanley, Pres., La Grange, will build a 100 ton capacity ice plant, here. Estimated cost, $60,000.

Ill., La Salle—F. Worn is interested in a stock company which plans to build a cement plant. Estimated cost, $40,000. Architect not selected.

Ill., Zeigler—The Zeigler Ice & Bottling Co. plans to build a 1 story, 92 x 92 ft. ice plant. Estimated cost, $50,000. Architect not selected.

Mich., Detroit—The Curtis Co., 536 West Lafayette Ave., is having plans prepared for the construction of a 3 story printing plant on West Grand Blvd. and Lincoln Ave. Estimated cost, $150,000. Smith Hinchman & Grylls, 710 Washington Arcade, Archts.

Mich., Grand Rapids—The Kent Storage Co., Front St., N.W., plans to build a cold storage plant. G. H. Hess, ch. Engr.

O., Canton—The Canton Ice Delivery Co., 601 4th Ave., N. E., has awarded the contract for the construction of a 1 story, 80 x 92 ft. ice plant. Estimated cost $100,000.

O., Cleveland—The Billings-Chapin Co., 1163 East 40th St., manufacturer of paint, is having plans prepared for the construction of a 4 story, 80 x 110 ft., factory on East 40th St. Estimated cost, $250,000. Lockwood, Green & Co., 1566 Hanna Bldg., Archts.

O., Cleveland—The Federal Knitting Co., 2882 Detroit Ave., has awarded the contract for the construction of a 3 story, 65 x 85 ft. factory on West 29th St. and Detroit Ave. Estimated cost, $60,000.

O., Columbus—W. L. Lillie Co., 255 Sycamore St., will receive bids about Jan. 1 for the construction of a 2 story, 40 x 250 ft. addition to its woodworking factory. Estimated cost, $100,000. J. B. Powell, 1455 Eastwood Ave., Archt.

O., East Palestine—The Natl. Fireproofing Co., 1126 Fulton Bldg., Pittsburgh, is having plans prepared for the construction of a 1 story, 100 x 100 ft. brick plant, here. Estimated cost, $60,000. S. F. Heckert, Bessemer Bldg., Pittsburgh, Archt.

O., Newark—The Consumers' Products Co. is receiving bids for the construction of a 1 story, 40 x 60 ft. ice plant. Estimated cost, $40,000. A. C. Bishop & Co., 327 Guardian Bldg., Cleveland, Archts.

Wis., Cedarburg—J. J. Wittenberg plans to build a 2 story, 60 x 85 ft. tire factory on Main St. Estimated cost, $35,000. Private plans.

Wis., Cumberland — The Cumberland Creamery Co. will receive bids until Jan. 1 for the construction of a 1 and 2 story, 50 x 100 ft. dairy. Estimated cost, $45,000. Private plans.

Wis., Maribel—The Maribel Strawcutter Co. will build a 1 and 2 story, 50 x 120 ft., factory. Estimated cost $45,000. Noted Sept. 15.

Wis., Milwaukee—F. C. Gross Bros. Co., 133 Muskego Ave., will build a 1 and 2 story, 56 x 145 ft. cold storage plant and warehouse on Muskego Ave. Estimated cost, $40,000.

Wis., Milwaukee—The Gugler Litho Co., 694 Bway., has awarded the contract for the construction of a 1 story, 66 x 106 ft. addition to its lithographing plant. Estimated cost, $60,000.

Wis., Milwaukee—H. C. Haeuser, Archt., 445 Milwaukee St., will open bids about Nov. 21 for the construction of a 2 story, 32 x 64 ft. bakery on North Ave., for H. M. Schwantes, 1063 16th St. Estimated cost, $40,000.

Wis., Portage—The Portage Co-Operative Canning Co., Michel Bldg., is having plans prepared for the construction of a 2 story, 198 x 250 ft. cannery. Estimated cost, $150,000. R. A. Webber, Portage, Archt Noted Sept. 15.

Wis., Sheboygan—The Wisconsin Mirror Plate Co., 20th and Maryland St., has had plans prepared for the construction of a 2 story, 60 x 118 ft. mirror factory on Indiana Ave. Estimated cost, $150,000. W. C. Weeks, 720 Ontario St., Archt.

Wis., Stoughton—The Stoughton Wagon Co. plans to build a 1 and 2 story, 75 x 210 ft. factory on Main St., to replace the one which was recently destroyed by fire. Estimated cost, $300,000. F. J. Vea, Mgr. Architect not selected.

Wis., Waukesha—The Commercial Appliance Co., c/o L. M. Taylor, Pres., Port Washington, has purchased a site and plans to build a 2 story, 50 x 150 ft. factory on Main St. Estimated cost, $75,000. Architect not selected.

WEST OF THE MISSISSIPPI

Col., Denver—J. J. Hoffman, 491 South Penn St., has purchased a site and plans to build a 1 story packing plant on York and 50th Sts., next spring. Estimated cost, $30,000. A. Breuner, Denver, Archt.

Growing

Last July we announced that we had published in that month the names, addresses and requirements of 133 concerns in the market for

Machine Tools and Machinery

In November the number of these items published was

189

This service is both expensive and difficult to maintain, but we have reason to believe that it is of value to the readers of the *American Machinist*, and is appreciated by them.

These leads are not easy to obtain, even by our carefully instructed field force. Our men are instructed to verify beyond doubt every item of information reported for publication in these columns.

If you are in the market, or if any of your friends are in need of new equipment, take advantage of our

Machine-Tool and Machinery Exchange

Minn., Minneapolis—The Minnesota Mfg. Corp., 732 3rd St., N., is having plans prepared for the construction of a 3 story, 46 x 132 ft. factory, on 8th Ave., between 3rd and 4th Sts., N., for the manufacture of cleansing powder. Estimated cost, $40,000. E. J. Miller, Secy. P. E. Crosier, 915 New York Life Bldg., Archt.

Mo., Aurora—The Helvetia Milk Co. plans to construct a 2 story milk condensery. Estimated cost, $200,000. J. A. Potter, representative. Architect not selected.

Mo., Clinton—The Coco Cola Bottling Co. has had plans prepared for the constructoin of a 1 story addition to its bottling works near Public Sq. Estimated cost, $5,000. J. C. Marshall, Mgr.

Mo., Ferguson—The Republic Photographic Co., Kansas City, has awarded the contract for the construction of a 1 story factory. Estimated cost, $125,000. Noted Nov. 3.

Mo., Joplin—A. B. Thomas Fruit Co., 7th and Virginia Sts., is having plans prepared for the construction of a 4 story, 120 x 150 ft. cold storage plant on 6th and Virginia Sts. Estimated cost, $100,000. A. B. Thomas, Mgr. Private plans.

Mo., Kansas City—The Valatia Mills, manufacturers of cotton bags, have awarded the contract for the construction of a 3 story, 50 x 113 ft. factory on 15th and Campbell Sts. Estimated cost, $100,000.

Mo., Poplar Bluff—C. Wielpuetz Bakery Co., Cape Girardeau, is having plans prepared for the construction of a 2 story bakery at 205 Poplar St., here. Estimated cost, $50,000. A. Weilpuetz, local mgr. Private plans.

Mo., Springfield—The Bromide White Lime Co., Woodruff Bldg., plans to construct a 2 story lime factory near the city limits. Estimated cost, $50,000. D. P. Klepinger, Secy. Architect not selected.

Mo., Shelbina—B. G. Litly & Son plan to construct a 1 story ice plant. Estimated cost, $30,000. Architect not selected.

Mo., Springfield—The Mapo Products Co. plans to build a factory for the manufacture of candy and syrups. Estimated cost, $12,000. Architect not selected.

Mo., St. Joseph—The Natl. Biscuit Co., c/o W. J. Rainalter, Mgr., Main and Jule Sts., will soon award the contract for the construction of a 2 story factory. Estimated cost, $35,000. Eckel & Aldrich, Forsee Bldg., Archts.

Mo., St. Louis—O. E. Schaefer, 1122 McCausland St., will soon award the contract for the construction of a 1 story, 82 x 126 ft. factory on LaSalle and Grand Sts. Estimated cost, $45,000. F. B. Edelmann, Title Guaranty Bldg., Archt.

Mo., St. Louis—The Scott Dying & Cleaning Co., c/o M. A. Hartsman, Pres., 3829 Olive St., is having plans prepared for the construction of a 2 story, 58 x 160 ft. dying and cleaning plant on Olive St. Estimated cost, $75,000. H. P. Hess, 4811 Cote Brilliante St., Archt.

WESTERN STATES

Cal., San Diego—The Bd. Educ., Guarantee Title Bldg., is having preliminary plans prepared for the construction of a training shop, etc., in City Park. Estimated 2 story high school, including a manual cost, $300,000. T. C. Kistner, 307 Bancroft Bldg., Archt.

Cal., San Diego—The San Diego Ice and Cold Storage Co., 110 9th St., will build a 5 story, 105 x 158 ft. cold storage plant, including 2 ice tanks, 60 ton capacity each and engine room, 8th, 9th, N. and Imperial Sts. Estimated cost, $300,000. F. P. Allen, 1st Natl. Bank Bldg., Archt.

Ore., Portland—The Doernbecker Mfg. Co. is having plans prepared for the construction of a 6 story chair factory on East 28th St., along tracks of Oregon-Washington R.R. & Navigation Co. Estimated cost, $500,000. M. Patterson, c/o owner, Engr.

CANADA

Ont., Bowmanville—The Ontario Potteries, Ltd. preparing plans for pottery plant. Estimated cost, $50,000. J. W. Black, Mgr. Private plans.

Ont., Chatham—Silverwoods, Ltd., London, is having plans prepared for the construction of an ice plant, on Maple St., here. Estimated cost, $100,000. A. E. Silverwood, Mgr. Private plans.

Ont., Toronto—Chapmans, Ltd., Kent Bldg., has awarded the contract for the construction of an artificial ice plant. Estimated cost, $70,000.

American Machinist

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Volume 55 NEW YORK, DECEMBER 1, 1921 Number 22

Safety Inspectors and Inspections

The Different Types of Inspection—Why Some Plants Are Refused Insurance—Importance of Standardizing Safeguards—Advantages of Helping Inspectors

By JOHN A. DICKINSON
Mechanical Engineer, Bureau of Standards

TO SOME managers, superintendents and foremen the visit of a safety inspector to a plant is regarded as a nuisance, or something worse. On the contrary, many plant officials welcome such inspections and are glad to carry out the recommendations which are made. If your plant is one which carries insurance in an old line or a mutual company and is located in a state which maintains a force of factory inspectors, it is probable that you will receive visits from inspectors belonging to three different organizations.

First: The inspector who makes a rating inspection. His card will read "Rating Board," or "Rating Bureau." His function is to make an inspection of your plant, noting the mechanical and structural hazards, take notes regarding the number of employees engaged on machine work, total number of employees, safety organization work and a number of other points which enter into the final adjustment of the basic or manual rate which is charged to your particular line of work. If the rating inspector finds conditions, generally speaking, better than the average your rate for compensation insurance will be below that given in the manual for your particular class of work; if your plant is sub-standard your rate will be higher. The function of the rating inspector, then, is to collect data from which the rate for your establishment may be computed.

Neither he nor the organization employing him makes any recommendations regarding conditions in your plant. His duties end when he turns in the data at his district board or bureau. The rate finally worked out for your plant is available to insurance organizations upon application.

It may be that subsequently another rating inspection will be requested by your insurance carrier to secure a reduction in rate on your plant, after you have installed guards or otherwise improved working conditions.

The insurance carrier will in all probability make an inspection of your plant shortly after the business is actually written. (In a few instances even before the policy is issued.) The purpose of this inspection is threefold: (1) To check the rate already set by the rating board or bureau; (2) to assist you in reducing your rate by recommending guards and improving conditions generally; (3) to make certain that there are no special or unusual hazards incident to the operation of your plant that would make your risk undesirable from an insurance standpoint.

The card presented by this inspector will carry the name of the company with whom you are insured and his visit will (unless yours is that long sought Utopia —a Perfect Plant), be followed by a set of recommendations covering various hazards on your plant. Generally, the inspector himself will take up these points with someone in authority before he leaves.

The insurance carrier reserves the right to cancel your insurance on a pro rata basis should you refuse to carry out recommendations which they believe necessary. A few companies mark such recommendations "Vital" or "Important," the others being submitted largely to enable you to effect a subsequent reduction in rate.

What Cancellation Means

Should your insurance carrier cancel or suspend your policy pending the carrying out of certain recommendations, you may rest assured that there are hazards considerably greater than are usually found in plants doing the same kind of work as is performed in your plant. The agent and the underwriting department generally are "from Missouri" and will agree to cancellation or suspension only after the unusual hazards have been clearly proved by the inspection department.

Probably in your own business your credit department has often refused to O.K. a bill of goods sold by one of your salesmen because the financial standing of the purchaser was unsatisfactory. The case of a cancelled or suspended risk is similar, it is an indication that the risk from a physical or moral hazard point of view is undesirable business. As an example, a case which came under my own observation might be cited. A small concern manufacturing case-hardening compounds was written by a local agent. On inspection it developed that the assured was melting up about 300 lb. of potassium cyanide (one of the most poisonous substances known) per day in a melting pot located in a basement, no artificial ventilation being provided. Inquiry developed the fact that during the previous summer several men had been overcome by fumes. This concern also ground charcoal in a small mill—giving rise to a serious dust explosion hazard—and stored a large amount of the material, generally several tons, in the main building which was of ordinary frame construction—which added the fire hazard from the spontaneous ignition of this material. In addition, the company bought and ground up old bones, the material being hand sorted, thus introducing the possibility of serious infection from minor cuts and abrasions as well as the possibility (admittedly slight) of anthrax.

These hazards were all in addition to the usual

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mechanical hazards and were in the aggregate so serious that the company canceled the business and refused to rewrite it unless the assured agreed to install a suction exhaust over the cyanide vat, store and grind the charcoal in a separate fireproof building and provide heavy gloves for the bone sorters. As the assured refused to carry out the suggestions, the company refused to rewrite the risk.

THE STATE INSPECTOR

It is probable that you will receive a visit from a third inspector during the course of the year. His card will carry the name of the state department, board or bureau that is concerned with factory conditions. His recommendations generally have the law behind them. Either the code under which the inspection is made is a part of the statute law of the state or the authority is given to some board or bureau to write such codes as may be necessary.

One of the most annoying features of these various safety inspections is the lack of uniformity in the resulting recommendations.

Often a set of recommendations has been carried out by a manufacturer only to have a long list of additional recommendations submitted subsequently by another inspector. This is one of the unfortunate results of the present lack of uniform safety codes—a subject that has been discussed at greater length in another paper*. There is one consolation in the present outlook. A series of safety codes are now in course of preparation, the work being handled under the auspices of the American Engineering Standards Committee and within a few years it is probable that state and insurance requirements will coincide and the various state laws will be in practical agreement on all principal points covered.

EFFECT OF THE PERSONAL ELEMENT

Another cause of variation in recommendations is the personal element; the training, experiencc and viewpoint of the inspector unconsciously influence him in making recommendations. Other things being equal, the longer the training and the greater his experience the better will be his inspection.

There is a certain type of factory executive who takes great delight in tripping up an inspector, in exposing his ignorance and criticizing his report in every possible way. I remember a particular case that came to my attention while I was making an insurance inspection in a large furniture factory. The superintendent showed me a report submitted by a state factory inspector.

One of the items called for the guarding of the drive belts of a surfacer, the room and building in which it was located being specified. The superintendent then pointed out quite triumphantly that the room mentioned was devoted to finishing and that the only machine that could be so mistaken was a sander. Later, in the course of my inspection, I saw the machine in question. It was an auto-fed, completely enclosed, multiple-drum sander, and resembled many of the newer types of surfacer. The mistake was a natural one, as I pointed out to the superintendent. Then it was that I found the reason for his antagonism; he informed me that the inspector in question had recently been appointed through political influence, and that prior to his appointment he had been a butcher.

Unfortunately such appointments are made in a few states although the tendency is to eliminate political influence and to make appointments on merit as a result of competitive examinations. Where such abuses do exist, however, the solution lies, not in abusing the inspector so appointed, but in demanding through manufacturers' or civic organizations that inspectors be appointed on merit only, and as a result of competitive examinations.

In the insurance field the men are generally the best obtainable for the salary allowed, this item, of course, being limited by the percentage of premium income set aside for inspection purposes.

WORKING WITH INSPECTORS

If more factory executives would realize the value of trained men in the inspection field, there would be better inspection service. If, in place of damning an inspector for his ignorance, the superintendent would go through the plant with the inspector, explain the work and name the machines, it would mean that the inspector would become familiar with the processes involved in a much shorter time and his recommendations would be correspondingly more valuable.

The inspector is governed largely by certain fixed rules and standards developed after a careful study of the statistics covering thousands of accidents, and which are reasonable and applicable in *most cases*. However, like all other rules there are exceptions. It may be that there are special conditions in your plant that cannot be taken care of in the usual manner. I have one such case vividly before me now. A state factory inspector insisted on a guard rail along a log carriage runway in a large sawmill, and specified a rail of standard height—42 in. A saw carriage is a rapidly-moving object, as anyone who has seen a sawmill in operation will admit, but in this case the standard handrail was not only undesirable but even dangerous. The superintendent of this particular mill was one of the type who saw the advantage of educating the inspector. He took the man into the mill and explained how a standard rail would prevent the escape of the three men that worked on the carriage should the log tear loose while being sawed or should the "steam nigger" (which places the log on the carriage and turns it over as needed) throw a log over the "knees" on to the setter's stand, or should the shackle connecting the carriage with its driving rod break, or should anyone of a dozen similar accidents happen. He did admit that the carriage-run should be guarded but said that a rail higher than the setter's platform was not only impractical but dangerous. The inspector agreed with him, and what is much more to the point *knew how to guard the carriage-run in the next sawmill he visited.*

Dozens of such examples might be cited. Explosive plants must have guards of special types and materials. The question of possible sparks from static electricity in plants where solvents are used must be given due consideration. Practically every industry has its own particular phases which must be known and given due consideration by the safety inspector.

It must be borne in mind that the state insurance or rating inspector must know the machines not only in your industry but in that of hundreds of different industries as well. He may be in a Portland cement mill to-day, an automobile factory tomorrow and then be sent in succession to a factory making clothespins, pickles, gas mantles, toothpicks, glass bottles or brooms. The

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*See "Standardization and Safety," by C. E. Oakes and the author in *American Machinist*, July 1, 1920.

wonder of it is that any man can ever learn the machines and processes that he meets in his daily work.

While, as we have pointed out, there may be conditions in your particular plant that will make necessary special types of guards, conditions of which the inspector may know little, the converse of the proposition also holds true. There may be, and probably are, hazards in your plant of which you know little or nothing, but which will be apparent to the trained inspector. Do not make the mistake of thinking that *because you have never had an accident under a given set of conditions that such an accident cannot occur.* A number of years ago a rather popular play pictured a college sophomore showing his father the town. One act showed them in a famous restaurant where the father when called down by the son for eating with his knife informed the crowd that he had "been eatin' with his knife for fifty years and never cut hisself yet." That attitude unfortunately is the one taken by some of the old-time manufacturers. They believe that having never had an accident on a given machine that they never will have.

In a certain plant where solvents were used in the manufacture of a synthetic compound, I once recommended a number of additional exits and flash-proof walls between mixers. The man in charge claimed that the process was absolutely safe, that he had been in charge of that plant for twenty years and that he knew more about the hazards of the business than any d— inspector in the business. Within six months a fire in that particular room took a toll of three lives and sent twenty men to the hospital, the total compensations amounting to twelve thousand dollars or eight times the amount needed to have carried out the recommendations on that particular building.

REQUIREMENTS DRAWN FROM CAREFUL ANALYSIS

There are two time-worn "saws" which, coupled together, are well worth remembering in connection with the reading of an inspector's recommendations.

"Experience is the best teacher," and "The wise man learns by the experience of others."

Remember that the requirements for state and insurance codes were drawn from a careful analysis of thousands (in some cases hundreds of thousands) of industrial accidents.

No plant of average size can judge its own hazards solely by its own records. It is only when thousands of cases are considered that the Law of Averages, which is the bedrock upon which insurance rates are based, can be depended upon to function properly.

A person loses perspective by daily contact with a thing. There is not one man in a hundred that can tell the number of steps leading up to his own front door, or the color of the rug in the living room, or describe in detail the pictures hanging in his own dining room. If you wish to look at a public building you do not stand on the front steps. You get far enough away to see the whole thing as a unit. Often as you watch a game of chess or checkers you will see moves which might win the game, yet the player himself is entirely oblivious of them.

The same thing is true in a factory. The inspector will often see hazards that are not apparent to anyone in daily contact with them.

In conclusion, let me make the following plea for the safety inspector: Remember that he is a human being, that he is honestly trying to make your plant a better and safer place to work in; that the more you co-operate with him the better will be his inspection; that his recommendations are based on thousands of accidents occurring under similar conditions, and that coming in from the outside he may be able to call your attention to conditions which you from your nearness to them have never recognized.

Automobiles in Japan

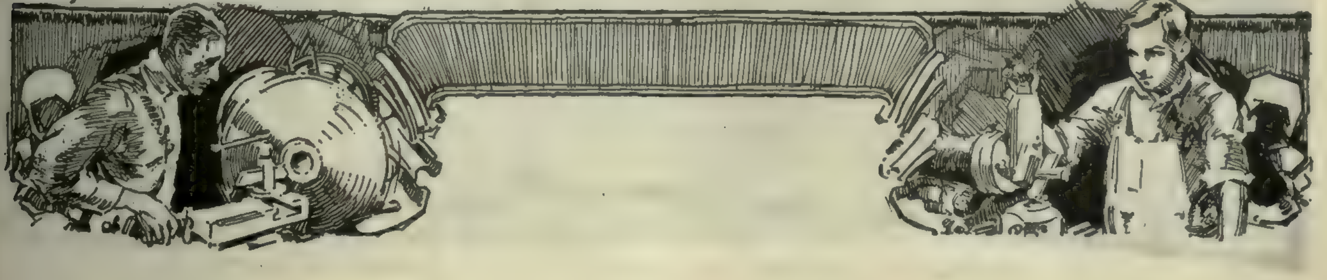
Commercial Attaché James F. Abbott

The Japanese have manufactured motor cars, and for a time they hoped to become independent from foreign manufacturers. It was soon discovered, however, that the cost of fabricating a complete car exceeded the cost of importing an American car, owing to the lack of facilities for working on a large scale, the relative inefficiency of the Japanese workmen, and the necessity for importing practically all the materials. The Department of War has been anxious to have an adequate number of cars or chassis which might be converted to military purposes. On this account they put through a subsidy bill, designed to induce the Japanese to import and own cars.

The Tokyo Bus Service has been developed and expanded; it is, however, hard to see how the proposition could be made successful except with some sort of official support. It is also understood that official support has been given the Tokyo Gas and Electric Co. to enable it to import truck chassis and manufactured buses.

While Japanese-made machines practically do not exist, it is customary to import chassis and to fabricate closed bodies for them in Japan; several companies, especially in Tokyo, do a good business in this line. This is accounted for by the climate, which makes closed cars almost a necessity, and by the burden of freight charges, which makes the cost of importing bodies such that the Japanese can usually compete successfully in this line.

The use of motor cars in Japan is generally limited to the large cities, owing to very poor roads, and the use of heavy trucks is hampered further by the frail nature of bridges. While most of the motor cars in Japan are found in the city of Tokyo, the market there has suffered severely within the present year from a local license tax assessed by the municipal administration, rendering the cost of the automobile in many cases prohibitive.



Automotive Service Methods and Equipment

IV. A Good Service Plant Layout—Progressive Operations in the Service Department—A Handy Motor Stand—Re-babbitting Fixtures—Other Tools

By HOWARD CAMPBELL
Western Editor, *American Machinist*

FOR efficiency in the matter of plant layout, the service plant of the Hellman Motor Corporation, Long Island City, N. Y., is an interesting study. An outline of the building is shown in Fig. 1. The salesroom is in the usual location, and the parts department is accessible both from the street and from the shop. The car owner in search of service drives into the service adjustment department, where the car is inspected. If the trouble is very serious an inspector's tag, on which are enumerated the troubles, is hung on the car and it is passed through the doorway indicated by the arrow into the repair department. If the motor is to be overhauled, it is lifted from the chassis by means of an overhead hoist and passed along an over-

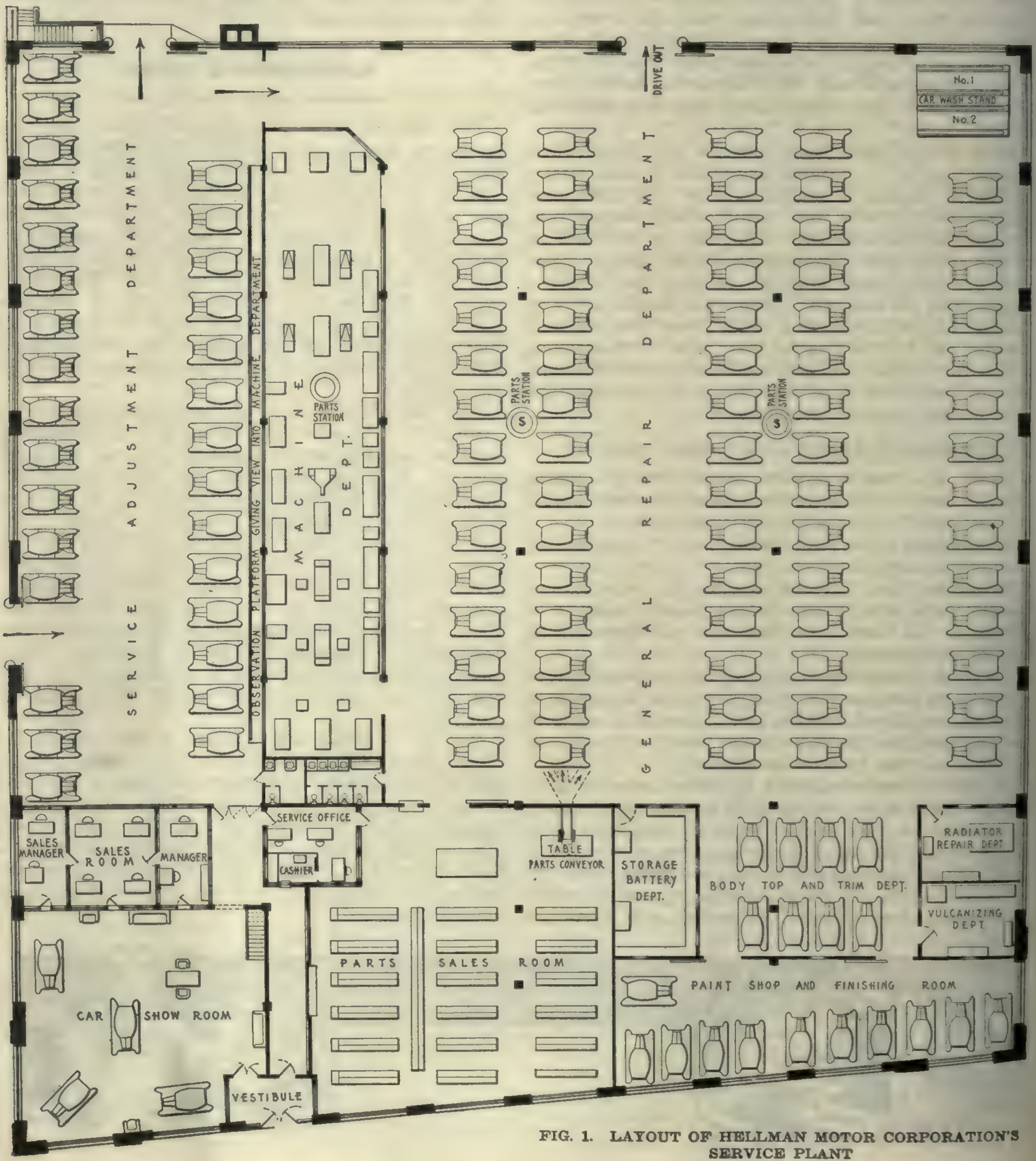


FIG. 1. LAYOUT OF HELLMAN MOTOR CORPORATION'S SERVICE PLANT

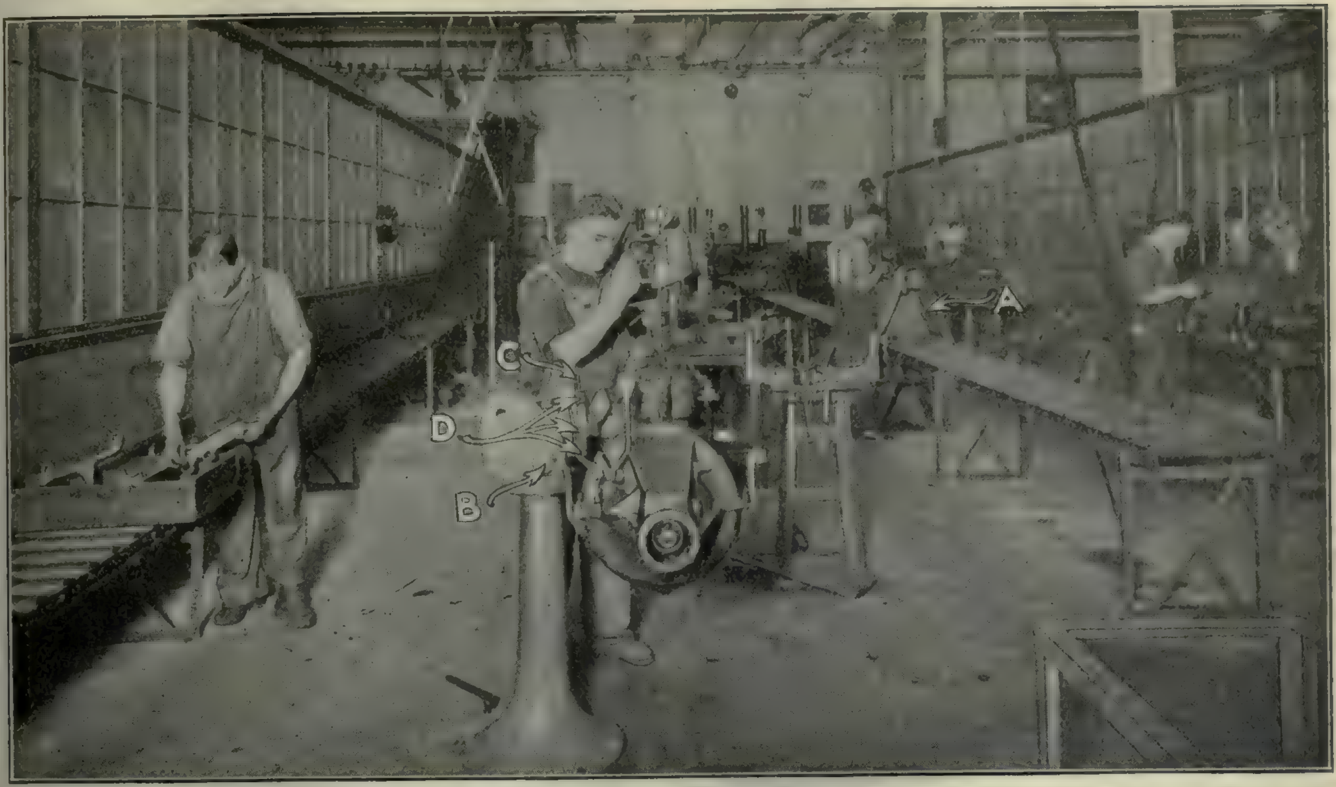


FIG. 2. GENERAL VIEW OF MACHINE SHOP

head track into the machine shop, through the doorway *A*. Just inside the doorway are two disassembling stands where the motor is disassembled. All the parts are then washed in a wash tank, after which they are inspected. The inspector puts scrap tags on the bad parts and makes out an order for replacements, sending both parts and order to the stockroom, which is adjacent to the machine shop. New parts are returned immediately and these, together with the parts that have been saved, are put on to what is called a "gunboat"—a rack in which are hooks and holes for all the parts that go into a Ford motor. One of these gunboats can be seen at *A* in Fig. 2. This rack then is started on its way through the machine shop via a roller conveyor. As it is passed to each operator in turn, that operator performs certain operations for which he has the tools and equipment, sometimes several operators performing their operations on a motor simultaneously. The result is that a motor can be overhauled completely in a very short space of time. At the left of the picture, Fig. 2,

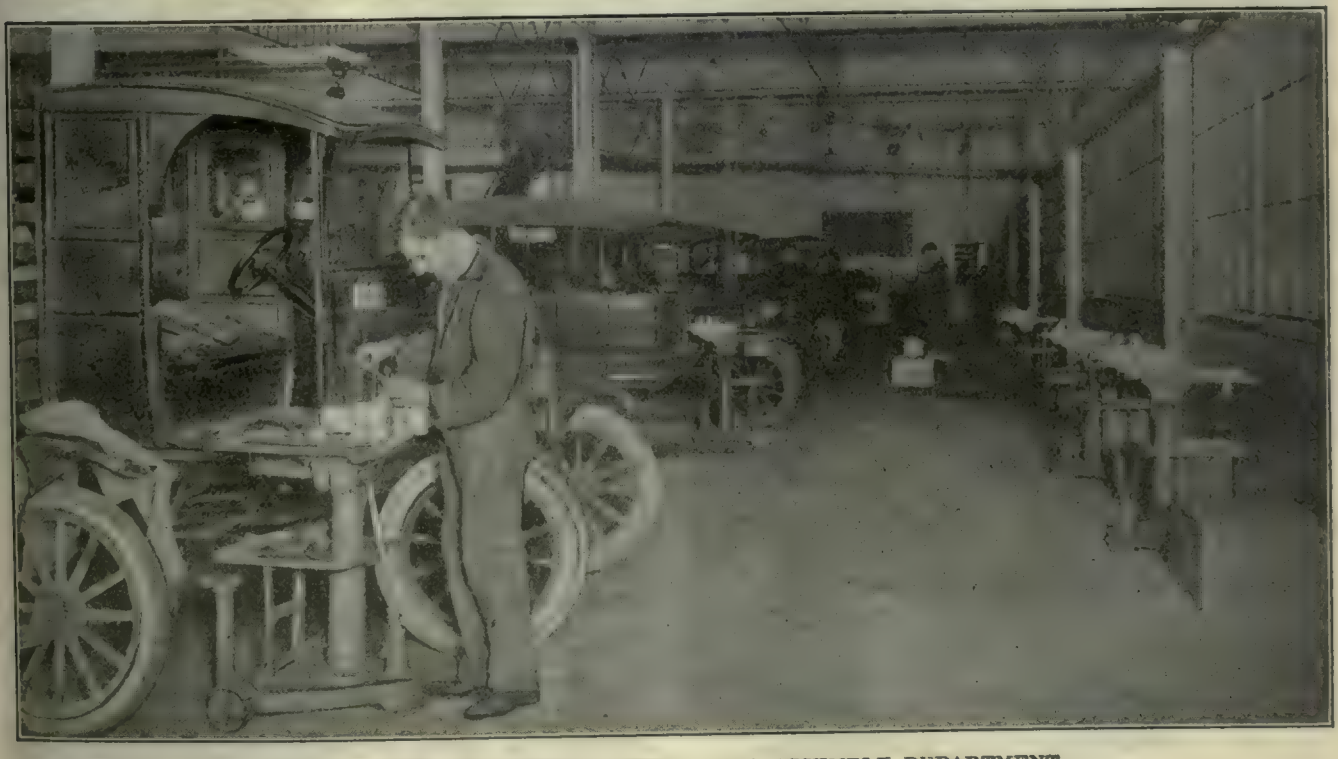


FIG. 6. VIEW OF GENERAL REPAIR AND ASSEMBLY DEPARTMENT

can be seen the conveyor by which parts are sent from the stockroom. All parts for one motor come in one box, together with a copy of the requisition on which they were ordered, so that there can be no mistake.

In the foreground, Fig. 2, is a motor stand of unusual merit. The motor can be locked in the position shown, or in several positions around the half circle to the opposite position. To change the position of the motor, the pin *B* is withdrawn, the section to which the motor is bolted swung to the position desired, and the bolt replaced. Provision is made for turning the motor to a horizontal position, this being accomplished by pulling out the pin *C*, turning the motor to the angle desired, and replacing the pin in one of the slots shown at *D*.

The operator shown in Fig. 3 is babbitting the main bearings of a Ford crankcase. The tool in use is a Hempy-Cooper combination ladle. The ladle is composed of part *A*, which is made to hold the babbitt and a section of a Ford crankshaft, the end of which can be seen at *B*. The ladle is made so that when it sets down on the bearing, the shaft is just the right height from the bottom of the bearing aperture to allow for a good bearing. A valve in the bottom of the ladle is controlled by the rod and button *C*. To operate, the ladle is set over the bearing, a sufficient amount of hot babbitt is poured into the ladle and the valve is opened, allowing the hot babbitt to run into the aperture and around the lower half of the shaft, forming the bearing. The ladle will hold enough hot metal for all three bearings, all of which can be poured in a very few minutes.

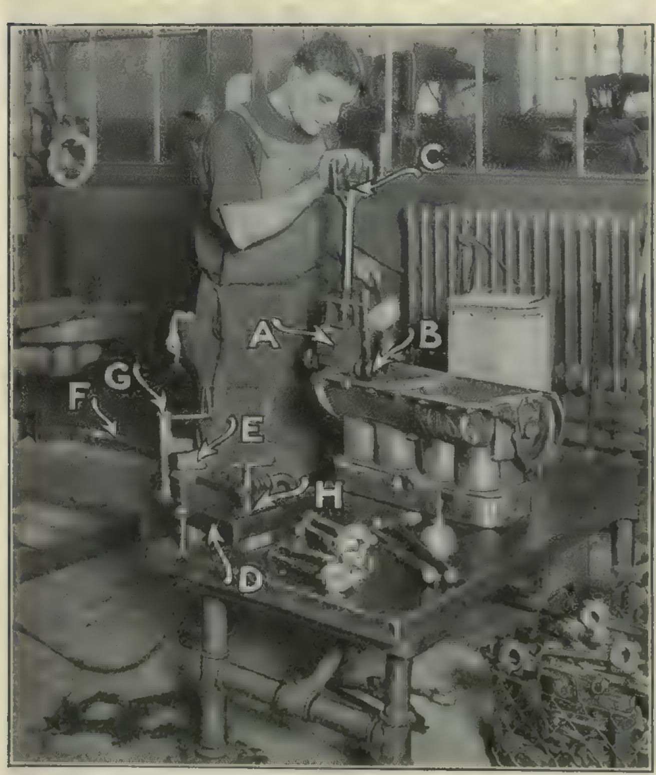


FIG. 3. REBABBITTING MAIN BEARINGS AND CONNECTING RODS

On the end of the table in Fig. 3 is a fixture for rebabbitting connecting rods. The principal part of this tool is a hollow cast-iron box *D*, to which is attached a hose and a small waste pipe so that water can be circulated in the fixture to keep it cool. The small end of the rod is slipped down over a pin at *H*, and the large end is clamped in to a seat which shapes the metal on the lower side of the rod. The piece *E*, which is clamped over the upper side of the rod, resembles a small iron wheel with a very wide rim and a projecting hub, with a solid web from the hub to the rim. The rim keeps the metal from flowing away, and the hub is the point upon which the clamp rests, as shown. A hole in the web allows the metal to flow through into the rod. A handle *F* is attached to part *E* so that it can be handled while hot. The pin *G*, which holds the clamp, is threaded at the lower end to screw into the base *D*, and has a shoulder which sets down on the clamp to hold it in position.

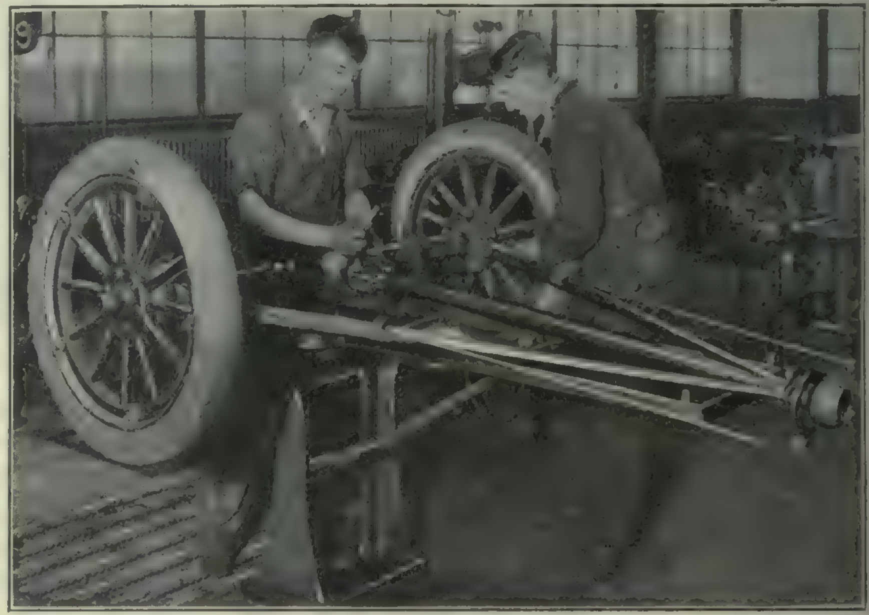


FIG. 5. AN AXLE STAND

A burning-in stand for finising main bearings to size is shown in Fig. 4. The crankshaft is tightened down in the bearings, and the flange end of the shaft is connected to the coupling at *A*. Then the machine is run at a speed which in a few minutes will practically melt the surface of the bearings so that as they solidify while the machine is running, a fine smooth bearing is obtained.

A stand for holding an axle while it is being worked on is shown in Fig. 5. The axle is held in two vises which are adjusted by means of handwheels as can be seen by referring to the empty stand in the background of the picture. A stand of this construction will allow the axle to be held in the position most desirable for the operator and gives access to all parts of the job without interference.

THE ASSEMBLY ROOM

A view of the assembly room is shown in Fig. 6. Positions for cars are marked out on the floor, and in front of each car, against the wall, is a substantial box into which all the small parts that are taken off the car are put. The box can be locked, if necessary, so that the parts that belong on one car will be reassembled to the car from which they were taken. A portable vise is

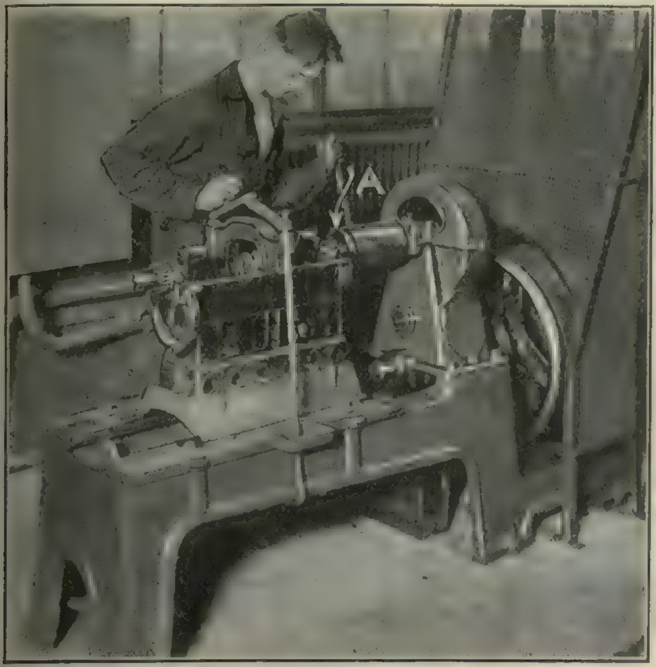


FIG. 4. BURNING-IN MAIN BEARINGS

supplied for each job, so that the workman need lose no time walking back and forth from the car to the bench. Each vise is equipped with two trays, and under the top tray is a small drawer which can be locked.

The room is built to accommodate seventy-four cars, arranged in five rows, with plenty of working space around each car. Cars that have to have the motor overhauled or other heavy repairing done go into the first row, the second is reserved for axle repairs, the third is for valve grinding and other minor repairs, the fourth for radiator and electrical repairs, and the fifth row is for trucks and tractors. An overhead monorail extends the full length of each row, the total length of the mono-rail system approximating ¼ mile. A gravity conveyor is provided from the stockroom, arranged so that boxes of parts can be sent to either one of the two parts stations. A mechanical conveyor in the stockroom, operated by an elecric motor, is used to lift the consignments of parts to a point high enough so that they will travel into the shop by gravity.

A Labor-Saving Wash Rack

A wash rack that will be interesting to garage owners and executives is shown in Fig. 7. As can be seen, ways are provided upon which the car is run so that it is off the floor. A series of vertical sprays is arranged under the car, thus doing away with a great deal of labor and lost time. A hose from the air-line is connected to the spray, the air adding considerable pressure to the spray and helping to remove the dirt.

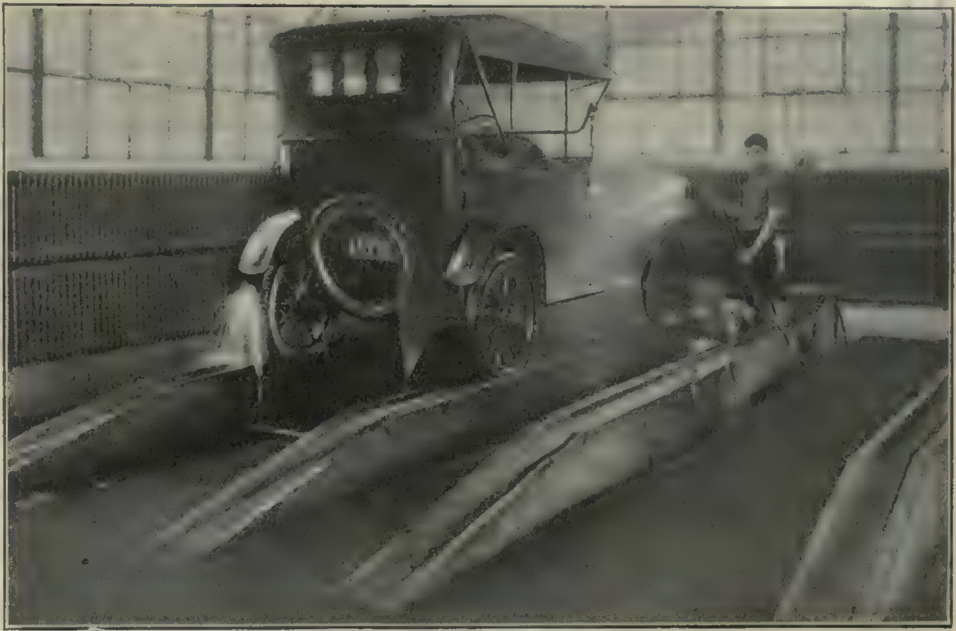


FIG. 7. CAR WASH RACK

Industrial Statesmen Needed

By James J. McCabe

Nothing like an entente cordiale prevails between labor and management. Management has not forgotten that organized labor during the war days exacted all that the traffic would bear. Management is resentful.

Heedless of the necessity for accelerating liquidation so as to hasten the return of normal conditions, labor is giving indubitable evidence of its intention to hold most of the advantages obtained during the stress of war. When necessity compels, the unionists retreat; but the line of retreat probably is studded with grudges. Indeed it may be surmised that in those cases where labor has been forced to give ground, the first propitious opportunity to recover that which has been lost, will be capitalized.

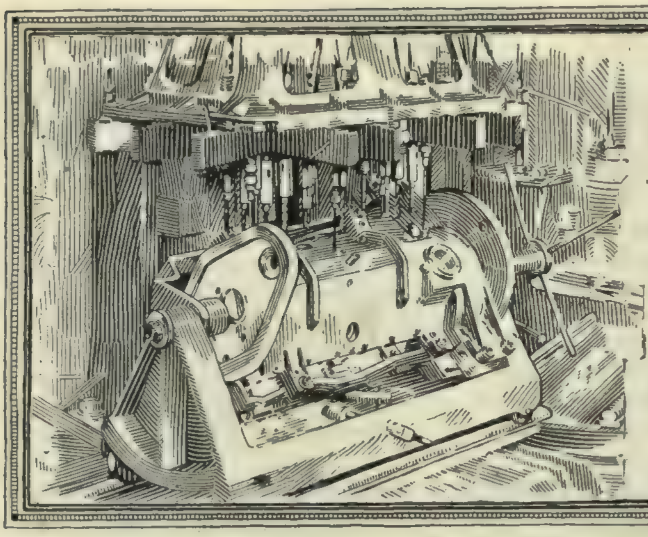
Management proclaims that profits of industry have been whittled down to the little end of nothing, while labor asserts that it cannot permit a full squeezing out of war inflation, inasmuch as the cost of living has not descended to the extent of more than a few farthings.

Without holding a brief for either interest, an onlooker from the side lines may be permitted to venture the statement that the country needs industrial statesmen rather than industrial warriors. Bandying words serve only to beget intolerance. Ruthless warfare by either side will not hasten economic repair.

At this time when wages must follow the general trends of the market places, and when organized labor is losing its potency, management has a golden opportunity to show labor that it is intent upon exemplifying the square deal. Now is the time for both employer and employed to abide by the counsels of fairness and to establish mediums for the free interchange of views with the object of fostering co-operation.

With co-operative organizations in every plant, with representatives of the employers and employed sitting together at council tables freely discussing conditions, intolerance would in due time give way to forbearance and understanding.

The task is one that calls for constructive industrial forces; not destructive, industrial warriors.



Tool Engineering

By

Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Inside Holding for Second-Operation Work on Lathes—Straight and Taper Arbors—Equalizing Collars, Washers and Driving Dogs—Plain and Quick-Operating Threaded Arbors

WORK which is to be held from the inside, locating either on a rough surface or by means of one which has been finished previously, often requires some form of arbor to hold it properly. A large proportion of work of this kind is held on a slightly tapering arbor by means of friction. Other pieces are of such a nature that some kind of a driver can be used either in a hole or slot or against some irregular portion of the work. Provision for driving is an important factor in the design of arbors, whether they are of the plain or expanding types. There are a number of types of arbors used in general manufacturing; a few of them are of the standard form, yet many classes of work require special forms according to the shape of the work or the general requirements of holding.

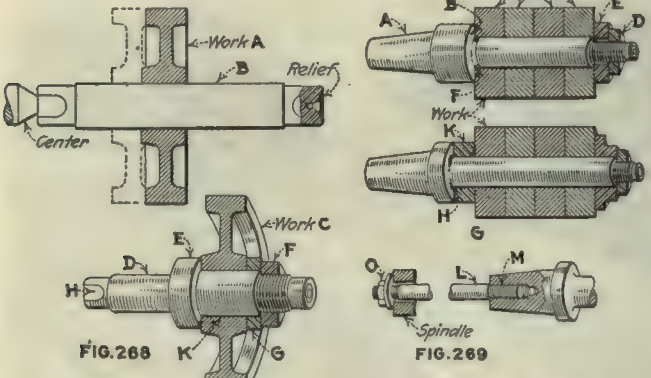


FIG. 268. TWO SIMPLE FORMS OF ARBORS. FIG. 269. PLAIN ARBORS WITH TAPERED ENDS

In Fig. 268 are shown two of the simplest forms of arbors. The work *A* is shown in position on a standard type of arbor *B*, designed to be held between centers on an engine lathe. The work is held in place entirely by friction. The common method of assembling the arbor and the work is to place the latter on an arbor press, and force the arbor into it under pressure. A taper of approximately 0.006 in. per foot is usually given to arbors of this sort. It will, therefore, be seen that the work might take the position shown or it might be as indicated by the dotted lines, depending upon the amount of pressure used when assembling the arbor in the hole.

For this reason, such arbors are somewhat objectionable in general manufacturing when a number of pieces of the same sort are to be made, because the tool setting must be different for each piece on account of the various positions it may take on the arbor. For many kinds of tool work or single-part manufacturing, arbors of this kind are very useful. As only one piece is being made at a time no difficulty is caused by the position of the work on the arbor.

If a number of pieces of the same sort are to be made, as in the example *C*, a plain arbor like that shown at *D* can be made up with a collar or shoulder at *E*. Against this shoulder the work can be firmly drawn up by means of a nut *F* and washer *G* as indicated. One end of the arbor is flatted at *H* to receive the "dog" which is used for driving. Arbors of this kind are made cylindrical at the part *K* which fits the work.

The material from which arbors are made differs in various factories, both machine steel carbonized and hardened, and tool steel being used. A machine-steel arbor, carbonized, hardened and ground, will give good results on a great variety of work. Cast-iron arbors are sometimes used when work is of large size and for special cases when only one or two pieces are to be

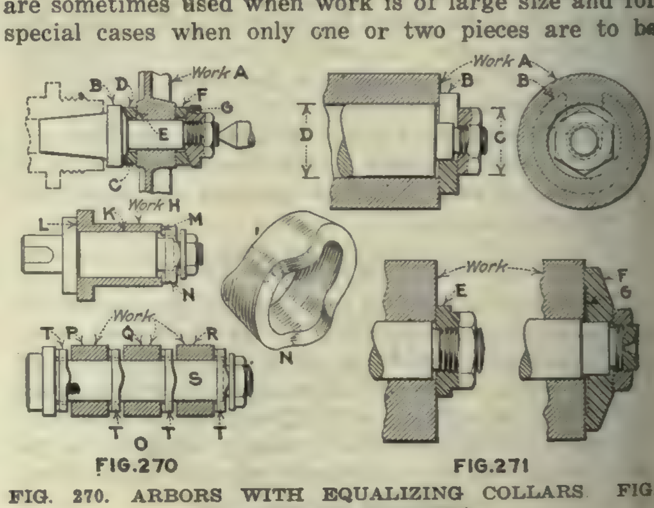


FIG. 270. ARBORS WITH EQUALIZING COLLARS. FIG. 271. USE OF WASHERS

For the authors' forthcoming book. All rights reserved.

machined. Satisfactory results can be obtained on this kind of an arbor; but if very heavy cutting is to be done, it is advisable to reinforce the centers in each end of the arbor by means of hardened steel plugs. In designing arbors which are to be used on centers, care must be taken to make the latter as generous as possible and to lap them out carefully after the hardening and before grinding, in order that there may be no firescale or dirt in the centers which might cause them to be ground inaccurately.

A very useful form of arbor, which can be employed in cases where a number of small pieces are to be turned, is shown in Fig. 269. The end *A* is fitted to the taper in the spindle of the machine to which it is to be applied. The arbor is turned up with a shoulder at *B*, against which the work *C* is clamped by means of a nut *D* and washer *E*. In this example the arbor is relieved slightly at *F* to permit grinding up to the shoulder. This relief, however, tends to weaken the arbor, so that it may break at this point under excessive strain. A remedy for this condition is shown in the example *G*, in which a fillet is made at *H* in order to give strength. A collar *K* is then used between the shoulder and the work, the collar being chamfered so that it will bear directly against the shoulder on the arbor. This makes a better form than the one previously described, as it is much more rigid and will stand greater abuse. Arbors of the kind shown here can be held in the spindle by means of a draw rod *L*, which is threaded into the end of the tapered portion *M*. The other end of this draw rod is threaded to receive a nut and washer, as shown at *O*. This method allows the arbor to be drawn back firmly into the taper on the machine.

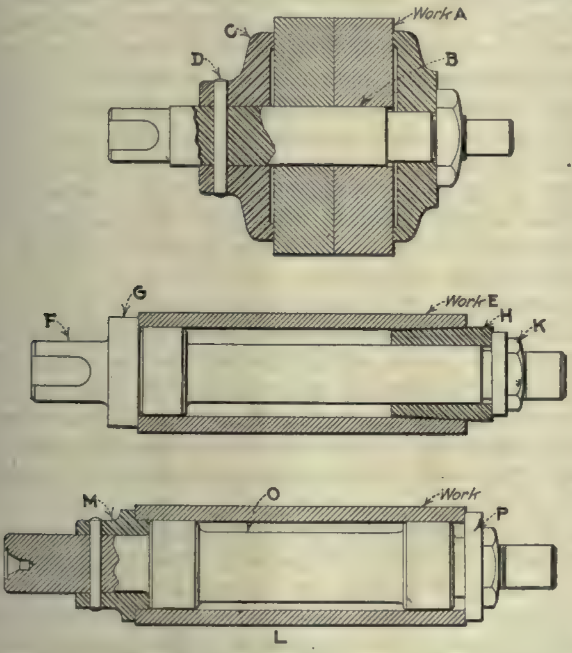


FIG. 272. SEVERAL FORMS OF STRAIGHT ARBORS

The various points brought up in connection with design should not be passed over by the designer as unimportant, as they are the result of long experience. It frequently happens in the drafting room that a designer, unfamiliar with this class of work, is called upon to design something on this order. The general design resulting is frequently all right, but refinements of the principle, which a more experienced man would incorporate in the design, are left out by the less experienced draftsman.

Work which has been bored and reamed may not have been faced on both sides of the hub, as in the example *A* in Fig. 270. In holding work of this sort on an arbor care must be taken not to clamp it against the rough surface unless suitable provision is made so that no distortion will result. The matter can be easily taken care of by using an arbor like that shown at *B*, having a shoulder *C* in spherical form. Against this shoulder a collar *D* rests, and the other side of the collar bears against the rough portion *E*. This side of the washer should be cut out so that it strikes against three points only. Another washer of similar form is used at *F*, in connection with a special nut having a spherical face *G*. By using this method, it is possible to clamp the work firmly and yet not distort the arbor by bringing unequal pressure to bear on the work.

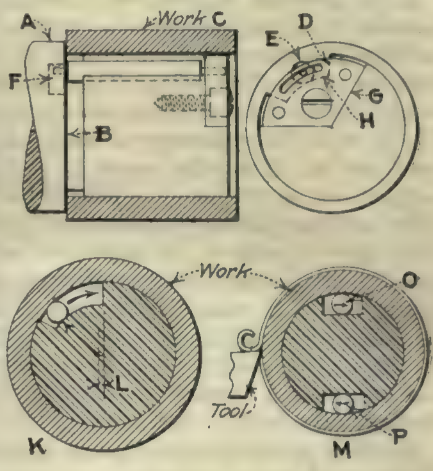


FIG. 273. ARBORS WITH DOGS FOR DRIVING

Another example, showing a piece of work *H* which has been reamed at *K* and faced at *L*, has not been machined on the small end at *M*, this portion being left rough. In holding this piece of work, therefore, it will be necessary to put an equalizing washer *N* against the end of the work, in order that it may not be distorted. A detail of this washer is shown separately, and has some advantages over the other style shown because it does not require a special nut. It is perhaps a trifle more difficult to make up than the other form, but there is not enough difference to be of great importance.

An application of a similar principle is shown at *O* in the same illustration. In this case, there are three pieces of work *P*, *Q* and *R* which are to be held at the same time on an arbor *S*. None of these pieces have been faced on the sides, so that it becomes necessary

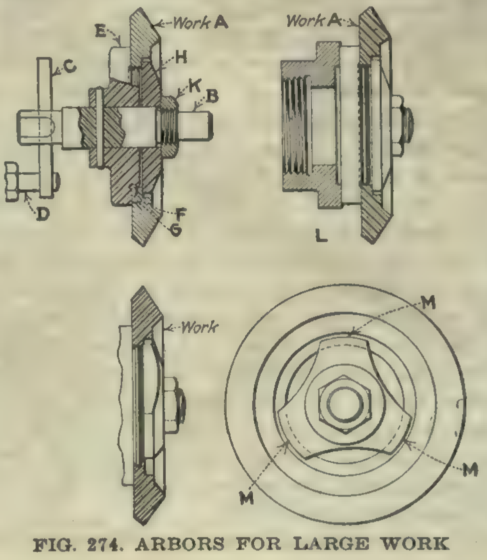


FIG. 274. ARBORS FOR LARGE WORK

to provide a number of equalizing collars, as shown at *T*. The design of this form of arbor will be readily understood from the illustration.

It is tiresome to unscrew a nut completely from a threaded member in order to remove the washer which perhaps is used to hold the work in position, as in the example *A* in Fig. 271. This trouble can be easily avoided by the use of a C-washer, such as that shown at *B*. It must be remembered that when this design is used the nut dimension must be considered across the corners, as shown at *C*. This should always be considerably less than the diameter of the hole *D*, as otherwise there would be no object in using the C-washer and it would be necessary to unscrew the nut completely before the work could be removed. This point is occasionally overlooked in designing, and the distance across the flats of the nut is considered, instead of the dimension across the corners. Care must be taken in this regard when using C-washers.

Another point along the same general line is that it is not good policy to screw up a nut against the face of a piece of work, as shown at *E*, without using a washer between the nut and the work. If this is not done, work will be marred by the sharp corners or edges of the nut while screwing it up. Small washers are to be avoided, unless the work is such as to make their use necessary. It is generally better to make up a form something like that shown at *F*, and relieve the washer at *G* so that it bears only on the outer edges, as shown. This is much better construction than if a small washer were to be used.

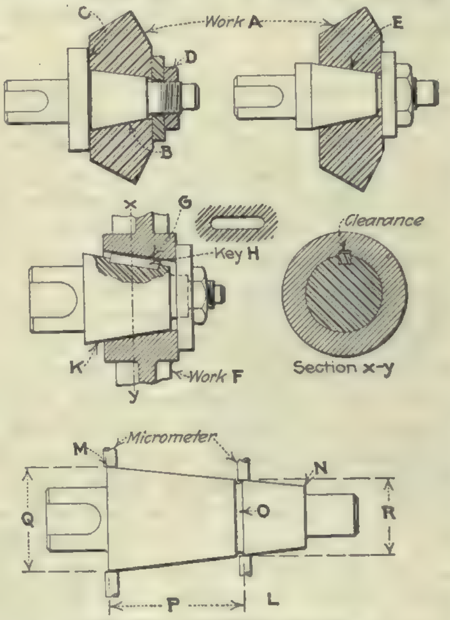


FIG. 275. TAPER ARBORS

Fig. 272 shows two pieces of work at *A* which are to be held on an arbor *B*. It would be expensive to make up this kind of an arbor with a shouldered portion at *C* as a part of the arbor. It is much better to make *C* in the form of a collar and pin it to the arbor with a straight or tapered pin, as at *D*. The hardening of the arbor must be considered when using this construction, as it might be difficult to drill and ream the pin hole unless the method of manufacture were to be carefully thought out. As it is shown here, there would undoubtedly be great difficulty in making it, yet by using an arbor of machine steel, carbonized and hardened, it is possible to allow an extra amount of stock at the point where the collar fits and turn this off after carbonizing and before hardening, thus leaving this part of the arbor soft enough so that it can be drilled without difficulty. A similar process can be used on the collar itself, so as to leave the portion through which the pin goes soft enough to be drilled.

Another method of holding a long sleeve is shown at *E*. This may be considered as a good example of what not to do. The arbor *F* itself has a shoulder at *G* against which work is clamped as indicated. The other end of the work is located by means of a bushing *H* having a slight taper on the outside. This bushing is forced into the end of the work by means of the nut and washer at *K*. There is no doubt about this method of holding, as there is sufficient friction developed to drive the work without difficulty. However, in attempting to disassemble the piece and remove it from the arbor, trouble will undoubtedly be experienced on account of the wedging action set up by the taper bushing inside the work. This could be avoided to some extent by making the bushing so that it would have a rather abrupt taper, in which case it would not stick in the work. Generally speaking, however, this method is not to be recommended.

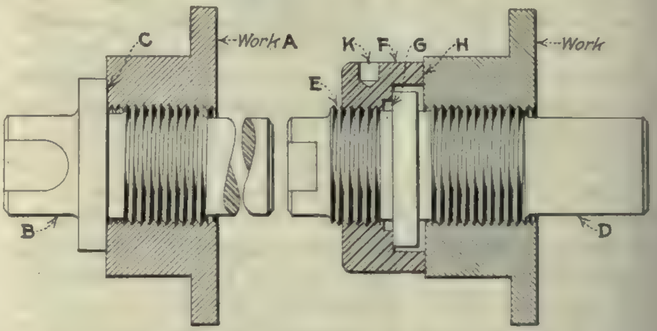


FIG. 276. PLAIN THREADED ARBORS

Another form of straight arbor is shown at *L*, which is a simple type of plain arbor having a collar *M* pinned to it at one end to act as a stop for the work. The arbor itself is relieved at *O* so that it does not bear along the inside of the work. This makes it much easier to place the work in position on and remove it from the arbor. The work is held in place by a nut and C-washer at *P*.

In order to avoid the necessity for placing the work on an arbor by means of pressure from an arbor press and to assist in making the operation more rapid, several forms of arbors have been devised which have automatic locking arrangements in their construction. Several examples are shown in Fig. 273. In one case, the arbor *A* has a shoulder at *B*, against which the work *C* rests. A slot *D* is cut lengthwise on the arbor to receive a roller *E*. This roller is turned down on each end to form pins, one of which enters a slot in the shoulder of the arbor at *F*, while the other enters a slot in a retaining plate *G* fastened to the end of the arbor. The curved portion or bottom of the slot *H* is slightly eccentric to the center of the work, so that when the piece is placed in position and pressure applied in cutting it, the roll becomes further away from the center of the mandrel and grips the inside of the work more and more strongly, according to the pressure applied. The principle is illustrated quite clearly in the detail at *K*. The amount of eccentricity *L* does not need to be great, as too large an amount would prevent the roll from gripping the work firmly and there would not be a wedging action.

Another method which gives quite similar results is shown in an end view at *M*. In this case there are two rolls *O* and *P* opposite to each other in straight slots. The cutting action tends to make them roll to the sides of the slots; and as they do so they become further away from the center, thus locking the work securely.

In Fig. 274 are shown several methods of making arbors for large-diameter work. The example *A* can be held in several different ways. The special arbor *B* is provided with a driver at *C*, and is intended to be held on centers in an engine lathe. By using a plug *D* in the faceplate, a "dog" is unnecessary. The arbor is provided with a collar *E*, pinned to it and so arranged that the work locates directly on the shoulder *F* and against the face *G*. It is drawn up in place by a large washer *H* and a nut *K*. This form of arbor can be mounted on an adapter, as shown at *L*, if the nature of the work requires it. The method of locating the work is, however, the same in either case, the only difference being in the application of the arbor to the adapter.

A point of importance in connection with the use of large arbors is the bearing of the washer on the work. If made so that it has a contact all around, any slight inaccuracies on the face against which it is clamped are likely to throw the arbor out of truth. It is much better, therefore, to give the washer a three-point bearing, as indicated at *M*. If it is made a loose fit on the stud, it will equalize any imperfections in the work to an extent sufficient to avoid trouble.

Work having a taper hole is often held on an arbor of some sort, and there are certain points which must be considered carefully in the design. The point has been brought out previously that it is difficult to ream a tapered hole so that the taper will bear an exact relation to the surface of the hub. On this account it is not usually possible to locate a piece of tapered work on the taper and at the same time against the face.

An example which illustrates this point very clearly is shown in Fig. 275 in the work *A*, which is located on a taper arbor *B* and at the same time against the shoulder *C*. It is drawn back on the taper by means of a nut and washer, as indicated at *D*. It looks very nice in the drawing; but in reality it would not be advisable to use an arbor of this kind, as the work might "make" on the taper *B* before it reached the shoulder *C*, or it might strike the shoulder *C* before the taper completely filled the hole. In one case the shoulder would be of no use, and in the other case the work would not be located centrally because it would not fit on the taper. By making up an arbor of this sort like that shown at *E* all trouble is avoided, and the work is located entirely by the taper, as it should be.

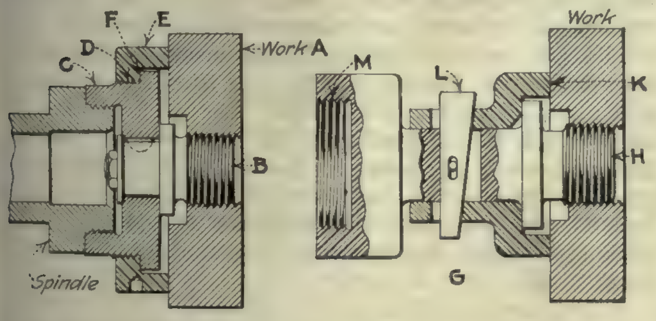


FIG. 277. TWO TYPES OF ARBORS FOR THREADED WORK

If a condition should be found such that it became necessary to locate by the taper and also against the shoulder, as might be the case with a piece of work having a wide flange which needed support, compensation could be made for the variation by using a taper spring bushing similar to one which has been previously shown. The necessity for such an arrangement on small work is comparatively rare. The work shown at *F* has a keyway cut in it at *G*. It is, therefore, a very good idea to take advantage of this fact in making up the arbor, and provide it with a key, as indicated at *H*. The arbor itself *K* is of similar form to that shown at *E*. The advantage of providing an arbor with a key is that it serves as the means of driving the work, so that it is not necessary to use great pressure in tightening it on the arbor.

A point of importance in the making up of taper arbors is indicated in the diagram at *L*. The toolmaker who makes up the arbor is obliged to measure it with micrometers in order to determine the taper. It is easy enough to measure across the corners, as at *M*, but it is practically impossible to measure the diameter at *N*. If an arbor is made up, however, like that shown, giving a slight relief to the portion *O* and giving the dimension on the arbor between the arrows at *P*, the toolmaker can readily measure these portions and the taper can be determined by giving dimensions *Q* and *R*. The total length of the arbor can also be given to the point *N*, but the diameter at this point should not be mentioned. A little care on the part of the designer will assist the toolmaker greatly on work of this character.

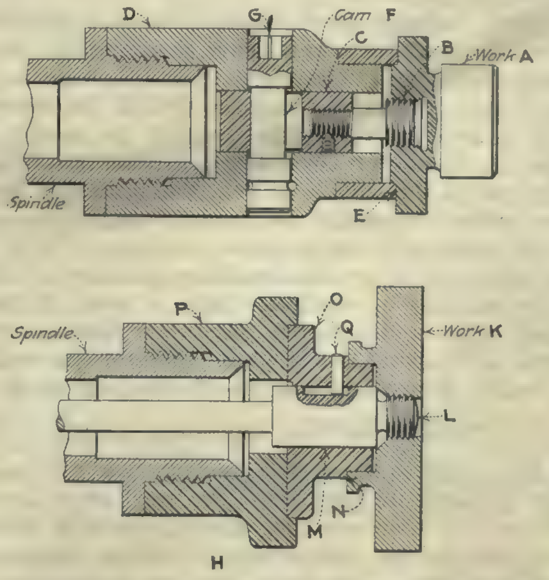


FIG. 278. QUICK-OPERATING THREADED-WORK ARBORS

We have previously discussed the holding of threaded work when an outside method of locating is necessary. There are many examples, however, when the inside of a piece of work is threaded and the location must be taken from this for some other operations on the piece. Many of the principles which apply to the outside method of holding are also of importance in connection with arbors for threaded work. The simplest form of threaded arbor, but one which is not to be recommended, is shown at *B* in Fig. 276. The work *A* screws onto a plain threaded portion of the arbor and brings up against the shoulder at *C*. The pressure of the cut sets up a wedging action between the work and this shoulder, so that it is very difficult to remove the piece after it has been machined. An arbor like that shown at *D* can be designed, however, which will give excellent results. This type is threaded at *E* with a left-hand, coarse-pitch thread on which the collar *F* is mounted. This collar is screwed up against the shoulder at *G*, thus forming an end stop for the work which screws against the portion *H*. Pin holes are provided in the collar at *K*, so that after the work has been machined the collar can be easily loosened and the work removed without trouble.

Fig. 277 shows a piece of work *A* which is screwed onto a threaded plug *B* located in a nosepiece *C* on the spindle of an engine lathe. In its general principles, this arbor is quite similar to that previously described, but the work is somewhat larger and the arbor is applied directly to the spindle, instead of being held between centers as in the other example. The portion *D* is threaded with a left-hand, coarse-pitch thread on which a collar *E* travels, until it brings up against the shoulder at *F*, thus forming the end stop for the work. The method of releasing the piece after it has been machined is obvious.

Another example which illustrates a poor method of holding the same piece of work is shown at *G*. In this example the arbor is threaded at *H* and the work screws onto it until it bears against the end of the sleeve *K*, which is held in its normal position by means of a wedge *L*. The arbor is arranged so that it screws on to the end of the spindle at *M*. The objection to this arbor is that the wedge will tend to distort the arbor, and the work will therefore not run true. In a very large and heavy arbor this trouble might not be caused, but for anything of small size there is such a force developed by the wedge that it cannot be relied upon for a purpose of this kind. It is better, therefore, to consider this design as another example of *what not to do.*

QUICK-OPERATING THREADED ARBORS

A very good example of a modern type of threaded arbor is shown in Fig. 278. The work *A* is screwed to the end of a threaded member *B*, which is fastened into a hardened and ground sleeve *C* fitting the inside of the nosepiece *D*. A hardened locating ring is provided at *E*, against which a finished portion of the work is drawn. The operation of the device is by means of a cam cut at *F* and operated by a socket wrench in the hole *G*. This cam bears against the rear end of the sleeve which pulls back the threaded plug. The operation of the device is very rapid and positive in its action. Care must be taken not to make the cam too abrupt, as a slight eccentricity is all that is necessary. The various parts of this mechanism should be hardened and ground.

The example at *H* shows a piece of work *K* having a somewhat different method of location from those previously described. The work screws on to a threaded plug *L*, which has a cylindrical portion fitted into the collar at *M*. End location is determined by the shoulder at *N*. The collar *O* is fitted to the nosepiece *P*, and carefully ground when in position so that the hole is perfectly concentric. The rod *L* extends back to the rear end of the spindle, and is operated from this point by the collet mechanism. The pin Q simply keeps the rod from turning, a slot being provided in the latter to permit end movement. A device of this type is very satisfactory and can be quickly operated.

Considerable care should always be taken when several parts are assembled on a faceplate or nosepiece to make sure that they are ground carefully, so that they will be perfectly concentric. The only way in which this can be done and be sure of the results, is to grind the parts in position on the machine on which they are to be used.

Judge Gary Speaks of the Future

Judge Gary, in his address before the Iron and Steel Institute, said:

"The resources of this country are so enormous and the necessities of the consuming public so extensive that there must be continuously transacted a large business, even though at times it is small when compared with the maximum periods.

"But it will be conceded that thrift even in a rich country may be interfered with, if not postponed. The pity is that often this is brought about unnecessarily and sometimes negligently or viciously. Even though we have now passed the most critical period in our recovery, I still think we would not be warranted in concluding we have arrived at the point where we can with certainty predict the exact time when there will be a return to a normal financial, commercial and industrial basis, for the world's economic structure has been terribly shaken by adverse winds during the last few years. There must be further adjustments. . . . The majority of reasons favor a return to large prosperity in the comparatively near future. Let us keep within the limits of our resources and be trustful. We should not anticipate much, if any profit, in our business during the present quarter. If there are losses it will probably be our own fault. Let us look up and ahead; look at the wealth of the country and not the present poverty of business. Let us bear in mind that in the long past we have, on the average, been well treated, and therefore in the future will probably receive still better consideration if we do our utmost to deserve it."

The Effect of Bolshevism Upon Russia

Status of the Kuznetskie Coal Basin and the Turkestan Irrigation Projects—Expressions from Lenin and Trotsky—Prevalence of Hunger Among the Workers

BY ROYAL R. KEELY

AFTER a trip to Petrograd and to manufacturing plants in the surrounding districts, I returned to Moscow, arriving March 1, 1920. The next day I wrote Lenin, telling him that there was no production and could be no production in Russia for at least ten years, and I specified the reason—a painful shortage of material, fuel, transport, trained workmen, clothing and food. For the workmen whom they had, there was no incentive to work; they had no wish to work and the hard conditions made it impossible. Then I mentioned that all Russia could hope to do in the ten years would be repair work, and that she would be lucky if she could do that. (Since that time, large quantities of cars and locomotives have been sent to the Baltic provinces for repair.)

In the same letter, I expressed my desire to return to America. Lenin sent me to Rikoff, head of the Supreme Council of National Economy, who said, "Yes, we have heard that you are ready to leave Russia. We are willing that you should go. However, it is our desire to interest American capital in our natural resources and we want you to take the necessary data concerning them to America." This seemed to me, at the time, to be a means of keeping in touch with Russia, until reconstruction should come, so I told him that I would be willing to consider his proposal.

Rikoff turned me over to the "Concessions Department" and I spent three or four weeks in conferences with experts and specialists about the various branches of Russia's natural wealth—the forests of the north, the Donnetz coal fields in Ukrain in the south, and the great Kuznetskie coal fields in Siberia; irrigation in Turkestan; water-power around Petrograd and in the south; flax, grain, hides and the Volga-Don ship canal. I studied engineers' and geologists' reports, for it was of considerable interest to me to have this chance of learning of Russia's natural wealth.

THE KUZNETSKIE COAL BASIN

Finally Rikoff said, "It is not enough for you to see the reports and talk with the specialists in the various fields. You must see these things for yourself." "Yes," I said, "but that is practically impossible because of the destroyed transportation." He replied, "That would be true for the ordinary traveler, but we will make it possible for you." He then sent me to the railway department where they told me that they had instructions to give me the best train Russia could provide, consisting of a new locomotive, American coal cars with coal enough for the round trip, International Pullman cars for myself and staff of experts, dining car, food, three train crews for twenty-four hours' operation of the train, and an automobile for side trips.

The first trip which they proposed was to the Kuznetskie coal basin, halfway across Siberia, and some 2,000 miles from Moscow. There may be found good coal in great quantities. In the Ural mountains, between Russia proper and Siberia, is a mountain of iron where the quality is good and the situation such that mining costs would be extremely low. The problem then was to take the Siberian coal 1,000 miles east to the iron ore, which would involve the building of a special coal railroad, after the practice of our American coal roads, where records have been established in low costs of transportation.

The next trip they suggested was to the Turkestan irrigation projects, the development of which, as I explained in a previous article, would be extremely expensive and would require years.

Both required the development of a market. With the industries, the economical foundation, and the civilization of Russia destroyed, as it is, there can be no market or excuse for such ventures. Nor can I conceive of any capitalist investing his money so as to put it at the mercy of this robber band.

It seemed to me that the Bolshevik idea of interesting American capital could have no practical result. Also, my seeing these things in a hurried trip could have no practical or useful result. I went back to Rikoff and told him my decision—that to me personally, such a trip would be very interesting, but the result could not justify the expenditure. Whenever I spoke of costs in Russia, I invariably met with some such answer as this, "Oh, what do we care for costs? We own everything, we are the proprietors. There are no capitalists to reap a profit. All that we make is ours. For wages and material we print our own money, as much as we like, and it costs us nothing." It was impossible to make them understand, that, by their clumsy, wasteful, inefficient methods, their necessities and products must cost more in human effort, drudgery and pain, than under the old "capitalistic system."

As a result of my request, Rikoff gave me a letter to Tchicherin, head of the Foreign Office, asking for a vise. I was told at the foreign office it would be necessary to get permission for me from Reval. After waiting two or three weeks, I was told that the agent in Reval must get permission for me from Washington.

Finally on May 1, 1920, I received all permits, documents and vises. One coming from the land of capitalistic oppression, America, to this wonderful land of freedom, Bolshevik Russia, must be astonished at this matter of documents. At home, my birth was never registered, and I lived my entire life and made trips to Europe, without a single official document of any kind—nothing to officially prove my birth, age, nationality or profession. But in Russia, people are loaded down with documents, an official passport, a compulsory labor book, permits for food and food cards, permits for a place to live, permits to ride on the street car—one to say you are permitted to ride, and a second to say that you are the person named in the first. In America, if one wishes to go somewhere, he buys a ticket and gets on the train. In Russia, five or six or seven documents are required, signed, counter-signed, and red-stamped, which it requires from one to two weeks to secure. Then, after your permits are secured, you must go and stand in line for your railway ticket.

With all my vises and permits, my baggage inspected and censored, an automobile was sent on May 7, 1920, to take me to the railway station. A coupé had been reserved for me in the courier car direct from Moscow to Reval, without change. White bed linen was provided and food for the journey was sent from Kremlin, the "Festung" of Bolshevism.

Before leaving, Lenin admitted me to his presence. We talked for a half hour of Russian difficulties. He told me of their success and how they would succeed in the future, in spite of all the opposition of capitalism. He tried to draw me out by suggesting, "I suppose you will have much to relate in America of the destruction in Russia." I replied simply that I had no desire or time to meddle in political affairs and would be busy making a living when I returned. But the order had already been issued for my imprisonment, although I did not know it at that time.

The Penalty of Knowing Too Much

On May 11 I arrived at the border at Yambourg. Three armed soldiers came to my coupé and said the commandant wanted to see me. Up to that time, I had had all that starving, destroyed Russia could offer—a good room, good food, secretaries, and freedom to travel and to see and learn of the real conditions. But this was my crime: I had seen and learned too much and the Bolsheviki did not dare to let me go. Therefore, the comandant at Yambourg, said, "There is a mistake on your passport. The numbers do not agree with those on our records and Esthonia objects." But the Esthonian agent had already vised my passport so that I knew he was lying. All day I sat in the office of the commandant and waited. He was deaf to my demands for explanation or action. At night, he turned me over to the local "Tcheckah," "The All Russian Commission for the Supression of Counter Revolution." These "Tcheckahs" have grown into a giant octopus, drunk with its power, always robbing, ever imprisoning and murdering those whom they have any suspicion of opposing their will. While they work inefficiently, they work effectively, because of the immense number in their employ. One never knows when he is speaking to an agent of the "Tcheckah." Many times they adopt the attitude of an anti-Bolshevik, simply to draw one out. Many of their best spies are women, nicely dressed and well fed, who live on the fat of the land.

After a session of the "third degree," which lasted from eight in the evening until eight in the morning, I was loaded, with my baggage and my three soldiers in a third-class coach and we returned to Moscow, when my prison life began.

The Bolsheviki have been successful in two things: first, in bringing every one down to the level of the lowest in pre-revolutionary times, and in destroying all the wealth of Russia; second, they have succeeded in destroying and suppressing all opposition. The prisons in Russia are always filled. They have taken all the prisons of the old regime, and to them have added many improvised prisons, such as the various monasteries of the cities. They have also had, scattered through the various villages, at the railway stations, ordinary freight box cars, which were used as temporary jails. They were without heat, and in the winter months were not very comfortable places for human beings. The leaders of other political parties are mostly in prison. Other members who are not in prison are scattered and prevented from communicating with one another.

Lists are constantly being circulated, demanding the full history of each individual. In reply to the question of political party, these various politicians usually state "non-partisan," for if they signified their allegiance to any other party, it would lead to persecution, possibly to imprisonment.

But in the prison is really the best place to study the Russian situation, for there is freedom of speech and less fear. The prisons are filled with those who have asserted themselves or in some manner expressed their individuality. They come from all over Russia and the personnel is constantly changing. The foreigners in prison, however, have had it far easier than the average Russian. Few of them have been shot, while the native is in constant danger. His relatives have to endure the greatest hardships and in prison or out makes little difference, for no Russian is allowed to leave Russia or to move from place to place.

One well-known Russian, who was a student of English with me, had been formerly a wealthy man and had owned a large estate. He had taken a great deal of pride in making his farm the best possible by introducing the most modern American and foreign machinery and equipment. He bred fine stock and was rendering a great service to Russia by demonstrating the better farming methods and bringing to his farm the best scientific foreign agricultural methods. Everything perishable on his estate was completely destroyed, the stock stolen and killed. And the sorrowful part is that no one has profited. I think the loss to Russia and her civilization is greater than to him personally, for he has health and youth and has not yet been shot. When the opportunity comes he will regain his losses far quicker than the nation will. He told me that before coming to prison he had always fear of prison, he was always hungry, his whole day was consumed in the most trying physical matters in connection with his struggle for a mere existence, staving off starvation. In prison he had quiet and rest and little fear of disturbance with only two hours' work per day.

Autocracy Has Increased

Few in the outside world can realize that in Russia today there is a more strict and destructive autocratic power than has ever existed before. Nowhere else in the world is there so little liberty. Freedom of speech—that is unknown. Freedom of the press—a joke.

Let me quote Lenin's own words: "We have arrived at autocracy," and "The object of the Communist Internationale is a struggle with force of arms for the suppression of the internationale bourgeoise and the creation of an international Soviet republic as a transition stage for the complete suppression of the State. The victory is incomplete until every part of Europe is revolutionized." Again he says, "In the autocracy of chiefs of communism and the communist domination of the people lies the pledge of our success." Also, "There can be no liberty or democracy," but there "must be submission to the armed vanguard of the proletariat. . . We must know how to apply at need, knavery, illegal methods, deceit, hide truth by silence," etc.

Trotsky, the other leader of the cause of freedom and liberty for the worker and peasant, says, "All artisans will be sent into the world and transferred from one place to another according to the indications of the government. We will have no pity for the peasants; we will make labor armies of them, with military discipline and communists as their chiefs. The masses of the workmen should be moved about, ordered and sent from place to place in exactly the same manner as soldiers."

Unemployment in the Metal Trades

In Comparison With Other Trades, the Metal Workers and Printers of New York State Are the Most Steadily Employed

By ERNEST S. BRADFORD
Economist and Statistician, Member of President's Conference on Unemployment

AMONG the charts presented at the President's Unemployment Conference, held recently in Washington, was one comparing the unemployment in the metal trades with other trades, such as printing, the building trades and clothing in New York State, and covering a series of years. The data on which the charts are based were collected by the statisticians of the New York State Industrial Commission for each month, beginning with 1904 and continuing until 1916. They cover, therefore, a long enough period to be significant of trends in the industries, and are believed to be typical, in many respects, of conditions in the metal trades throughout the country.

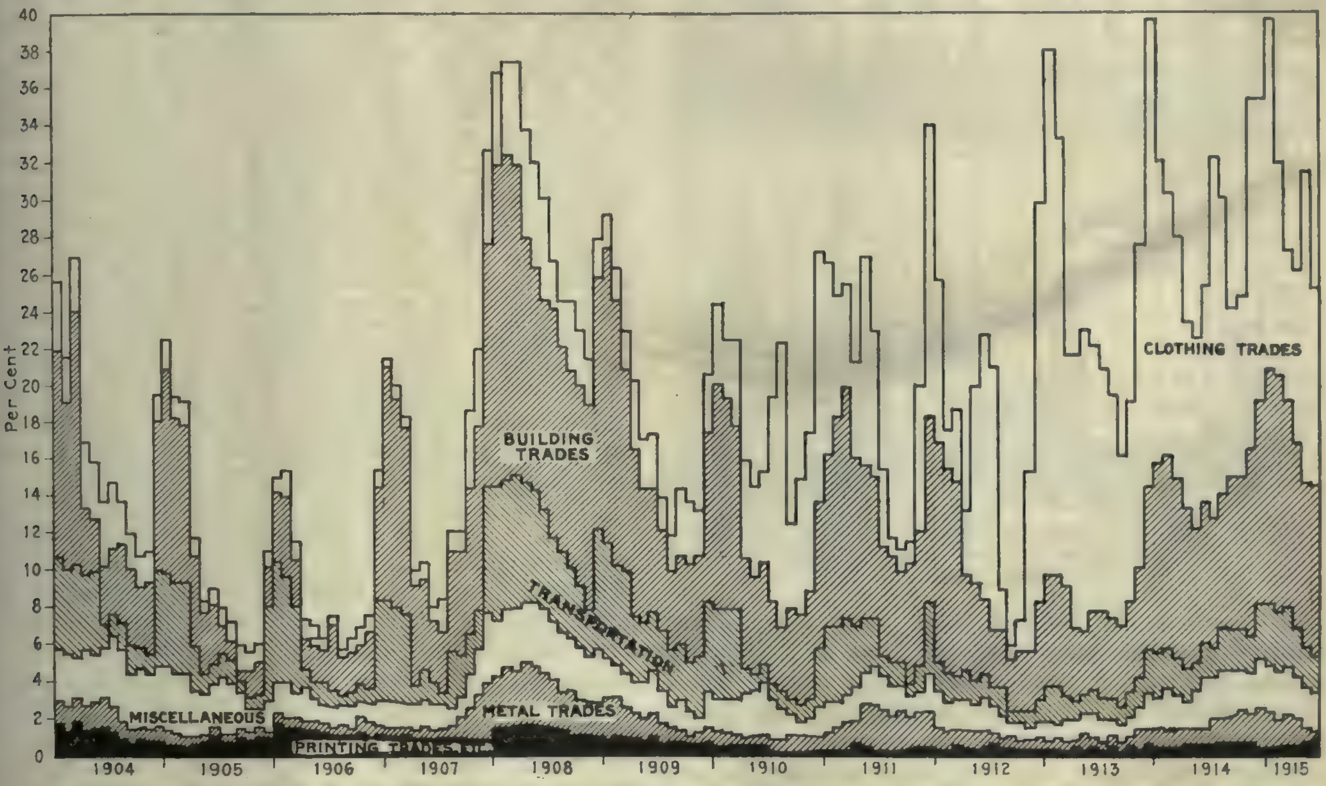


FIG. 1. PERCENTAGES OF UNEMPLOYMENT IN INDUSTRIES OF ORGANIZED LABOR IN NEW YORK STATE, BY MONTHS, 1904-1915

Unemployment Situation Covering Twelve Years Previous to 1916

The charts show the percentage of unemployed among organized wage earners at the end of each month, winter and summer, for more than twelve years, the practice having been discontinued in 1916. Of the four industries covered by charts, Figs. 1 and 2, two have a comparatively low average of unemployment, namely, the metal trades and printing; while two others, the building and the clothing trades, have very high percentages of unemployment and a wide range between the high and low points.

The metal trades are a comparatively stable industry. The fluctuations shown on the chart indicate that they are less subject to seasonal variations than to the influence of depressions and periods of unfavorable business. The depressions of 1908 and 1914, and the dull business conditions of 1911 are all reflected in the higher percentage of idleness in machine shops. In this respect they are in marked contrast to the building trades, which have both a periodic and a seasonal curve, the percentage of unemployed rising sharply to a peak each winter and falling to a low point during the summer.

The chart, Fig. 2, shows even more clearly the relative stability of the metal trades and printing, in New York State, and the high unemployment in the building and clothing trades. While the exact percentages in the two latter industries are probably greater in this state than in the country as a whole, it is clear from other data that they will generally average higher than the metal trades.

The inclusion of unemployment due to sickness and strikes, not a large amount on the average, when compared with unemployment due to lack of work, does not materially change the curves of the charts, except at a few points in the clothing trades.

Present Abnormal Unemployment vs. Unemployment in Normal Times

The present situation is not normal, the average unemployment, estimated frequently at about 10 per cent of all manufacturing employees, having risen to about 25 per cent (the percentage arrived at by the subcommittee on statistics of the Unemployment Confer-

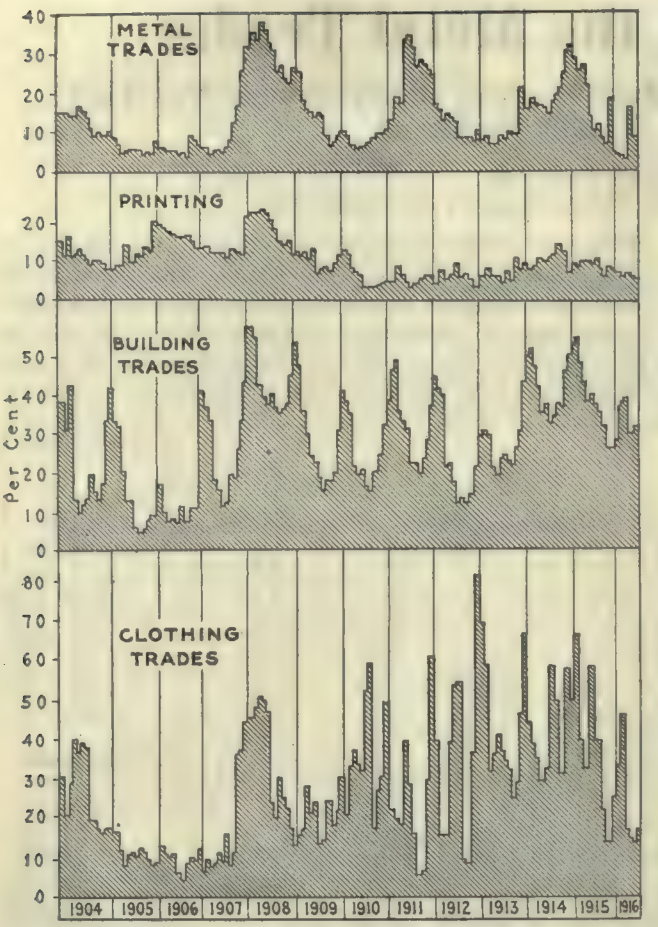


FIG. 2. PERCENTAGES OF UNEMPLOYMENT IN FOUR INDUSTRIES IN NEW YORK STATE, BY YEARS, 1904-1916

ence) as a rough approximation. The four million persons now unemployed should shrink to between a million and a million and a half during normal times. A period such as the present affects even such stable industries as the metal trades.

Production Costs and Selling Prices

By John R. Godfrey

When Johnson was going around the country getting dope on how to run machine tools to the best advantage, he also picked up a little other information on the side. And it opened his eyes wider than they've ever been before. He sort of boiled over the other night when we met on the train, and unburdened his soul of some of his discoveries.

"Godfrey, old man, we've been paying all our attention to the wrong thing in the machine business. Being mechanics we've naturally thought only of production and we've chased a dollar in this department 'til it begged for mercy. And all we've saved hasn't added a dollar to our bank account or saved the customer a cent. It gets lost down along the line long before it gets to him.

"We've plumb overlooked the fact that the cost of direct, productive labor is a darn small part of our total. We've crowded up on time, we've bought new machines and new steels to save a few cents in production time and thrown it away in cost systems and things which eat up more than we realize. But most of all we're weak at the selling end—hence the fancy salaries and commissions, the plaid trousers and the spats on the fellow who sells the stuff we make. Doesn't always know much more about a motor than a cat, but he has a line of talk that puts the name on the dotted line and he gets three times as much for that as the shop men for making the whole motor.

"I ran into one motor shop—a big one to be sure—where they have a wad of special high-priced and high-production machinery. The machine overhead is high, of course, but the labor cost on a four-cylinder motor block, complete and ready to assemble—is a shade over 60 cents.

"Another car that sells for about $1,100 has a total labor cost of $62 and one of the high-grade cars that sells at about $2,500 costs about $250 for labor. And then we waste our good time and breath talking about deflating excessive wages. Why if the men worked just because they liked to wear overalls and be away from home all day, the customer wouldn't know it when he bought a car—even if they took it off the selling price, which they probably wouldn't.

"You see Godfrey, there are so darn many factories building cars that are so near alike you couldn't tell 'em apart without the name-plate, that the selling costs eat up from 40 to 50 per cent of the selling price. On the big, fancy, build-one-once-in-a-while cars, its away above this. And it's all because there are too many people in the game. It's the cost of keeping up big show rooms in expensive buildings, of having Chesterfieldian salesmen to jolly the prospective victims, and all the frills that go with it—not to mention catalogs with tooled covers and costly wash drawings to show you what the car ought to look like, but doesn't.

"It's that sort of stuff we pay for whenever we buy a car, no matter what the make—excepting of course our little faithful Henry, that doesn't have to because it gives you real honest-to-goodness value for the price. After about 90 per cent of the present makers go to the wall, we'll buy automobiles just about as we do bicycles now—and at about half the present price.

"But what I'm getting to, Godfrey, isn't automobiles at all, but my own line of motors. And that's almost as bad except that, as we haven't a retail trade, we don't have to pay rent for fancy show rooms. What I want to know is, how can I cut out a lot of indirect labor such as superintendence, selling costs, etc.?

"If I can do this and reduce my selling price, can I expect a larger demand? Or, are there too many motor builders now and if so am I in the list of 'stayers' or 'goers'? Does it mean consolidation or elimination in my particular case? I don't want to kid myself into thinking I've got a good chance to survive, if I haven't. I'd better quit now while my credit is still good, at least.

"I'm dead sure we have too much motor building capacity in the country for a long time to come. That means we've tied up altogether too much capital in the industry. It ought to be working somewhere else. Perhaps I ought to quit voluntarily and go to raising hell—or chickens, down on my farm. Wish you'd think it over and let me know what you think about it, Godfrey. Haven't given you a chance to say a word, I know—but drop in and talk it over with me soon."

Johnson touched a tender spot with me in his monologue. He's dead right about the overcapacity, but I don't see him among the quitters by a long ways. I believe he'll work out a way to stay in the game because he likes it and knows it and thinks it well worth while.

Organization and Management of the Small Shop

X. Qualifications of a Successful Executive—Co-operation Between Producers and Management—Taking Employees Into Confidence—Modern Business Ethics

BY ELMER W. LEACH

IF YOU glance back through the several articles of this series and notice that each one deals with a separate and distinct phase of small shop organization and management with which you must be familiar if you are to be successful, it may cause you to suspect that in order to profitably conduct a small manufacturing business you must be a many-sided specialist.

You may become discouraged through the belief that you must have a thorough training in every branch of business conduct, and a super-human master mind with which to guide and direct your operations. But the successful business men of the manufacturing industry have not necessarily possessed those characteristics. True it is that when we are privileged to hear some prominent national figure we usually recognize in his make-up a certain mysterious magnetism of personality and influence to which we can readily credit the ability he has evidenced in business.

Yet if we stop to analyze those seemingly mysterious qualities, we find they are made up of quite commonplace virtues, not at all as complicated nor as impossible of duplication as we had at first supposed.

I have heard inspiring talks by big men on such subjects as "Principles of Extending Credit," or the "Relation of Advertising to Sales Return;" and though my interest was held from the first to the very last word, and though I was unquestionably listening to a real message, I found in many cases, after I had had an opportunity to think it over for a few days, that a number of the thoughts the speaker had presented were facts which I already knew or methods with which I was already familiar. The obvious things, which we may not have stopped to consider as important, are usually coupled together to produce the sort of bigness that goes with success.

To be successful requires ability, but it need not necessarily be the sort of ability that requires a university degree or a linen collar. If a man knows how to work hard and is willing to work hard, if he understands the product he is making and the market he is entering, and if he knows how to judge the relative value and importance of things, he stands a mighty good chance of being favored by Fortune with a successful career. I say a man must know how to work hard, because nothing comes easy in business. There is a definite ratio between effort and return; and the man who believes he has a "duck soup proposition" should quit before he starts.

When we come to a hill we don't shut off the gas—we step on the accelerator harder than ever to give the car the greater power that will send it over the top on high. And it is exactly the same in business. We are confronted with a succession of hills and valleys, and when we come to the hills we must step on it *hard* if we are going to make the grade. In these days the grade is especially steep, and it is certainly hard to understand why some men should accept conditions as an excuse or an alibi to "lay down." Present conditions have proved a real opportunity to the men with clear vision and foresight, and where one man slows up because he lets people tell him that business is rotten, the other man steps on the gas and gets the business that was there for the going after.

A man must also not only be *willing* to work hard—he must *enjoy* working hard. You can no more expect to be successful in business if you do not enjoy your work than you can hope to have a real home if you are not happy in its development

When you are employed by someone else, you are given a certain kind of work to which you are probably particularly fitted. That is your task, and because of your aptitude for it, you enjoy doing it. But in business for yourself, there is an ever-changing variety of tasks, some pleasant, some very unpleasant; and there must be a spirit of willingness showing up plainly as you tackle each job to make way for the next job. Picking the easy job out of the bottom of the pile never gets the top of the pile cleaned up. It is the conquering of something that was difficult that should give a man the greatest satisfaction.

We have talked before of the necessity of knowing your product and your market. Business conduct depends on facts, not on guesswork. And yet I am sure that the man who said "Only fools are certain, wise men stop to think," must have been in business, for certainly the soundest business is at times and in some ways uncertain. And when those uncertainties crop out and present their annoying perplexities, it is the man who can base a decision or a judgment on *knowledge*, who is indeed fortunate.

For after all, it is not the facts themselves, but the ability to use them, upon which business decisions depend. If you could conduct a business with mere facts, you might buy an "American Machinists' Handbook." It contains more facts than you could memorize in a hundred years. But the "American Machinists' Handbook," simple and complete as its tables may be, must be backed up by the ability to think if those tables are to be usable. The ability to determine the relative importance and value of things is truly (if I may quote Shakespeare) "A consummation devoutly to be wished."

In the early days of your small shop you will probably be "the whole cheese." Your volume of business, your limitations of capital, and a number of factors will combine to keep you busy on detail work of various kinds. But there comes a time when you may have a man who puts in his entire time packing and shipping. You wonder if he can be entrusted with the detail of making out the bills of lading, or marking the crates, or determining the roads over which the shipments should be routed, or deciding upon the sequence in which the orders should be filled. Right there is where you will sink or swim, according to your decision. A man's ability as a manager depends upon his ability to divorce himself from detail work. If you cannot have confidence in that other man's ability, and through that confidence clear your own mind so it is free to grapple with bigger problems of broader scope, your small shop will always be small.

The value of your own time depends entirely upon how it is limited by the valuation that you place upon it through the way you use it.

I know a gentleman who a year ago owned a substantial interest in a comparatively small manufacturing plant that bid fair to develop into a much larger organization. But he was always complaining that he had so much to do that he didn't know where to start. His partners soon sickened of that sort of thing, and arranged to employ a man who would take charge of everything that smacked of "office work," so that my complaining friend could devote his entire time to creative and experimental work, and be free from worrying about the details of shop supervision.

But the new arrangement didn't last ten days! Why? Simply because a man who had organized a business could not prove himself big enough to let someone else handle the details. It may be of interest to add that this gentleman is now working in a garage repairing cars when he might have enjoyed this year a good salary and a four-figure dividend besides.

One other thing that must be indelibly written upon your convictions is the fact that "times have changed since father was a boy," and the personnel of a shop is no longer divided into the two former diverging classifications of "the boss" and "the men."

There was a time when a man was only considered as a part of his machine, and labor was bought and bargained for the same as any other commodity. The theory that capital and labor had nothing in common was advanced, and possibly justly so. But those times are past; fortunately, we can believe that they are gone forever. There is no problem today that interests an employer so keenly nor to which he devotes more serious thought than the problems of his employees. He wants conditions in the plant to be such that the workmen will be contented and congenial. He wants them to know that their troubles are his troubles, and that they can always feel free to come to him for advice and counsel.

Employers now realize and like to have the men understand that they are not working *for* the management, but *with* it. True it is that age and ability give different men different capacites for accomplishment, and so to each one there is designated the niche that he is to fill in the scheme of things. But no individaul is independent of any other individual, and the same thing is true of groups. If there were no shop men, there would be no product to back up the merchandising efforts of the office force. And if there was no office force, the shop men could not dispose of the product they built. So the two groups are really one big group, and all kinds of effort are closely interwoven to produce the smooth running organization.

One of the things we like to have the men in our factory surely understand is that a part of the labor of every man in the plant goes into the building of the goods we send out on every order. When the men realize that fact, the fellow at a lathe does not think that his job is merely to machine castings. He gets the broader viewpoint—he sees that he is just as important a cog in the wheel of giving service and making sales as anyone. He is helping to get orders and to fill them just as much as are the sales manager and the shipping clerk. If his work is good, it helps make the finished product good and helps make that finished product easy to sell. If his work is turned out on time, he helps give prompt service and helps the sales department back up its promises of quick delivery.

So shop magazines, employees' clubs, welfare committees, and plans of self-government and participation in profits are finding their way into the management of factories, and employer and employees have closed the breach that was formerly supposed to keep them apart. Managements are taking their men more and more into their confidence regarding the progress of the business. The average workman in the average shop used to believe that about twenty-five cents out of every dollar of sales went into profits. A majority of them would have called their employers liars if they had been shown financial statements giving actual conditions.

But the new trend of practice has changed all this. It is a good plan to make up a chart showing the division of every dollar of sales. Probably material and labor take care of half of it. Then there is sales expense, interest, taxes, rent, depreciation, advertising, and a host of other items; and in any number of plants where employees might have thought that the war offered opportunity for hog-wild profit making, the chances are that not more than four or five cents out of each dollar of sales went into profit. But with the enormous volume of business that came with the war, it was sound judgment for most manufacturers to operate on a smaller margin than before. And when the men in the shop see what a slice of the dollar their labor represents, they usually can understand how little a drop in their individual efficiency it takes to entirely wipe out the thin slice for profit.

It has usually proven rather startling to make out a chart showing what it means if every man stays away from his work one day a month. Usually a man thinks, "Oh well, they'll never miss me today; they can get along all right without me." But if you figure that practically all the overhead expenses go on just the same whether every man is at his machine or not, and if you set those overhead totals up against the decreased production that results from every man not being on the job every day, you will probably give your composure quite a jar, and present yourself with some information well worth a lot of study.

A GUIDING THOUGHT

This article concludes the series in which I have tried to give from my own experiences in business some practices and theories that others might use as guideposts in charting their ships of promise through the uncertain channels that lie between the Sea of Insecurity and the Port of Sure Results. Though I have put a great deal of thought and work into the preparation of what has gone before, I should prefer that it all be forgotten as is the casual reading of an idle moment rather than have you overlook the thought with which I close.

And this is that thought: do not ever let the smallness of your shop prevent you from being big in the observance of the principles of business ethics.

Your shop, in fact, will not be known by the size that might show up in a photograph, but by the bigness displayed by the men who manage its affairs. That bigness will be evidenced by adherence to originality in design of equipment, by clean methods of advertising and sales promotion, by fairness in reference to or contact with competitors, and in other similar ways. If you have actually conceived the design of something new that seems to fit into some corner of the world's requirements, other manufacturers who may happen to be filling their portion of that same corner will not object unreasonably when you take your place in the crowd. True, they will take steps to meet the changed conditions which your competition may bring about; but as a general rule, their competition will be clean and above board as long as yours is.

Everyone in business is trying to get as much business as possible, trying to develop his business to as large a volume as possible; but we all recognize the other man's right to existence. It is only the trouble-maker to whom we deny that right—the man who upsets everything by his utter disregard of all that is fair and square.

Fortunately, mortality among trouble-makers is high; but even during their temporary intrusion they can tear down what may have taken years to build. For one thing, they are often content to follow the line of least resistance in designing their equipment. They are satisfied to "grab off a chunk" of the other fellow's market, rather than create a market of their own. Usually they are clever enough to be able to do this without making themselves legally liable, but such methods are typical only of the "fly-by-night" manufacturer, and the trouble-maker invariably pans out to be that kind of fellow. In going after business they overlook the possible merits of their own product, and play constantly upon the seeming faults of competitive goods. The world is too full of knockers as it is, and so the man who tries to market his own product by knocking another usually fails.

I like a booster. I should think that everyone would like a booster, even though he might be one of the "toot your own horn" type; for in business it is often necessary and desirable to do a little horn-tooting to call attention to something you may want to emphasize. We are all proud of the man who is trying to lift himself up by building his own organization of bricks that are solidly cemented into place, one carefully laid on the one underneath; but only a very few (and the value of their support is most questionable) approve of the man who tries to make an entering wedge by featuring possible weaknesses in products he may be wishing to replace.

THE SPIRIT OF MODERN BUSINESS

Co-operation has placed a new meaning to competition. Through trade associations and other agencies we are meeting our business competitors on equal ground to discuss together our common problems. A spirit of mutual helpfulness has taken the place of the old-time suspicion that made your competitor step over to the other side of the street at your approach, or become visibly uneasy around the collar when circumstances may have made it impossible for you to avoid collision. Those were the methods of "the old school." Only in very exceptional cases will you find them practiced in the business world as you will enter it. It is well that you should know of these new conditions, for when a shop is small, the time frequently comes when some slight variation from common practice may appear to bring an advantage. But the advantage is always temporary, if it is there at all, and the reaction at some later time will surely offset any possible gain.

In contrast to the shop where copying of design, duplication of sales methods, cutting of prices or rates, indiscriminate extension of credit, haphazard granting of dealer's or jobber's terms without definite knowledge of the established standing of that dealer or jobber, is that new type of manufacturing shop that I ask you to keep ever before you as the ideal after which your own business will be patterned. It may be housed in a small building, but in its unpretentious way it is setting a mark in its own sphere of influence. By the honest methods which characterize its conduct, and by its careful avoiding of all that has been proved detrimental to the best interests of men in business, it has definitely proved that there is a logical place for the small shop in the field of manufacturing endeavor.

To the owner of such a small shop, I cannot help but wish that we might draw aside the curtain which hides us from the future, and catch a glimpse of what a few years of effort will bring to him. I am sure we would see a large plant of which he might justly be proud; we would see a distribution of his product that would indicate a real accomplishment in merchandising; we would be shown a financial statement that would reflect unquestionable ability as a business leader.

Truly, it would be a small shop grown big through organization and management.

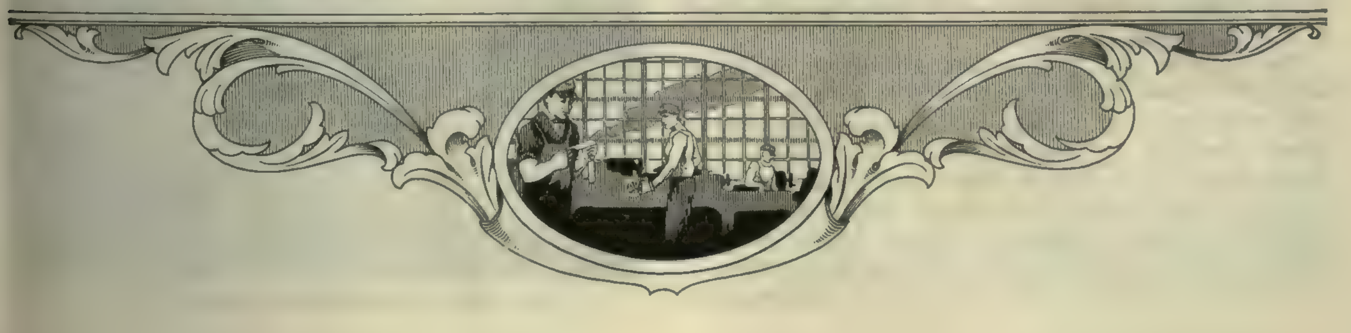
Piston Work in Motor Repairing

By F. L. Nichols

I would like to add a little to the author's remarks on the fastening for piston pins, in the article on piston work in motor repairing, page 473 of the *American Machinist*.

Don't use casehardened setscrews with fine threads. A heat-treated screw is all right, but casehardened ones jar loose on this job quickly. I might also add that this holds true with adjusting screws on valve lift rods.

As to the oil holes in the piston pin, if you must put them in, be sure to put them toward the side in the piston rather than at the top or bottom. I have in mind two makes of cars built several years ago. Both used a hardened pin with a hardened bushing in the piston end of the rod; both used splash oil feed; both had two countersunk holes in the top of the rod to feed oil to the pin, with pins of practically the same size in both engines. The cars in which pins without holes were used would run several years without having to have new pins. The other make of car had four holes at the top and bottom of pins, allowing oil to dodge out when the pressure came on the pin and the engines would knock badly if new pins were not fitted each year.



Getting Airplane Details on a Manufacturing Basis

Economical Methods in Radiator Construction—Soldering Tube Ends in Multiple—Punches and Dies for Fittings Made Adjustable by Insertion of Loose Pieces

SPECIAL CORRESPONDENCE

ONE of the necessary requirements for the development of the airplane industry is a simplification of design and sufficient standardization to enable parts to be built in large enough quantities so that the price may be brought within reason. It is interesting to note that the Curtis Engineering Co., Garden City, Long Island, N. Y., is making strides in this direction, two interesting examples being illustrated herewith. Fig. 1 shows a completed radiator which can be applied to a nuumber of different types of planes, while Figs. 2, 3 and 4 show how this radiator is being manufactured in a business-like manner.

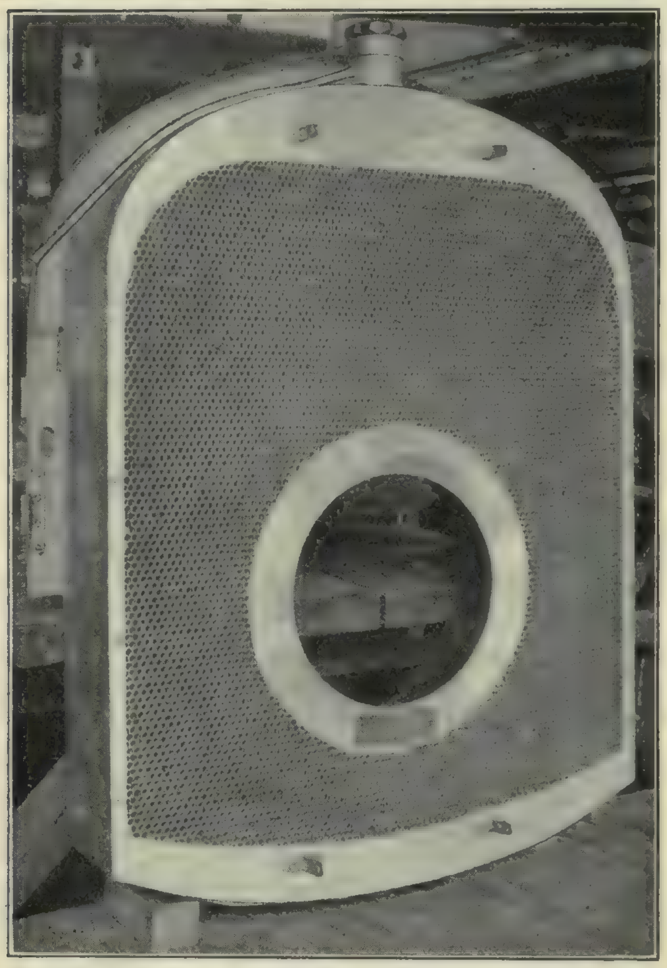
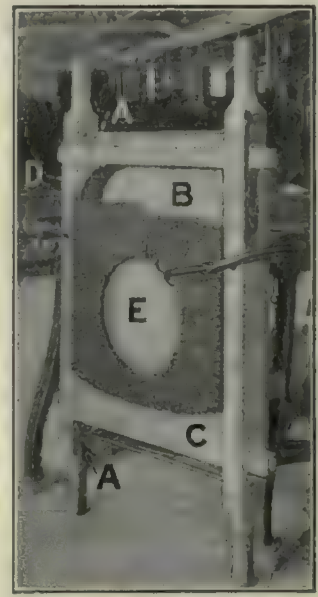


FIG. 1. COMPLETED AIRPLANE RADIATOR

The radiator core is composed of short copper tubes, having the ends expanded into hexagon forms, so that they will nest into a regular honeycomb design without special handling. These tubes are assembled in the frame shown at *A*, Fig. 2, which is clamped against a bottom board *B* so as to locate all the tubes endwise. The lower form *C* shapes the bottom of the radiator and the corner pieces *D* round off the upper corners.

It will be noted that the tubes do not fill the entire space, but are laid in around a circular piece *E*, which leaves an opening for the engine shaft where it projects for the propeller hub connection. A completely filled form is shown in Fig. 3, the tubes being all ready to have the ends soldered.

The soldering is done as shown in Fig. 4. Extra clamps are put on the mould, as at *A* and *B*, and two men then handle the core as shown, lifting it away from the bottom board and dipping it first in the acid tank at the left and then in the melted solder, as shown in the illustration. Suitable gas flames keep the solder melted and enable the radiators to be very quickly handled. By using this frame, which allows both ends of the tubes to project as much as necessary,



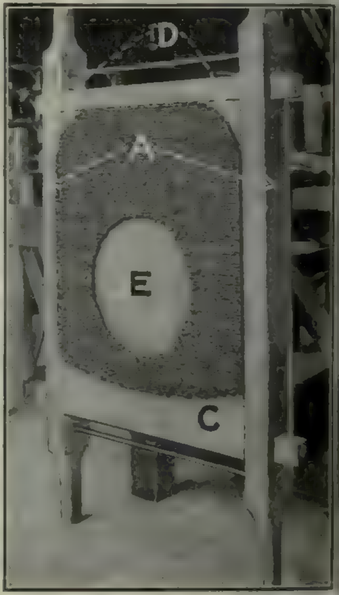


FIG. 2. FILLING THE CORE FRAME. FIG. 3. FRAME FILLED READY TO SOLDER

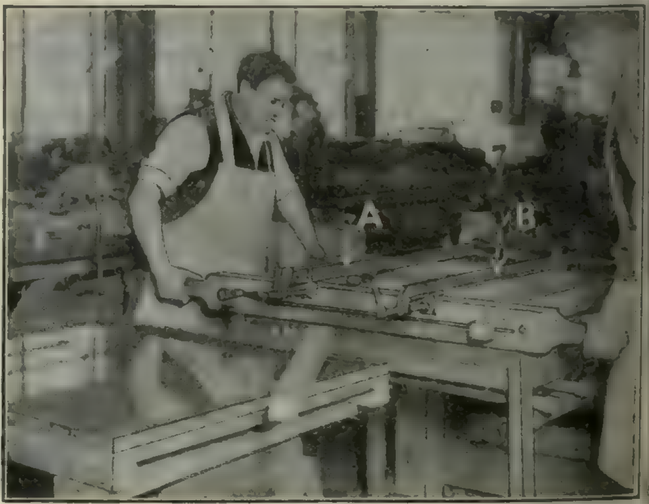
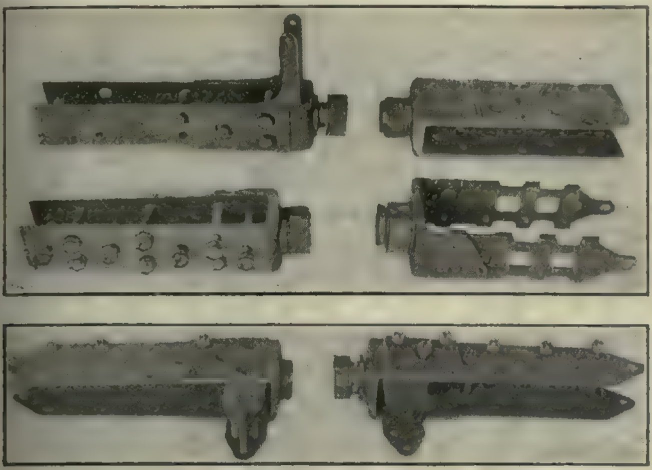


FIG. 4. SOLDERING THE TUBES

both ends can be easily soldered by simply reversing the frame.

Several fittings used in attaching wing sections to the fuselage are shown in Figs. 5 and 6. Fittings of this kind have in many cases been extremely expensive owing to the fact of their being built in very limited quantities, and in some cases, machined from solid forgings.



FIGS. 5 AND 6. AIRPLANE FITTINGS FOR WINGS AND FUSELAGE

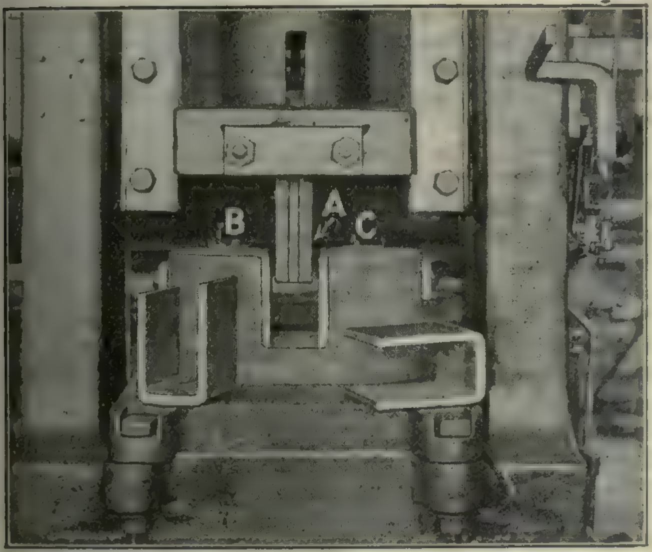


FIG. 7. ADJUSTABLE PUNCHES AND DIES

As a method of reducing costs in cases of this kind, the Curtis company is forming some of its fittings in the press shown in Fig. 7, using very simple punches and dies, as can be seen. The punches are built up of flat steel, and can be easily varied in width, as shown at *A*. The side pieces in the die at *B* and *C*, can also be easily changed to suit the particular fitting. Two of the pieces formed are shown in front of the die.

The way in which the fittings are used can be seen in both Figs. 5 and 6, particularly Fig. 6. Here the formed fitting is supplemented by a comparatively thin sheet steel lining which extends as far as necessary along the spar or other wooden part of the wings. This has greatly reduced the cost of many of the fittings and is a step in the right direction. These costs add tremendously to the expenses of building safe and substantial airplanes and it is only by findnig less expensive methods, especially as to the time required, that commercial aviation can be stimulated at this time.

American Tractors in Foreign Lands

Modern implements and tractors are now being extensively used in Tunis, according to a report received from Consul Harris N. Cookingham, at Tunis, and the demand is increasing, owing to the fact that the area of land under cultivation is being gradually extended. The labor shortage, which is particularly acute during the harvesting season, is a factor which has an important bearing on the demand for implements which are required to supplement the deficiencies of th labor supply. The sizes of the farms vary from 600 to 750 acres, and the purchasing power of the owners of fairly large farms is sufficient to enable them to purchase modern implements. The United States supplies most of the implements used in Tunis.

There are at present about 600 tractors in the country. In introducing tractors there is a certain amount of conservatism to overcome, but once the farmer is convinced of the superiority of mechanical traction over the draft animal, he becomes very enthusiastic about tractors. The farmer's lack of knowledge of the intricacies of machinery and motors and the lack of good mechanics in the country are serious drawbacks, and the importance of service in connection with the sale of machinery, and especially of tractors, can not be too greatly emphasized. The types of tractors best suited for use in Tunis are not specified in the report, nor the horsepower required. Prospects for the sale of tractors in Australia are good, according to a report recently received from Trade Commissioner A. W. Ferrin.

The report mentions four obstacles to the introduction of tractors on a large scale, all of which, however, will in time be overcome. The most important of these obstacles is the adverse exchange rate, which raises the price of the American tractor to a point which the farmer considers nearly, or quite, prohibitive. The high Australian tariff is another obstacle, but under an amendment to the tariff act recently adopted, providing that tractors "which are not produced in Australia" shall pay a duty of 10 per cent instead of the 40 per cent duty now charged on all tractors, the duty will be materially reduced on those types not made in Australia. The decision as to the types of tractors that will be affected by the amendment has been left to the new tariff board, which has not yet been organized.

There are at present three Australian firms manufacturing tractors of the round-wheel type, and another concern, the Murnane Tractor Co., is now being organized. Of these tractors the Sunshine, manufactured by H. V. McKay, is the most important. The Jelbart, manufactured by Jelbart Bros., is an oil-burning machine, which is making considerable progress and which shows great economy in cost of fuel as compared with kerosene and gasoline burners. The third machine is manufactured by MacDonald Bros., who, while continuing work on their tractor, are devoting most of their energies to making road rollers.

American Cars Win Test

American cars, which made up the greater part of the entries, won the reliability contest held in Christiania on Oct. 1 and 2, according to a report from Consul General Alban G. Snyder, Christiania. The contest was over a route of some 700 kilometers; speed was regulated and was not to exceed 75 kilometers an hour at any place.

Hand Versus Machine Finished Bearings

The High Cost of Precedent and Prejudice—A Comparison of Machine and Hand-Finished Surfaces—Some Examples of Better and Quicker Work

By E. A. Dixie

THE editorial on page 571, Vol. 54, of the *American Machinist* under the above caption carries a sound workable suggestion which if followed would, I believe, revolutionize our present methods of finishing both cylindrical and flat bearing surfaces. But precedent and prejudice have such a grip on us that I fear it will be a long time before makers of machine tools will have the courage to finish flat and cylindrical bearing surfaces by machine. It will be a still longer time before they will be able to convince machinery buyers that properly machine-finished bearings are, at their worst, better than the best hand-finished ones.

People are accustomed to buying machine tools which have scraper marks on their bearing surfaces, yet nine buyers out of ten are not competent to distinguish a well scraped approximately flat job from a fancy piece of "frosting" which is anything but flat. To the uninitiated the poor job is usually more attractive than the good one. To an expert the fancy work of the ornamental scraper hand is an abomination. He knows that it is often a disguise put on to hide poor machine work. The less flagrant examples of real scraper "fitting" show undeniably that an attempt has been made to make the work flat and not fancy. But the average buyer of machinery does not know this or if he does he heeds it not.

The Fallacy of Hand-Scraping

Because some machined surfaces are not as accurate as some which have been finished by hand it is going to be a difficult job to convince the machinery buyers that any machined surfaces can be better than any hand-finished ones. For many years the fallacy has been accepted without question that the hand work of the highly skilled mechanic is very much better than the best examples of machine work. Sir Joseph Whitworth, one of the old-time mechanics and the most dogmatic engineer of his day, was responsible for much of this superstition. It was he who early in the last century evolved the method of originating flat surfaces by scraping three surface plates together in the manner now so well known. Whitworth's plates were probably flatter than any of the slides of any of the machines in his own or any other plant at that time. But we have advanced somewhat in machine design and construction since the days of Whitworth, Silver & Gay, Lathe & Morse and the other old-time machine tool builders of a hundred years ago. Conditions which may have been true at that time may be anything but true now. I think it was James Watt who wrote to his partner Boulton about as follows:

"The new boring machine is an entire success. It bores a hole so true that the hole does not vary in diameter from end to end more than the thickness of a half-crown piece."

A "half-crown piece" is about the size and thickness of our silver half-dollar. What would a mechanic nowadays think of work which would take a feeler gage the thickness of a half-dollar? About three years ago at Watervliet Arsenal I saw a hole bored 16 in. in diameter by about 70 ft. long in hard gun steel. When inspected that hole was found to be round and true to size within 0.002 in. and to be straight from end to end within 0.010 in. The hole referred to in Watt's letter was the bore of a cast iron pump cylinder possibly 6 to 8 ft. in diameter by 8 to 12 ft. long.

Another Trade Superstition

Somehow, many years ago, the erroneous idea originated that if a bearing is ground (lapped), the abrasive remains charged into the metal and will for all time continue to cut. That fable spread from one mechanic to another and from one generation to the next until now it is generally accepted throughout the trade as true. The sole reason why it is accepted is because most of us are too lazy to investigate. It is easier to accept it than to prove that it is or is not true. Within the past two months I have heard it repeated by a man who formerly was one of the most highly skilled toolmakers in this country and who now is considered one of our greatest machine tool designers. He was warning one of his toolmakers against lapping in a bronze bearing with crocus, "because you will never be able to get the crocus out again."

The writer of the editorial quotes that much scraper work is "digging holes in perfectly good bearing surfaces." He is right. I believe it is perfectly safe to say that there are no scraper hands who are capable of scraping a surface as flat or round as it can be machined. There are a few concerns who appreciate the fact that even a planer can produce practically flat surfaces. These concerns have the best planers, keep them in proper condition and employ only skilled men to run them. In this way they get surfaces which are practically flat and which, but for the ignorance, prejudice and precedents which hold the machinery buyers in slavery, would require no scraping at all. They are compelled by convention to do some scraping but even at that they are ahead of the game by having surfaces which are easier to scrape.

In the East is one concern which has had the courage to put out a number of high-grade machines, the flat bearing surfaces of which are just as they come from the planer. There is absolutely no scraping on their product and I have yet to hear of a single complaint regarding the accuracy of their work. But I believe their planed surfaces could be further improved by lapping them together, for the following reason:

At a certain manufacturing plant there are some machines which, in construction and design, are very similar to small metal planers. That is to say, they have a reciprocating platen which is mounted on a bed provided with V's. These machines are used for ruling the lines on glass diffraction gratings. This work is infinitely more accurate than the work required of any metal planer; the lines on the glass must be straight and equally spaced within approximately 0.000001 in. If they are not, the grating will show a "ghost," *i.e.*, a false image, which means that it is unsalable. These machines have been in almost constant operation for several years and I was informed by the man in charge that the slides do not show any signs of wear. There are two reasons for this, *i.e.*, their design and the methods used in their construction. Regarding the design; the sliding member is made the same length as the slides on which it moves. This is an element of machine design which should be more often employed. While it does not insure against wear, it insures uniform wear throughout the length of the bearing surfaces.

However, the most important factor in reducing wear is the method of finishing the bearing sufaces. Before describing it I will digress for a moment to give the reader some idea of the rigid conditions under which these machines are operated.

They are in a vault far under ground. The temperature is controlled by means of a very sensitive thermostat connected with a bank of electric lamps. After the work is placed and the machine started the ruling of the lines is automatically carried on to the finish without any supervision whatsoever. If a man goes into the vault and remains but a few minutes, the heat of his body will influence the thermostat which in turn will shut off first one of the lamps, then another and another until either he or the rest of the lamps go out. The machine is driven by a water motor which is supplied with water at a constant head from a tank which is kept always overflowing. This gives an almost uniform drive.

How the Machine Was Built

When the machines were built, the slides were planed and scraped but the final finishing was done by lapping. The upper member was used as an ordinary lap and the operator pushed it back and forth till the ways were finished. The first set of ways when finished were rigidly inspected and found to be out of parallel. The cause was traced to the radiated heat from the operator's body. Correction was then made by the operator, using an iron hook several feet long. With this hook pivoted in a projection on the lap and his body screened behind a non-conducting shield, the work was this time brought to a successful conclusion.

If it is possible to finish such super-accurate ways in this manner there is no reason why ordinary machine ways should not be lapped to a high degree of accuracy, if some one only had the courage and initiative to undertake it. The saving would be considerable and the accuracy greatly enhanced.

Where I am now they build a grinding machine which falls within the "precision" class. The boss scraper is a highly skilled man and he tells me that it takes about 10 hr. to scrape the sliding member to fit the bed. I am satisfied that this work could be better done by lapping, and in less than half the time.

At the Landis Tool Co., Waynesboro, Pa., they use a "rubbing-in" machine. After the scraper hand has put the red "marking" on the work and placed the sliding member, one end of a connecting rod is pivoted to it. The other end of the connecting rod is pivoted to a crank which is driven by a pulley and belt. When the machine is started it causes the sliding member to be rubbed back and forth on the bed, its function being merely to show the bearing. If instead of being used with marking, the rubbing-in machine were employed as a lapping-in machine with a suitable abrasive on the sliding member it would finish the bearing. Further, one man could probably operate several of these machines and each one of them would no doubt be able to turn out more and better work than any scraper-hand and at a fraction of the cost.

In the preceding paragraph I have used the term "suitable abrasive." It is possible that the harder abrasive such as carborundum, alundum, emery, etc., might be too hard for such work; if so, there are other abrasives which have been tested and found to be suitable for similar work.

Machine Work Better and Quicker

One of the largest boring mill manufacturers in this country formerly scraped the spindle journals and bearings of his mills. If my memory serves me right, this operation on a certain size of mill took about 9 hours. They now lap to a bearing direct from the turning and boring. Both the members are cast iron and the abrasive they use is ground Turkey stone with oil. The bearing is 50 per cent better and the time for finishing has been reduced to half an hour. When lapping, one must remember that the cutting efficiency of the abrasive can be readily controlled by modifying the lapping lubricant. Generally speaking, a thin oil such as gasoline or kerosene will cause the abrasive to cut more rapidly than a thicker oil. If a viscous oil or grease be used, the abrasive action of a finely powdered abrasive can be entirely suspended, the film of lubricant being thicker than the distance the abrasive particles project above their seats in the metal members being lapped.

There is, however, no sound reason why the harder abrasives should not be used. One of the large manufacturers of high-grade Corliss engines grinds-in (laps) his Corliss valves with carborundum, which is next hardest to the diamond. He tells me that after many years' experience with this method of fitting his valves, he has yet to see a case where the carborundum has given any trouble or caused the valves or their seats to wear unduly. If the work is properly done, valves thus seated have practically a 100 per cent bearing, which is about 50 per cent better than the best scraped bearing. There is therefore every reason why they should give better and longer service.

If carborundum gives such excellent results when used to lap-in cylindrical bearings, I see no reason why it should give any less desirable results when used to lap flat bearings.

Some months ago I had occasion to require three plane surfaces of cast iron. These were to be as flat as it was possible to make them and for this reason it was decided that they should be lapped together. Great care was taken to plane them true and after this it was decided to have them scraped in order to save time during the lapping operation. An expert scraper was instructed to make them as flat as he could, time being no object. The plates each contained about 325 sq.in. of surface. The scraping time was about 20 hr. for the three. When they were tested on a standard surface plate they were found to be flat, as scraped surfaces go, and to have a good uniform bearing, quite good enough for the start of the lapping operation.

For the information of those who have never lapped a job of this sort I may mention that the procedure is exactly the same as when originating three surface plates by scraping; *i.e.*, No. 1 is lapped with No. 2; then No. 1 with No. 3; then No. 2 with No. 3, the lapping and changing being carried on till any two of the plates tested together will show a bearing all over, not in spots as with a scraped surface.

I am now sorry that I did not keep a photographic record of that lapping job. The scraped plates which seemed so accurate when tested with a standard scraped surface plate showed up very badly when the lapping abrasive took hold. There were areas which did not show any bearing for several square inches until quite a while after lapping was begun. Besides these areas there were twists and winds which were never suspected till the lapping showed them up in all their crookedness. Owing to certain conditions which the plates had subsequently to fulfill (and partly due to our ignorance) we used a very fine grain of carborundum (60-minute powder). For this reason the lapping took a long time, about two days. But when the plates were finished they were flat. We have since made several sets of these plates lapping them directly after planing, and have finished them in considerably less time than it took to scrape the first set. The lapping operation is done entirely by machine, the operator merely supervising the work. Gasoline and kerosene are used as a lubricant during the lapping operation. When the plates are finally pronounced correct they are thoroughly cleaned off and run together dry. After running thus for a short time there seems to be no further cut left in the abrasive which is supposed to be charged into the plates.

In conclusion permit a few words regarding the comparative accuracy of hand and machine-finished precision plane surfaces.

As an experiment I tested a block of hardened steel which had been hand lapped by an expert. In my kit I have a machine-made optical flat which is accurate to $\frac{1}{10}$ of a light wave length; in other words, it is accurate to approximately 0.000001 inch.

On testing the hand-lapped job it showed nearly half a ten-thousandth out of flat while a number of machine-lapped blocks were within from 0.00001 to 0.000003 in. of being flat.

I do not know whether I have proved my case, but I believe I have advanced some evidence that machine-finished bearings, both flat and cylindrical, can be more accurate and cheaper than hand finished ones. I believe I have also submitted some fairly conclusive proof that there is nothing to fear from abrasive charged into the metal of bearing surfaces. It is now up to the manufacturers of machines to do a little experimenting along these lines to the end that they may be able to reduce their costs, improve their product and be in a position to convince skeptical buyers that machine-finished bearing surfaces are better in every way than hand-finished ones.

Increasing Output by Preventing Tuberculosis

The problem of labor turn-over must always be considered in any plan of efficient production. This is a truism, of course, but how many production engineers have considered labor turn-over as involving not only the worker who leaves his job for another but the worker who leaves his job for a hospital or grave?

The bare statements that no less than 700,000 men and women of working age in this country are afflicted by a preventable and curable disease and more than 92,000 of them die annually from this disease, sound startling. This is the case, and tuberculosis is the disease. Yet the 92,000 or more workers who die from tuberculosis are only 70 per cent of the total death roll from this disease. During the past year 132,000 persons of all ages died from tuberculosis in the United States.

In addition to the million active cases of tuberculosis existing here, it is estimated that there is also at least another million persons who have the disease in a latent or quiescent form. The ever-present danger to this latter group is that at any time over-exercise, unwise living or a slight reduction in their powers of resistance may cause the disease to assume an active and frequently fatal form.

The economic loss due to tuberculosis has been estimated at no less than a half billion dollars annually. Worst of all, it is a loss which can be avoided, since tuberculosis is preventable and curable.

The National Tuberculosis Association which now has 1,200 affiliated organizations in all parts of the country, is carrying on a widespread campaign of education in respect to the nature of tuberculosis and the effective means of combating it. Despite great odds, this is a winning fight, for in the fifteen years since the association began its work the death rate from tuberculosis in the United States has dropped from 200 to 120 for every 100,000 population. Statisticians estimated that in view of the present population this reduction of the death rate means a clear saving of 75,000 lives a year.

One every important phase of the educational work of the association deals with tuberculosis in industry. Here the problem resolves itself into various phases. Prevention of infection is sought by furnishing safeguards against spitting, sneezing and coughing. To build up and maintain the resistance of the individual constant health education of workers and periodic medical examinations are given.

In regard to the return on such an investment in better conditions, the National Tuberculosis Association has estimated that on an average two and one-half years could be added to the average life-time of every individual in the United States if tuberculosis were removed as a cause of death. This would mean a gross saving of at least twenty-five billion dollars to the industries and people of this country. To remove the disease or reduce it to a negligible minimum would cost probably in the neighborhood of two billion dollars.

The purpose of the National Tuberculosis Association and its allied agencies is to unite communities all over the United States in order to secure the machinery and assistance necessary to prevent and control tuberculosis. The Fourteenth Tuberculosis Christmas Seal Sale which will be held in December of this year provides the revenue for this great health and life-saving movement. Every dollar's worth of seals purchased means a blow aimed at this disease.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Tools for Forming a Flanged Cover

By H. Schmid

On page 403, vol. 55, of *American Machinist*, S. A. McDonald describes a set of tools for forming a flanged cover in three operations following the blank and draw. Here is one that forms a similar cover in *two* operations, *including* the blank and draw. The cover, of 0.025-in. brass, is shown in Fig. 1, and in Fig. 2 may be seen in outline sketch the tools that complete it. As the blank and draw are accomplished by standard tools differing in no respect from thousands of others, the preliminary operation will not be considered. Referring to Fig. 2: *A* represents the cover as it comes from the first operation, in place in the forming tools at the beginning of the press stroke. The recess in the upper die *B* is made to conform to the shape of the upper half of the flange, while the remainder of the shape of the cover is in the lower die *C*. The block *D* fits the inside of the blank. All of these pieces are, of course, made of tool steel and hardened.

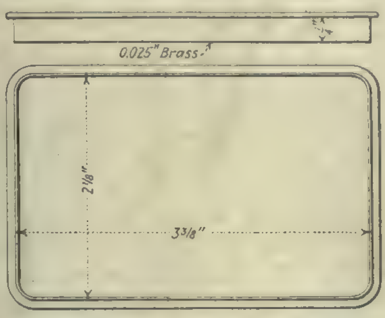


FIG. 1. THE COVER, BLANKED AND FIRST DRAWN

The plate *E* is also of tool steel and acts against studs *F* (of which there are several) to strip the finished cover.

A rubber bumper of the usual form encircles the stud *G* and acts against a plate (not shown) to lift the block *D* as far as the limiting screws *H* will allow, at which time the bumper plate abuts against the under side of the die shoe. As the press gate nears the end of its upward movement, nuts on the draw-rods *I*, attached to the upper tools, strike the plate *E* and carry it further into the recess in the under side of the die shoe, stripping the cover through the rods *F*.

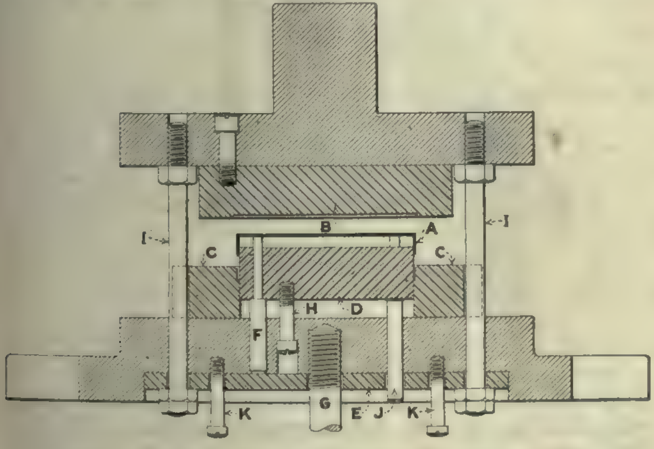


FIG. 2. TOOLS FOR COMPLETING THE COVER

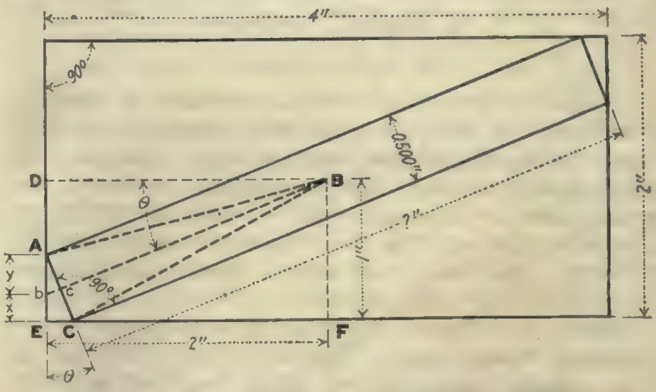
The rods *J* bear upon the lower bumper plate and thus the block *D* follows the upper die *B* with the cover clamped between them until the bumper plate reaches the upper limit of its movement, after which rods *I*, plate *E* and studs *F* strip the cover. Screws *K* have no function other than to hold the plate *E* in place when the tools are out of the press.

In following the action of these tools it will be plainly seen that when the pressure comes on the cover there is no place for the metal to go but into the formed recesses of the dies.

Calculating the Size of a Gage Plug by Triangulation—Discussion

By Henry R. Bowman

This article gives a solution to A. D. Hallet's problem on page 31 of the *American Machinist.* The problem is to find the length of a gage 0.5 in. wide which will exactly fit in a rectangular hole 2 in. wide and 4 in. long.



LAYOUT TO DETERMINE LENGTH OF GAGE

The most practical method would probably be to set up four Johannson gage blocks at exact right-angles and the required distance apart, and grind the test gage carefully until it fits in properly.

The mathematical solution illustrated in the accompanying figure, requires the finding of the altitude of an isoscoles triangle *ABC*, where the apex *B* is the intersection of the diagonals of the gage and the side of the hole. The base *AC* equals 0.5 in., and the points *A* and *C* are touching the lines *DE* and *EF*, respectively.

It is impossible to construct the diagram, except by trial, as there are two variable factors, the angle θ and the altitude *Cc*. It is evident that the calculation must be performed by trial also.

On a piece of tracing cloth draw a line 0.5 in. long, bisect it, and erect a perpendicular line of indefinite length. Lay out on a separate sheet a rectangle 1 x 2 in. Adjust the tracing until the lines are in the proper position, as shown. Measure the angle θ with a protractor and it will be found to be about 22 deg.

The altitude *Bc* equals *Bb-cb.*

$$Bb = \frac{2}{\cos\theta}$$

$$bc = 0.25 \tan\theta$$

But the side $(x + y)$ divided by cos θ must equal 0.5, showing that the angle θ must be decreased. Therefore, a number angles must be tried until one is found which gives the required result.

Let $\theta = 21° 56' 36''$;

$$\text{Then } x = 1-(2 \tan\theta); \quad y = \frac{0.25}{\cos\theta}$$

$\frac{x+y}{\cos\theta} = 0.499992 +$, which is accurate enough for gage work.

$$bc = 0.25 \tan\theta = 0.100719 +$$

$$Bb = \frac{2}{\cos\theta} = 2.15620891 +$$

$2\ (Bb\text{-}Bc) + 2 \times 2.055489 = 4.11098$, which is the required length of the gage.

[Editors Note: A solution by C. E. Pearce to Mr. Hallet's problem appeared on page 400 of the *American Machinist.* Mr. Bowman's solution has been selected for publication out of a number of contributions, since it gives a very practical method, without the sustained calculation and the use of a biquadratic equation, such as in Mr. Pearce's and in most of the other solutions submitted.]

Logarithmic Formulas for the Solution of Right Triangles

By J. B. Conway

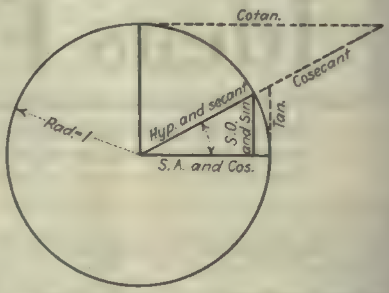
In making calculations for designs and in checking drawings, it is often desirable that logarithms be used, especially for the solution of right-angle triangles. On some classes of work this is necessary, owing to the great degree of accuracy that is required and that is obtainable by using "logs." When one is not accustomed to using logarithmic and natural functions of angles, considerable time may be lost.

Tables of different forms have been compiled and published from time to time to facilitate the use of trigonometric functions, but when logs are employed these rules must be converted into the terms of logarithmic functions before they can be used. It is to afford a ready guide for the solution of such problems that the following formulas have been prepared. The functions of the angle being given in terms of logs, it is necessary only to solve the equations as they stand.

$$\begin{aligned}
\text{Log S.O.} &= \text{Log Hyp.} + \text{Log Sin } A. \\
\text{Log S.O.} &= \text{Log S.A.} + \text{Log Tan } A. \\
\text{Log S.A.} &= \text{Log Hyp.} + \text{Log Cos } A. \\
\text{Log S.A.} &= \text{Log S.O.} + \text{Log Cot } A. \\
\text{Log Sin } A &= \text{Log S.O.} - \text{Log Hyp.} \\
\text{Log Hyp.} &= \text{Log S.O.} - \text{Log Sin } A. \\
\text{Log Cos } A &= \text{Log S.A.} - \text{Log Hyp.} \\
\text{Log Hyp.} &= \text{Log S.A.} - \text{Log Cos } A. \\
\text{Log Tan } A &= \text{Log S.O.} - \text{Log S.A.} \\
\text{Log Cot } A &= \text{Log S.A.} + \text{Log S.O.} \\
\text{Log Sec } A &= -\text{Log Cos } A. \\
\text{Log Cosec } A &= -\text{Log Sin } A.
\end{aligned}$$

The diagram is self explanatory and is given for reference only. The abbreviations, S.A., S.O., and Hyp., are for side adjacent, side opposite, and hypothenuse.

In using logarithmic tables which give only the logs of degrees and minutes, leaving the odd seconds to be found by interpolation, the following formula will be found helpful in this respect, as very few log tables go into detail relative to this operation. First, let the difference between the log of the smaller and the next larger angle be denoted by *D*, which is given in most tables as the "tabular difference." Then let the odd seconds in the given angle be represented by *s*. To find the log of the complete angle we have,



FUNCTIONS OF A RIGHT-TRIANGLE

$$L = D \times \frac{s}{60} \pm \text{Log of the original angle.}$$

First drop the seconds in the given angle, and then find the logarithmic function of the remaining angle. Next find the tabular difference between this logarithmic function and the same function of the angle next larger in the table. Multiply this tabular difference by the number of seconds in the angle and divide the product by 60. Add this result to, or deduct it from the logarithm found, depending upon whether or not the logarithm to be determined is that of a function or co-function of the angle.

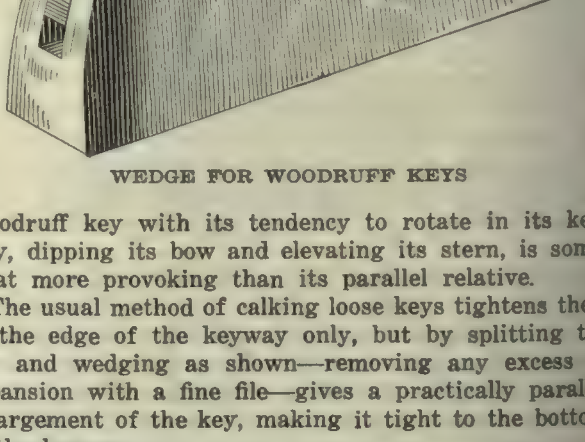
In finding the angle whose logarithm is given, when this angle has odd seconds, the same formula holds, with the exception that *s* and 60 are inverted in the equation.

Holding a Woodruff Key

By W. S. Rowell

The accompanying sketch shows a good method of overcoming that very exasperating condition—a loose Woodruff key.

Any loose key may be seriously at fault, but the Woodruff key with its tendency to rotate in its keyway, dipping its bow and elevating its stern, is somewhat more provoking than its parallel relative.


Saw cut and sheet metal wedge

WEDGE FOR WOODRUFF KEYS

The usual method of calking loose keys tightens them at the edge of the keyway only, but by splitting the key and wedging as shown—removing any excess of expansion with a fine file—gives a practically parallel enlargement of the key, making it tight to the bottom of the keyway.

EDITORIALS

Eliminating Hand Work

THE past decade has seen the elimination of much hand work in all sorts of machine building. Motor bearings, for example, which were formerly scraped and fitted by hand in all high-grade shops, are now finished by careful reaming with better and more uniform results. There are still a few exceptions but the great majority of high-grade motor manufacturers no longer fit bearings by hand.

This elimination of hand work seems to be more extensive in cylindrical work than on flat surfaces. A few machine-tool builders with excellent reputations for the quality of their product, have abandoned the scraping of such sliding surfaces as planer ways and similar parts, but most builders still consider it necessary. Careful attention to clamping so as to avoid springing, to seasoning to prevent change in shape, and in planing to insure accurate results, will make most of the hand work unnecessary. It is not a case of eliminating skill, but of replacing the skill of hand scraping, which is often laborious, by skillful planing.

Grinding is also a possibility in this direction which will doubtless be greatly developed in the future. But, whatever the means, there can be no question as to the necessity of finding a satisfactory substitute for hand scraping in many places.

But no matter how much of the laborious hand work we eliminate, somewhere along the line we shall need all the human skill possible. We shall not do away with the highly skilled artisan—only relieve him of much that is now laborious and make him more productive in other ways which require even more ability.

The Compensation of Approval

THERE are still many who profess to believe that a fat pay envelope is the only thing which appeals to the worker. But those who study the problem of industrial management with a broad point of view know that there are other important factors. High wages alone do not make for contentment, for harmony or co-operation, and not always for a large output.

Good pay is a prime requisite, not only to contentment but to general prosperity. For with just a bare living wage there can be no buying of the little refinements and household appliances, which not only make life more livable, but make many industries possible. Nor can there be any laying aside of the fund which is so necessary for the rainy day.

Whether the workers themselves fully realize it or not, there is an underlying desire for recognition of some sort, for approval of good work, for something which shows beyond question that they are a part of the institution. The idea of being only a number on the payroll does not appeal. They want to feel that they and their work are necessary to the turning out of the finished product.

They have no use for flattery or fulsome praise, and are quick to discover insincerity of any kind, but they appreciate consideration and fairness, and show this appreciation in many ways. They like to be consulted about changes which affect them rather than to have new rules posted without notice and with no reason given. Plants with means for communication between the men and the management, whether by committees, by works councils or otherwise, are almost unanimous as to the improved feelings which result.

This is a particularly good time to give this matter careful consideration and to lay the foundation for better understanding when business comes back in full force. When one shop can increase its output over one hundred per cent per man at a time when most shops were complaining of a falling off in production, there must be something in the difference in management. And this was accomplished without any incentive of piece work or bonus, but on straight day work, which many declare to be inefficient in every way. No manager who cannot point to a similar record can afford to be contented with his methods of securing production.

Standardizing German Industry

NEVER has the question of standardization been brought home to us with greater force than by Dr. Agnew in his report on the industrial standardization of Germany, which appears elsewhere in this issue. And no matter how we feel as to its advisability, it behooves us to give it careful study and attention.

There can be no question as to the advisability of reducing the number of parts to be carried in stock, and of eliminating unnecessary sizes and kinds of machines and fittings. Capacities of machines, sizes of motors, motor bases, etc., can well be standardized to the general benefit of the whole industry. Practices which are simply the result of accident or of tradition should be eliminated. Lowered unit costs might be made possible by mass production of larger quantities of many parts. This has been the case with bolts and screws for example, these being formerly made by each machine builder and to his own standard.

Standardization should be studied from all angles. There are many things which can be standardized to advantage, sometimes in a single plant, occasionally in an industry. Private and selfish reasons must not stand in the way of reducing costs in the use of machines and machine parts, even if it means wiping out some of our existing practices. But let us be sure that the proposed standards are really improvements and not mere changes to conform with some finely worked out theory.

Whether or not we decide to follow Germany in its wholesale standardization, we should keep thoroughly informed as to what is being done there and in other countries. We should also aid in the work of the American Engineering Standards Committee to secure desirable standards and to prevent the formulation and adoption of others which do not seem to be practicable. In any case we should bear in mind the effect on the industry, or the country as a whole, and not on the particular individual who may be affected adversely.

Shop Equipment News

Gray "Maximum Service" Planer

There are many features of design and construction worthy of note in the planer now being placed on the market by the G. A. Gray Co., Cincinnati, Ohio. Of particular note is the feature of centralized control. This can well be appreciated by noting in Fig. 1, the grouping of the controls at the operator's position on the right of the machine.

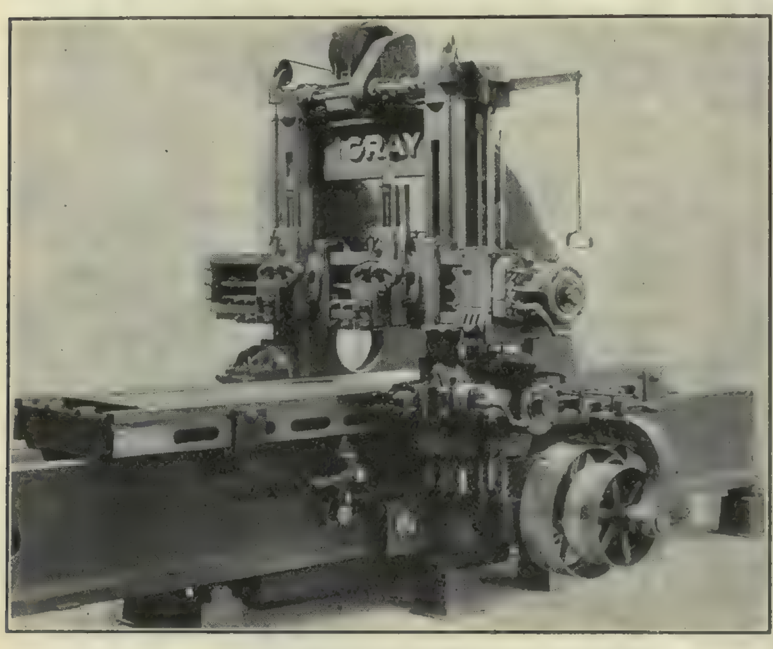


FIG. 1. GRAY "MAXIMUM SERVICE" PLANER

The feed motion is positive. It is adjusted by turning the knob shown at the operator's end of the cross-rail, until the required feed is indicated on the graduated dial. A partial turn of the wrist gives any feed from 0.01 to 1 in. in steps of 0.01 in. The feed dial is automatically locked as soon as the operator's fingers are removed from the knob. The feed mechanism for the rail heads is mounted on the end of the rail, and that for each side head is mounted on the head itself, being always within convenient reach. Rail-head and side-head feeds are entirely independent, so that one can be changed without affecting the other. Feed changes may be made while the planer is running. The large size of the feed dials, see Fig. 2, makes it easy to set feeds instantly, and to see exactly what the feed is at any time.

The rapid-traverse motion is applied to the side-heads, as well as to the rail heads. To move a head, the operator simply shifts the proper lever located on the end of the rail. Shifting the lever disconnects the feed for that particular head, engages the rapid-traverse mechanism and starts the small traverse motor in the proper direction. Moving the lever back to neutral throws out the rapid-traverse clutch, stops the motor and re-engages the feed. Neither the motor nor any part of the rapid-traverse mechanism is in motion, unless a head is actually being moved.

As the traversing mechanism is entirely separate from the feed mechanism, one head can be rapidly set for the next cut while the other head or heads are still feeding. Throwing in the traverse mechanism automatically disconnects the hand cranks, so that they do not revolve and endanger the workman. The rail head levers are at the end of the rail, and the lever for each side head is on the head itself. Shearing pins safeguard the traverse mechanism in case the rail heads are accidentally jammed together. Safety stops obviate the possibility of lowering the side heads too far.

To elevate the rail, the operator pushes up the stirrup hanging near the end of the rail, and to lower the rail he pulls it down. The stirrup is locked in the neutral position, but a quarter turn of the operator's wrist unlocks it. As this stirrup is suspended from a universal joint, the operator may stand in front of the rail, where he can see the position of the work and tools. The control is said to be so exact that the rail can be set to a line.

The motor that operates the rapid traverse also furnishes the power for the rail setter. One movement engages the elevating mechanism and starts the motor. Bringing the lever to the neutral position disengages the elevating mechanism and stops the motor. Safety stops obviate the possibility of raising the rail too high. Turning a crank on the operator's end of the rail releases or tightens the clamps that lock the rail to the housings. The automatic adjustment insures that the rail is clamped equally rigidly at both

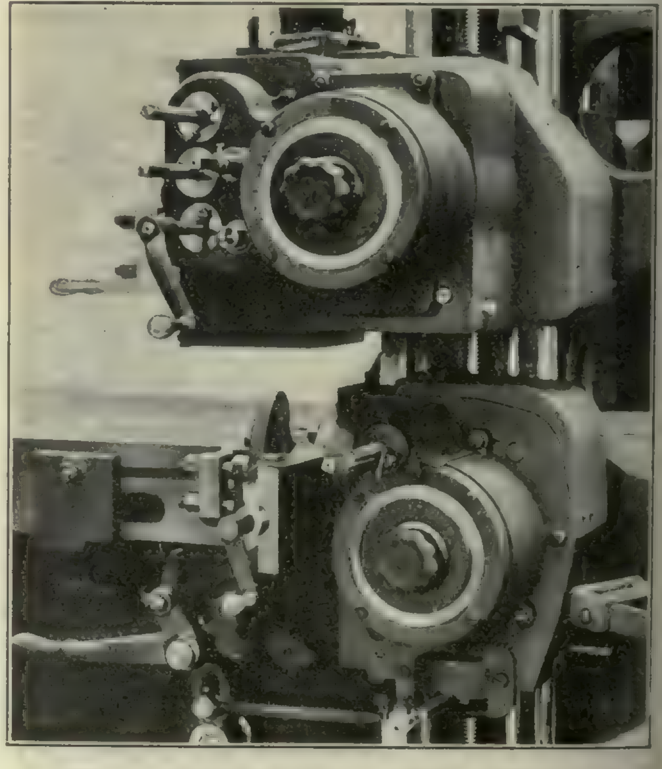


FIG. 2. ARRANGEMENT OF FEED CONTROLS

ends. The rail is locked to the inside of the housings, thus stiffening the rail, as it shortens the length of the rail subject to torsional strain. A moderate pull on the crank is said to clamp the rail more firmly than is possible with outside clamps tightened with a wrench. As the lever operating the rail setter is also on the operator's side of the machine, the planer hand can release the rail, raise or lower it, and reclamp it without moving away from the operating position. This saves time and reduces the idle time of the planer.

The result of these improvements is to bring the control of practically all of the functions of the planer to the operator's usual position. Besides the raising, lowering and clamping of the rail, he can, without moving from his position, set the feed on the rail heads or on the right-hand side head; traverse either rail head or the right side head quickly by power; set the micrometer collars on the rail screws so as to measure accurately the travel of the tool; and, of course, use the tumbler which controls the movement of the table. In doing these things he is in position to watch the tools and so avoid accidents. This is of importance, not merely because it adds to the convenience of the operator, but because the elimination of physical effect makes it possible for the operator to work fast without fatigue, and should result in more accurate work.

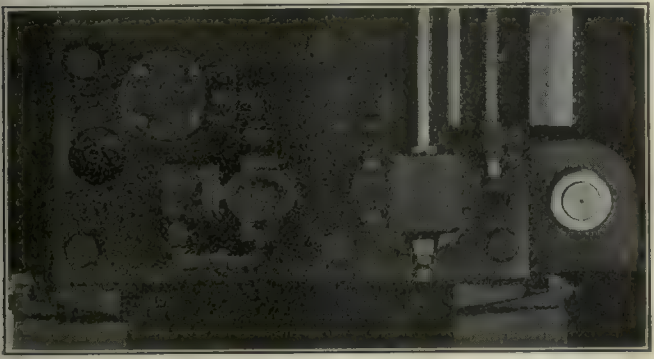


FIG. 3. POSITION OF OIL PUMP

The bed of the planer is made full length; that is, the working surface of the table never overhangs, even when taking the maximum stroke. In this way, the table is always rigidly supported, even when run out to the front end of the planer for setting-up work. By eliminating the table overhang, the wear that otherwise takes place at the ends of the bed is obviated. Incidentally, there is no dripping of oil on the floor from overhanging table V's.

The table is of box section, with an interrupted center wall running the entire length and tying the top and bottom plates rigidly together. The usual transverse walls and posts are also provided. All stop-pin holes open into the cored openings of the table, and are easily cleaned from the outside. Chips are removed through the openings in the side of the table.

All of the driving gears run in a bath of oil, so as to minimize wear and prolong their life. An oil pump, shown on the side of the housing in Fig. 3, is direct-connected to the drive shaft, and delivers a flood of oil not only to the V's but also to all of the drive-shaft bearings. The operator's time is thus saved, as he does not have to oil all of these bearings. The pump is of the reversible type, operating on the return as well as on the cutting stroke.

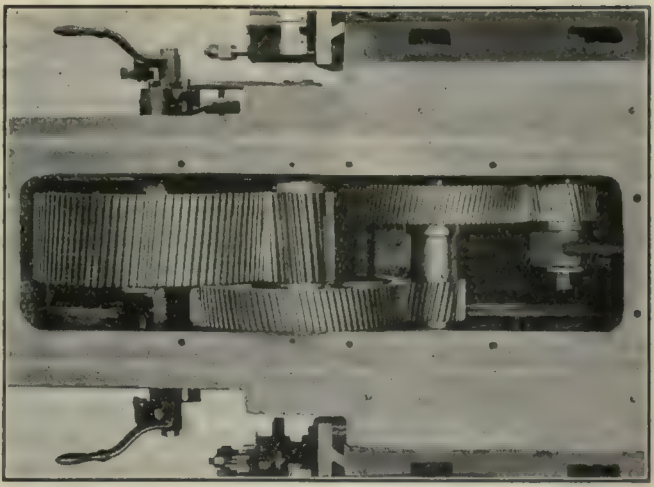


FIG. 4. HELICAL GEARS IN DRIVE ARRANGEMENT

From the pump the oil flows through a filter, the cover plate of which can be seen above the pump, and thence to a hole in each V at the center of the bed. Each table V has a large oil channel, running the full length of the V but closed at the ends. From this channel the smaller supplementary oil groves carry the oil to all parts of the bearing surface. By this means the oil supply is kept constant at all points regardless of the relative position of the table. The filter can be easily removed for cleaning.

The surplus of oil dripping from the table V's and rack flows through a screen into a settling basin at each end of the bed. The settling basin eliminates the fine metal particles entrained in the lubricant and which would otherwise be carried back to the bearings. The oil then flows to the center of the machine through the pump and filter, so that only clarified oil passes to the bearings and V's. The oil pipes are inside the bed, and there are no oil pans, channels or pipes in sight.

To simplify the oiling of other parts, central oil wells have been placed on the rail and side heads. Oil pipes lead from the central well to the different oil holes, so that the operator merely fills this large reservoir instead of many separate oil cups. This not only saves time, but also obviates the danger of overlooking inconspicuous oil holes. From the reservoir the oil is drawn through wicks by capillary attraction, so that only clean oil reaches the bearings.

One of the most important features of the planer is the gearing which drives the table. The involute helical gearing used is said to produce a drive of unusual smoothness, durability and power. All the gears are helical, the arrangement being show in Fig. 4. Helical gears are stronger than spur gears of the same pitch and width of face. They also give continuous pitch-line rolling, since there is always some point on the pitch circle where the mating teeth are in contact.

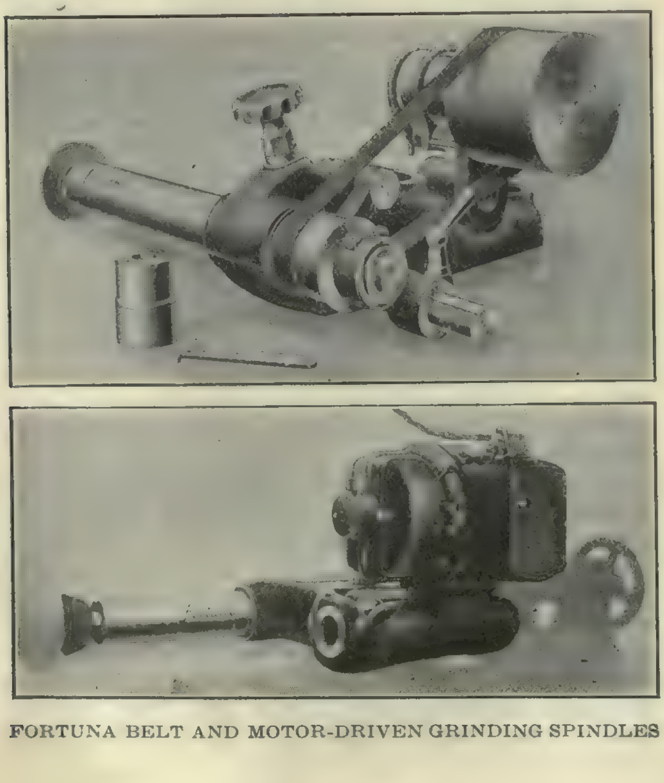
Advantage is taken of the fact that helical gears produce end thrusts, by arranging the rack so that the end thrust of the bull gear (which amounts to about one-tenth of the driving force) opposes and compensates for the side thrust of the cutting tools when they are being fed away from the operator's side of the machine, as is the case most of the time. As the tool pressure increases, the balancing thrust of the bull gear and pinion increases in proportion, for more power is required to drive the table. This equalizes the pressure and wear on the two sides of the V's, and overcomes the tendency of the tools to push the table up the side of the V's. The diameters and helical angles of the remaining gears of the train are said to be so proportioned that their end thrusts very largely balance one another. Bronze thrust collars, provided with forced lubrication, take the resultant end thrusts.

As planer work is usually placed close to the operator's side of the machine, the rack is accordingly placed slightly to the operator's side, so that the driving force will coincide as nearly as possible with the line of action of the cutting tools. The helical table rack is of unusual width, which gives great strength. The teeth have a very low pressure angle, greatly reducing the tendency of the bull gear to lift the table. The gear on the main pinion shaft is keyed to the pinion hub, thus relieving the shaft of torsional strain.

To insure correct tooth action, the teeth are cut by the generating process to true involute form. In order to avoid interference and to obtain smoothness of action and stronger teeth, the pinion teeth are so cut that the greater part of the tooth face lies outside of the pitch circle. The teeth have a low pressure angle, are cut full depth, and have a short arc of approach and long arc or recess, increasing efficiency as well as the number of teeth in contact. This form is said to have the advantage of permitting the use of pinions of large diameter and strong teeth, without the use of stubbed teeth, high pressure-angles and low gear-ratios.

Fortuna Grinding Spindles

The Fortuna internal and face grinding spindles have recently been placed on the American market by the Coats Machine Tool Co., Inc., 110 West 40th St., New York, N. Y. They are intended primarily for shops where no large grinding equipment is installed, but where it is necessary to produce accurately ground holes. The spindle is supported by substantial clamping blocks; short and stocky spindles are used. All attachments are interchangeable and the clamping blocks are built symmetrically, permitting quick reversing of the countershaft or motor, so as to enable the spindle to work to the left as well as to the right. The blocks are equally suitable for mounting on grinding machines and lathes. The spindles are equipped with "Norma" ball bearings throughout, and are made in three types.



FORTUNA BELT AND MOTOR-DRIVEN GRINDING SPINDLES

The Type J spindle is for internal grinding only where no heavy axial thrusts are encountered, the sizes of work handled being from ½-in. hole and 2½-in. depth of 2⅛-in. hole and a depth of approximately 20 in. Because of the simple bearing design, the spindle may be run up to 80,000 r.p.m., it is stated. It should work preferably in a horizontal position.

The Type D spindle is for both internal and face grinding. In addition to the annular ball bearings, the spindle is equipped with one axial thrust ball bearing, and may therefore be used for face grinding, employing a cup wheel. This type should also preferably be used in a horizontal position. If it is intended to use spindles of type J or D in a vertical or inclined position, they can be furnished with a special lubricating device. However, with the exception of the small spindles, type DD spindles are recommended for such purposes.

The Type DD spindle is for vertical internal anl face grinding. The spindle is equipped with double thrust ball bearings, and can therefore stand the heavier axial thrusts in each direction. They are, therefore, not only suitable for internal or face grinding, but also for grinding internal radial grooves. They may be used in any desired position. The minimum diameter to be ground with types D and DD is 1⅞ in. with a maximum depth of 9¾ in., and a minimum diameter of 4½ in. and a maximum depth 36 in.

With the aid of abrasive pencils, holes as small as 5/64 in. in diameter may be ground to a maximum depth of 13/32 in., or 7/16 in. with a maximum depth of 1⅜ in. The clamping blocks for holding the spindles are furnished either with closed or hinged bearings, for belt drive or with a built-in motor for either direct or alternating current up to 250 volts.

At the top of the illustration is shown a belt-driven clamping block of the hinged stype, holding a type D internal and face grinding spindle. At the bottom is a rear view of a type D internal and face grinding spindle, with a cup wheel held in a type A clamping block driven by a d.c. motor, and mounted on a lathe for face grinding.

Dusenbury Duplex Planer Tool No. 2

On page 969, Vol. 54 of the *American Machinist*, the Dusenbury duplex planing tool made by the Waltham Machine Works, Waltham, Mass., was described. The company has now placed on the market the No. 2 size of the tool, the toolbits being ½ x ¾ in. in size.

The tool consists of a cage mounted on a shank and carrying two cutting tools in such a manner that a cutting stroke can be made in either direction. This feature is especially adaptable to use on planers, so that a cut may be taken with both the forward and the reverse movements of the table. Each tool is held in a suitable clapper box, so that clearance is obtained for one tool while the other is cutting.

Pratt & Whitney Full-Automatic Engine Lathe

An engine lathe that is completely automatic in its movements—introducing and gripping the work, turning one or more shoulders to predetermined length and ejecting the finished piece, thus rendering it independent of its operator—has been placed on the market by the Pratt & Whitney Co., Hartford, Conn.

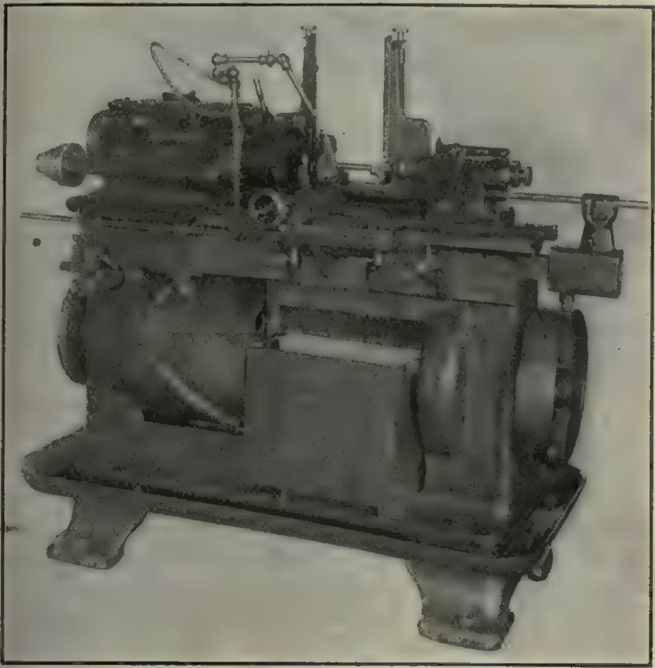


FIG. 1. FRONT VIEW OF LARGE P & W GEARED-HEAD LATHE

Specifications: Length of work accommodated; maximum, 15 in.; minimum, 3¼ in. Diameter; maximum, 1⅛ in.; minimum, ½ in. Maximum traverse of carriage, 12 in. Floor space, 6 ft. 7 in. x 2 ft. 7 in. Height, 4 ft. 8 in. Weight, 2,750 lb. Horsepower required, 2.

The machine is intended to handle cut lengths of bar stock or small forgings that must be turned upon centers. The operator is concerned only with maintaining a supply of work in the magazine, and in inspection of the product to see that the cutting tools are functioning properly. One operator may, therefore, run a battery of machines, the number depending somewhat upon the length of the cut and the amount of stock to be removed.

The machine has all the features of an engine lathe: a pair of centers upon which the work is supported while being turned; a loose driver for rotating the work; a carriage with a cross-slide; and a toolpost in which may be held a forged tool or any of the commercial holders for toolbits of high-speed steel. Instead of a lead screw or feed rod, however, the traverse movement of the carriage, as well as all other of the automatic movements, is actuated by drum and face cams carried on a shaft that extends longitudinally through the bed of the machine. Strips bolted to the surface of the drum and adjustable dogs on the face cam constitute the actual cam surfaces that cause the movements, and these dogs may be changed or adjusted to suit the work in hand.

The front shear is made much wider in proportion than is usual on the standard engine lathe, and the carriage is mounted entirely upon it. This leaves the space between the shears unobstructed, so that pieces of work upon being released by the centers may drop through the bed into a removable pan provided to receive them.

A swiveling bar mounted on brackets in front of the carriage carries a slide that connects with the cross-slide, and enables the lathe to turn any taper up to 6 deg. included angle; while by substituting a suitably shaped "former" bar, irregular forms may be turned.

The machine is made in two sizes, and with cone or geared head, as desired. In Fig. 1 may be seen the larger size of machine with geared head, while Fig. 2 shows the smaller one fitted with a four-step cone for direct belt drive. Provision is made on the larger machine to bolt a suitable motor directly to the back of the bed when an individual drive is wanted.

In action, the work is fed into the machine from a magazine supported by brackets rigidly attached to the rear of the bed. The magazine is composed of two grooved uprights adjustable to and from each other to accommodate different lengths of work, the grooves being adjustable as to width to suit different diameters. The lowest piece of work in the magazine rests upon the work carrier, where it is held by two fingers. These fingers are adjustable to suit different diameters of work, and are so supported by springs that they will yield slightly when the work is being placed upon the centers in order to adapt themselves to slight variations of diameter, to the small irregularities to be expected in forgings, or to "out-of-roundness" due to careless centering.

At the proper point in the cycle of movements the carrier moves forward, bringing the piece held in the fingers into alignment with the centers. The tail center then moves up, pushing the work through the jaws of the driver and into contact with the live center. The carrier then moves back, allowing the next piece in the magazine to drop into the fingers, the driver grips the work, and the carriage moves the tool up to the cutting

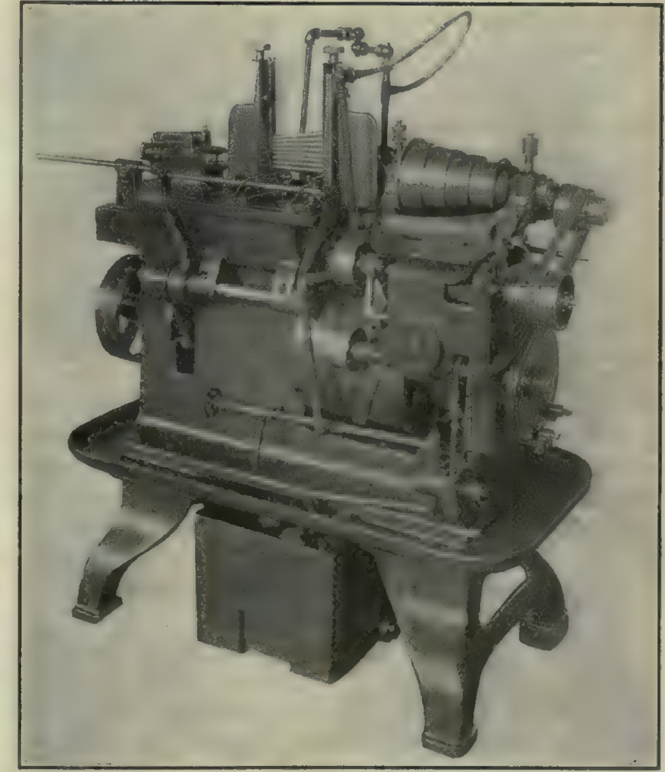


FIG. 2. REAR VIEW OF SMALL LATHE WITH CONE HEAD

Specifications: Length of work accommodated: maximum, 11 in.; minimum, 2½ in. Diameter of work: maximum, ⅝ in.; minimum, ¼ in. Maximum traverse of carriage, 8 in. Floor space, 5 ft. 3 in. x 2 ft. 1 in. Height, 4 ft. 8 in. Weight, 1,625 lb. Horsepower required, 1½.

position. The drum shaft has two speeds; and all the foregoing movements are performed at the high speed, thus reducing the waste time. The adjustable dogs on the face cam enable the operator to time these movements to suit the work.

The driver is made in the form of a special chuck with three cam-shaped jaws that are opened by a friction ring operated from the camshaft, and that are closed by the force of coil springs in tension. The shape of the jaws is such that the greater the resistance caused by the cut, the harder will the jaws bite; and, though the ends of the jaws are hardened, they are polished so that they will leave no impression on the work. The body of the chuck is so mounted on the spindle nose as to float laterally, and thus the pressure of the driver upon the work is equalized and no side strain is imposed.

Provision is made for slight variations in the length of the pieces by a slip-ring device in the mechanism that moves up the tail center, so that the endwise pressure upon the centers is always the same despite small discrepancies in this respect. There is also a friction joint in the levers that operate the work carrier, so that if a piece of work becomes displaced and interferes with the free movement of the parts, the machine will cease to function before any part is broken.

The tool being advanced to cutting position, the speed of the camshaft changes from fast to slow and the turning operation is carried forward to completion. Then the spindle is again changed to the fast movement, opening the driver, withdrawing the tail center to allow the work to drop out, and moving the carriage to the extreme right of its travel. At this point the carrier brings the next piece to place between the centers, the carriage moves to the cutting position, the speed of the camshaft changes to slow, and the cycle is repeated.

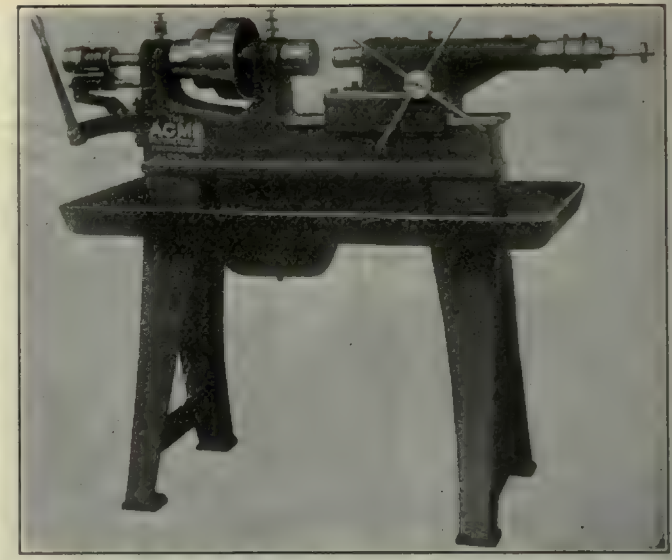
The geared-head machine has four spindle speeds on direct drive and four slower speeds when the back gears are brought into engagement. Four changes of speed of the automatic movements for each spindle speed are provided on the larger machine and three on the smaller one. The hand lever at the extreme left of the bed in Fig. 1 provides for changing the speed of the camshaft from fast to slow, or *vice versa*, or for disengaging the power movement entirely and turning the mechanism by hand by means of a crank handle on the squared end of the projecting wormshaft.

An ample supply of cooling liquid for the cutting tool is assured at all times by a chain-driven pump which runs at a constant speed. The tank for the liquid is mounted on rollers, and may be removed from the machine to facilitate washing and refilling. The machine is not considered an experiment, as its prototypes have been in constant service for a long time in the shops of its builders, turning the blanks for taps and reamers.

Acme Horizontal High-Speed Drilling Machine

The accompanying illustration shows a horizontal high-speed drilling machine recently added to the line of the Acme Machine Tool Co., Cincinnati, Ohio. The machine is especially adapted to drilling small deep holes, such as grease-cup holes in king bolts, or similar work requiring high-speed drilling.

The design of the machine in general is similar to that of a hand-screw machine, the work spindle and the chuck operation being identical. The work is held in the automatic chuck, which is opened and closed by operating the lever located at the front head end of the bed.


ACME HORIZONTAL DRILLING MACHINE

The drill spindle, which takes the place occupied by the turret of a lathe, is provided with a No. 1 Morse taper at the front end for holding the drill chuck. The spindle is driven by means of a flanged pulley belted to the countershaft. The spindle and pulley are provided with ball bearings. The ball bearings for the pulley are mounted on a separate stationary sleeve, through which the spindle passes, thereby relieving the spindle from belt pull and allowing it to be operated easily and quickly. The spindle is mounted in a separate sleeve having rack teeth into which mesh the gear on the pilot wheel shaft. The pilot wheel serves to move the spindle backward and forward, and the collar on the end of the spindle acts as a stop gage when the drill has reached the desired depth.

The spindle is held in a casting adjustably mounted on the sliding saddle, the arrangement permitting locating for long or short pieces. The spindle is ordinarily run at approximately 3,000 r.p.m. This speed, together with the work-spindle speed of 500, gives a combined drilling speed of 3,500 revolutions per minute.

"Triplex" Bench-Type Combination Machine

A bench machine which combines the functions of the lathe, milling machine and drill press has recently been placed on the market by the Triplex Machine Tool Corporation, 18 East Forty-first Street, New York, N. Y. The machine, a general view of which is shown in Fig. 1, is motor-driven and hand-fed throughout, with the exception of the feed when screw cutting. One of its principal features is the fact that the head can be so shifted on its supporting arm that it may operate at any angle. The spindle can also be fed out a distance of 3 in. by means of a pilot wheel, especially for use in milling and lathe work, and can be locked in position.

The spindle is driven by means of a ¼-hp., reversible ball-bearing motor running at a speed of 1,750 r.p.m. Six speeds are provided for the spindle, the lowest being 90 and the highest 1,150 r.p.m. The change in speed is obtainable by operating the knob shown just above the spindle, so as to shift gears. The motor is belted to the gear shaft, and has a two-speed cone pulley. The spindle itself is so made as to hold either a faceplate, spring collet or a chuck.

The entire head, including the motor, can be moved up on the circular portion of the frame overhanging the base, so that the spindle occupies any desired angle. The head is counterbalanced by a weight on the inside of the circular column. The machine is shown equipped for lathe work, the spindle being in a horizontal position.

The tailstock is mounted on the end of the base, so as to carry a dead center. It can be removed when desired. A knee or bed mounted on the circular column carries a saddle in which the table of the machine is mounted. The knee can be locked in position on the column, after being raised to the required height by means of a handwheel. A bolt is provided for locking the overhanging end of the base to the tailstock. For the turning of tapers, the knee can be swung slightly on the column and then locked in position by the two locks just mentioned. A handwheel is provided for feeding the saddle longitudinally, and another for feeding the table transversely to the work. The table in this case serves as a toolslide, and carries the toolpost and tool.

When cutting threads on the machine, a master screw mounted on the extension of the spindle at the rear of the machine is used, since no lead screw is provided. The work is held in a chuck or spring collet, and while the spindle is revolving, a handle holding a nut segment is placed in contact with the master screw, so that the spindle is caused to feed forward. The cutting tool remains stationary. At the end of the cut, the nut segment is thrown out automatically by the taper on the handwheel next to the master screw, and the spindle is returned to its starting place by means of the pilot wheel.

The machine is adapted to milling work, the arbor being mounted in the spindle of the machine and supported by the tailstock at the other end. The work can be secured to the table, or in a vise which is provided. End mills can be held in the spindle by means of spring collets, as shown in Fig. 2. When desired to operate the head at an angle, it is lifted on its arm, which is graduated in half degrees, with the divisions spaced $\frac{1}{16}$ in. apart, so that close settings can be made. The head is clamped in position by means of a single nut.

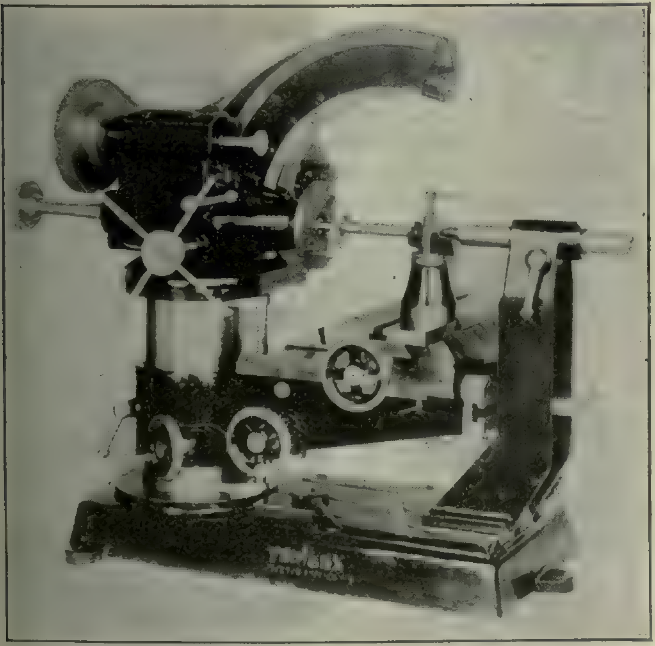


FIG. 1. TRIPLEX COMBINATION MACHINE USED AS A LATHE

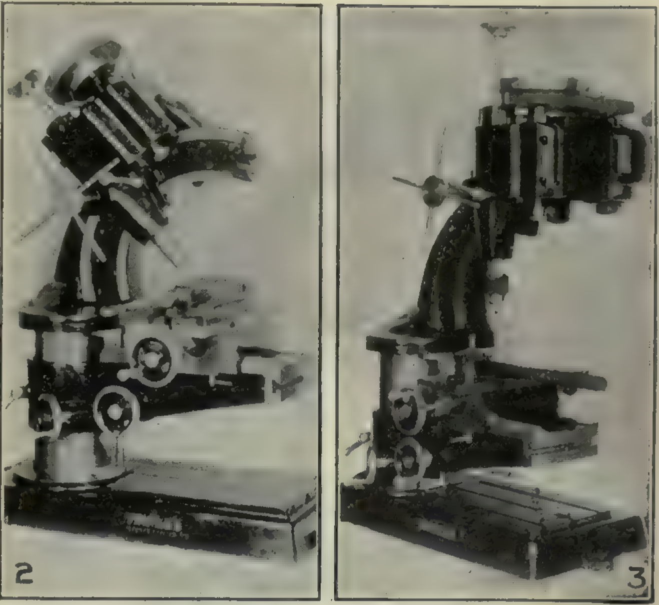


FIG. 2. ANGULAR MILLING. FIG. 3. TRIPLEX MACHINE USED AS A DRILL PRESS

Specifications: Table, 5 x 14½ in. Feed: longitudinal, 10 in.; transverse, 6 in.; vertical, 4½ in. Spindle travel, 3 in. Swing: over table, 8 in.; over ways of bed, 14½ in. Center distance, maximum, 14 in. Diameter of milling arbor, ⅞ in. Spring collet capacity, ½ in. Bench space, 16 x 26 in. Height, maximum when spindle is vertical, 43 in. Weight, 450 lb.

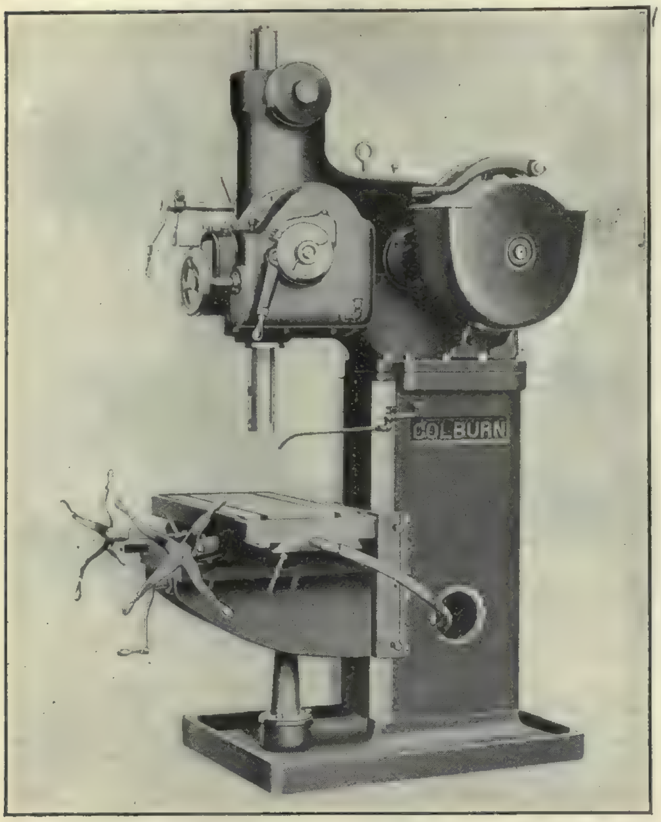
When the spindle is swung to a vertical position, as shown in Fig. 3, the machine can be used as a drill press. This position is suitable also for vertical milling. The machine is furnished with a Jacob's No. 6 drill chuck, which has a capacity up to ½ in. When desired, the bed or knee can be swung entirely out of the way, so that the work can be fastened directly to the base of the machine by means of the three ½-in. T-slots.

The machine is intended to provide a complete machining equipment, although it has a very small floor space. It is stated to be especially adapted for use in toolrooms, on steamships, in experimental shops, laboratories and the like. It is well adapted to use on angular jigs and fixtures, and on small production work requiring angular drilling or milling operations.

Colburn No. 6 Heavy-Duty Drill Press

The Colburn Machine Tool Co., Cleveland, Ohio, is placing on the market a No. 6 size of its heavy-duty manufacturing drill press. The machine is intended for drilling holes up to 3 in. in diameter in steel. Its rated swing is 28 in. The controls are centralized on the front of the machine, so that it is not necessary for the operator to move from his position in order to effect changes of speed and feed.

The machine is driven through a constant-speed belt to tight and loose pulleys mounted on the main driving shaft, as shown in the accompanying illustration. No countershaft is required. All the gearing is placed inside the head casting, which forms an oil-tight box. The driving gears are made from chrome-nickel steel and have stub teeth, while the feed gears are made of high-carbon steel. No clutches are used, the speed changes being effected by sliding the gears. The gears



COLBURN NO. 6 HEAVY-DUTY DRILL PRESS

Specifications: Capacity in steel, 3 in. Swing, 28 in. Maximum distance: spindle to plain table, 36 in.; spindle to compound table, 30 in.; spindle to extended base, 53½ in. Power feed, 18 in. Working surface: plain table, 20 x 24 in.; compound table, 18 x 30 in.; extended base, 24 x 24 in. Vertical adjustment of table, 13 in. Compound table: longitudinal travel, 20 in.; transverse travel, 8 in. Total height, spindle up, 115 in. Floor space: with plain table, 33 x 63½ in.; with compound table, 65 x 71 in. Net weight: with plain table, 4,020 lb.; with compound table, 4,545 lb. Export box, 128 cu.ft.

run in oil. Automatic lubrication by splash is provided for all of the journal bearings, although the vertical bearings are lubricated by means of wicks, which draw the oil by capillary action.

The spindle is of large diameter, and has a No. 5 Morse taper hole. Its driving quill is bronze bushed, and has rack teeth cut directly on its surface. Two quick changes of speed may be made by means of sliding gears operated by a handle. By the use of transposing or change gears, forty-eight different spindle speeds ranging from 30 to 375 r.p.m. can be obtained. Two feeds having an approximate ratio of 3 to 1 are obtainable by means of a slight movement of the worm-feed handwheel. By the use of transposing gears, 36 feeds ranging from 0.005 to 0.134 in. per revolution of the spindle are obtainable. By means of the capstan wheel rapid movement of the spindle may be obtained.

The speed transposing gears are located in a box on the left-hand side of the machine, and are so arranged that they can be quickly changed. The feed transposing gears are located in a box on the front of the spindle head. Because the machine is intended primarily for manufacturing operations, it is not deemed necessary to have a complete range of feeds and speeds operated by a quick-change lever.

The work table is provided with a large oil groove around its edge, and has T-slots for the clamping of work. It can be furnished in either the plain or the compound style, the latter being illustrated. Owing to the long bearings provided, and to the supporting screw, the table is said to be very rigid. The movements of the compound table are controlled by hand by means of the two capstan wheels placed at the front of the machine.

A geared tapping attachment can be furnished, this attachment consisting primarily of a set of friction clutch reversing gears having a reverse ratio of about 1½ to 1. The attachment is driven directly from the driving shaft, and is controlled by means of a lever placed at the front of the machine, so that the direction of motion can be instantly reversed. An automatic tripping mechanism can be set to trip the feed at any desired depth. It is also possible to return the spindle automatically to the top of the stroke after tripping, the spindle being counter-balanced to facilitate this movement. It is stated that safety and interlocking devices are provided on the machine to fully safeguard its operation. The speeds cannot be changed while the machine is running. All gears, pulleys and running shafts are enclosed.

The machine can be provided with an extended base to provide for the accommodation of work requiring considerable height under the spindle. A constant-speed motor of 10 to 20 hp. can be mounted at the rear of the machine on the lower part of the column, being connected by belt to the tight and loose pulleys. The coolant is circulated by means of a pump driven from a small pulley on the main driving shaft. A storage tank is provided in the lower part of the column, while a flexible pipe conveys the coolant from the table to the tank.

The machine can also be furnished in gangs of two, three, or four spindles. In such cases, the same base and table serves for each unit, and the columns are joined. The distance between the spindles is 35 in. Each unit is driven separately by means of a belt, thus making it possible to utilize only the spindles desired. All of the attachments suited to the ordinary type of machine can be supplied on the gang drill.

G. E. Arc Welding Device

A semi-automatic arc welding lead has just been developed by the General Electric Co., Schenectady, N. Y., for use in conjunction with its automatic arc welding head. It retains the continuous features of the automatic apparatus, yet allows the operator to direct the arc as required by the conditions of the work.

The apparatus consists of a welding tool to be held by the operator, which acts as a guide for the electrode

G. E. ARC WELDING DEVICE

wire. In the handle of the tool is a switch for operating the control on the panel of the automatic welder to start and stop the movement of the electrode wire. Attached to the tool is a 10-ft. length of flexible steel tubing, with an adapter on the other end for attaching it to the automatic welding head. The wire passes from the feed rolls of the head into the flexible tubing and thence to the arc through a guide nozzle in the welding tool. The automatic welder functions in its accustomed manner, tending to hold the arc length constant, and the operator merely directs the arc as required by the particular job in hand.

The field of application of the semi-automatic is the welding of products where the seams to be welded are of very irregular contour, or on very large work where the travel mechanism and clamping necessary for the full automatic welder would be complicated and costly. In many cases the edges of the seams are not accurately prepared, making gaps in some places and tight fits in others. The automatic welder with mechanical travel cannot compensate for these conditions by varying the speed, or by manipulation of the electrode, but with the semi-automatic, they are taken care of.

The semi-automatic welder may also be used for building up metal rapidly, as in the case of filling up blow holes in castings, or building up worn spots, etc. The speed of deposition of the metal varies widely, being somewhere between the ordinary hand speed and that of the automatic, according to the conditions of the particular job. In general it is about twice as fast as hand welding.

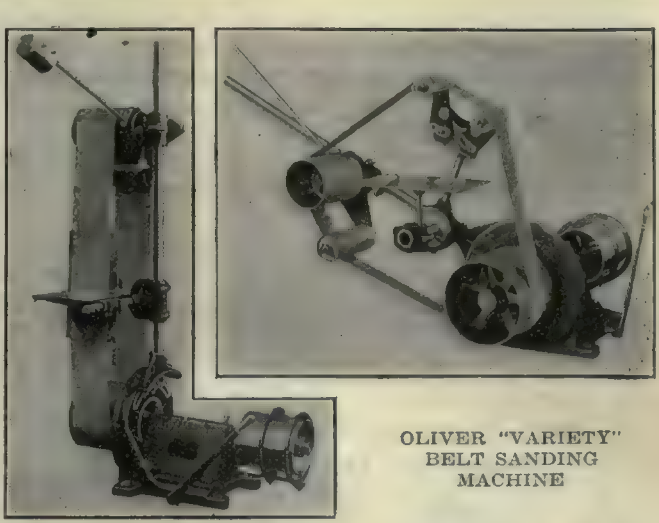
In its use the following advantages are claimed for the device: Saving in time ordinarily lost in changing electrodes; saving of from 10 to 20 per cent in electrode material ordinarily thrown away as waste ends; operators become proficient in the use of the tool very quickly, as they do not require the muscular training necessary for hand work; continuous operation results in few interruptions in the welding, each interruption being a potential source of defective welds.

Oliver No. 127 "Variety" Belt Sanding-Machine

The Oliver Machinery Co., Grand Rapids, Mich., has recently added to its line the belt sanding-machine shown in the accompanying illustration.

The flexibility of the machine will be understood from the two positions in which it is here shown. The main drive pulley is mounted on the countershaft in such a way that the entire frame of the machine may be swung around the center of the countershaft. The supporting arm carries brackets for supporting the main idler pulley and the tension idler. A smaller arm carries the table and backing plate and in place of the latter special or flexible pads may be substituted.

The edging table is 10 x 12 in. and can be tilted either up or down 30 deg. It can be adjusted in or out and has drilled holes for attaching a wood top or special forms. The backing plate is 10 in. wide and can be adjusted in or out to suit the tension on the belt, and has drilled holes for attaching flexible pads. The main idler is adjustable up or down the arm to take care of various lengths of belts. The tension idler is pivoted about the center line of the main idler and is balanced by weights to give the proper tension to the belt. Both the main and tension idlers are leather covered and run on ball bearings. The driving pulley is also leather covered and the countershaft runs on roller bearings.


OLIVER "VARIETY" BELT SANDING MACHINE

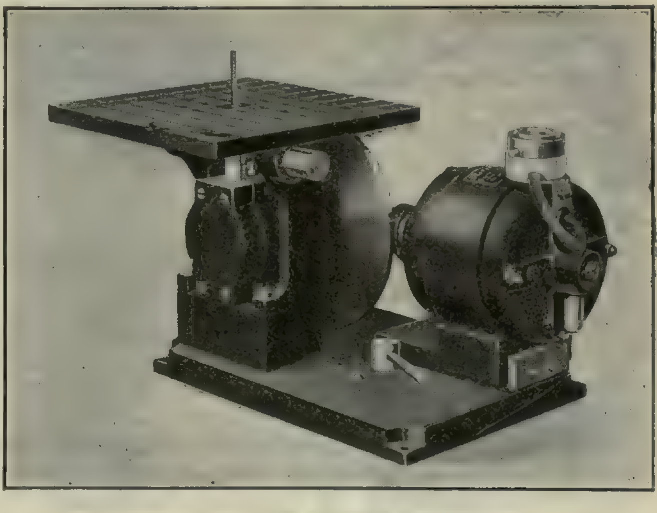
A fork idler to be used in oval sanding, is mounted on the machine in place of the regular table. It is rigid in construction and carries two aluminum idlers, adjustable to the work, running on ball bearings. The sanding belt is 10 in. wide and 14 ft. long. The tight and loose pulleys are 10 in. diameter and 5 in. face and run at 900 r.p.m. The equipment includes edging attachment, fork idler and all necessary wrenches; floor space, 48 x 96 in.; height over all, 80 in. The machine can be furnished with either belt or motor drive. Weight (belt driven), crated, 450 lb.; boxed for export, 650 pounds.

Haskins Die Filing Machine

The die filing machine shown in the accompanying illustration has been brought out by the R. G. Haskins Co., 27 S. Desplaines St., Chicago, Ill.

The machine is motor driven through a friction disk and the motor is mounted on a dovetailed slide in such a way that by sliding it forward or backward, speeds ranging from 300 to 700 strokes per minute can be obtained. Provision is made for stopping the machine without stopping the motor. The motor is ¼ hp. and is provided with ball bearings.

Reciprocating motion is imparted through a hardened and ground steel block and guide, entirely enclosed and having ample provision for lubrication. The table is 9 in. square, adjustable for filing at an angle and is


HASKINS DIE FILING MACHINE

locked in position by a lever. Grooves in the top of the table catch the filings, preventing them from lodging under the die. The driving spindle is of nickel steel, heat-treated and ground.

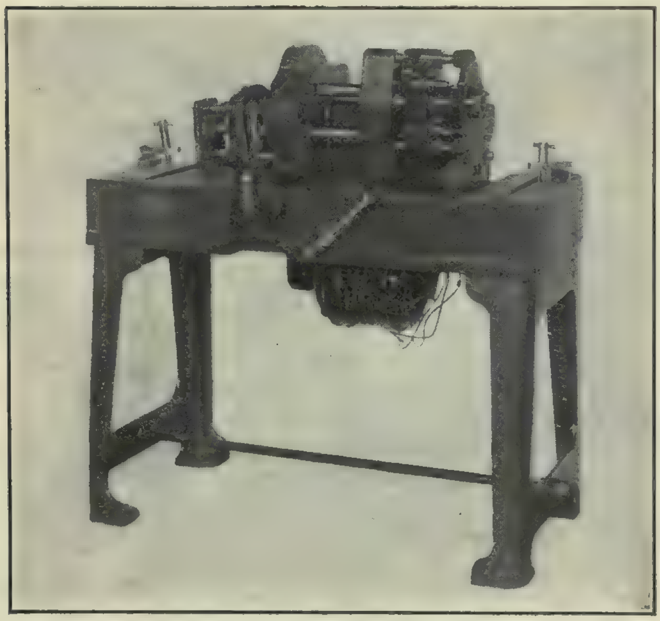
Standard filing-machine files are used and are furnished in sets of twelve in various shapes. The shanks are ¼ in. in diameter.

The machine is light and portable and can easily be carried from bench to bench. Its range of speed permits the filing of brass and other soft metals at the proper cutting speeds. The maker claims that it is in every respect a precision machine.

Manufacturers' Consulting Engineers Crankcase Drilling and Boring Machine

The crankcase drilling and boring machine shown in the accompanying illustration has been recently placed on the market by the Manufacturers' Consulting Engineers, McCarthy Building, Syracuse, N. Y.

The machine is equipped with a driving motor and two movable heads which are fed in opposite directions by a hand lever. Each head carries a number of drills and a boring head, the number depending on the character of the operation to be performed. The machine as illustrated carries three drills and one boring head in each of the movable heads, and is intended for drilling and boring crankcases for the attachment of starters and generators.



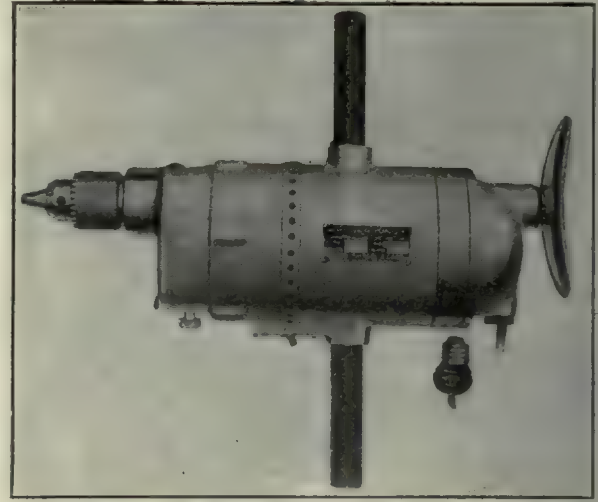
CRANKCASE DRILLING AND BORING MACHINE

Jones, MacNeal & Camp "Power King" Portable Electric Drill

The portable drill shown in the accompanying illustration has recently been placed on the market by Jones, MacNeal & Camp, 533 South Clinton St., Chicago, Ill.

The body of the drill is built in three sections. The section nearest the chuck contains all of the gears as well as the mechanism for changing the speeds. The middle section contains the motor, switch and all the wiring. This section is so designed as to permit examination and repair of all parts without disturbing the motor bearings. The armature or the field need only be removed when replacement is necessary. The rear section is merely a protecting cap and contains no bearings.

The case is aluminum and the breastplate is interchangeable with a handle. A feed screw can be furnished in place of the handle or breastpate so that the drill can be used with a bracket or "old man."



"POWER KING" PORTABLE ELECTRIC DRILL

The motor is universal and can be operated by either alternating or direct current. It was specially designed and built by the General Electric Company for this drill. The spindle, armature shaft and drive shaft run in ball bearings, those for the spindle being of the combination radial and thrust type.

While the speed of the motor is constant, two speeds for the spindle are provided through helical gearing of alloy steel, heat-treated and ground. The gears run in a chamber packed with grease insuring constant lubrication.

Fifteen feet of cord and an attachment plug are furnished with each drill. The drill is made in eight sizes for drilling holes from $\frac{3}{16}$ to 1 in., and with spindle speeds of 1,400 to 2,400 and 300 to 375 r.p.m. Motors for either 110 or 220 volts can be furnished.

Hartman Universal Drilling Fixture

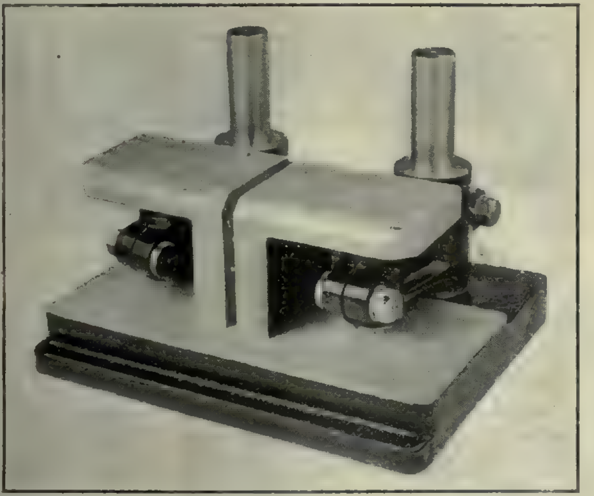
The device shown in the illustration is intended for use on a drill press in the toolroom or machine shop, and has been brought out recently by the Hartman Manufacturing Co., 308 Pearl St., Hartford, Conn. It is designed to take the place of the many parallel strips and pieces of blocking that are needed where there is much drilling of irregular shaped pieces to be done, and where the quantity of any one kind does not warrant the expense necessary for the construction of a special fixture or jig.

The fixture consists primarily of a base block and two adjustable angle plates that may be placed in any position relative to each other and securely fastened. The base is accurately scraped and, with the angles swung out of the way, may be used as a bench plate for setting up or laying out work. The back edge is machined square with the surface, so that the device may be turned on edge and clamped to a larger angle plate on the drill press table when desired. A ledge on the front of the base provides for the use of clamps without obstructing the working surface.

One edge of each of the small angles is bevelled to 45 deg., so that when the two edges are placed together a V is formed for holding round pieces. By adjusting the distance between the angles, the V may be made of any size and will provide an opening at the bottom to allow a drill to pass through. Setting the angles out of parallel with each other makes a V capable of holding tapered pieces with the upper surface level or at any desired slant. The opposite edge of each angle is rabbetted, so that by reversing the relative positions a thin piece of flat stock may be held for drilling. A flat piece of any width within the limits of the device and of any shape may be thus held provided it has two straight edges, not necessarily parallel.

By raising one angle block and securing it in position on top of the other an internal angle is provided, while by raising one angle block to a higher level and clamping it in position, two parallel surfaces of any relative height are secured. The clamping device is said to be sufficiently rigid that drilling may be done without appreciable deflection while either of the blocks is raised above the base and unsupported other than by the clamping arm.

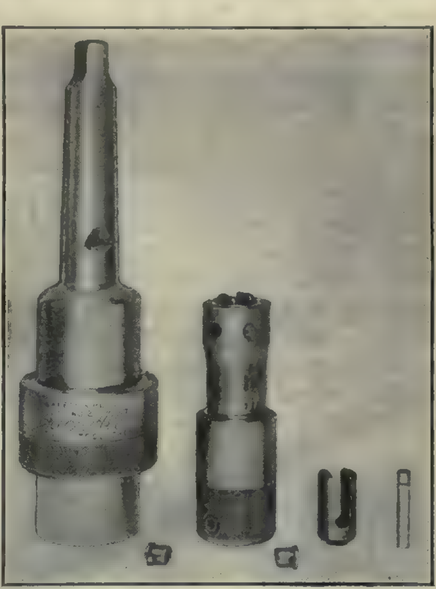
All the clamping bolts are pinned to prevent rotation, and all the nuts are of the same size so that but one wrench is needed. The base, angle blocks, and clamping arms are of cast iron, and the swivel posts and clamping bolts are of heat-treated steel. The base covers a space of 8 by 12 in. and the height of the posts is 7½ in. The weight of the device is approximately 60 pounds.


HARTMAN UNIVERSAL DRILLING FIXTURE

"SaveAll" Quick-Change Drill Chuck

The quick-change drill chuck shown in the illustration is intended for holding drills with taper shanks. It is known as the "SaveAll," positive, safety, quick-change drill chuck, and is being placed on the market by the SaveAll Tool Co., 59 River St., Waltham, Mass. The chuck has a safety device to prevent breaking and burning of drills, taps, reamers and counterbores. A soft steel pin, which drives the collet, is sheared off when the cutting tool is overloaded. The pin is held in place by a pointed screw positioning in a groove in the pin; and when it has been sheared, it can be removed by loosening the screw and inserting a new pin. Certain sizes of shearing pins are applicable to drills of various diameters, the same pin being used with $\frac{37}{64}$ to $\frac{29}{32}$-in. drills.

The drill or tool is held in the collet, which can be slipped into the chuck when the sleeve on the latter is raised. Lowering the sleeve forces inward jaws which engage the collet on its taper end. At each end of the collet there are bearing surfaces, which enter holes in the chuck, preventing the collet from getting out of line, and giving it a solid bearing. A compensating collet lock for automatically taking up wear and eliminating end motion is provided, as well as a Bristo hollow safety set screw for preventing the tool from pulling out. Collets can be changed while the machine is in motion or at rest.


"SAVEALL" QUICK-CHANGE DRILL CHUCK

In the small end of the collet is an ejector, a light blow on which releases the drill or tool. The capacity of the No. 2 chuck is ¼ to 2-in. taper-shank drills, i.e., Nos. 1, 2, 3 and 4 Morse tapers. In the illustration are shown a chuck, collet, ejector and shearing pin, while in front are the two jaws. The chuck is simple and durable, there being but four working parts and no rolls, keys, drifts or springs. With the exception of the shear pin, all parts are hardened.

By reducing the danger of burning and breaking the drills, the maker claims that an operator is enabled to drill safely at the maximum efficient cutting speed of the tool. It is stated that in a 2-in. screw machine drilling ¾ x 5¼-in. holes in machinery steel at 6½ in. per minute, three to five pins were sheared per 300 holes, which was the production for 8 hours.

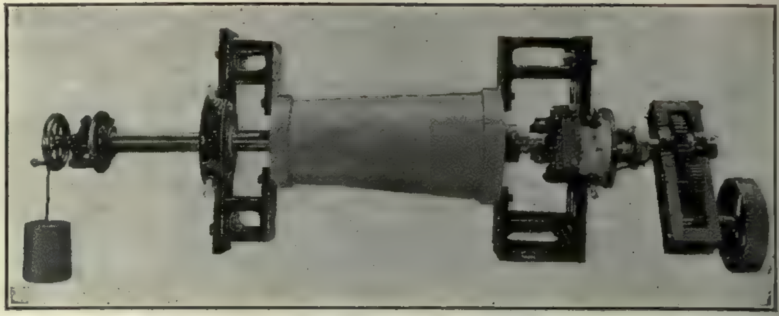
Pedrick Portable Taper Boring Bar

The Pedrick Tool and Machine Co., 3638 North Lawrence St., Philadelphia, Pa., has recently placed on the market a portable boring bar intended for the boring of tapered holes. The tool is adapted to large work, such as boring and re-boring marine propellers. It is adjustable for any degree of taper, and can be used for boring straight holes also. It is not necessary to supply fixtures for different sizes of holes.

In the accompanying illustration, the bar is shown set up for boring the taper hole in a cylindrical casting. The piece being bored serves as a support for the machine, and to it are fastened the crossheads that hold the boring bar. Each crosshead has four setscrews for adjusting and aligning the bar after it has been roughly centered in the hole. The taper is derived from a cross-slide and yoke into which the bar is secured by a gudgeon pin, the degree of taper being controlled by the distance the slide is moved from its central axis.

The driving gearing is stationary, so that it may be driven by means of a belt, electric motor or portable pneumatic drill in either a vertical or horizontal position. On the opposite end of the bar is the feed case. By preventing the handwheel of this feed case from turning, as by means of a weight as shown, the feed becomes constant and automatic.

An arm can be mounted so as to face the ends of the cylinder being finished. This operation, however, requires the removal of the crossheads and space-blocks, as well as a different means of holding the bar. Spiders, which are held in the bore at the top and the bottom by means of setscrews, serve for this purpose. The bar is thus adaptable to the boring of holes with any degree of taper, as well as to the facing of the hub on such large work that requires finishing in position and cannot well be placed in a machine.

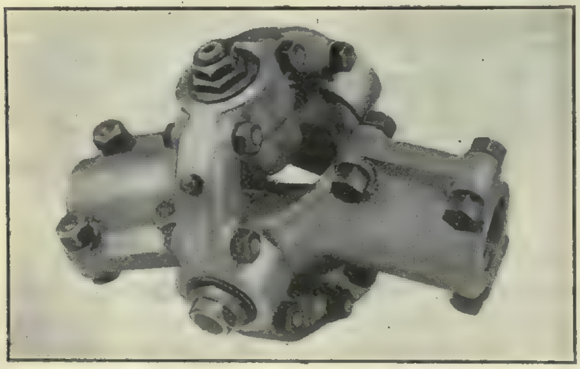


PEDRICK PORTABLE TAPER BORING BAR

American Adjustable Universal Joint

The Hartman Manufacturing Co., 308 Pearl St., Hartford, Conn., has recently place on the market a universal joint intended especially to transmit relatively large powers. The usual ball is replaced by a ring that surrounds the forks and carries the hardened steel studs which have tapered bearings in the fork ends. This ring is in two parts, as shown in the illustration herewith, so that the joint may readily be assembled or disassembled, and adjustments made to compensate for wear. An annular oil chamber within the ring holds a large supply of oil. The sleeves also are split, and may thus be applied to shafts without disturbing the endwise position of the latter.

As the joint is primarily intended for motor-boat service, the castings are of bronze, but may be supplied in malleable iron or steel if desired. The joint is made in all commercial sizes for shafts from ⅝ to 2 in. in diameter.

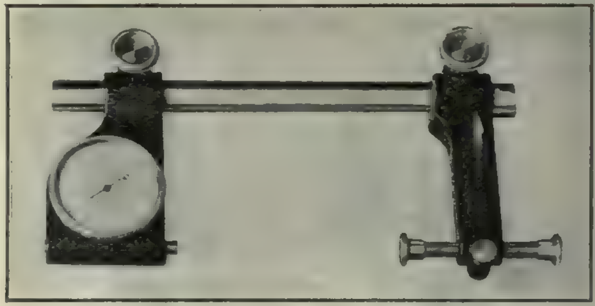


AMERICAN ADJUSTABLE UNIVERSAL JOINT

Horstman Extension-Beam Indicating Caliper

The F. W. Horstmann Co., 196 Coit St., Irvington, N. J., has recently placed on the market the extension-beam indicating caliper shown in the accompanying illustration. The device is similar in principle to that described on page 917, Vol. 50 of the *American Machinist*, its capacity being greater, however. The rear surfaces of the arm are flat, so that by laying the device on a plane surface and tightening the clamping screws, the plunger and adjusting screw can be kept in alignment. The beam is ordinarily 6 in. long and ½ in. in diameter, although any length required can be furnished.

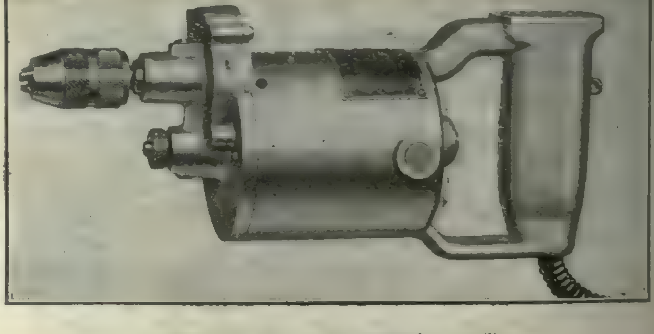
The uses of the device are stated to be varied. On a lathe it may be used for gaging across the face of chucked work of large diameter, and on a planer for duplicating wide pieces. By reversing the arms on the beam, the tool becomes an inside indicating caliper, and can be used on any size hole above 4¾ in. Since the dial is graduated in thousandths of an inch, it is possible for the operator to see directly the size of the work in relation to the desired size, instead of feeling the size, as with plain calipers.



HORSTMAN EXTENSION INDICATING CALIPER

Lovejoy No. 3 Electric Drill

The electric drill shown in the illustration herewith and formerly made by the Ideal Electric Drill Co., is now being made by the Lovejoy Tool Works, 319-331 West Ohio St., Chicago, Ill.



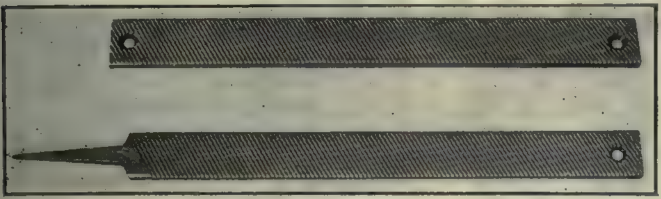
LOVEJOY NO. 3 ELECTRIC DRILL

The drill has a capacity for drilling ¼-in. holes in steel. It weighs only 4 lb. and is furnished with either a 110 or 220-volt motor suitable for direct or alternating current. The switch is conveniently placed and is operated by the thumb. The drill has ample ventilation with provision for oiling, and is driven through a bronze gear.

Steele-Sayward File

The file illustrated herewith has recently been placed on the market by the Steele-Sayward Co., 79 Milk St., Boston, Mass., under the trade name "Hygrade Hand Miller."

While the tool has the appearance of an ordinary mill file, the teeth are milled instead of being forced up by the usual process of file cutting.

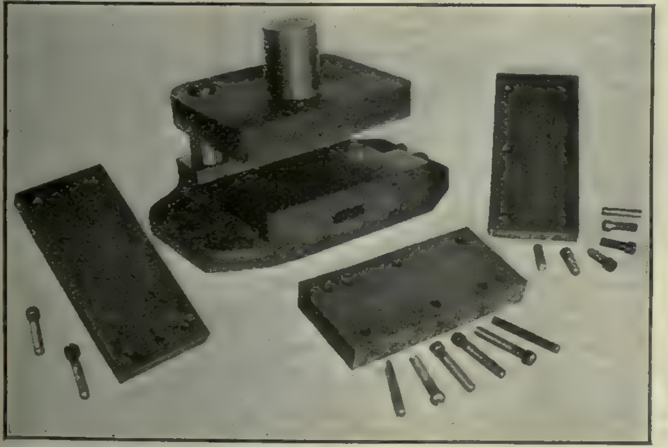

STEELE-SAYWARD FILE

The following claims for this tool are made by the maker: That the process of forming the teeth does not harm the grain structure of the steel; that the steel is especially heat-treated to give maximum hardness and toughness to the teeth; that the tool works equally well on all metals and alloys; that when used on lead, solder or babbitt the teeth do not become clogged.

Files can be furnished either in the blade type as shown at the top of the half tone, or in the tang type at the bottom.

Diamant Standard Punch and Die Sets

In the construction of metal cutting dies there are certain unit parts which are of the same general design and for the purpose of supplying shops not making punches and dies on a manufacturing basis, the Diamant Tool and Manufacturing Co., 91-97 Runyon St., Newark, N.J., has brought out standard punch and die sets as shown in the illustration.


"DIAMANT" STANDARD PUNCH AND DIE SET

The sets are made in five sizes capable of a very large number of combinations, so that the purchaser may be able to fill his needs without the inevitable loss of time were he to have patterns and castings made and do the machine work himself.

The die sets are furnished complete in every respect, with the exception of the die openings and the holes for inserting the punches in the punch plate. Screw holes are drilled and countersunk and all screws and dowels required are furnished.

It is claimed that die blanks are of good grade of oil-hardened steel. They are from 0.006 to 0.010 in. oversize to allow for shrinkage in hardening and for final grinding.

Shepard Electric LiftAbout

To provide an electric hoist applicable to all load-moving jobs the Shepard Electric Crane and Hoist Co., Montour Falls, N. Y., has brought out the hoist illustrated herewith under the name of "LiftAbout."

The hoist can be installed wherever a chain block could be used, providing electric current is available.

The motor is especially designed for hoisting service and can be furnished either for direct or alternating current.

SHEPHARD ELECTRIC LIFTABOUT

Mining Machinery in Great Britain

The present is considered a very favorable time for American manufacturers of labor-saving mining machinery to stimulate the sales of their products in Great Britain, according to a report just received from Consul John R. Bradley, at Cardiff, Wales, who points out that the operators there are overlooking no opportunity to increase production and to decrease costs. Of course, it is recognized that for some time British labor has been opposed to the employment of such machinery, notwithstanding which fact it appears that more and more equipment is constantly being employed in the various British coal fields. Owing to the importance of coal as an export commodity and the absolute necessity of producing it at a price which shall be attractive in the world's markets, it is felt that public opinion in Great Britain is becoming increasingly favorable to the employment of such machinery.

NEWS SECTION

Railroads and Brotherhoods Sign Agreement

A recent report, verified by the American Association of Railway Executives, is to the effect that four of the leading railroad brotherhoods have signed agreements with railroads in the Eastern, Western and Southeastern districts whereby regional adjustment boards are to be set up as provided in the Esch-Cummins law. The Brotherhood of Locomotive Engineers, Order of Railway Conductors, Brotherhood of Locomotive Firemen and Enginemen and the Brotherhood of Railroad Trainmen are the organizations included in the agreement.

It is expected that the creation of these boards will relieve the Railroad Labor Board of the necessity for settling many minor disputes and so enable it to devote more time and effort to principal issues.

Each board will have eight members, one representing each brotherhood and four representing railroads in the particular district.

◆

Engineering School in Springfield

Under the personal direction of William Roberts, consulting engineer, a new phase of technical education has been established at Springfield, Mass., in the organization of the Engineering School of Drawing, which has opened in that city.

The school has evidently filled a long-felt want, as judged by the full attendance at both the day and night sessions. The students in this novel course are given actual problems to work out, and are permitted, when capable, to work on drawings and plans for work which the school contracts for.

Mr. Roberts was formerly an engineer with the Bosch Magneto Corporation and the Rolls-Royce of America, at Springfield.

◆

Army to Sell Castings

A lot of 13,500,000 lb. of motor forgings and castings are to be sold by the Air Service of the Army. Informal bids will be received until Dec. 10. They are to be sold on a scrap-metal basis. Quantities are as follows: Steel, 11,534,937 lb.; cast iron, 1,041,249 lb.; bronze, 750,000 lb.; aluminum, 189,022 lb.; brass, 12,407 lb. The materials are open for inspection at the Long Island Air Reserve Depot, Long Island City, N. Y.

R. R. Shops Not Sold

A current report of last week to the effect that the West Albany car repair shops of the New York Central Railroad had been sold to the American Foundry Co. has been declared erroneous by an official of the railroad. The shops are now operating, work having been resumed after amicable arrangements had been made at a conference between the employees and G. A. Carson, master car builder.

◆

Willys-Overland Nearing Capacity Production

A recent report from Toledo, Ohio, quotes John N. Willys, president of the Willys-Overland Co. as stating that the company has orders for $50,000,000 worth of Willys-Knight and Willys-Overland cars. It is also said that the company plans to produce 150,000 cars in 1922, necessitating the employment of some 12,000 men in its main plant.

This great increase in business is due in part to a newly established sales plan in which the cars are sold direct through dealers, eliminating the distributors and hence a great deal of time and expense.

◆

Worcester Foundries Change Hands

Agreements have been made for the transfer of the property of the Standard Foundry Co. to the Crompton & Knowles Loom Works and the sale of the foundry property of the Whitcomb-Blaisdell Machine Tool Co., owned by Boston interests, to the Standard Foundry Co. These concerns are all located in Worcester, Mass. The latter has been contemplating the erection of a large foundry at New Worcester, but with the acquisition of the Whitcomb-Blaisdell foundry, which will enable it to double its capacity, the former will not now be necessary. The Standard foundry is close to the loom works and the addition will permit the latter to make all of its own castings rather than have some of them made by outside foundries as has been the practice for many years.

Crompton & Knowles interests have always been financially in control of the Standard Foundry Co., a corporation, of which Charles F. Hutchins is president and treasurer. Robert F. Herrick and his associates in Boston own the Whitcomb-Blaisdell business and foundry property.

New England Engineering Societies Active

The New England section of the Society of Automotive Engineers had its fall meeting in Springfield, Mass., Nov. 18. In the afternoon the American Bosch Magneto Corporation's plant was inspected. There was a banquet at Hotel Kimball in the evening, following which E. B. Newill, engineer in charge of the isolated electric lighting plant section of the Westinghouse Company, in Pittsburg, read a paper on farm lighting plants. He told of the improvements in apparatus and the increased extent to which such systems have been installed in recent times. The meeting was under the direction of R. E. Thompson, chief engineer of the Westinghouse in Springfield. James A. Moyer, head of the division of university extension of the State Department of Education, presided.

The Engineering Society of Western Massachusetts had its November meeting on the 22d in Greenfield and Turners Falls. Power stations and the canal of the Turners Falls Power and Electric Co. were visited in the afternoon. A demonstration was given of the workings of the system, including the new hydro-electric station which supplies power to a 66,000-volt transmission system operating through western New England. Dinner was served at the Weldon Hotel in Greenfield, after which C. C. Chesney, manager of the General Electric Company's Pittsfield plant, spoke on the million-volt transmission experiments. Charles P. Perin, consulting engineer, gave an account of electrical developments in India. Members of the Engineering Club of the Greenfield Tap and Die Corporation attended.

◆

Argentine Orders Equipment

The Argentine State Railways signed a contract, on Oct. 30, with an American manufacturing company to supply seventy-five locomotives, valued at $3,500,000, and with an American car company to furnish 2,000 freight cars, valued at $5,000,000, according to a report from Edward F. Feely, the commercial attaché of the Department of Commerce at Buenos Aires. Additional credit amounting to $1,500,000, in which both firms will participate, will be opened in favor of the State Railways for the purchase of supplies and spare parts. The total credit is for a period of five years and amounts to $13,000,000.

Lenin Admits Defeat of Communism in Russia—Financial Help From Outside Needed To Restore Government and Business

By Our Latvian Correspondent

On October 17 the government of Soviet-Russia founded, by a special decree, the State Bank of Russia with a capital of two thousand milliard paper roubles.

It is not the re-opening of the former State Bank of Russia, because there is nothing left from the old bank. The former State Bank of Russia was closed some years ago as a "pernicious institution which should not have place in an honest socialistic country."

The banks were regarded by communists as the chief social evil, as the chief supporters of the despised capitalistic regime, because they helped to accumulate the wealth in the hands of individuals and to enslave the poor. In a communistic state there should be no riches, all should be equal, and the banks, preventing such unequality, were regarded as superfluous and pernicious.

Formerly all the money drawn in the form of taxes or otherwise for the public service was consigned to the State Bank and likewise all drafts for the public service were made on it. When the communists began to re-organize the state, adopting it to the communistic regime, all taxes were abolished, all public services (postal, telegraph, railroad, electricity, hospitals, etc.) became costfree, industry was nationalized, free trade prohibited, all was concentrated in the hands of the government. After that nobody asked about credit, or about open money transactions. The communistic government decided to destroy the capitalistic monetary system by printing paper money as much as possible. All banks were closed and securities confiscated.

Some experimental years passed and in the last months the communistic government of Russia made all public services payable again, introduced taxes, allowed free interior trade, denationalized the industry, restricted the rights of laborers, violating by it the doctrines of Marx. Now they are opening the banks and trying to stabilize their paper rouble.

Thus, by restoring the old "despised" capitalistic organization the communists returned to the starting point whence they went four years ago towards a real socialistic regime.

What caused the communists to turn aside from their course taken four years ago? Why were they not able to establish the socialistic régime in Russia? Are the communists able to restore sound economic conditions in Russia? These questions are of great importance for the whole world. The communistic doctrines of Marx are yet in favor among laborers in countries where they are not yet applied to everyday life as in Russia. The real practicability of the doctrines were not finally tested till now. Russia was the experimental laboratory for this task and the experiments were in continuity till the last months. Now when the experimenters returned to the old capitalistic régime, putting aside the Marx's doctrines, we know the test is finished, the Marx's doctrines lost their prestige and—in order to reach a better life—the world has to find other, more trusty means and ways.

In the very beginning of their régime the communists hoped that under their management everybody would deliver his belongings to the common household, would work willingly for the whole community and—in exchange for his work—would receive from the government a definited, part of the commodities and services necessary for his living.

Money then should become superfluous and personal work the sole measure. Who does not work, is not able to exist. The money was to be destroyed, not by confiscating it—because it could be hidden—but by destroying its value. To destroy the value, money has to be printed and distributed as much as possible.

This decision was accepted by the communists immediately after the overthrowing of Kerensky in October, 1917. One should note the sudden rising of the amount of paper money in November, 1917.

The amount of paper money in Russia was (in Milliards=1,000,000,000):

August,	1914	..... 1.7 M. roubles
January,	1915	..... 3.1
“	1916	..... 5.7
“	1917	..... 9.2
November,	1917	..... 19.0
January,	1918	..... 27.0
“	1919	..... 61.0
“	1920	..... 225.0
“	1921	.....1168.0

It was easy for the communists to force the whole population to compulsory work (for the common welfare). They invented different methods and kept everybody pretty busy. But they failed to deliver—in exchange for the work — the promised commodities necessary in everyday life.

The population, in spite of the communistic agitation, failed to be sensible and not everybody wished to work for the common welfare. The laws were changed by paper decrees, but the psychics of the people could not be altered so easy. The bayonets, bullets, sentences of death, prisons, famine and other punishments were not able to make compulsory work productive. The productivity decreased almost as quickly as did the value of the paper money.

At the end of 1920 the productivity of Russian industries, in comparison with the same in 1916, was as follows (the figures are from an official government report):

Industry	Percentage
Iron mining	2.25
Copper “	0.60
Manganese “	2.60
Asbestos “	6.00
Salt “	17.00
Coal “	20.00
Pig iron industry	2.20
Semi-finished products	2.30
Agricultural machinery	1.50
Cotton tissues	4.00
Flax tissues	25.00
Sugar	7.00
Matches	15.00
Paper	10.00
Rubber	5.00

Communism All Wrong

By the management of communists the country is driven to a nonplus, there is famine and poverty, all is destroyed, foreign credit and sympathies are lost.

Here is demonstrated the impracticability of the communistic doctrines and the inability of the labor class to manage the government's affairs.

Of course, the masses are highly malcontent and the general opinion prevails that the sole salvation lies in the abandonment of the communistic régime. The majority of the communistic leaders, it seems, are recognizing the truth, that their radical ideas were wrong or at least, unapplicable in the present world's organization.

It is interesting to read the explanation of the new economic policy of the communistic Russian government. It sounds like this:

The former financial policy of the war-communismus was based on the using of emission, as the sole resource of income, reports the commissary of finances; the task was to make the money valueless and useless in economic life. Now when private property and private rights are recognized and we have free trade, such a task is out of question. We must think, how to stabilize the money.

Formerly the intention was to keep the whole economic activity in the hands of government. Now, when private initiative is again freed and there is a free exchange of commodities, the former financial policy has to be entirely changed.

We have to stop the emission, because we do admit that an excessive emission is preventing the development of a sound private economic activity. It requires a strong medium of exchange and it is impossible to manage the state without that.

In order to curtail the emission we are introducing taxes, payable in money. All public services are to be paid by the users. All payments in kind to the laborers and employees will be stopped.

To this time the soviet government acted as a social provider; henceforth it will act as a calculating master who manages his household without deficit.

Lenin Surrenders

Lenin in his recently famous speech was more open.

"Our new economic policy," he declared, "lies in the strategic retreat; before we are totally defeated, let us retreat and rebuild all anew, but more solidly.

"Our old economic policy was not able to evoke the productive power, which by the program of our party was fixed as the fundamental task. . . . We are defeated and retreating.

"Our new economic policy denotes that the peasants will have free trade. The concessions to foreigners and the leases to capitalists—it is the restoration of the capitalism. . . It is evident that capitalism has to grow."

"The fundamental question is—who will first make use of the new conditions? Will the peasant join with the proletariat or with the capitalist?"

"The question is—who will outrun? If the capitalists will succeed, they, no doubt, will whip off the communists. If the proletariat, joined with peasant, will be able to keep the capitalist in check, we have won."

"Remember, the capitalists of the whole world are against us and they are stronger than before."

"Our activity should not be based on the direct transition to communism, the peasant has to take interest in the socialistic régime. Here we failed. So long as the masses remain indifferent, it is impossible to maintain the compulsive régime. Until now we were not able to interest the masses in our scheme."

"We have to base every branch of our industry on everybody's personal interest. Collective advisement, individual responsibility. . . We have to carry on this policy with a strong hand."

"No country has so many meetings as we have. . . One should understand what is fit for the meetings, what for the management. . . Manage more firmly than the capitalists, otherwise we all shall be hanged up and that will be deserved; do not chat, if you have to manage."

"The capitalists and concessionaires will earn a hundred per cent profit beside you. Let them do it. You have to learn to do the same and only after that will you be able to carry on the communism."

" . . We must admit, that the conditions have bettered after we introduced the new economic policy. . ."

Communism in Russia will die a slow death. It is dying already. The communist leaders will help destroy the communistic régime because they are human beings and wish to keep their offices. They are adapting their activity to the wishes of the masses.

In order to stabilize their aenemic paper rouble, to minimize the work of the printing press, the communists introduced taxes and made the public services payable. What are the actual revenues?

During the first month, after the taxes were introduced, there were the following revenues:

From railroads.....	18	milliard	roubles
" trade taxes..	3	"	"
" lease of buildings	1	"	"
" Moscow street cars	2	"	"

The collected amounts are of nothing, if we remember that the government budget for the 1921 amounts to six thousand milliard roubles, with, perhaps, 95 per cent deficit.

All the budgets of Russia in the last six years were deficient. The shortage was: Year 1915, 75 per cent; 1916, 75 per cent; 1917, 82 per cent; 1918, 67 per cent; 1919, 77 per cent; 1920, 87 per cent.

We have no information about the proposed deficiency in 1921 but it should not be under 95 per cent.

The surest way to derive the necessary six thousand milliard roubles lies again through the printing press. It is impossible to predict what will be the value of the paper rouble at the end of 1921. It may happen the proposed budget will not suffice to cover the government's expenditures.

Could not the paper money be redeemed by platinum, gold or silver?

If the information is true, the government is coining silver roubles. The fixed amount should reach some hundred million roubles. As we understand, these silver roubles will be used on foreign markets.

As to the platinum, there were rumors that Russia will coin platinum money. True, Russia has the best platinum mines, but in 1920 these mines produced only about 20 poods (one pood = 36,11 avoirdupois pounds). In July, 1921, there were produced 2 poods, 20 pounds.

We doubt the communists have considerable reserve of this precious metal. If they had, it should have been sold in foreign countries long ago; the needs of Russia are too many.

Russia has rich gold mines, but their output at present is very small.

In 1920 all the gold mines of Russia produced about 90 poods of gold. The future hopes were brighter and the output for 1921 was fixed as follows:

From Ural mines, 71 poods; West-Siberia, 27; Middle-Siberia, 58; East-Siberia (Lena), 120; total, 276 poods.

The output was fixed and expected but it will be much smaller. Thus, according to reports for the current July month there was produced:

In Ural mines, 1 pood 10 pounds; West-Siberia, 26 pounds; Middle-Siberia, 14 pounds; total, 2 poods, 10 pounds.

It seems, in 1921 there will be produced only a few poods. Why could not the Lena mines be operated again with full capacity? That is a question to be answered apart. In short, they can not be operated under the present communistic régime.

If we remember that in 1912-13 all the gold mines of Russia produced 3,635 poods of gold, valued at 30.4 millions, and compared this quantity with the present output of, perhaps, 70 poods, all the rumors of Russian gold reserves must grow calm.

In 1914 Russia produced 611 poods of platinum, that was 94.1 per cent of the whole world's platinum output. In 1920 she produced only 20 poods.

In 1912 Russia produced 923 poods of silver. We have not dependable information about the silver output in 1920, but it could not be comparatively better than the gold and platinum.

Increased export? Of course, there is some help. Although there is famine and poverty in Russia, her exports increase. Here is no place to go in details, but the export of Russian flax, lumber, bristles, furs, etc., is rather large. The famine, the worn-out machinery and railroads, etc., require help.

The best solution of the Russian financial problem would be the help of foreign credit. The foreign credit has to wait for some more important decrees, some more changes in the new economic policy of Russia.

Steel Treaters Compare Methods of Manufacture

At the November meeting of the American Society for Steel Treating, held in the Engineering Societies Building, New York City, last week, T. H. Nelson, works manager of Henry Disston & Sons, Philadelphia, Pa., lectured on "How Tool Steel Is Made: Comparison of Foreign and American Methods of Manufacture." Mr. Nelson illustrated his remarks with a series of lantern slides showing the preparation of steels and manufacturing processes.

Dr. Frederick Giolitti, the well-known Italian metallurgist and authority on case hardening, was a guest of honor at the meeting.

The lecture season, from December to June, has been well laid out with a series of practical talks on steel treating and related subjects. George L. Norris is in charge of this activity of the association and he promises some interesting meetings.

Postmaster Hays On Tariff

In the course of an address before the Fifth Avenue Association, in New York, Nov. 15, Will H. Hays, the Postmaster General, made significant references to the tariff situation. His utterance in some quarters at least is interpreted to mean that there will be no effort to hurry the enactment of the tariff bill. An extract from Mr. Hays' speech is as follows:

"Before 1914, we were a debtor nation—the largest in the world. Today, we are precisely the opposite. We are the largest creditor nation in the world. Just what is the effect of the enormous importance of this change in our economic and commercial position in relation to the rest of the world I do not pretend to know. I merely point out that no thorough or open-minded or candid consideration of the tariff question can be complete without including consideration of this new factor. Regardless of what an investigation of this point might reveal —omitting this factor altogether, it is a fact that to thoughtful men there must be approval of a certain hesitation and disposition to be cautious and a determination to be sure footed in the consideration of the whole subject of the tariff. Conditions throughout the world are so chaotic that it's difficult to foretell exactly what is needed. The very basic condition on which a tariff is built—the cost of manufacturing in various European countries with relation to our own cost of manufacture, and the value of the currency of the various European countries with relation to the value of our own currency, is at the present moment as fluctuating as quicksand. To build a dependable tariff on such a foundation is difficult, of course. It has been thought by many that we could overcome these handicaps by a device which is called American Valuation, and which provided that all customs duties shall be estimated upon the value of goods at the time when they arrive in the United States and in terms of American money. The Congress in a proper eagerness for information has made an appropriation of $100.000 to investigate the device and otherwise determine what might be done to help us toward writing a permanent tariff. This was proper, but a much better arrangement and one which is very definitely in the mind of the administration for accomplishment, is to make the Tariff Commission a really useful and functioning institution which will constantly study the situation and with sufficient authority, which ought to be given it, be able to meet any and all conditions which obtain or emergencies which may arise. The work of the special investigation has been going on and with the adjustment of our international relations by the accomplishment of the steps which the President has in mind we may expect relief from some of the conditions of fluctuation and instability so that proper permanent tariff making is possible."

British Motor Tax Receipts

The number of motor vehicles of all kinds registered in Great Britain from Jan. 1 to Aug. 31, 1921, was 870,782, and the gross amount of taxes collected was £9,876,105, which is distributed as follows: England and Wales, £8,777,863; Scotland, £888,227; Ireland, £210,015.

The Business Barometer.

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
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Thanksgiving, a peculiarly American holiday, has been described as a "festival of hope in a land of hope." The description certainly fits the day we celebrated last week, for all over the country there was to be discerned a revival of optimism as the people stopped work and contemplated for a few hours the blessings they enjoy.

The news from the Disarmament Congress encourages the hope that an effective agreement along the lines of the Hughes proposal will shortly be reached and that under it the world will be able to quickly redevote itself to the arts of peace. The most important product of the Congress remains nevertheless the sentiment created and the better understanding between the nations that has been promoted.

The United States Congress has adjourned after passing a tax bill which pleases no one, and is described by Senator Smoot as generally and properly "condemned by the American people," but we can at least be thankful and hopeful because there is an election in November, 1922, at which an entirely new House of Representatives and thirty-two new Senators may be chosen.

Still another reason why business men should be thankful is to be found in a letter from the New York Federal Reserve Bank to the member banks of that district in which they are instructed to report the rate of interest charged by them on paper offered for rediscount. This is assumed to be a feeble effort to restrain profiteering among the banks that deal with the public and, while those who are sarcastic are calling attention to the fact that it comes from an institution which made a profit of 129 per cent on its capital last year, it is at least to be commended as indicating a sensitiveness to criticism which it is to be hoped will become more general among Federal Reserve officials.

This I say because many of those who read this letter have of late been writing me asking why they should be charged 7, 8 and even 9 per cent for bank accommodation when the Federal Reserve rediscount rates are so much lower. Such rates would seem to be unjustifiable when good commercial paper is easily salable in New York at 5 per cent, and I advise those borrowers who feel oppressed to put the facts before the Federal Reserve Bank in their district. The buyers of credit are about the only class in the community who have not resorted to a "buyers' strike," and it is about time they acted, for the ever-increasing accumulation of gold seems to make still lower rates a certainty.

Net gold imports for the year up to Nov. 10 were $604,000,000, which is about one and a half times the world's gold production in that period and unless the accepted laws of finance are fallacious or suspended the effect of this continued influx must be to increase the price of other things as expressed in terms of gold. By impounding the gold in the banks and restricting credit by high interest rates bankers have until recently succeeded in averting what some of them have called "gold inflation," but from the action of the markets last week it seems doubtful whether it will be much longer possible to keep people from exchanging cheap money for things that are really more valuable. Take cotton for instance. Years ago Wm. B. Dana said that because it was instantly convertible and could be held indefinitely, cotton was more nearly money than any other form of merchandise. It advanced sharply last week in the face of a ginner's report that indicates a crop far in excess of the government estimate, but still too small for the needs of a normal world. In the trade the advance is ascribed to various technical factors, but the real reason is probably a subconscious appreciation of the fact that under present conditions cotton is cheaper than gold. The same statement applies to grain. Wheat is 11 cents above the lowest and corn is again selling at over 50 cents in Chicago, not because there is any change in the relation of supply to demand, but because money has become or is becoming worth less than food at current prices. Copper, another article that has many attributes of money, is again higher and probably for the same reason.

In the security market the same influence is at work. Liberty Bonds are at the highest of the year. Some issues are in fact higher than since January, 1919, and other bonds, taxables as well as tax exempt, are in eager demand at advancing prices. New issues which total possibly one hundred millions a week are readily absorbed. Because of the ease with which bonds can be sold, the government will probably be able to dispose of all the railroad obligations that it holds, thereby putting itself in funds to finance the roads so that the passage of the refunding bill will be unnecessary. Railroad earnings for October thus far reported are better than expected, and as rates are reduced and traffic stimulated they will probably show further improvement. Some confident buying of low-priced railway stocks is at last noticeable, and the entire stock market is distinctly firm. It seems to be only a question of time when the plethora of money will be felt in a general revival of stock speculation.

Even export credit men, who have had greater reason to be depressed than many who have talked more loudly and despondently, are finding conditions on the mend. At a meeting in New York last week they reported increasingly successful efforts of foreign firms to pay off their indebtedness to our merchants, marked depletion of stocks abroad, and reviving inquiry in our export markets.

Reports from the automobile, petroleum, rubber, iron and steel, and hide and leather centers all show increasing cheerfulness and steady markets. Building and building materials continue active, and cement production during October was the largest ever recorded in a single month. The boom in the fur trade is almost phenomenal. I have been assured by three different manufacturers that they have seldom known better business. There are, however, a few clouds. One of them is a decline in wool at auctions abroad which probably will have to be reflected here, and the quietness and labor troubles of the woolen goods trade. The sugar market is somewhat easier and cattle and hog prices have declined further despite the steadily increasing assistance given by the War Finance Corporation to livestock raisers.

Another cloud is the ever present financial predicament of Germany. Not only do her printing presses turn out their weekly increment of marks, but her export trade is steadily declining and her capacity to pay for her imports, let alone her reparations indebtedness, is even more uncertain than it was at Versailles. It is generally admitted that it is futile to expect her to pay 500,000,000 gold marks on January 15.

Fears, however, that this failure will involve French finance in serious difficulties seem not well founded, for remarkable progress has been made in repaying debts due by the State to the Bank of France, hence reducing inflatoin. The British Empire, barring ever present Irish and Indian threats, sends cheerful news and London expects sterling to continue to advance. Russia's trade is increasing and the establishment of a state bank with all the functions and liberties of private banks is one of the most important steps yet taken in restoring a capitalistic system.

On the whole, the sunshine lights by far the largest area and in our country particularly the shadows are so nearly gone that we have every reason to be profoundly thankful and rationally confident of the future.

Engineer Reserve Corps

In an effort to co-ordinate regular academic training, with that in military engineering, engineer units of the Reserve Officers' Training Corps have been established in twenty-one technical institutions, as follows: Massachusetts Institute of Technology, Yale University, Carnegie Institute of Technology, Virginia Military Institute, Virginia Polytechnic Institute, Alabama Polytechnic Institute, University of Alabama, University of Tennessee, University of Cincinnati, Rose Polytechnic Institute, University of West Virginia, University of Illinois, Iowa Agricultural and Mechanical College, University of Iowa, University of Kansas, Missouri School of Mines, Colorado School of Mines, California Institute of Technology, Oregon Agricultural College, Johns Hopkins University, State College of Washington.

Under this arrangement 3,500 students are enrolled this year, as against 2,800 last year. After four years of instruction, totaling some 600 hours, the student is commissioned in the Engineer Officers' Reserve Corps.

Industrial Standardization in Germany

Digest of Information Secured by D. G. Agnew, Secretary, American Engineering Standards Committee, in Germany, England and Other Countries

Insufficient attention has been given to the role which standardization is playing in German industrial reconstruction. The German industries are planning and are carrying out a far-reaching program of standardization as a necessary step in building up an unprecedented industrial structure which must rest in large measure on an extensive foreign trade. The German work is of special interest to those responsible for the management of American industries, not only because of its importance, but also because of the similarity in the historical conditions surrounding the national standardization movements in Germany and America.

Prior to 1917 a vast amount of standardization work had been carried out in Germany by individual companies, and by engineering societies and industrial associations, but, as was the case in America before the organization of the American Engineering Standards Committee, the work had not been unified along national lines.

As has been the case with all the other national standardizing bodies except the British, which was organized in 1901, the success of the standardization work carried out by all the various countries during the World War as a part of their national programs, was a chief cause of the formation of the central German body. It is called the Normenausschuss der Deutscher Industrie, and was organized by the Verein Deutscher Ingenieure, at the suggestion of the German government in 1917. The present membership consists of engineering societies, industrial associations and government ministries, and in addition there are 700 firms who are contributing members. The work of the Normenausschuss deals only with those subjects which concern two or more industries or branches of industry.

It is remarkable that the national standardization movement in Germany should have been so thoroughly organized and that so much work should have been accomplished in four years, for 144 approved standards sheets have been issued and over 500 others have been so far developed that they have been published in tentative form. The standards are issued under the general designation of "German Industrial Standards." The Germans were the first of the national bodies to publish standards in loose-leaf form. The work is so divided as to make each sheet as nearly independent as possible. Firms purchase these sheets in quantity, issuing them directly to designers, draughtsmen and foremen for use as working drawings and data sheets. The sale of sheets amounts to about 100,000 monthly. This plan is now followed by the Austrian, Dutch, Swedish and Swiss bodies.

The organization provides an extensive information service on standardization work in Germany and other countries, which is available to the industries as well as to their working committees. This is along much the same lines as the information service which has been started by the American Engineering Standards Committee. In this connection it is interesting to note that in general the German and Japanese industries appear to study foreign developments much more closely than do those of other countries.

Organization and Methods of Work

Next to the American Engineering Standards Committee, the German organization is the most decentralized of the national standardizing bodies. There is a main committee composed of representatives of the various national organizations supporting the movement and a smaller executive committee. The detailed technical work of each project is in the hands of a working committee which in Anglo-Saxon countries would be called a "sectional committee," i.e., a committee made up of representatives of all bodies interested in the particular subject in hand.

Proposals for new subjects for standardization must come from some responsible body. The industry concerned is consulted, generally by a conference of the various organizations interested, to determine whether it is the consensus of opinion that the work should go forward. In case it is decided to undertake the work, the conference designates the chairman of the working committee.

The central office digests the information available on the subject for the use of the working committee. When agreement is reached in the committee on the draft of a standard it goes to the central office for editorial work. There it is scrutinized to see whether it is consistent with other standards; whether points have been included which concern other working committees; whether the drawings and nomenclature are in approved form, etc. After this editorial checking the central office has the draft of the standard put into proof form. It is then reviewed by an official clearing house committee, which contains a representative from each major line of work being carried on by working committees. If any change in substance has been made, it goes back to the working committee. If no such change has been made, it is published in the *Mittielungen*, the official publication of the Normenausschuss, as a tentative proposal. Upon recommedation of the working committee, the standard is mailed to the members of the executive committee with a supporting statement. With their approval it is then republished as an official proposal. Six weeks are allowed for criticism when a standard is finally published unless additional important criticisms are received.

Work in Special Industries

The foregoing refers to the work of the central body only, which is limited to subjects common to two or more industries. In addition there are some fifteen organizations known as special industry committees, each of which deals with the standardization work peculiar to a single industry, such as shipbuilding, electrical, agricultural, automotive, elevator, locomotive, paper, textile and woodworking.

These committees are closely affiliated with, but not strictly an organic part of, the central body. They are organized not by the Normenausschuss, but by one or more technical or trade associations concerned with the particular subject in hand. Standards formulated by the special industry committees are published by the organization responsible. In most cases the final standards are published in loose-leaf form modeled closely after that of the standards issued by the Normenausschuss itself. These standards are submitted to the Normenausschuss before publication, in order to keep them consistent with the regular series of German industrial standards.

The volume of work being carried out through these special industry committees appears to be at least as great as that under the direct control of the central body.

Characteristics of Continental Work

Looked at broadly, and with exceptions such as must always be made in general statements of the kind, the continental countries are going much further into dimensional standardization than are the Anglo-Saxon countries. This includes interchangeability of supplies and of machine elements, the interworking of parts and of related apparatus made by different makers, and the interchangeability, so far as the use is concerned, of complete machines and apparatus. By far the greater part of the work of the Normenausschuss is dimensional, greater attention being paid to such matters as machine elements, screw-threads, bolts and nuts, standard diameters, and systems of limit gaging. The Anglo-Saxon mind takes more to matters having to do with purchase and contract, such as specifications for materials, and for performance of apparatus, methods of test, etc. The Normenausschuss itself has done very little of this type of work as yet, but it has been highly developed by some of the German special industry committees, for example, in the electrical industry. Some of these special industry committees are very active in the elimination of types, sizes and grades of manufactured products, and a special word, "Typung," has been introduced for this type of work.

On the Continent there is a greater dependence upon theoretical and fundamental considerations, the Anglo-Saxon temperament giving rise to a much larger degree of expediency in adjusting commercial considerations in the process of arriving at agreements.

German manufacturers will go farther in yielding apparent temporary commercial advantages for the sake of advancing their national industry as a whole, than is the case in America or Great Britain. Three principal reasons for this are: the great economic pressure under which German industry is laboring; the mental trait of more readily acquiescing in decisions affecting national welfare; and the belief that an essential to the rehabilitation of German industry is the rebuilding and great enlargement of their export trade, for which the importance of standardization on national lines is more readily apparent than it is in the home market and domestic trade.

The Germans have not yet had their

standards translated into foreign languages for use in export, as the British are doing, but they are now giving consideration to this question.

“Preferred Numbers”

As typical examples of the German work, their system of “preferred numbers” and their standard series of handles may be mentioned. The first is a fundamental piece of work, founded on theoretical considerations and of the first importance. It is a simple system of numbers for use in all new standardization work, in which gradated numerical values are required, such as standard gradated diameters of pulleys, thicknesses of plates, or capacities of machines. The Germans believe that its use will lead to great economies in material, in reducing the number of sizes, ranges, etc., simplify the carrying of stocks and facilitate interchangeability. It may be shown theoretically that, under average conditions, a given number of standard sizes laid out according to these numbers, will be better fitted to any series of jobs taken at random, than would be the same number of sizes laid out in any other way, and this with a minimum of material.

The standard handles furnish a typical example of German love of thoroughness of detail. There are two shapes, each adapted to a particular method of use, and there is a series of sizes for each shape. The profiles have been worked out with the most extreme care, an efficiency engineer having been employed to make time-motion studies to determine the exact profile that would insure the greatest accuracy in operation with the minimum fatigue of the workman's hand. It is felt that by doing a thorough job once for all, different industries and firms will be saved from doing the same thing over and over, but always less well, and that at the same time interchangeability is introduced.

Industrial Significance

The standardization movement in Germany is particularly significant, since Germany is one of the three leading industrial countries. The industries of Austria, Holland, Sweden and Switzerland are so intimately related to those of Germany on acount of geographical and other relationships, that they are necessarily affected very largely by developments in Germany. It appears that the work is being woven very intimately into the industrial fabric. The very large number of standard sheets purchased by the industry, and the fact that the central organization has 5,000 firms which are co-operating members, are a sufficient indication of the thoroughness with which the Germans pursue their aim.

There seems to be a striking analogy between the present standardization movement in Germany and the research movement developed there a generation ago. Whatever estimate one may place upon the rôle it played in German industries generally, everyone agrees that research was fundamental in the development of the great chemical industries. The rôle which the Germans are expecting standardization to play in all their industries would be not unlike the rôle which research has played in their chemical work. A copy of a report on this subject, which was rendered to the American Engineering Standards Committee by its secretary, will be sent upon request.

Ordinary Expenses of Government for October

Ordinary expenditures of the government increased by more than $37,-600,000 during October as compared with September, while disbursements on the public debt fell off by about $627,000,000, according to the monthly statement issued by the Treasury.

During October ordinary expenditures totaled $304,157,955 as against $266,523,932 in September, while public debt disbursements for the month amounted to $546,394,200, compared with $1,173,842,743 in the previous month.

Interest on the public debt amounting to $130,000 was the largest item under ordinary expenditures for the month, while $457,571,000 in certificates of indebtedness retired was the largest item under public debt payments.

United States Civil Service Examinations

The United States Civil Service Commission announces open competitive examinations for junior technologist on Jan. 11, March 8 and May 17, 1922. Vacancies in the Bureau of Standards, Department of Commerce, for duty in Washington, D. C., or elsewhere, at $1,200 to $1,500 a year, and in positions requiring similar qualifications, at these or higher or lower salaries, will be filled from these examinations. As the higher-salaried positions are usually filled by promotion, appointments are usually made at the lower salaries, but persons showing in their examinations that they are unusually qualified are occasionally appointed at the higher salaries.

All the citizens of the United States who meet the requirements, both men and women, may enter these examinations; appointing officers, however, have the legal right to specify the sex desired in requesting certification of eligibles.

The Bureau of Standards covers a wide field of work in physics, chemistry, engineering and industrial technology, including research and standarization, and offers valuable experience in these professions, combining as it does theoretical, experimental and practical work. The duties of the appointee will be in connection with original investigations in some field of the bureau's work. The chances for advancement are good for those who prove capable. Experience in the bureau is considered an admirable training for scientific work, and its close connection with the industries makes particularly valuable as a training in industrial research. The bureau's facilities make it perhaps the best equipped physical laboratory in the world.

Examinations will be given in the following optional subjects and applicants must state in which they desire to be examined: Rubber technology, leather technology, paper technology, textile technology, oil technology, general technology.

For the purpose of this examination the word “technologist” shall be construed as applying in connection with some industrial manufacturing process where said manufacturing process is based upon the fundamental principles of an applied science.

Further information can be obtained from the Department of Commerce, Washington, D. C.

Schwab Speaks for Steel Industry on Disarmament

Concentration of the energies of mankind upon constructive rather than destructive activities will make possible greater permanent prosperity for the steel industry than will armanent competitions, in the opinion of Charles M. Schwab. Among the thoughts expressed by Mr. Schwab at the dinner given Marshal Foch by the American Iron and Steel Institute, in New York, on Nov. 18 were the following:

“From the beginning to the end of the war, our industry furnished for war purposes nearly fifty million tons of steel. The mere figure does not picture to the mind what that means. And yet fifty million tons of steel would build a modern railway ten times around the earth.

“During the war we talked of a bridge of ships across the Atlantic. Fifty million tons of steel put into the hulls of ships would actually build a bridge of ships from the United States to France.

“It was truly a war of material and machines as well as of men, and, we, of the American iron and steel industry like to think, not that we won the war, but that we accomplished in full the part that was assigned to us.

“I am at the head of the largest war materials manufacturing works in the world. The shipyards of my company build more naval ships than are built in any other yards under one management in the United States. But, I have been thrilled beyond expression, as has every good American, by the brilliant and statesmanlike scheme laid before the Conference at Washington by Secretary Hughes. The carrying out of that plan may involve great monetary loss in some quarters, but such a thing as financial loss can be of no consideration when compared to the inestimable boon to mankind which would be involved in the realization of that magnificent plan. What red-blooded American would not, indeed, make any sacrifice if the burden of armament could be lifted from the shoulders of humanity. May God speed the day when this noble conception can be realized!

“If disarmament inflicts a money loss upon us, the American iron and steel industry will accept it willingly and gladly. We will do so not in a spirit of mere idealism and self-sacrifice, but in a belief that the greatest permanent, material prosperity would be brought about by the concentration of the energies of mankind upon constructive activities; upon means for well-being, and not for the destruction of civilization.”

◆

Taylor Society Now in Session

The annual meeting of the Taylor Society opened today with the annual business session as the first event on the three-day program. The meeting is being held in the Engineering Societies Building, 29 West 39th St., New York City. Thursday will be devoted to a general public session; Friday to sessions for sales executives and plant managers. Friday afternoon there will be a session for office managers and on Saturday morning a period will be given over to labor managers.

On Saturday afternoon there will be a luncheon for Henry R. Towne, honorary president of the society.

Economic Research Bureau Shows Nation's Income

Some interesting figures on the extent and distribution of the income of the United States are furnished in a report just issued by the National Bureau of Economic Research. This organization was formed for the purpose of finding and placing before the public the facts in regard to economic questions. Its board of directors is composed of men of widely divergent views, but each report must be approved by all the directors.

This report states that the total national income increased very greatly between 1910 and 1919, when measured in current dollars; it increased less when calculated in unchanging dollars based on 1913 prices; the per capita income in terms of 1913 dollars increased still less. These facts are brought out in the following table:

	Total National Income (Billions)	Per Capita Income (Dollars)	Total Income in 1913 Dollars (Billions)	Per Capita Income in 1913 Dollars (Dollars)
1910	$31.4	$340	$32.2	$349
1911	31.2	333	31.7	338
1912	33.0	346	33.2	348
1913	34.4	354	34.4	354
1914	33.2	335	33.0	333
1915	36.0	358	35.2	350
1916	45.4	446	40.7	400
1917	53.9	523	40.8	396
1918	61.0	586	38.8	372
1919	65.9	629	37.3	358

In 1918, which is the year concerning which we have the best information, 1 per cent of the income receivers obtained 14 per cent of all the income; 5 per cent obtained 26 per cent of the income; 10 per cent had 35 per cent of the income, and 20 per cent had 47 per cent of the income.

One of the most interesting tables shows how the product of the large, organized industries is divided between investors and management on the one hand, and salary and wage earners on the other. The record by years is as follows:

	Share of Investors and Management Per Cent	Share Paid in Wages and Salaries Per Cent
1910	31	69
1911	28	72
1912	28	72
1913	28	72
1914	26	74
1915	28	72
1916	33	67
1917	31	69
1918	23	77

This appears again to indicate that the shares vary materially with periods of prosperity and depression, and bears out the general indication that our participation in the war was accompanied by a lessening of inequality of distribution.

The sources from which the income is drawn maintain a remarkably steady relation over the ten years studied. Taking a general average, agriculture contributed 17 per cent of the total; manufacturing 30 per cent; transportation about 9 per cent; mining a little over 3 per cent; banking over 1 per cent, and government about 5 per cent. The large group of the miscellaneous, such as merchants, retailers, professional men, domestics, various forms of service and others too numerous to mention, contributed in the aggregate about 33 per cent. The share of agriculture increased from 16 or 17 per cent in the years 1910-16, to 18 and 21 per cent in 1917 and 1918. It is as yet too early to get the final results for 1919 and 1920.

The time honored opinion that America is a nation of spendthrifts is brought into question by the report. The savings of individuals going into extension of plant as represented by new corporate issues of securities; public improvements financed by state and municipal bond issues, and the great number of private houses built each year, all these mount up to a large total. The bureau is now engaged in making a more precise estimate of these yearly totals.

Corporation Savings

In addition, the bureau points out the great importance of savings by corporations. These are distinct from individual savings, and consist of the earnings of corporations which are not paid out as dividends but are laid aside as a surplus and used for new investments or extensions of plant. From the point of view of the stockholders, they are involuntary savings made by the corporation for their benefit. In the aggregate, they mount up to a large total.

Year	Corporate Savings (Billion Dollars)
1910	$1.2
1911	0.9
1912	0.9
1913	1.0
1914	0.5
1915	1.6
1916	3.9
1917	3.4
1918	1.7
1919	1.3

All of this indicates that despite the free spending of the American people they directly or indirectly manage to increase the national wealth at a surprisingly rapid rate.

Obituary

J. N. D. **Reeves**, 77 years old, retired president of Reeves & Co., Columbus (Ind.) machinery manufacturers, died recently at his home in Plainfield, Ind. He lived at Columbus the greater part of his life, making Plainfield only a temporary home. He was well known to business men throughout the state.

J. **Frank Durston**, for many years one of the leaders in industrial activity in Syracuse, N. Y., died at his home there on Nov. 16. Mr. Durston was president of the Durston Gear Co. of Syracuse, which was the successor to the Le Fevre Arms Co. of which he was also president. Besides this he was president of the Sanford Motor Truck Co.

George W. Eccles, general manager of the Davis & Farnum Manufacturing Co., of Waltham, Mass., died suddenly on Nov. 11. He was 50 years old.

A. A. **DeLoach**, head of the A. A. DeLoach Co., of Atlanta, Ga., manufacturer of mill machinery, and internationally known as the inventor of the DeLoach turbine water wheel and friction-driven sawmill engine, died Sunday, Nov. 20, at his home in Atlanta following an extended illness.

Forthcoming Meetings

The annual meeting of the **Taylor Society** will be held in the Engineering Societies Building, New York City, on Dec. 1, 2 and 3.

The annual meeting of the American Society of Mechanical Engineers will be held in the Engineering Societies Building, New York City, on Dec. 5 to 9.

A dinner-meeting of the Metropolitan section of the S. A. E. will be held at the Automobile Club, New York City, on Dec. 15.

Increase in Exports of Machine Tools

While exports of metal working machinery increased slightly in October over those of September, the total exports movement is so small as to be almost insignificant. The value of all metal-working machinery exported during October, 1921, was $680,931. Brazil made heavier purchases than any other single country. The falling off of purchases by the United Kingdom, British India and by Japan were most marked. The detailed figures, which are those of the Department of Commerce, are as follows:

	Oct., 1920	Oct., 1921
Metal-working machinery:		
Lathes	$358,088	$146,128
Other machine tools	1,170,075	143,224
Sharpening and grinding machines	247,788	89,272
All other	1,556,908	302,307
Total metal-working machinery	3,332,859	680,931
Exported to:		
Belgium	124,676	6,337
France	488,330	68,751
Italy	105,700	92
Norway	23,737	1,273
Spain	112,081	5,006
Sweden	34,910	1,173
United Kingdom	661,401	81,999
Canada	446,354	57,035
Mexico	80,179	37,630
Cuba	90,534	24,921
Brazil	37,092	126,377
Chile	126,948	23,518
China	102,511	5,303
British India	79,910	101,746
Japan	404,019	61,709
Australia	75,864	11,731
Netherlands	....	1,286
Argentina	....	7,172
Dutch East Indies	....	1,715
Other countries	338,613	56,157

Machine tools imported during October, 1921, were valued at $17,756.

Business Items

The board of general appraisers of the customs service has ruled that clutch driving disks are properly classified for tariff purposes under the general provision for manufacturers of metal. As such they take a duty of 20 per cent ad valorem and are not dutiable at 30 per cent ad valorem as "finished parts of automobiles," as was contended by the Collector of Customs at Detroit.

The Norton Company, manufacturer of grinding machines, of Worcester, Mass., has added four directors to its board. They are W. LaCoste Neilson, general sales manager; Henry Duckworth, controller; Louis E. Saunders, research engineer, and John C. Spence, superintendent.

The American Protective and Credit Service Corporation, 23 Union Square, New York City, will publish a monthly bulletin on the prevailing conditions in Cuba. It will be called "The Cuban Collector," and will be mailed to any of our readers on request.

Alfred Herbert, Ltd., Coventry, England, announces that after Dec. 31 its New York office will be closed. All communications should be sent direct to Coventry or to such branches or affiliated companies as the case demands. E. D. Mitchell, who has been manager of the New York office, will return to England the early part of the new year to take up duties at the home office.

The Exeter Machine Works, Inc., of West Pittston, Pa., announces the appointment of the English Tool and Supply Co. as exclusive sales agent for the Exeter rotary pump line in the Kansas City district. The English Tool and Supply Co. specializes in the marketing of tools and supplies for railways, machine shops and mills.

The foundries, machine shops and other properties in Talladega, Ala., owned by the Talladega Foundry and Machine Co., have been sold to Morris W. Bush and associates, of Birmingham, Ala. The properties consist of one small plant and one large one, the latter representing an investment of about $150,000 and regarded one of the most modern pipe plants in the South. The small plant is now in operation and the new owners expect to start the large plant in the near future.

Slater & Tuck, founders and machinists, of Beloit, Wis., have sold their plant, including five fully equipped buildings, to the American National Manufacturing Co., of St. Louis, Mo. The new owners contemplate erecting a new brass foundry in the future.

The shopmen of the Chicago & North Western Railroad, at Chicago, have agreed to accept a lay-off of one day each week and retain a full force, rather than the management's alternative of a six-day week with 90 per cent of the force. It is estimated that the wage saving by this change will be about $1,500,000.

The Sedalia Machinery and Supply Co. has opened offices in Sedalia, Mo. W. R. Large is the proprietor.

The Combustion Engineering Corporation has opened two branch offices—one at 216 Latta Arcade, Charlotte, N. C., and another at Seattle, Wash., where the Fryer-Barker Co. will be the agent.

The Rivett Lathe and Grinder Co., of Boston, Mass., has opened sales offices in the Kerr Building, Detroit, Mich. The Reed-Prentice Co. occupies the same office. The Rivett company requests that all communications for that territory be sent to the new office, as facilities have been provided for prompt attention and service.

The Crane Co., 836 South Michigan Ave., Chicago, manufacturer of steam fittings, pipes, valves, etc., has awarded a contract for a three-story addition to the present plant at West Second St., Davenport, Iowa. The Crane Co. has also acquired the plant of the Glenmore Lubricant Co., Ohio, which it will use as a distributing station after certain renovations and installations of new equipment are completed.

The Austin Machinery Corporation has established a branch factory and distributing agency at Woodstock, Ontario. It is known as Canadian Austin Machinery, Ltd.

The Exeter Machine Works, Inc., of West Pittston, Pa., announces the appointment of the Hendrie & Bolthoff Manufacturing and Supply Co., of Denver, Col., as exclusive sales agents for the Exeter rotary pump line in the Denver district. The Hendrie & Bolthoff Company specializes in the marketing of tools, pumps and supplies for railways, machine shops and mills.

Springfield, Mass., is reorganizing its Evening School of Trades after the plan of the night technical schools of Pittsburg. A three-year course in engineering has been authorized. The present one-year course will be continued. Engineers of leading manufacturing establishments in this section will serve as instructors.

The H. B. Smith Co., Westfield, Mass., has instituted night shifts in its two plants and increased its force to 1,300 to catch up with orders.

The Century Machinery Co., Holyoke, Mass., has given a mortgage of $400,000 to Jeremiah N. Hubbard and Joseph B. Weis, both of Holyoke, to secure an issue of bonds payable Nov. 1, 1931.

The Jackson Metal Products Co., of Jackson, Mich., has been taken over by the Earl Motors, Inc. It will be operated as one of the manufacturing units of the Earl company.

Personals

Lawrence J. Stoddard has resigned the position of sales manager of the tool division of the Greenfield Tap and Die Corporation, Greenfield, Mass., to accept a position with the Lakeside Forge Co., Lakeside, Pa.

Don M. Crawford has sold his interest in the Crawford-Macbeth Co., to his partner, Mr. Macbeth. He will retire from active participation in the general foundry and machine business, but he will continue to advise the sales force of the company, which will be continued by his partner under the name of F. A. Macbeth Company.

H. F. Hoevel has resigned as secretary and general manager of the Hoevel Manufacturing Co., Jersey City, N. J. The sale of Hoevel sand-blasts is now in charge of J. M. Batton.

F. T. Coup has been appointed district manager in charge of the Cincinnati office of the Wagner Electric Manufacturing Co., of St. Louis, Mo. Mr. Coup was formerly in charge of the Milwaukee district.

Harry R. Jones has resigned as president of the United Alloy Steel Corporation, Canton, Ohio; **Edward L. Hang** has resigned as vice-president and secretary. Both men will continue to serve on the board of directors.

Myron E. Forbes has been elected a vice-president of the Pierce-Arrow Motor Car Co. He is also treasurer of the company.

O. B. Iles, of the International Machine Tool Co., Indianapolis, Ind., has been appointed chairman of the committee on division of constitution and by-laws of the National Machine Tool Builders' Association, by President August Tuechter. Paul E. Thomas, of the Kempsmith Manufacturing Co., Milwaukee, Wis., and H. P. Dix, of Wilmarth & Morman Co., Grand Rapids, Mich., are the other members of the committee.

Ernest Reich, of 11 So. LaSalle St., Chicago, Ill., is now engaged in marketing of domestic and foreign patents. Owners of meritorious inventions are invited to communicate with him with a view of selling or exchanging the manufacturing rights of American patents for foreign inventions.

Arthur G. Hertzler, sales manager of the Bearings Company of America, of Lancaster, Pa., has resigned his position and will remove to his new home at Salt Lake City, Utah.

John P. Ilsley, formerly of Niles-Bement-Pond Co., New York, and later with the Reed Prentice interests, of Worcester, is now the New England manager of the selling branch of the Solvay Process Company, Syracuse, N. Y., with headquarters at 89 State St., Boston, Mass.

J. H. Wilhelm, **L. E. Larson** and **John Cetrule**, consulting engineers of New York City, have been elected president, vice-president and secretary-treasurer, respectively, of the Triplex Machine Tool Corporation, which manufactures the Triplex line of combination machines. This new connection will not in any way interrupt their active practice as consulting engineers.

George Carrel, brother of J. Wallace Carrel, general manager of the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, was elected Mayor of that city, at the November election.

L. W. Wallace, executive secretary of the Federated American Engineering Societies, addressed the Engineering Society of York, Pa., in that city on Nov. 21. He discussed the activities of the Federation.

Alexander V. Dye has been appointed a trade commissioner of the Department of Commerce with headquarters at London, England. He will devote particular attention to the coal situation. He has been instructed to pay a personal visit to the British coal fields and report on his observations. Mr. Dye was formerly with the American International Corporation and has been very successful in efforts to introduce American coal mining machinery into British mines.

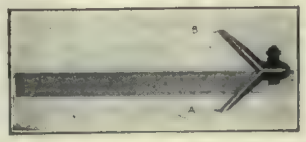
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Center Head, Combination

Brown & Sharpe Mfg. Co., Providence, R. I.

"American Machinist," June 23, 1921.

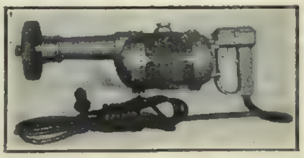


The center head furnished with the combination squares now made by the concern is ground so that both arms are of equal length, and the points *A* and *B* are equidistant from the edge of the scale. This permits the use of the center head on work of large diameter, as shown by the dotted arc.

Grinder, Portable, Electric

Black & Decker Mfg. Co., 111 S. Calvert St., Baltimore, Md.

"American Machinist," June 23, 1921.



This portable electric grinder embodies the principal features of the portable electric drill made by the same concern. The grinder is equipped with a pistol grip and trigger switch, making it unnecessary for the operator to shift either hand to start or stop. While the machine is essentially a portable grinder, it is supplied complete with a quick-detachable base and adjustable toolrest, so it can be used as a bench grinder. The equipment includes two 5 x 1-in. grinding wheels, a wire brush wheel, and a rag buffing wheel. The machine is equipped for grease lubrication throughout, has forced air cooling, chrome-nickel steel gears and shafts, and aluminum alloy housing. The principal specifications are: motor, ½ hp.; speed, no load, 3,200 r.p.m.; and net weight without base, 21 lb.

Attachment, Grinding, Reamer, "Common Sense"

G. L. Wood, 16 Stafford St., Worcester, Mass.

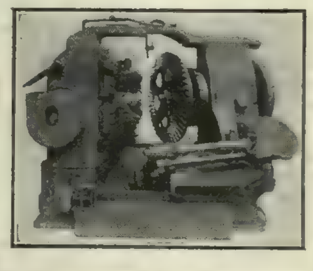
"American Machinist," June 23, 1921.

The device is adapted particularly to hand expansion reamers having pilots, but it is applicable also to the grinding of machine reamers, boring bars, pin-cutter bars and taps. Reamers from ½ to 2 in. in diameter can be held. The reamer is expanded a sufficient amount to permit of the removal of the dull edge, and is then ground to size. It is said that the reamer can be kept to proper size throughout its entire length as long as it is expandable. The cutters of boring bars can be ground without removing them from the bars, any angle of rake or clearance up to 5 deg. being obtainable. Machine and hand taps can be reground when broken by cutting off the broken end and grinding any angle of taper and relief by the use of the tooth-rest gage.

Planer, Bevel-Gear, Two-Tool, 37-Inch

Gleason Works, Rochester, N. Y.

"American Machinist," June 30, 1921.

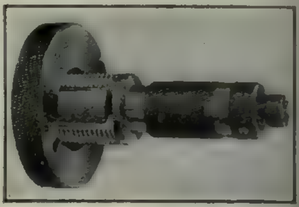


This machine is intended as a general-purpose machine for cutting large diameter and coarse-pitch bevel gears. It can cut any gears up to 26 in. cone radius, handling miter gears up to 37 in. in diameter and crown gears up to 52 in. The longest face that can be cut is 10 in., and the largest pitch 1 diametral. On the bed is mounted a pivoted work head and a stationary column carrying the tool heads. The column houses the speed-change box, crankplate drive and the slides carrying the tool heads. The distance between the tool heads is varied as the work is fed in, by means of a follower on a formed template, thus shaping the tooth. The tools reciprocate and cut alternately, working on opposite sides of the same tooth when finishing. Speed and feed changes are provided. Gages are furnished for quickly setting the tools.

Micrometer, Thread, Internal

John Bath & Co., Inc., Worcester, Mass.

"American Machinist," June 23, 1921.

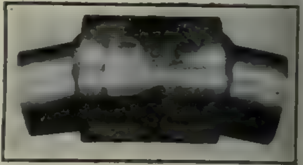


The tool is intended for the measurement of internal threads. With it, the size of a tapped hole, ring thread gage, or other internal thread may be obtained directly in units of ten-thousandths of an inch. The four measuring jaws are supported and held in alignment by closely fitting dovetail slots in the body of the micrometer, and may be adjusted for size by means of a micrometer screw and graduated sleeve. Adjustment is provided so that when wear occurs on the measuring jaws, the micrometer may be referred to the master reference ring and set correctly to size. The micrometer can be furnished with any number of threads per inch, in sizes from 1 to 5 in. in diameter.

Coupling, Shaft, Free-Floating, Whitney

Kay Manufacturing Co., South Norwalk, Conn.

"American Machinist," June 23, 1921.

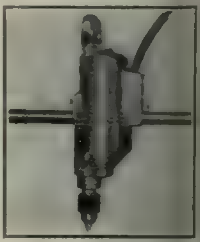


The coupling allows for both parallel and angular misalignment of the shafts being connected, as well as providing for axial movement, such as the floating of an armature. The power is transmitted from the driving to the driven hub through a floating link. A casing surrounds the parts, the hubs being prevented from slipping out by retaining rings fastened in the ends of the casing. There are no projecting flanges or pins. The hubs have square holes cast in the large ends, into which the ground ends of the semi-steel link fit. The link can thus slide in the holes and swivel in any direction, because of the rounded shape of its ends. The smallest part of it is thicker than the shafts being connected. The coupling is made in sizes to fit shafts from ⅞ to 6½ in. in diameter, although couplings having special and tapered bores can be furnished.

Drill, Portable, Electric, Two-Speed

Louisville Electric Mfg. Co., 31st and Magazine Sts., Louisville, Ky.

"American Machinist," June 23, 1921.

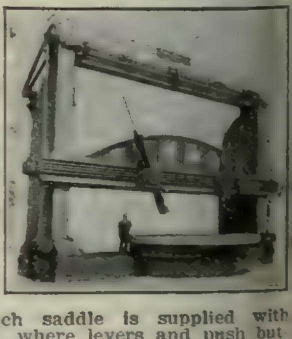


The concern has recently developed a line of portable electric tools, such as drills, grinders and motors, among which is the No. 3 two-speed Universal drill shown. The speed changes are obtained by shifting a knob located close to the handle. The switch for operating the motor is controlled by a small knob on the handle. The gears are made of heat-treated chrome-nickel steel. The frame is of aluminum throughout and is force-ventilated for cooling. Jacobs chucks are a part of the standard equipment. The drill shown has a capacity of ½ in. on high speed and ⅝ in. on low speed. The length over all is 17½ in., and the weight 19½ lb. A breast plate, interchangeable with the spade handle, can be furnished.

Boring Mill, 35-Ft.

William Sellers & Co., Philadelphia, Pa.

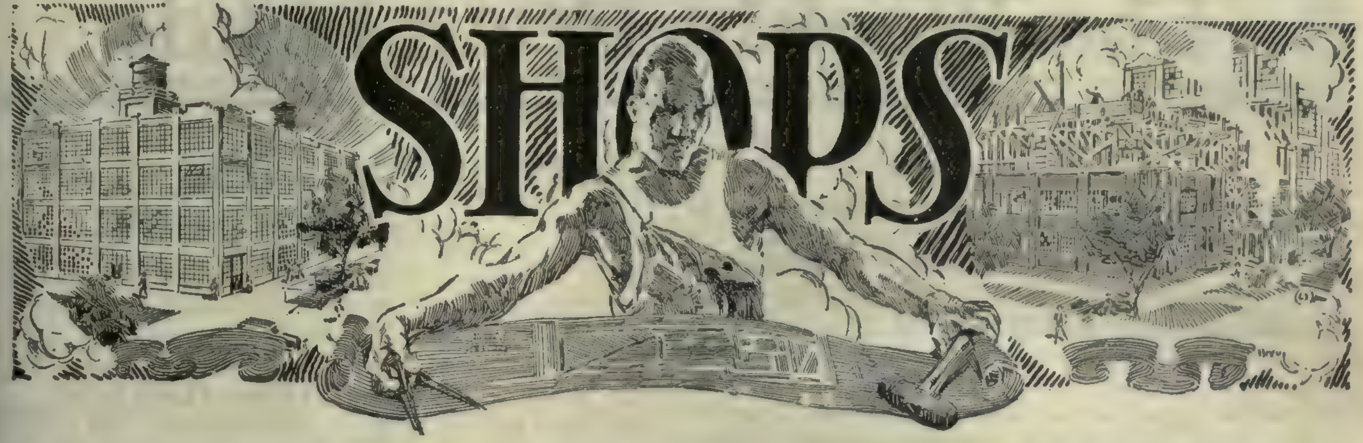
"American Machinist," June 30, 1921.



This boring and turning mill is intended for machining the castings used in large hydro-electric power units. It is probably the largest machine of its type ever built, measuring 35 ft. between the uprights and 18 ft. between the table top and the tools when the crossrail is in its highest position. The bed of the machine weighs about 50 tons. The table weighs about 40 tons and is 19 ft. 10 in. in diameter and 2 ft. 3 in. thick. The cross girt carries the lifting and traverse machinery drives. The machine is driven through a 50-hp. motor, and has a speed range of 0.19 to 6 revolutions per minute. The feed range is from 1/64 to 1½ in. per revolution of the table. Each saddle is supplied with a wooden platform for an operator, where levers and push buttons give complete control of every movement.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED



Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Mass., Chicopee Falls—The Stevens-Duryea Co.—radial drills, 3 ft. and 3½ ft.

Md., Baltimore—The Continental Garage & Service Corp., 715 Gaither Bldg., J. E. Hyatt, Purch. Agt.—complete equipment for automobile repair shop, including lathe, drill presses, power hack saw, arbor press, gasoline system, tanks, etc.

N. Y., New York—J. Stolz & Son, Inc., Highbridge Station, Commerce Ave., W. J. Stolz,. Purch Agt.—one electric floor grinder, 220 volt., a.c. with 2 emery wheels approximately 12 in.-14 in. diameter.

N. Y., Syracuse—H. H. Franklin Co., 302 South Geddis St.—one multiple spindle drill press, head at least 11 x 20 in., table at least 19 in. x 30 in., equipped not less 16 spindles, maximum capacity of 5/16 in.

N. J., Camden—W. J. Kelly, 675 Ferry Ave—machine tools and machinery for proposed machine shop on Haddon Ave. and Euclid St.

N. J., Camden—J. B. Moery, 284 North 34th St.—equipment for auto repair shop including lathe, drill press, etc.

N. J., Florence—The Florence Pipe, Fdry. & Machine Co.—equipment for machine shop including lathes, planers, boring machines, etc.

Pa., Philadelphia—J. K. Altemus, 2824 North 4th St., M. Altemus, Purch. Agt.—lathes, boring machines and grinders.

Pa., Philadelphia—L. F. Seyferts Sons, Inc., 437-441 North 3rd St.—

One 72 in. engine lathe, to swing at least 60 in. over carriage, 22 ft. between centers, standard modern tool, preferably motor driven.

One die sinking machine.

One Bliss drawing press, not less than 2½ in. stroke.

Pa., Pittsburgh—The Raylo Co., 1228 Fulton Bldg.—equipment for the manufacture of mechanical specialties.

Pa., Spring City—The Spring City Glass Co.—tools and machinery for proposed machine shop.

Ala., Birmingham—G. R. Mueller Co., Brown-Marx Bldg.—complete equipment for structural steel fabricating shop, including punches, shears, steam hammer, bending rolls, riveting hammers, air tools, etc. (used if in good condition). Punch, capacity not less than ¾ in. hole through ¾ in. steel plate, throat from 30 to 48 in. with architectural jaw and various shearing attachments, prefer motor driven machine for 220 volt, 3 phase, 60 cycle current. (used if in good condition).

La., New Orleans—The Louisiana Metal Cabinet Wks., 1019 Bienville St.—one late model G. A. Ohl 10 ft. 6 in. power press brake with and without die, 10 gage capacity (new or used); one late model Jones & Lamson or equal, flat turret lathe with full equipment, 2¼ in. x 26 in. (new or used); one Madison cylinder grinding machine or equal (new or used).

Va., Ashland—The Ashland Garage, England St., V. Priddy, Purch. Agt.—drill press, small lathe and shop tools.

Va., Richmond—The Auto Radiator & Fender Co., 1013 West Broad St.—metal folder and small lathe.

Va., Richmond—The Natl. Motor Co., 1629 West Broad St.—drill press and hydraulic press.

Va., Richmond—The United States Government, Richmond P. O., H. Thornton, Post Master—full line of machinery for repairing motor trucks.

W. Va., Charleston—The Nitro Mfg. Mine Supply Co., P. O. Box 1494, P. J. Rowan, Secy.-Treas.—machinery, etc., for proposed foundry and machine shop.

Ill., Chicago—E. L. Denison, 17 West Garfield Blvd.—

One Universal miller.

One power hack saw.

One boring machine.

One shaper and sticker.

Ill., Chicago—Lathrop Paulson, 2459 West 48th St.—a very large geared power press.

Ill., Chicago—The Paramount Knitting Co., 337 West Madison St.—power pipe threading machine.

Ill., Chicago—N. M. Stone Co., 2000 North Major Ave.—one die filing machine.

Ind., Michigan City—Haskell & Barker Car Co. Inc., F. O. Reemer, Purch. Agt.—

One 12 ft. gate shear, capacity ¾ in. plates.

Two single 3 gag punches, ¾ in. capacity.

One horizontal punch machine, ¾ in. capacity.

One gang punch machine, 10 ft. between housing.

One No. 9 Williams-White bull dozer.

One 750-ton capacity Bliss press.

Two 96 in. deep gap pit riveters, ¾ in. rivet capacity.

Two 48 in. shallow gap side riveters, ½ in. rivet capacity.

One drawbar riveting machine.

Two Allen compress riveters.

Two Allen pinch bug riveters.

O., Cleveland—The Minnehaha Spring Water Co., 3658 Prospect Ave.—complete tin shop equipment (used).

Mich., Detroit—The Michigan Auto Top & Trimming Co., 123 Winder St., M. Raymond, Purch. Agt.—one 36 in. band saw, one 12 in. joiner, Universal woodworking machines and milling machines.

Mich., Escanaba—The Wolverine Delta Motor Co—medium size lathe and an air compressor.

O., Lisbon—The Wright Mfg. Co., Water St.—one 10 in. x 5 ft. lathe.

O., Minerva—The Lewis Electric Co.—48 in. or 72 in. squaring shears, 2 spot welders.

O., Toledo—The Natl. Supply Co., Clair and Washington Sts., manufacturer of mill supplies, H. E. Otis, Purch. Agt.—one 24 in. Steinle turret lathe, (used).

Wis., Appleton—The West End Auto Co., 476 South St.—equipment and machinery for auto repair shop.

Wis., Beloit—Morks Garage, P. O. Box 227—equipment for proposed auto repair shop on Main St.

Wis., Burlington—J. A. Luke—machinery and equipment for auto repair shop including press, 1 or 2 ton.

Wis., Madison—C. S. Hansen, 902 Jenifer St.—lathe, drill press and small garage tools.

Wis., Milwaukee—The Badger Auto Repair Shop, 458 14th Ave., A. L. Mutke, Purch. Agt.—one 18 in. lathe with 10 ft. bed.

Wis., Milwaukee—Jim's Repair Shop, 1524 Galena St.—one arbor press.

Wis., Milwaukee—The Mechanics Auto Co., 1914 North Ave., E. J. Sanhuber, Purch. Agt.—6 or 8 ft. lathe with 16 in. swing, standard make.

Wis., Milwaukee—The Milwaukee Shock Absorber Co., c/o H. L. Baker, 738 Wells Bldg.—machine tools and machinery for the manufacture of shock absorbers.

Wis., Milwaukee—The Milwaukee Tool & Forge Co., 220 Becher St., C. J. Lemont, Secy.—one light steam hammer.

Wis., Milwaukee—Scharf Garage Co., 516 Burleigh St., A. Scharf, Purch. Agt.—small lathe and drill press.

Wis., Milwaukee—M. Sigwart, 622 5th St. (machinist)—one bench lathe.

Wis., Prairie-du-Sac—Schmalz Bros. Co.—equipment and machinery for auto repair shop.

Wis., Milwaukee—The South Side Radiator Repair Co., 483 American Ave., A. W. Leverenz, Purch. Agt.—one hub press, 2 ton capacity.

Wis., Milwaukee—The Western Machine Co., 248 4th St., manufacturer of automatic screw machine products, W. E. Beckman, Purch. Agt.—two 4 spindle automatics of standard make.

Ia., Clayworks—Johnston Bros. Clay Wks., D. G. Johnston, Purch. Agt.—one large lathe to turn a 20 ft. or 14 ft. shaft, also to turn a pulley at least 48 in. in diameter.

Kan., Independence—The Bd. Educ.—machine shop and manual training equipment for proposed High School.

Que., Montreal—Bramsons Auto Service, Ltd., Phillip Sq., L. Bramon, Purch. Agt.—$2,000 worth equipment for new garage.

Que., Montreal—M. Miller, 976 St. Urbain St.—$250 worth tools for auto repair shop, including small lathe.

Del., Wilmington—C. Warner Co., A. D. Warner, Jr., Purch Agt.—a locomotiye crane and crusher about 36 in. x 18 in., also 2 dredging pumps and centrifugal water pump.

Md., Baltimore—D. C. Elphinstone, 408 Continental Bldg.—Two electric welding machines.

One stiff-leg derrick, wood or steel, 75 ft. boom, 5-ton capacity.

One air compressor, steam driven, 100 cu. ft. 100 lb. pressure.

One air compressor, gasoline driven, portable, 100 cu.ft. 100 lb. pressure.

Three-hundred pieces sheet steel piling, 12 in. wide, 25 ft. long.

Md., Baltimore—The Maryland State Dairymen's Assn., Inc., 812 Fidelity Bldg., H. Egli, 425 Courtmand St., Engr.—complete machinery for handling milk and manufacture of milk by-products.

The Weekly Price Guide

This Week's Market

Structural shapes and soft steel bars continue to be quoted at $1.50, Pittsburgh, for large tonnages; $1.60 per 100 lb. in small lots. Plates are quoted at $1.50@$1.60 per 100 lb. No. 28 black steel sheets are quoted, at the mill, at $2.75@$3 as against $2.90@$3 and No. 28 galvanized at $3.75@$4 as compared with $3.90@$4 per 100 lb., formerly.

Increased discounts are quoted on wrought steel pipe. Electrolytic copper has advanced ¼c. and tin ½c. per lb. Slight advances are reported in copper bars and aluminum ingots; brass rods, sheets and tubing have dropped ½c. per lb. in New York warehouses. Copper sheets, wire, bars and tubing have advanced ½c. and babbitt metal ¾c.; while coke plates, bright, base size, have dropped 1c. per lb. in Cleveland warehouses.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$22.50
Northern Basic	22.02
Southern Ohio No. 2	23.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	28.50
BIRMINGHAM	
No. 2 Foundry	18.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	23.26
Virginia No. 2	28.74
Basic	20.75
Grey Forge	22.50
CHICAGO	
No. 2 Foundry local	21.70
No. 2 Foundry, Southern, sil 2.25@2.75	24.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	22.46
Basic	20.96
Bessemer	21.96

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.25@2.50	3.53	3.10	3.38
No. 12	2.30@2.55	3.58	3.15	3.43
No. 14	2.35@2.60	3.63	3.20	3.48
No.16	2.55@2.80	3.73	3.30	3.58
Black				
Nos. 17 and 21.	2.60@2.85	3.80	3.55	3.95
Nos. 22 and 24.	2.65@2.90	3.85	3.60	4.00
Nos. 25 and 26.	2.70@2.95	3.90	3.65	4.05
No. 28	2.75@3.00	4.00	3.75	4.15
Galvanized				
Nos. 10 and 11.	2.75@3.00	4.00	3.75	4.15
Nos. 12 and 14.	2.85@3.10	4.10	3.85	4.25
Nos. 17 and 21.	3.15@3.40	4.40	4.15	4.55
Nos. 22 and 24.	3.30@3.55	4.55	4.30	4.70
No. 26	3.45@3.70	4.70	4.55	4.85
No. 28	3.75@4.00	5.00	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel			BUTT WELD	Iron	
Inches	Black	Galv.	Inches	Black	Galv.
1 to 3	68½	56	¾ to 1½	44½	29½
			LAP WELD		
2	61½	49	2	39½	25½
2½ to 6	65½	53	2¼ to 4	42½	29½
7 to 8	62½	49	4½ to 6	42½	29½
9 to 12	62½	49	7 to 12	40½	27½
			BUTT WELD, EXTRA STRONG, PLAIN ENDS		
1 to 1½	66½	55	1 to 1½	44½	30½
2 to 3	68½	56			
			LAP WELD, EXTRA STRONG, PLAIN ENDS		
2	59½	48	2	40½	27½
2½ to 4	63½	52	2½ to 4	43½	31½
4½ to 6	62½	51	4½ to 6	42½	30½
7 to 8	58½	45	7 to 8	35½	23½
9 to 12	52½	39	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded.	63%	49%	60½%	47½%	60%	46%
3½ to 6 in. steel lap welded.	54%	40%	58½%	44½%	57%	43%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	5.00	6.00	4.28
Spring steel (light) (base)	6.00	6.00	3.68
Coppered Bessemer rods(base)	8.00	8.00	6.03
Hoop steel	3.53	3.14	3.28
Cold rolled strip steel	6.25	8.25	6.75
Floor plates	4.85	2.64@2.80	5.23
Cold finished shafting or screw	3.88	3.50	3.83
Cold finished flats, squares	4.38	4.00	4.35
Structural shapes (base)	2.78	2.64	2.88
Soft steel bars (base)	2.68	2.54	2.78
Soft steel bar shapes (base)	2.68	2.54	2.78
Soft steel bands (base)	3.28	....	3.48
Tank plates (base)	2.78	2.92½	2.88
Bar iron (2.00@2.10 at mill)	2.68	3.52	2.78
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
3/16	8.50		12@13
⅛	7.15		11@12
5/32 to ¼	6.75		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.25
Tin, 5-ton lots, New York	30.00
Lead (up to carlots), St. Louis, 4.60; New York	5.00
Zinc (up to carlots), St. Louis, 4.97½; New York	5.37½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.20	20.00	20.00
Antimony (Chinese), ton spot	5.50	6.50	6.00
Copper sheets, base	20.75	22.00	22.50
Copper wire (carlots)	16.50	17.00	15.75
Copper bars (ton lots)	19.50	23.50	19.00
Copper tubing (100-lb. lots)	21.00	23.50	22.50
Brass sheets (100-lb. lots)	16.25	17.00	18.25
Brass tubing (100-lb. lots)	18.00	19.00	20.00
Brass rods (1,000-lb. lots)	14.25	16.00	15.25
Zinc sheets (casks), (8% dis. carlots)	11.00	10.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ½), (case lots)	19.50	21.00	18.00
Babbitt metal (best grade)	40.00	39.75	34.00
Babbitt metal (commercial)	14.00	13.50	8.00

—Shop Materials and Supplies

MONEL METAL—Base price in cents per lb., f.o.b. Bayonne, N.J.:

Shot	35.00	Hot rolled machined rods (base)	53.00
Blocks	35.00	Hot rolled rods (base)	42.00
Ingots	38.00	Cold drawn rods (base)	56.00
Sheet bars	40.00	Hot rolled sheets (base)	55.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grades "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

OLD METALS--Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.50	10.25
Copper, heavy, and wire	9.50	10.50	9.50
Copper, light, and bottoms	8.00	8.00	8.25
Lead, heavy	4.00	3.75	3.75
Lead, tea	3.00	2.75	3.00
Brass, heavy	6.50	6.00	8.00
Brass, light	5.00	4.00	5.50
No. 1 yellow brass turnings	5.25	5.00	5.25
Zinc	3.00	2.00	2.75

TIN PLATES—American Charcoal Plates—Bright—Cents per lb

	New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:			
IC, 20x28, 112 sheets	20.50	19.00	18.50
IX, 20x28, 112 sheets	23.00	21.50	20.90
"A" Charcoal Allaways Grade:			
IC, 20x28, 112 sheets	17.50	16.75	17.00
IX, 20x28, 112 sheets	20.50	19.50	19.60
Coke Plates, Bright			
Prime, 20x28 in.:			
100-lb., 112 sheets	12.50	12.00	14.50
IC, 112 sheets	12.80	12.30	14.80
Terne Plate			
Small lots, 8-lb. Coating:			
100-lb., 14x20	7.00	6.25	7.25
IC, 14x20	7.25	6.50	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb.	.055@.09	.09	.10
Wiping cloths per M., 13¼x13¼	....	55.00	55.00
Wiping cloths per M., 13¼x20½	....	65.00	65.00
Sal soda, 100 lbs	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb	2.55	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.72	.77	.76
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 75 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville	per ton		$3.00@3.15
Coke, prompt foundry, Connellsville	per ton		4.00@4.50

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	—50%	—60%	60-10-10%
1⅛ and 1¼x3 in. up to 12 in.	—40%	-60-10-10%	-60-10%
With cold punched sq. nuts	—30%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	—40%	....	$4.00 off
Button head bolts, with hex. nuts	—20%	$3.90 net	.....
Hex. head and hex. nut bolts	—20%	....	-65-5%
Lag screws, coach screws	—50-10%	....	—60%
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	—50-10-10%	50-5%
Bolt ends, with hot pressed nuts	—50%	....	—55%
Tap bolts, hex. heads	—20%	....	.....
Semi-finished nuts all sizes	—70%	—75%	—80%
Case-hardened nuts	—60%	....	.....
Washers, cast iron, ½ in., per 100 lb. Off list	$5.00	$5.50	$3.50 net
Washers, cast iron, ⅝ in. per 100 lb. Off list	4.25	3.75	3.50 net
Washers, round plate, per 100 lb. Off list	3.00	....	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	2.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	2.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.50	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.50	3.00	4.00
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	-50-10%	60-10-10%	-65-5%
Rivets, tinned	-50-10%	60-10-10%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$3.70	3.50	3 43
Cone heads, ditto (net)	3.80	3.60	3.53
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅞ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$4.03 base
Copper rivets	—50-10%	—40-10%	—50-10%
Copper burs	—25-10%	—15%	—10%

	New York	Cleveland	Chicago
Lard oil, pure, (50 gal. bbl.) per gal.	$0.90	$0.85	$0.90
Lard cutting oil (50 gal. bbl.) per gal.	0.60	0.50	0.55
Machine oil, lubricating, per gal.	0.45	0.35	.....
Belting—Present discounts from list in fair quantities (½ doz. rolls)			
Leather:			
Light grade	50-5%	50-5%	50-5%
Medium grade	45%	40-10-2½%	.....
Heavy grade	40%	40%	.....
Rubber and duck:			
First grade	50-10%	50-10%	.....
Second grade	60-5%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	List $9.00 less 20-10-5%	50-10-5%'	-20-10%
Emery paper	List 11.00 less 20%	$11.00 net	-20%
Emery cloth	List 32.75 less 10%	32.75 net	-10%
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll	$4.50 net	....	list+10%
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	List $1.65 less 20%	.....	-10%
Cloth	List $3.55 less 10%	.....	-10%

Pa., Philadelphia — P. E. Flotron Co., Lafayette Bldg.—general ice manufacturing machinery for proposed plant at Pleasantville, N. J.

Pa., Philadelphia—O. Hauck & Sons, 1227 North 4th St., saws, planers and cut-off machines for proposed box factory.

Pa., Philadelphia — Ivins & Co., 627 North Broad St., H. S. Roberts, Pres.—conveying machinery, mixing machines, and electric ovens for bakery.

Pa., Philadelphia — The Rogers Hosiery Mill, Wyoming and Germantown Aves.—new shuttles, knitters, etc.

Pa., Pittsburgh—The Mackintosh Hemphill Co., 12th St., manufacturer of castings—5 ton crane.

Pa., Pittsburgh—The Natl. Tube Co., Frick Bldg., A. Boax, Ch. Engr.—5 ton and 7½ ton jib cranes.

Ala., Flomaton—The Escambia Sand & Gravel Co., C. D. S. Clarkson, Mgr.—sets of nested screens for laboratory work, sand sieves from 10 to 200 mesh, and gravel screens from ¼ to 1 in.

Ga., Atlanta—The Atlantic Ice & Coal Co., Washington St. Viaduct—machinery and equipment for proposed ice plant on Murphy and Benjamin Sts.

Miss., Gulfport—The Mississippi Cane Syrup Co., A. L. Byrd, Purch. Agt.—peanut shelling machinery, also capping and filling machinery and other equipment for use in plant with daily capacity of 3,000 gal. of syrup and molasses per day.

S. C., Badham—The Dorchester Lumber Co., manufacturers of North Carolina pine, band sawn and kiln dried—equipment for proposed mill at Garnett.

Tenn., Knoxville—The Indian Creek Land & Timber Co., P. O. Box 1094—one 18 to 24 in. 3 side planer and matcher; 24 to 30 in. cabinet planer; horizontal double spindle boring machine; vertical hollow chisel mortiser; circular resaw; self feed circular rip saw double end trim saw; cut off saw and other wood-working machinery, (used).

Va., Orange—The Pamunkey Oil & Development Co., J. M. Flaherty, Mgr.—standard drilling rig to drill up to 3,500 ft. Also interested in contract drilling.

W. Va., Huntington—Seaman Implement Co., 735 3rd Ave.—boilers (used), also woodworking machinery.

W. Va., Huntington—Mary Elizabeth Coal Co., First Natl. Bank Bldg., H. H. Morris, Pres.—will receive bids about March 1 for complete mining machinery and supplies.

Ill., Chicago—H. C. Christensen, 7258 Union Ave.—machinery for $300,000 ice plant.

Ill., Chicago—The Holbrook Mfg. Co., 2732 Cottage Grove Ave.—20 in. multiple spindle borer and one band saw.

Ill., Chicago—The Stafford Mfg. Co., 218 South Wabash Ave., furniture manufacturers, E. Stafford, Purch. Agt.—sand drum, 30, 36 or 40 in. long.

Ill., Chicago—The Garden City, Plating & Mfg. Co., 1430 South Talman Ave., A. Robertson, Purch. Agt.—surface grinder suitable for toolroom use.

Mich., Detroit—The Bd. Water Comrs., Jefferson and Randolph Aves., is receiving bids for two 3½ ton gasoline operated cranes.

Mich., Detroit—The Monarch Stamping Co., 1402 4th St.—miscellaneous equipment for making metal stampings.

Mich., Escanaba—The Pampa Land Co., D. E. Glavin, Pres.—saw and tie mill machinery.

Mich., Kalamazoo—The Kalamazoo Stationery Co.—full line of envelope making machinery for its printing plant on 7th and Everett Sts., S., Richmond, Va.

Mich., Menominee—The Menominee River Sugar Co., Wells Ave. and Pine St.—special machinery for sugar beet dumps at Sherwood, Wis.

O., Cleveland—The city, J. B. Gascoigne, 618 City Hall, Engr.—Will receive bids until Dec. 16 for a 2 ton overhead portable crane, for use on sewage treatment plant.

O., Cleveland—The Saw Sales Co., 1368 West 3rd St.—30 in. or 32 in. wood band saws (used).

O., Cleveland—The Standard Envelope Mfg. Co., 1011 Oregon Ave.—18 x 36 in. Lewis Shepherd jacklift trucks, with 6 in. wheels (used).

Wis., Fond - du - lac — The Combination Door and Screen Co., 180 Ruggles St.—wood working machinery for proposed factory.

Wis., Jump River—F. Skabroud, Jr.—cheese making machinery.

Wis., Merrill—The Heldt Fdry. Co., E. Heldt, Purch. Agt.—two brass furnaces, one cupola furnace, moulds, ladles, etc.

Wis., Milwaukee—The Caldick Furniture Co., 136 3rd St., C. Luhrsen, Purch. Agt.—one cut-off saw.

Wis., Milwaukee—The Ebony Ink Co., 82 Mason St.—special machinery for proposed factory on Villard St., North Milwaukee.

Wis., Milwaukee — The European Shoe Mfg. Co., 331 Grove St., L. Kronios, Purch. Agt. — vamping machine and eyelet machine.

Wis., Milwaukee—The Milwaukee Washing Machine Co., 155 West Water St.—one electric spot welding machine.

Wis., Milwaukee—The Milwaukee Sanitary Wiping Cloth Co., 460 4th St., M. Shapiro, Purch. Agt.—special machinery for the manufacture of wiping cloths.

Wis., Milwaukee—O. Pietsch Dye Wks., 254 West Water St.—special machinery and motors for proposed plant.

Wis., Owen—E. Z. Box Co., G. E. Anderson, Purch. Agt.—power saws and nailing machines.

Wis., Sheboygan—The Calumet Packing Co., c/o P. M. Peacock, Secy., 309 Michigan Ave.—special canning machinery for proposed plant at Dundas.

Wis., Wisconsin Rapids—The Co-operative Creamery Co., R.F.D., J. A. Rouhan, Purch. Agt. — refrigerating machinery, separators, churns, etc.; also belt driven cheese and butter making machinery.

Ark., Texarcana—The Louisiana & Arkansas Ry. Co., W. F. Wright, Purch. Agt. —set of bending rolls, 12 ft. or more between housings, 12 in. between upper rolls, (power operative), rolls to be operated through friction clutches.

Minn., Hibbing—Currie & McGraw—complete line of blacksmith shop equipment.

Ont., Acton—The Acton Tanning Co.—grinding equipment, vats, etc., for proposed leach house which was recently destroyed by fire.

Ont., Kincardine—F. B. Coombe Furniture Co.—additional wood-working machinery.

Ont., London—E. Grandier, of Teasdell Hosiery Co. — hosiery making machinery for Port Elgin plant.

Metal Working Shops

NEW ENGLAND STATES

Conn., Hartford—J. P. Nielsen & Co., 86 Maple Ave., will build a 2 story, 45 x 90 ft. addition to its garage on Maple Ave. Estimated cost, $40,000.

Conn., New Haven—J. W. Hine, Inc., 88 Commerce St., will build a 1 story, 90 x 90 ft. addition to his garage. Estimated cost, $40,000. Noted March 24.

Conn., New Haven — C. P. Judge, 581 State St., has awarded the contract for the construction of a 1 story, 80 x 130 ft. garage on State St. Estimated cost, $40,000.

Conn., Plainville—The Plainville Castings Co. has awarded the contract for the construction of a 1 story, 65 x 160 ft. addition to its casting shop.

Mass., Lowell—H. Pitts, Hurd and Warren Sts., is having plans prepared for the construction of a 2 story, 80 x 150 ft. garage on Middlesex St. Estimated cost, $125,000. Ashton, Huntres & Alter, 477 Essex St., Lawrence, Archts.

Mass., Northampton—Bd. Trustees, Smith College, will soon award the contract for the construction of a 2 story, 45 x 120 ft. garage and laundry on campus. Densmore & LeClear, 88 Broad St., Boston, Archts. and Engrs.

Mass., Springfield — D. A. Loomis, c/o Gagnier & Augers, 327 Main St., has awarded the contract for the construction of a 1 story, 70 x 145 ft. garage on Main St. Estimated cost, $40,000.

MIDDLE ATLANTIC STATES

Md., Frostburg — D. E. Gunter has awarded the contract for the construction of a 1 story service and auto repair shop. Estimated cost, $48,000.

N. J., Camden—W. J. Kelly, 675 Ferry Ave., has had plans prepared for the construction of a 2 story, 100 x 100 ft. sales and machine shop on Haddon Ave. and Euclid St. Estimated cost, $60,000. R. Draper, 436 Haddon Ave., Archt.

N. J., Camden—J. B. Moery, 284 North 34th St., is having plans prepared for the construction of a 1 story, 40 x 100 ft. garage and repair shop on 41st and Maple Sts. Estimated cost, $40,000. Lackey & Hettle, 509 Federal St., Archts.

N. J., Florence—The Florence Pipe, Fdry. & Machine Co., has awarded the contract for the construction of a 1 story, 60 x 250 ft. machine shop. Estimated cost, $75,000. Noted Mar. 31.

Pa., Philadelphia—D. D. Cassidy, 1918 North Woodstock St., has had plans prepared for the construction of a 1 story, 36 x 120 ft. garage at 1935 North Woodstock St. Estimated cost, $45,000. H. R. Stackhouse, 129 South 15th St., Archt.

Pa., Pittsburgh—The Denk Eng. Co., 45 Shannon Bldg., recently organized with $200,000 capital stock, is having plans prepared for the construction of a plant for the manufacture of mechanical products. Private plans.

Pa., Pittsburgh—The United States Lock Nut Corp., 400 Michigan Ave., Chicago, plans to construct a plant here. Estimated cost, $500,000. Architect not selected.

Pa., Pittsburgh—The Ward Baking Co., 3100 Liberty Ave., plans to construct a 1 story auto repair shop. Estimated cost, $50,000.

Pa., Spring City—The Spring City Glass Co., c/o O. Granger, will build a 1 story, 24 x 48 ft. machine shop. Estimated cost, $10,000.

SOUTHERN STATES

W. Va., Clarksburg—The United Mfg. & Equipment Co. is having plans prepared for the construction of a machine shop. Private plans.

MIDDLE WEST STATES

Ill., Hinsdale—The Stuyvesant-Peabody Coal Co. has awarded the contract for the construction of a 2 story, 120 x 208 ft. service building. Estimated cost, $250,000.

Ill., Waukegan — Wilson & Ohm, 215 South Genesee Ave., have awarded the contract for the construction of a 2 story, 50 x 130 ft. garage. Estimated cost, $45,000.

Mich., Detroit — Simons Sales Co., 436 West Willis Ave., has had plans prepared for the construction of a 1 story, 50 x 170 ft. sales and service station on Woodward and Canfield Aves. Estimated cost, $85,000. A. Kahn, 1000 Marquette Bldg., Archt.

Wis., Beloit—Morks Garage, P. O. Box 227, has awarded the contract for the construction of a 1 story, 50 x 120 ft. garage on Main St. Estimated cost, $56,000.

Wis., Milwaukee—The Conro Estate, 902 Wells Bldg., will soon award the contract for the construction of a 3 story, 80 x 114 ft. garage and loft building on Bway. Estimated cost, $150,000. R. Razall, 114 Grand Ave., Archt.

Wis., Milwaukee—O. Pietsch Dye Wks., 254 West Water St., will soon award the contract for the construction of a 1 story, 120 x 160 ft. dye works, (1st unit), on 3rd St. Estimated cost, $50,000. H. E. Birkholtz, 216 West Water St., Engr.

WEST OF THE MISSISSIPPI

Ia., Des Moines—F. Rogers, 615 Clinton St., is having plans prepared for the construction of a 3 story, 50 x 132 ft. garage. Estimated cost, $50,000. F. A. Harris, 3815 4th St., Archt.

Minn., Minneapolis—The State Bd. Control, Capitol, St. Paul, will receive bids until Dec. 2 for a 3 story metallurgical laboratory on the State University campus here. Estimated cost, $225,000. D. F. Mullen, Secy. C. H. Johnston, 715 Capitol Bank Bldg., St. Paul, Archt.

Mo., St. Louis—The Adalil Realty Co., c/o P. H. Bierman, Ry. Exch. Bldg., will soon award the contract for the construction of a 1 story, 60 x 234 ft. garage on Washington and Spring Aves. Estimated cost, $55,000. O. J. Popp, Odd Fellows Bldg., Archt. Noted Nov. 24.

Mo., St. Louis — J. Forshaw Stove & Heating Co., c/o J. Forshaw, 111 North 12th St., will soon award the contract for the construction of a 7 story, 25 x 100 ft. factory at 109 12th St. Estimated cost, $75,000. A. B. Groves, Stock Exch. Bldg., Archt. Noted Oct. 6.

Mo., St. Louis—J. G. Perculers, Jr., 603 Wainwright Bldg., is having plans prepared for the construction of a 1 story, 45 x 150 ft. garage and machine shop at 5152 Southwest Ave. Estimated cost, $45,000. Private plans. E. J. Sudhoff, 2648 California Ave., lessee.

American Machinist

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Volume 55 NEW YORK, DECEMBER 8, 1921 Number 23

Elements of the Heat-Treatment of Steel

Operations in Heat Treatment—Changes in Structure While Heating—Changes Produced by Tempering and Hardening—Seasoning—Effect of Carburization

BY H. J. FRENCH
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MODERN practice of heat-treatment has become quite complex and necessitates a definite knowledge of the structural changes taking place in the metal and how they may be controlled. It is the purpose of this article to deal, of necessity briefly, with the fundamentals of this process in its various phases and to point out some of the factors involved in successfully carrying out the operations involved. This discussion will, moreover, be limited to plain carbon steels, but will later be supplemented by more detailed discussions, both as to methods and special alloys.

Heat-treatment may be considered a process by which, intelligently applied, the properties of metals are varied and controlled within well-defined limits for the benefit of mankind. The operations which will be considered are as follows: (1) Normalizing and annealing; (2) hardening; (3) tempering; (4) seasoning; (5) casehardening.

Common to all these operations are heating and cooling; thus it will be well first to consider what occurs in iron and steels when heated and cooled. In order to obtain a proper conception of changes which take place it must be borne in mind that steel is essentially an alloy of iron and carbon. However, certain impurities such as manganese, phosphorus, sulphur and silicon are always present in the commercial product, due to peculiarities of manufacture, but their effects may be ignored in this preliminary discussion as the proportions usually found in plain carbon steels are small and held within close limits.

THERMAL TRANSFORMATIONS

Let it be assumed for the moment that a furnace is available which may be heated and cooled at a definite and practically constant rate; also that the relation between rate of heating, size of this furnace and the sample which is to be heated, is such that the latter will be uniformly heated throughout with the furnace. If then a piece of pure iron is placed in this unit it will steadily increase in temperature with time until about 767 deg. C. (1,411 deg. F.) is reached, when it will be noticed that the rate of rise in temperature of the sample has decreased despite the uniform rate of increase in temperature of the furnace. But soon the rate of temperature change of the iron increases and when the sample has once more reached the temperature of the furnace the two again change at equal rates. At about 910 deg. C. (1,670 deg. F.) a similar effect is observed but this time of greater magnitude.

These thermal effects, or, as they are commonly called "thermal transformations," in pure iron are of the greatest importance and are accompanied by physical changes. They are commonly designated as the Ac_2 and Ac_3 transformations while the reverse changes which take place on cooling are referred to respectively as Ar_2 and Ar_3.

Typical heating and cooling curves for pure iron are shown in Fig. 1. There it will be noted that the Ac_2 transformation (which is accompanied by loss of magnetism) occurs at almost the same temperature as Ar_2 (where the iron regains its magnetic properties), whereas A_3 occurs at a distinctly lower temperature on cooling than on heating. This phenomenon which indicates a resistance of the metal to transformation is often referred to as "lag" or "hysteresis."

If carbon is added to pure iron (by definition this is essentially steel) a third thermal change is observed at a temperature below A_2 which is designated Ac_1 on heating and Ar_1 on cooling. It likewise shows lag and this lag increases in magnitude with the carbon content, which immediately suggests that it is directly associated with a carbon change. If heating and cooling curves of steels of different carbon contents are obtained and the temperatures of occurrence of the transformations plotted against the carbon content, as shown in Fig. 2, that portion of the well-known iron-carbon equilibrium diagram is obtained which is in reality the basis of the heat-treatment of steels.

STRUCTURE OF CARBON STEELS

The carbon in steel is present as a definite compound Fe_3C (iron carbide) called cementite and it is the condition of the cementite which controls the physical properties of steel. At room temperature the carbide is in its stable and free condition and may be readily distinguished under the microscope from the pure iron (called ferrite). When steel of less than 0.85 per cent carbon is heated the cementite goes into solution in part of the iron beginning at the temperature of the Ac_1 transformation. With further increase in temperature this solution absorbs more and more of the remaining ferrite until at the Ac_3 transformation the last traces are absorbed and the entire mass is a single solid solution (called austenite or gamma (γ) iron. At Ac_2 the iron also changes from its stable form at room temperature (alpha (α) iron) to beta (β) iron which is non-magnetic. In heating steels containing more than 0.85 per cent carbon the solution of cementite in iron absorbs the excess carbide as the temperature is raised in a manner similar to that explained above for ferrite in low-carbon steels.

On cooling the reverse reactions take place. For example, when a steel containing 0.85 per cent carbon is slowly cooled from a high temperature the solid solution previously referred to is retained until a temperature of about 700 deg. C. (1,292 deg. F.) is reached when a change of the entire mass to a finely divided mechanical mixture of ferrite and cementite, called pearlite, takes place. As the proportions of carbon and iron in the pearlite are constant for steels of various carbon contents, those alloys containing less than 0.85 per cent carbon have an excess of ferrite which, in cooling, precipitates at temperatures represented by the line *GOS*, Fig. 2. More and more of the excess ferrite is released by the solid solution as the steel cools until at 700 deg. C. (1,292 deg. F.) there remains just enough to form pearlite with the cementite. Steels containing more than 0. 85 per cent carbon have an excess of cementite which in cooling begins to precipitate at temperatures represented by the line *SE*, Fig. 2. To summarize, the line *GOS* represents the precipitation of the excess ferrite, *SE* the cementite and *P'S'K'* the pearlite.

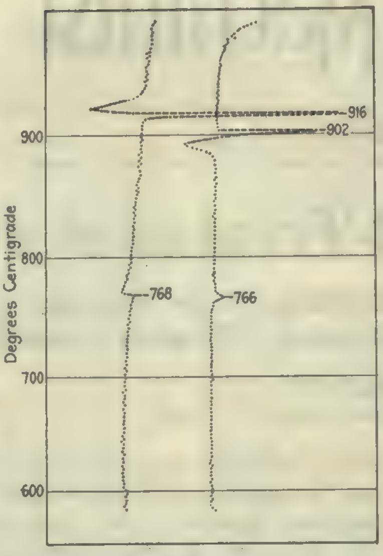


FIG. 1. HEATING AND COOLING CURVES OF PURE IRON (INVERSE RATE METHOD)

PHYSICAL PROPERTIES OF STRUCTURES IN TRANSITION

The change of the solid solution (austenite) to pearlite takes place gradually and the main structures which may be recognized under the microscope in this transition are called, in order, martensite, troostite and sorbite. Microphotographs of all these are shown in Figs. 3 to 7 inclusive.

Each structure is characterized by definite physical properties. Austenite is practically non-magnetic, has medium strength and very low elastic limit, but has high ductility and is of medium-high hardness. Martensite is very hard (its hardness being second only to cementite) and has high strength but is extremely brittle, while troostite has medium strength and is somewhat less brittle. Sorbite is somewhat softer than troostite but extremely tough, while pearlite is the softest of the five structures mentioned and is only harder than pure iron (ferrite).

It must be evident, inasmuch as these changes take place gradually, that if it is possible in any manner to stop the transition from austentite to pearlite at any given stage, the structure of the steel and therefore its properties may be varied. Rapid cooling as by quenching in water tends to preserve the structure of the solid solution because there is insufficient time for the complete change to pearlite while the steel is quickly brought from the high temperature to that of the room. The resulting structure may be martensitic and the steel extremely hard. On the other hand, slow cooling allows sufficient time for the complete change to pearlite and the steel is soft and ductile and easily machined while between these two extremes there are rates of cooling which give intermediate properties.

When steel is heated to just above the upper critical range a new crystalline arrangement is obtained and the previous structure, stable at room temperature, is obliterated. The grains of the solid solution (austenite) are small, but they will grow if the steel is held for some time at the high temperature. Increase in grain size also takes place more rapidly with greater rise in temperature, and this coarseness is maintained when the steel is cooled. Coarse grain is, therefore, an evidence of overheating (shown in Fig. 8). It may be remedied by allowing the steel to cool blow Ar_1, for it is here that the carbide precipitates, and then reheating

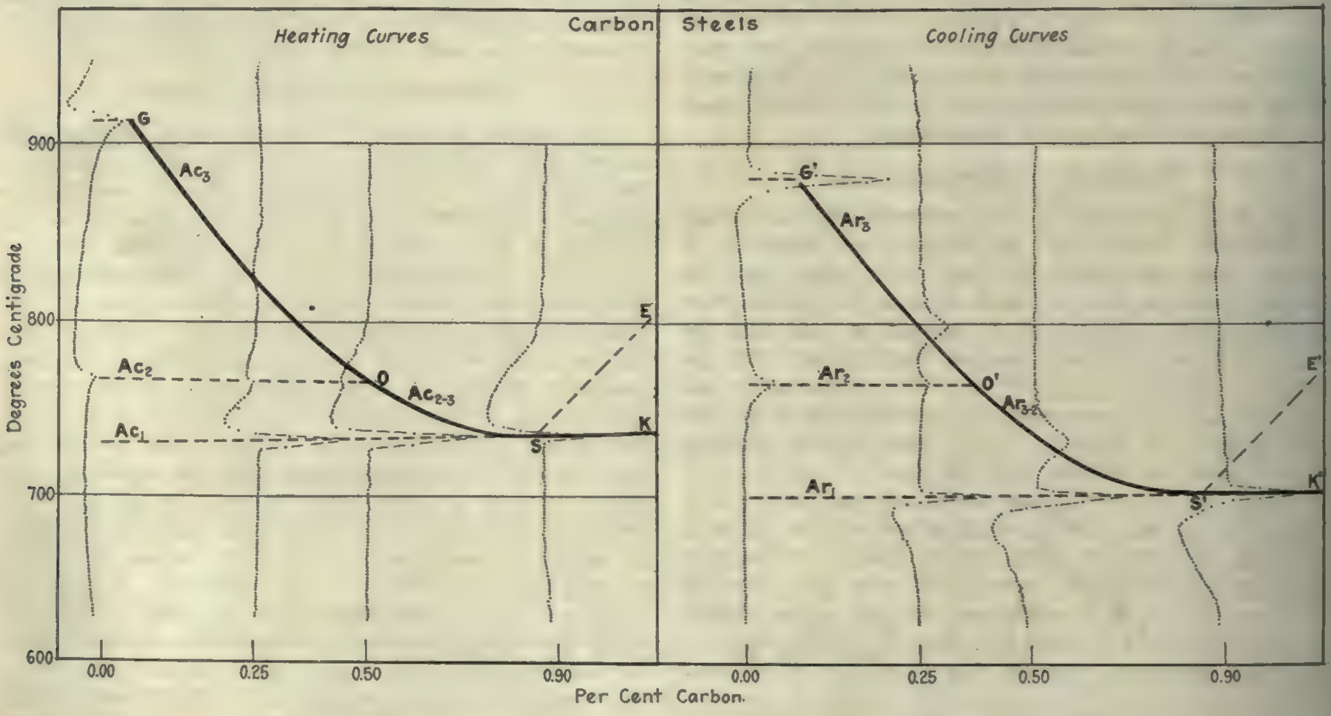
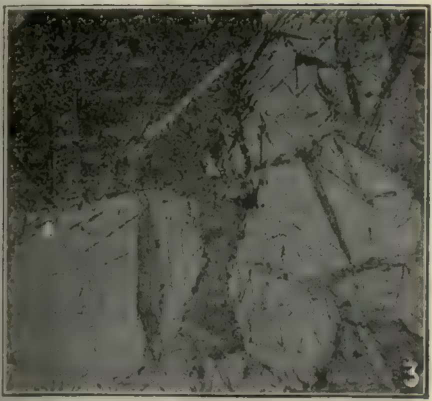
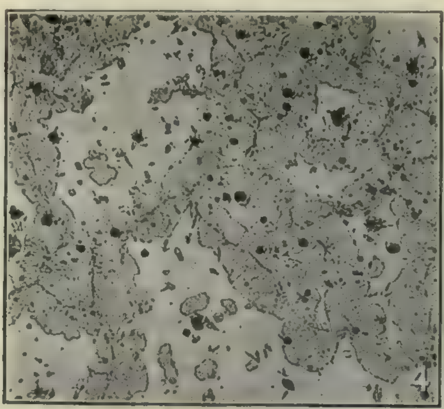


FIG. 2. HEATING AND COOLING CURVES OF CARBON STEELS





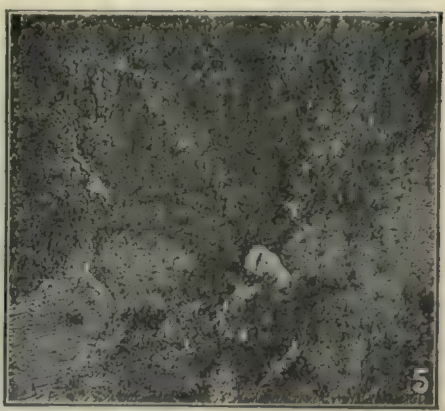
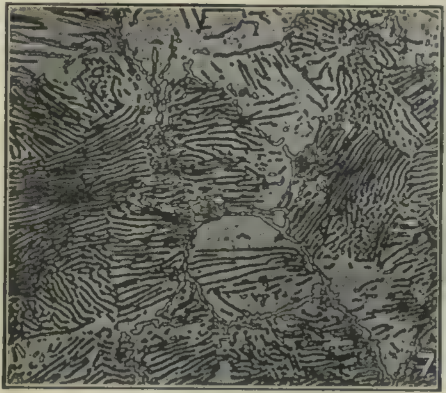


FIG. 3. AUSTENITE (WHITE) AND MARTENSITE (DARK), SHOWING CHARACTERISTIC NEEDLE-LIKE STRUCTURE OF THE LATTER. OBTAINED IN RAPID COOLING FROM HIGH TEMPERATURE. FIG. 4. TROOSTITE (DARK). OBTAINED IN QUENCHING FROM A HIGH TEMPERATURE AT A MORE MODERATE RATE THAN FOR FIG. 3. FIG. 5. SORBITE AND PEARLITE. OBTAINED IN THE SHANK OF A COLD-CHISEL AFTER QUENCHING, THE POINT OF WHICH WAS MARTENSITE



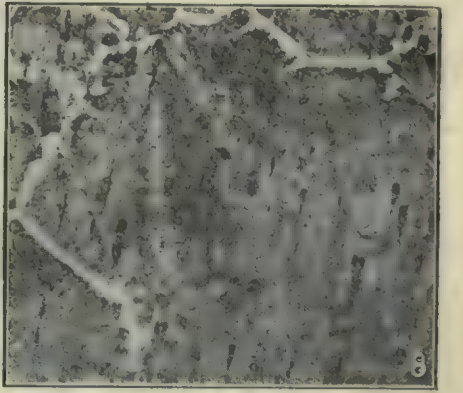


FIG. 6. SORBITE IN HIGH CARBON STEEL. OBTAINED IN TEMPERING THE HARDENED ALLOY. FIG. 7. PEARLITE, SHOWING LAMINATED STRUCTURE (FERRITE AND CEMENTITE) CHARACTERISTIC AT HIGH MAGNIFICATIONS. OBTAINED BY VERY SLOW COOLING FROM A HIGH TEMPERATURE. FIG. 8. OVERHEAD STEEL, SHOWING EXTREMELY COARSE GRAINS OF PEARLITE SURROUNDED BY FERRITE (WHITE)

to a temperature just above the line *GOSK* in Fig. 2. This will again bring the carbon into solution, the resulting structure being shown in Fig. 9. A graphical representation of these considerations is given in Fig. 10. Theoretically the best temperature to use is one just above the line *GOSK* of Fig. 2, for in this manner the finest grain size will be obtained, but practically the best results are often obtained by exceeding the theoretical values considerably. However, if the metal is taken above the range of proper heating and becomes "burned" there is no remedy other than remelting and production of new steel.

One of the most important factors in heat-treatment which must be considered in all operations is the size (and shape) of the material. In heating large masses rapidly the surface becomes considerably hotter than the interior, for it takes time for the heat to diffuse throughout the steel, and this results in a greater expansion at the surface than near the center. If the material has low heat conductivity, preventing rapid diffusion, and a high coefficient of expansion, the stresses set up by the superficial heating may exceed the strength of the metal and it will rupture. The same principles also apply to cooling; in fact, frequently some difficulty is encountered from minute quenching cracks which result from even moderate rates of cooling large masses. While such defects are often hard to detect they form a source of weakness and when the material is subjected to severe service may ultimately result in failure.

The effect of size on the physical properties of heat-treated steel is marked. A steel which, when water quenched in a half-inch round section from a high temperature is martensitic, will when similarly treated in a larger section, for example one-inch round, have a different structure and therefore different properties. The one-inch section may be martensitic at the surface but the interior will be largely troostitic and may even show evidence of sorbite at the center.

An example of the magnitude of the effect of size on the tensile properties of steel under heat-treatment is shown in Table I, below.

TABLE I. STEEL OIL QUENCHED FROM 871° C. (1,600° F.) AND TEMPERED AT 555° C. (1,030° F.)

Size	Tensile Str. Lb. per Sq.In.	Elast. Lim. Lb. per Sq.In.	Per Cent El. in 2 In.	Per Cent Red. of Area
½ in. rd.	130,000	95,000	21.5	58.0
1 in. rd.	123,300	86,000	23.7	61.3

With increase in cross-section, it is seen that the elastic properties, strength and hardness are lowered, while the ductility increases.

The shape of the material is likewise an important factor in treatment. Sharp corners in machined or partly machined forgings are frequently a source of difficulty, as are also more or less abrupt changes from large to small sections. The latter may become cold while the larger portion of the mass remains at a relatively high temperature. Such large temperature differences, even though only momentary, set up internal strains of considerable magnitude which are quite liable to cause fracture. Further reference to these factors will be made in the following paragraphs when

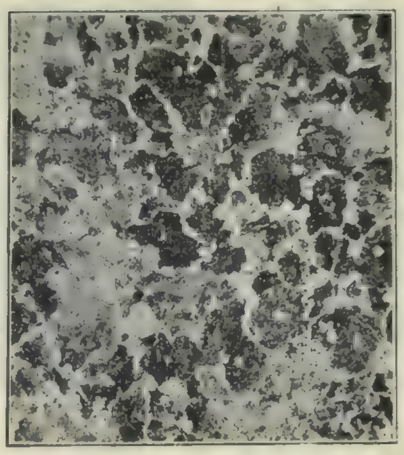


FIG. 9. OVERHEATED STEEL
After first cooling it was reheated to above the A 3 transformation. Not yet wholly refined but in better condition than the steel shown in Fig. 8.

considering in more detail the operations of annealing, hardening, etc. Both normalizing and annealing consists in heating the steel to a temperature above the thermal transformations and slowly cooling. Normalizing refers to air cooling while annealing is properly applied when a slower rate, as cooling in a furnace, is used. These terms are, however, often loosely applied. Annealing is at times used in place of the more commonly employed terms "tempering" and "drawing," and also for heatings carried out between cold passes in production of seamless tubes, cold-finished rods, etc. In these cases the temperatures employed are usually either below or within the thermal critical ranges and the material is cooled at varying rates. In the present discussion the definitions given at the beginning of this paragraph will be adhered to and a special qualifying phrase will be used when a special modification is referred to as "inter-pass annealing," "partial annealing," etc.

The purpose of either normalizing or annealing may be one or more of the following: (1) To refine the grain of the steel; (2) to soften for machining; (3) to remove stresses due to quenching, cold-working, etc.; (4) to produce definite physical properties.

To refine the grain of the steel all that is theoretically necessary is to heat to a temperature slightly in excess of the line *GOSK* of Fig. 2 and allow to cool. In actual practice, however, this process may be much more complex, depending upon the material and its previous history. In normalizing or annealing steel castings of refractory structure, temperatures slightly above the critical ranges maintained for a long time, or high temperatures for a short time, are often insufficient to obliterate the original cast structure and it then becomes necessary to considerably increase the time-temperature relationship and frequently to subject the material to a double or more complicated treatment.

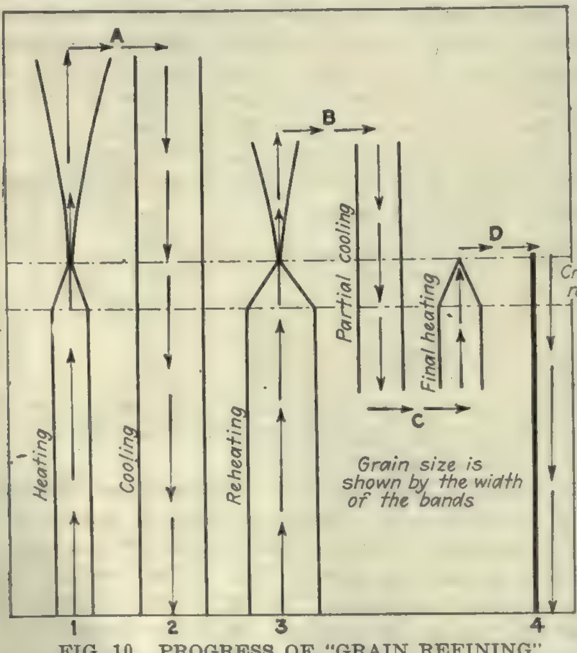


FIG. 10. PROGRESS OF "GRAIN REFINING"
1. Original structure. Medium coarse grain. 2. Very coarse structure, resulting from severe overheating (*A*). 3. On reheating to *B* this structure is partially refined but the temperature is too high for refinement. By cooling to a little below the critical range (*C*) and then finally heating to slightly above (*D*) the steel is brought into satisfactory condition and 4, grain is refined.
Note: Micrographs prepared in the Metallographic Section, Bureau of Standards, Washington, D. C.

A simple heating slightly above the transformations is sometimes also inadequate for the refinement of rolled or forged carbon steel in cases where this work has been finished at a somewhat low temperature. In order to completely remove all traces of "banding" in such rolled steel a preliminary quenching from a high temperature is sometimes used.

SOFTENING FOR MACHINING AND REMOVAL OF STRESSES

To soften for machining or to remove stresses due to quenching, cold-working, etc., a temperature above the critical range is not necessary. In general, a "partial annealing" using a temperature of about 600 deg. C. (1,112 deg. F.) will be sufficient to remove stresses and soften for machining all steels of less than 0.85 per cent carbon. For higher carbon alloys slow cooling from a higher temperature through the A_1 transformation is greatly to be desired and more often necessary.

TABLE II. INFLUENCE OF RATE OF COOLING ON 0.50 PER CENT CARBON CYLINDER STEEL, 6-IN. ROUNDS

Treatment	Brinell Hardness	Remarks
Cooled in furnace from 843° C........	126	Steel too soft; tore very badly.
Cooled in still air from 843° C..	143	Steel still soft and tearing, but better than 126 hardness.
Cooled in gentle air blast from 870° C..	159	Machines well; little tearing, except at higher cutting speeds.

When cooling from temperatures below the transformations the steel will not be in its best condition either for subsequent treatment or for machining, but of course the choice of temperature is dependent upon the previous history of the material, its composition and the properties desired.

In "partial annealing" the rate of cooling is immaterial, but when the critical ranges are exceeded the rate at which the steel passes through these is of greatest importance. The slowest rate of cooling from just above the critical range will give the softest steel but will not necessarily produce metal which is in the best condition for machining. A single example of this is shown in Table 2 from which it will be noted that the steel in its annealed and softest condition tore badly in the turning operation, whereas with the same metal subjected to a faster cooling, as in an air blast, this difficulty was removed. This point is of considerable importance for there is in general not as great care taken in these preliminary operations as in the hardening and tempering.

PRODUCTION OF DEFINITE PHYSICAL PROPERTIES

In reality the foregoing discussion deals with particular phases of the production of definite physical properties by annealing and normalizing, but what will here be considered chiefly is control of properties ordinarily found in specifications for structural mate rials. While the same principles apply as in the previous dicussion it will probably be enlightening to have test values available.

In Table 3 are given approximate figures for the tensile properties of various grades of open hearth steel as rolled. Where special properties are required after annealing or normalizing, a balance must be obtained between the chemical composition, size of material and the time-temperature relations in heating and cooling. The quantitative effect of some of these variables in individual cases is shown in Table 4. In view of the previous discussion the results should be self-explanatory.

TABLE III. APPROXIMATE TENSILE PROPERTIES OF ROLLED CARBON STEELS IN SMALL SECTIONS

Carbon Range, Per Cent	Elastic Limit Lb. per Sq.In.	Tensile Str., Lb. per Sq.In	Per Cent Elong. in 2 In.	Per Cent Red. of Area
0.08 to 0.18	30,000 35,000	45,000 58,000	34 30	70 60
0.18 to 0.28	35,000 41,000	58,000 68,000	30 25	60 50
0.32 to 0.40	44,000 49,000	70,000 82,000	23 20	45 38
0.45 to 0.55	51,000 56,000	88,000 98,000	20 13	36 30
0.53 to 0.63	52,000 58,000	90,000 105,000	20 12	32 28
0.70 to 0.80	74,000 84,000	133,000 145,000	11 7	15 10
0.80 to 0.95	74,000 84,000	135,000 150,000	9 6	15 10
0.90 to 1.10	80,000 90,000	147,000 162,000	8 5	15 6

TABLE IV. QUANTITATIVE EFFECTS OF VARIATIONS IN CHEMICAL COMPOSITION, SIZES OF MATERIAL AND TIME-TEMPERATURE RELATIONS IN HEATING AND COOLING

Per Cent Carbon	Treatment	Tensile Str. Lb. per Sq.In.	Yield Pt. Lb. per Sq.In.	Per Cent El. 2 In.	Per Cent Red. A.
0.14	As rolled	59,500	45,000	37.5	67.0
	Annealed 866° C	54,500	31,000	39.5	67.0
0.46	As rolled	86,500	52,500	22.5	30.7
	Annealed 819° C	79,500	48,000	28.5	46.2
0.71	As rolled	128,000	66,000	15.0	20.5
	Annealed 800° C	111,500	46,500	16.5	24.0
1.01	As rolled	152,000	86,000	9.5	13.3
	Annealed 790° C	99,400	53,800	24.0	36.2
0.25	As received	74,500	....	12.7	25.3
	Annealed 720° C.				
	30 min	64,500	40,800	32.5	62.7
	12 hours	63,000	35,400	31.0	57.3
	Annealed 900° C.				
	30 min	66,000	38,700	32.5	54.8
	12 hours	66,100	56,100	29.0	57.5
0.47	As received	82,600	....	6.2	18.8
	Annealed 720° C.				
	30 min	73,500	48,400	29.0	58.6
	12 hours	65,600	26,300	30.5	42.7
	Annealed 900° C.				
	30 min	72,700	40,400	28.0	46.3
	12 hours	67,000	57,200	30.0	43.5
0.95	As received	120,500	....	7.0	5.6
	Annealed 720° C.				
	30 min	88,000	....	22.0	45.0
	12 hours	75,500	31,600	23.5	35.4
	Annealed 900° C.				
	30 min	114,500	....	10.0	15.4
	12 hours	107,000	80,900	11.9	11.0

NOTE.—Results taken from the Sixth Report of the Alloys Research Committee and "The Effect of Carbon on the Physical Properties of Heat Treated Carbon Steel," by J. H. Nead, T.A.I.M.E., 1915, p. 218.

(To be continued in next week's issue.)

A Mechanical Encyclopedia

BY NICHOLAS HEYMAN

On page 399 of *American Machinist* Albert F. Guyles comments on the suggestion relating to a "Loose-Leaf Mechanical Encyclopedia." The writer has been cutting up fourteen different trade papers for quite a time, and files these loose-leaf sheets in the manner related below. The method has given satisfaction and, above all, permits of a handy reference file that takes up but little room.

As each issue is received it is placed in a tray, to wait for an opportune time to be read. Each month those papers that have been examined are placed in a paper cutting machine and the bindings severed. In the absence of such a machine an ordinary sharp knife will do. The advertisements are cast aside and all articles are kept for examination and classification. In examining the articles, any of little value in the judgment of the reader are cast out.

THE METHOD OF FILING

The scheme used in filing consists in putting the articles in heavy manila folders which are marked in the upper right-hand corner with a single letter. The folders run from *A* to *Z* and then start over again with a subscript; as A_0 to Z_0, A_1 to Z_1, etc. Each article is then marked in the upper right-hand corner with the letter of the folder and the sequence number of the article, viz: A_0—25. If the article covers more than one page, the several pages are fastened together and each sheet numbered with the article designation in case one page is torn from the article in handling and should go astray.

Now it sometimes happens that more than one article comes together, and quite frequently that a new article starts on the last page of the preceding one. In this instance the marking would be, for instance: B_0—4/6. This is taken to mean that in folder B_o, article No. 4 (fourth in sequence), has on its last pages articles Nos. 5 and 6; the latter complete or in part.

Now the last page is marked at its top thus: B_0—60 the number in the circle indicating that article 6 is back of article No. 4. If you looked for article No. 6 it would be found with the beginning on some other sheet. The number on the top of the page will indicate No. 4 in a circle which shows that No. 6 starts on the back of No. 4. Experience shows that from seventy-five to one hundred articles such as one finds in trade papers make the folder just stout enough to be conveniently carried.

It is quite evident that the value of this method of filing articles depends entirely on the care with which the articles are cross-indexed. Any article or subject is easily found by reference to the cross-index file. The writer at present has 35,000 articles covering a variety of subjects, and has been paid for the labor spent in its upkeep many times over.

Methods and Tools Used in Machining the Peerless Differential Carrier and Gear Case

Turret Lathe Tooling for Special Jobs—Drilling Fixture for Rapid Handling of Work—Interesting Gages for Surfaces Which Are Not Easy of Access

By FRED H. COLVIN
Editor, *American Machinist*

THE machining of the differential carrier, which supports the differential case, and is in turn supported by the rear axle housing, is accomplished by the methods shown in the accompanying illustrations. The sequence of operations is:

Operation 1—Bore large holes, counterbore, tap, face flange and cap bearings.
Operation 2—Drill fourteen holes; ream two.
Operation 3—Drill three holes, one for $\frac{1}{8}$-in. pipe tap.
Operation 4—Spot-face holes in flange.
Operation 5—Face to length and chamfer.
Operation 6—Spot-face both sides of two holes.
Operation 7—Countersink and tap four holes.
Operation 8—Drill and tap three holes for plugs.
Operation 9—Mill slot in bosses.
Operation 10—Face flange.
Operation 11—Bolt bearing caps to carrier and tap $\frac{1}{8}$-in. hole.
Operation 12—Final inspection.

The first major operation is to bore and face the carrier in the bell shaped chuck shown in Fig. 1. The tooling is done with typical Gisholt equipment, utilizing the turret toolpost as well as the main turret in order to insure the necessary accuracy of the various surfaces.

Locating the carrier by the face of the bolt flange, the bolt holes are drilled under the Baush multiple spindle drilling machine shown in Fig. 2. This also drills the holes for tapping to receive the bolts which hold the caps. The drill bushings for these holes are held in the projections *A* and *B*. The ears which hold the bearings project up through the fixture as shown at *C* and *D*. It will also be noted that a reamer is positioned at *E* for reaming one hole for a dowel pin fit which locates the carrier in future operations.

After the caps, which have been machined previously, are bolted in place as shown in Fig. 3, the bearing seats are bored in the double-headed machine shown. The carrier is located by means of the dowel *A* and held in position by the bolt and C-washer as at *B*. Both bearing seats are then bored simultaneously, a finished carrier being shown at *C*.

The machining of the differential gear case involves a number of interesting operations, the sequence being as follows:

Operation 1—Turn, face, counterbore, form radius and bore.
Operation 2—Turn, face and chamfer.
Operation 3—Drill eight $\frac{13}{32}$-in. holes.
Operation 4—Drill eight holes for $\frac{3}{8}$-16 taps.
Operation 5—Counterbore sixteen holes.
Operation 6—Tap eight $\frac{3}{8}$-16 holes.
Operation 7—Mill oil grooves.
Operation 8—Bolt halves together.
Operation 9—Grind 2.0625 diameter.
Operation 10—Grind flange diameter.
Operation 11—Drill and ream four $\frac{3}{8}$-in. holes.
Operation 12—Inspect.

The first operation on the flange part is performed in a Potter & Johnson machine as shown in Fig. 4. This machine turns, bores, faces, counterbores, forms the radius and bores the inside of the case. The tools are shown in the turret, and a completed piece is on the cross-slide which shows the part of the case that carries the ring gear on its large flange. By the second operation on this piece the back side is machined and as can be seen in Fig. 5, three tools in the cross-slide as well as those in the turret are utilized.

The drilling heads shown in Fig. 6 are both mounted on a Cincinnati-Bickford drilling machine which is provided with a table, allowing the fixture to be moved from one spindle to the other. These heads each carry eight drills which drill the holes for the ring gear and the other half of case.

After counterboring and tapping, oil grooves are milled at four points across the inner face as shown at *A*, Fig. 7. This is done on a Whitney hand milling machine with a small end mill. The stop screws, as at *B*, position the table so as to insure the proper depth of groove, and the side movement is also limited by suitable stops.

The two halves of the differential gear case are then

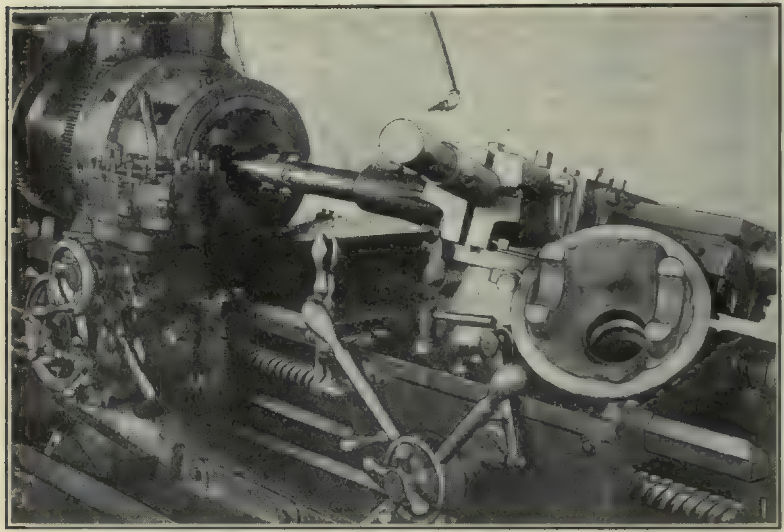


FIG. 1. BORING AND FACING DIFFERENTIAL CARRIER.

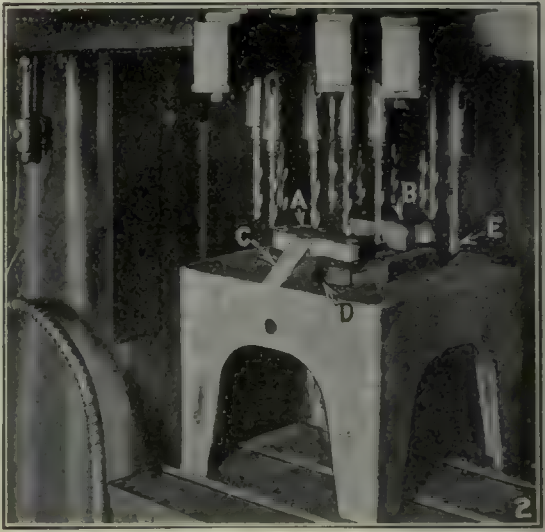
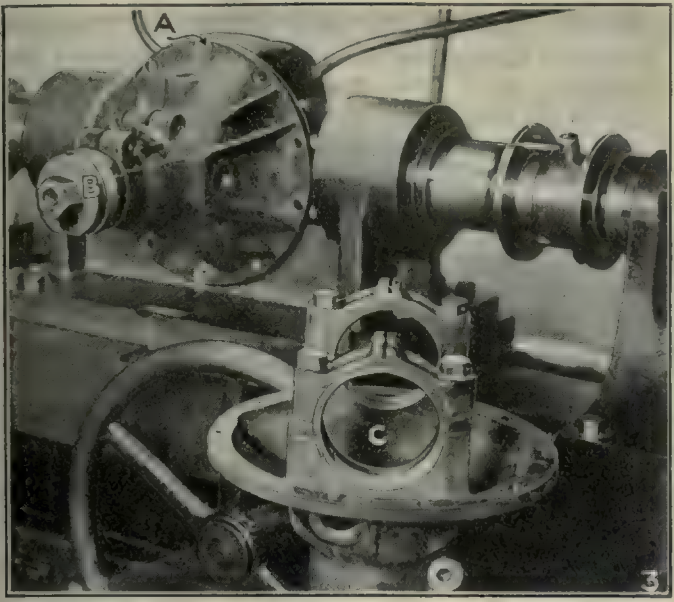


FIG. 2. DRILLING HOLES IN FLANGE AND BEARINGS



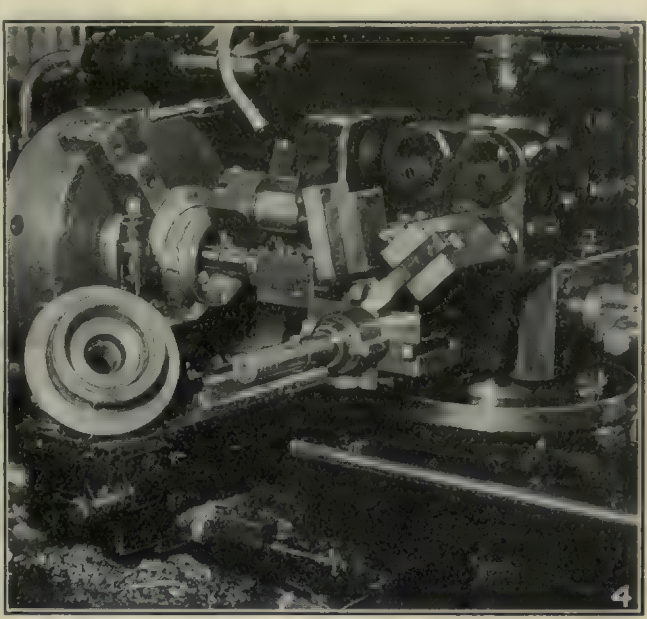
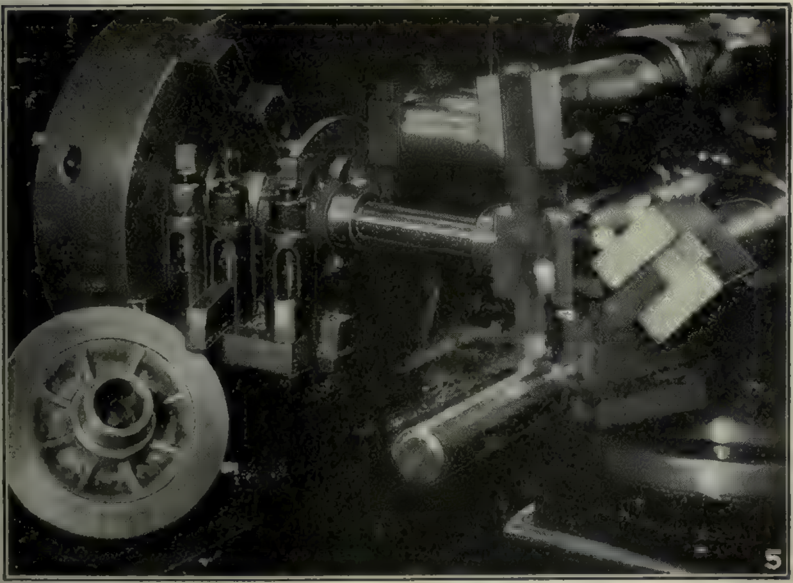


FIG. 3. BORING THE BEARINGS. FIG. 4. MACHINING THE INSIDE OF DIFFERENTIAL CASE



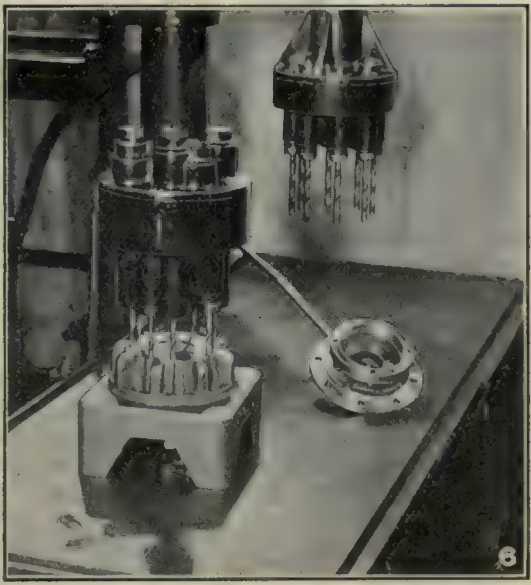
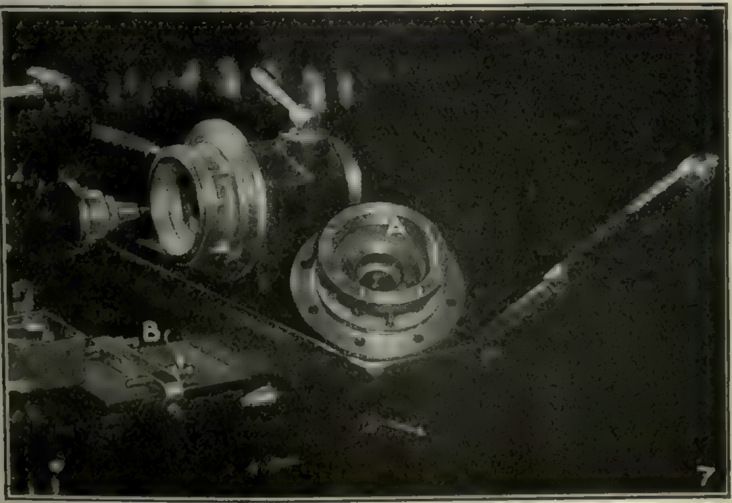


FIG. 5. THE SECOND OPERATION. FIG. 6. DRILLING THE TWO SETS OF HOLES



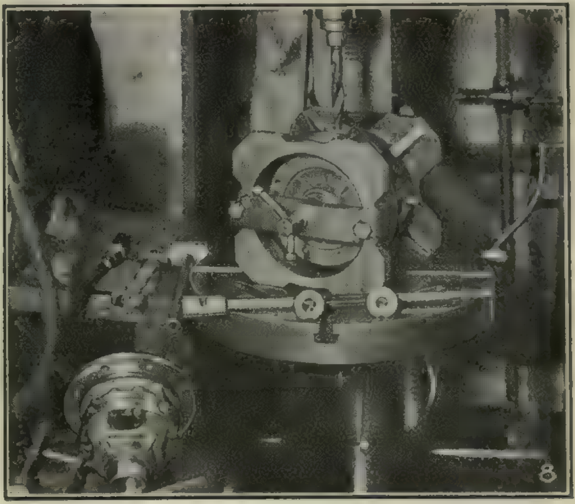


FIG. 7. MILLING OIL GROOVE IN FACE. FIG. 8. DRILLING CROSSHOLES FOR SPIDER

bolted together and placed in the fixture shown in Fig. 8. Here the four crossholes for the differential spider which carries the bevel pinions are drilled and reamed.

The tool for turning the ball in the gear case is shown in Fig. 9. This tool is held in the turret and a rack plunger *A* operates the sector around the pivot *B*, which moves the tool *F* in the proper arc. The plunger *A* is operated by the cross-slide.

The setting of the tool to the proper radius is gaged by the device shown in Fig. 10 in which the parts are lettered to correspond with Fig. 9. The yoke is located in the center of the pin *B* by means of the fixed cone points *C* and *D* and is set to the proper radius and when in place, as shown in the lower view, the cutter *F* is adjusted to meet the gage screw *E*. The adjustment is secured by the cone pointed screw *G* and the setscrew *H* locks the cutter in position.

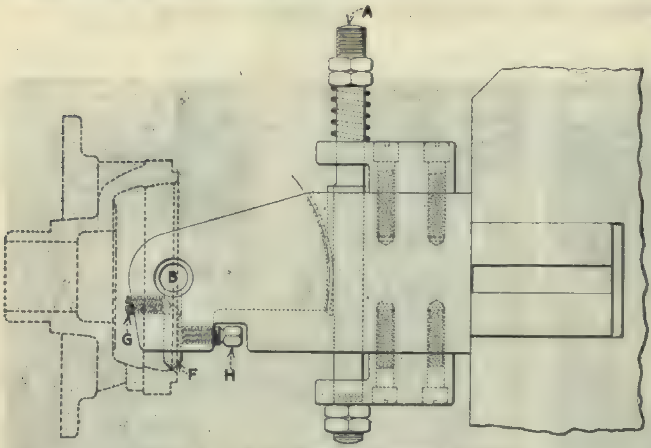


FIG. 9. RADIUS TURNING TOOL

TWO INTERESTING GAGES

The gage shown in Fig. 11 is used for checking the distance between faces *A*, *B*, *C*, *D* and *E* in the first operation. These faces must bear a definite relation to each other, within close working limits. At the "Go" end of the gage, the feeler *F*, 0.062 in. thick, is used. At *C* a grinding allowance of 0.005 in. is left for finish. The feeler *F* will pass the "Go" end of gage at *C* but will not pass the "No Go" at *D* by 0.002 in. The same is true of faces *B* and *E*, except that no allowance for grinding is made here. The faces *B* and *C* are held in close relation with *A* on account of the cross pin drilling operation in which *C* is used as a working face.

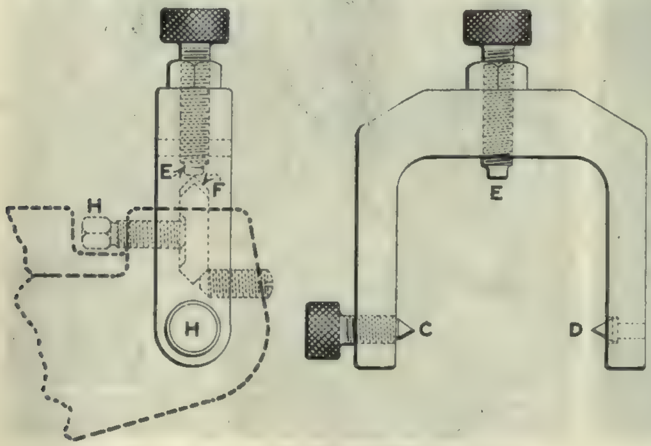


FIG. 10. GAGE FOR SETTING TOOL

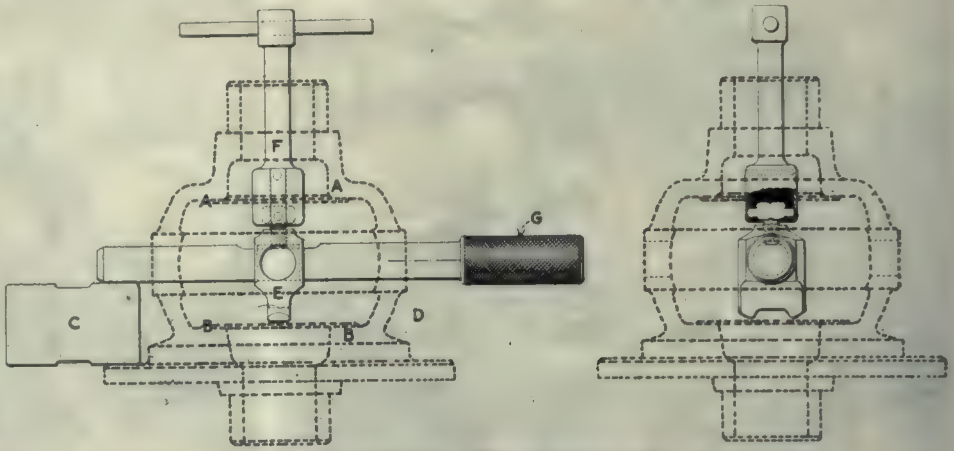


FIG. 12. GAGING THE CROSSHOLES

Another interesting gage which is used on the final inspection is shown in Fig. 12. The two halves of the case are bolted together, as shown by the outline. The screw of the rider *E* is slipped into the socket wrench *F* which holds it by means of a ball retainer. The rider is then placed in the center-hole and the bar *G* passed through the holes for the spider and through the rider *E*.

The rider is then fastened to the bar by its screw and the wrench removed. The bar *G* is then moved both to the right and to the left. By swinging the bar, both the "Go" and "No Go" ends of the rider are brought over the surfaces *B B* testing their relation to the crossholes. In a similar way the surfaces *A A* are tested by simply swinging the rider up to contact with these points.

By using a "Go" and "No Go" distance gage at *C* and *D*, the relation of the holes to the flange is also tested at the same time. This gage is very complete and can be modified for various uses in other lines of work.

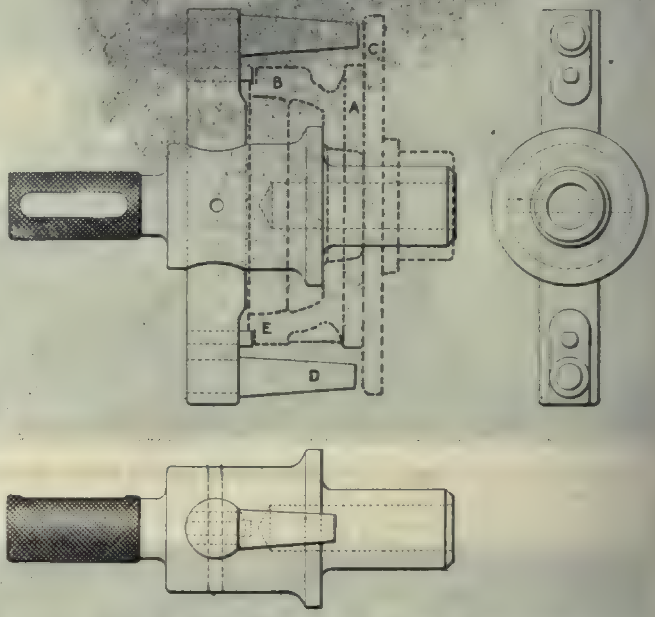
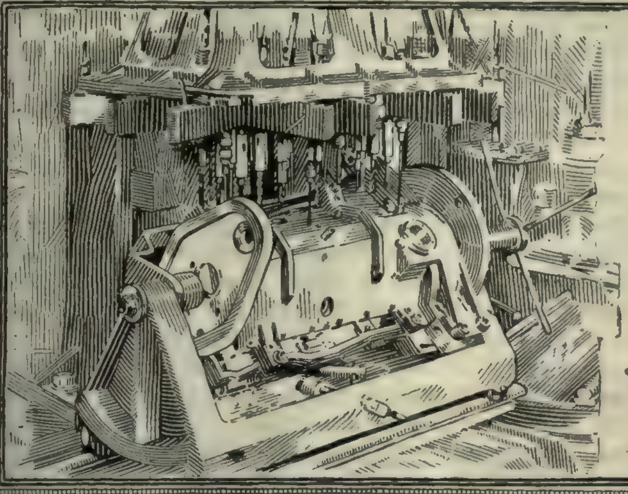


FIG. 11. GAGE FOR THICKNESS OF CASE



Tool Engineering

By

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Work-Holding Fixtures for Lathes Concluded—Second-Operation, Inside-Holding Methods—Various Types of Expanding Arbors—Design of Taper, Split-Ring and Expanding-Pin Arbors

A COMMON form of expanding arbor is illustrated in Fig. 279, the work *A* being held on the cylindrical portion of the arbor *B*, the taper end of which fits the spindle of the machine. The cylindrical portion C is split with saw cuts in three or more places so that it can be expanded on the end to hold the work. In the example shown, the expansion is done by means of a pull-back rod *D*, which has a taper end *E* fitting the taper portion of the arbor. In order to make it spring properly, the end is relieved by a recess as shown at *F*. This type of arbor really expands only on the extreme end; and, although for a great variety of work this action is sufficient to hold the piece, there is considerable likelihood of its running out of true after it has been in use for a while. This trouble can be avoided to some extent by a construction similar to that shown, in which the plug that centers the jaws and expands them has bearings at *G* and *H* which tend to keep it true. If the plug is true, the arbor itself will be accurate.

Another method of expanding the same general type of arbor is shown at *K*. In this case the arbor and expanding plug are self-contained, and the plug is tightened by means of a wrench at *L*. When this type of arbor is designed care must be taken to make the cylindrical bearing *M* long enough, so that it will assist in keeping the plug true and central. It is usually necessary to make the threaded portion a rather free fit, in order that there may be no cramp in the operation.

The two arbors mentioned are both designed to be used in the spindle of the machine, but it sometimes is necessary to provide an additional support, particularly when work is a little longer than normal. The example at *O* illustrates a method which can be used in cases of this kind. The arbor *P* is very similar to those previously shown. The plug *Q* is quite long and has a long bearing at *R* in the arbor itself. The end of the plug, which is squared up to receive a wrench, is so made that it has a countersunk hole in it to receive the center *R*. The extra support provided by this center enables the operator to take heavier cuts on the work.

In Fig. 280 are shown several illustrations of special arbors of the expanding type. The work shown at *A* illustrates a principle in arbors of this kind which is all right; but its application to the work shown is very bad indeed, on account of the lack of support which the work and the end of the arbor receive. It might be possible to use this same arbor with a center support and obtain good results from it, but its application as it is shown is not to be recommended. Several points in the construction are worthy of note. The arbor *B* screws into the nosepiece *C* and fits a tapered portion *D*, which centers it accurately. The end of the arbor is split in three places at *E*, and is expanded by means of a taper plug *F* operated by the collet mechanism on the machine. The general construction of the arbor and the method of operation are excellent.

An unusual type of expanding arbor is shown in holding the work *G*, which is a long shell of metal that has been rough-bored on the inside surface *H*. It is to be finished on the outside and the end in this operation. The body of the arbor *K* fits and is fastened to an adapter shown by the dotted lines. This arbor is ground on the outside *L* and fitted with a series of hardened rings *M*, which are chamfered to receive the hardened and tempered spring rings *N*. The operation of the device is by means of the rod *O* which pulls back on the collar *P*, thus tending to force the spring rings out against the inside of the casting, and gripping it securely. The rod *O* is operated by the collet mechanism. In order to locate the work properly two stop pins are provided at *Q*. It is necessary to support the outer end of the work by means of a center point, as shown by the dotted lines.

Another example of an expanding arbor is shown at *R*, the work in this instance being a hub which has been previously bored at *S* and finished at this end of the casting. The work locates on the portion *S*, and the other end of the arbor is arranged so that it will expand and grip the inside of the portion *T*. The plug used is similar to one shown previously, but it is so arranged that shell tools can be piloted on the portion *U* for machining the inside surface *V*. A center is used to support the end of the arbor.

The designing of split spring-arbors must be done with care, particularly as regards the proportioning of the material about the parts which are to be expanded.

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In order to bring out the principles involved, two exaggerated examples are shown in Fig. 281. In one of these the section through *X–X* is too heavy, while in the other example the section through *Y–Y* is too light. In considering the matter, it must be remembered that the closer the design approaches a hinge construction the more successful the arbor will be, yet at the same time this matter must not be carried to extremes as in the case *Y*, because an extremely thin section might be cracked and ruined in hardening. There must be metal enough to withstand the heat and sudden cooling when the arbor is hardened and tempered.

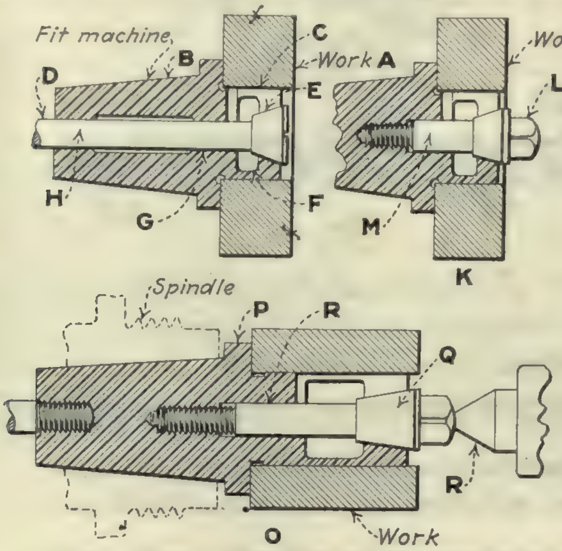


FIG. 279. ARBORS EXPANDED BY TAPER PLUGS

It is customary to drill some fairly large holes at the end of the slot, as indicated at *A* and *B*, to assist in permitting spring to the jaws. Care must be taken also to avoid sharp corners around the hinged point, as they would be likely to cause cracks in hardening or fracture in use. Large fillets like that shown at *C* and *D* are a decided advantage in the design. Extra precautions should be taken in regard to these points if a successful arbor is to be made.

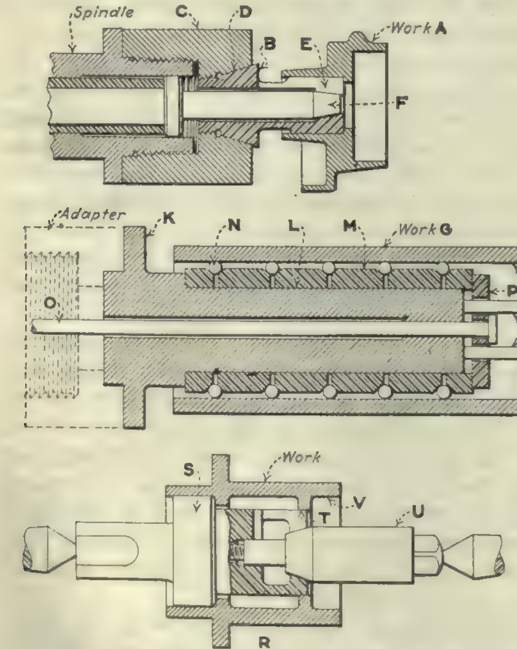


FIG. 280. SEVERAL VARIETIES OF SPECIAL EXPANDING ARBORS

Many varieties of arbors depend for their success upon the expansion of a loose split ring. Fig. 282 illustrates several points in connection with the design of split rings for arbors of this kind. The work shown at *A* is held on a tapered arbor *B* by means of a ring *C*, which is drawn back on to the taper by means of the nut and washer at *D*. This particular ring is cut only in one place at *E*. As a consequence, the expansion is not even and untrue work will probably result from its use. This is probably the cheapest form of expansion arbor which can be made in using a split ring. It is not recommended, however, because the entire principle of it is incorrect.

Referring to the illustration at *F*, another ring is shown which is split in three places, all of which splits are from one end of the ring. If an attempt were made to use this ring on an arbor such as that shown at *B*, it would not expand at all because one end of the ring is solid. If, however, the end of the arbor were to be relieved a trifle so that the bushing would not bear at this point, there would be a certain amount of expansion, but it would be all at one end of the bushing. The proper way to make a split ring is like that shown at *G*, where the ring is cut by three slots from each end, which permits it to expand equally all over. In making up a ring of this sort the toolmaker commonly leaves a "tie" of metal at the end of each slot, as indicated at *H*. This "tie" is left in during all the operations on the work. After grinding, however, a thin wheel is used to cut it out, thus permitting the ring to expand. This method assists greatly in the various operations, as the work is not so difficult to hold true. Fig. 283 shows two very good examples of arbors in which the split-ring principle is used. The work *A* locates against a shoulder on the piece *B*, which in held in the nosepiece *C*. The ring *D* is split at both ends in three places with saw-cuts running nearly up to the center of the bushing *E*. A draw rod *F* runs through the center of the arbor and is provided with a taper end at *G*, which is supported by the center shown at *H*. In operation, the draw rod is pulled back, thus expanding the ring at *G* and at the same time pulling it back until it rides on the taper at *D*, which causes this end to expand, thus gripping the work firmly at both ends. In the design of an arbor of this sort, care must be taken to make the taper on *G* slightly larger than that at *D*, in order that sufficient pulling action will be exerted in addition to the expanding, so that the end *D* will be carried back and expanded.

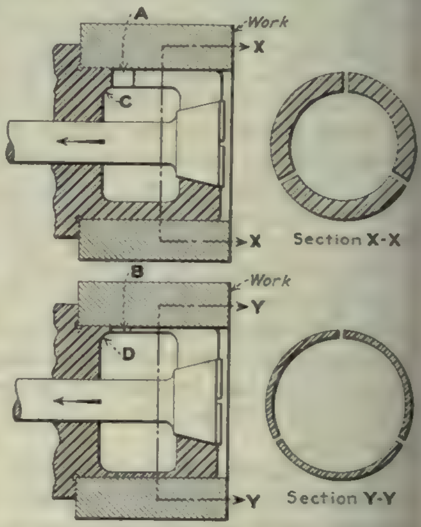


FIG. 281. DESIGN OF SPLIT SPRING ARBORS

A somewhat similar arrangement is shown for the work *K*, which arbor, however, is of much heavier construction than the other. The nosepiece *L* is fitted with a sleeve *M* having a taper at *N*. The bushing *O* is made in similar form to that previously mentioned, and it is expanded by means of a tapered plug *P* which is drawn back by means of the rod *Q*. In this case also the taper *P* should be more obtuse than that at *N*, in order to provide equal expansion on both ends of the bushing. The screws *R* and *S* simply act as retainers to hold the bushing in place.

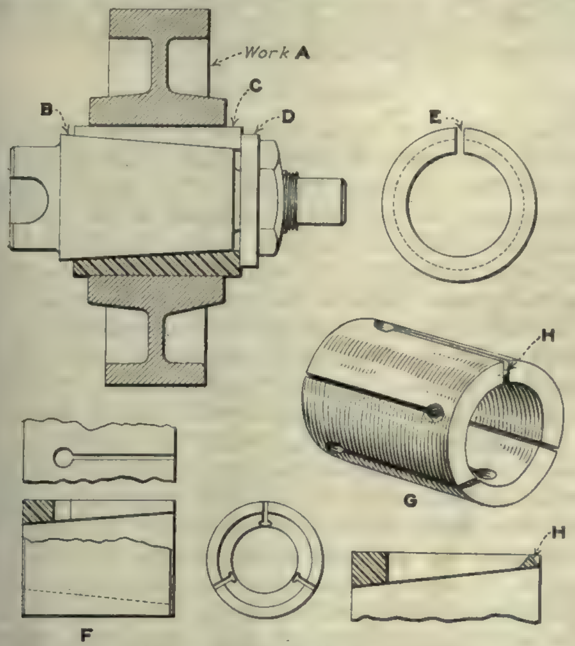


FIG. 282. USE OF SPLIT RINGS IN ARBOR DESIGN

Expanding Arbors

In Fig. 284 are shown two arbors of special design and used for long work. In one example, the work *A* is located on a hardened ring *B* at one end of the arbor, a stop being provided for the inside of the work at *C*. The other end of the arbor is tapered at *D*, and at this end a spring expanding ring *E* is located. This ring is split in three places and has a spring wire ring *F* to hold it together. The other end of the bushing has a shoulder on it, as indicated at *G*. A threaded collar *H* is provided with a supplementary ring *K*, which grips the shoulder at *G* and pulls the split ring back over the taper portion of the arbor, thus expanding it until it grips the inside of the work. A fiber disk is interposed between the shoulder of the collet and the sleeve *K*. To assist in placing the work on the arbor a tapered ring is provided at *L*. One end of the arbor at *M* is held on centers and "dogged." The other end receives its support from the work itself which has a countersunk portion *N*, in which the tailstock center is placed.

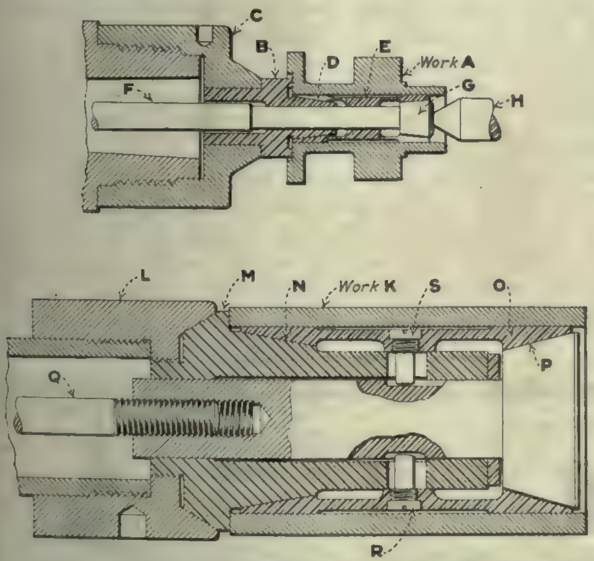


FIG. 283. TWO SPECIAL ARBORS WITH EXPANDING SPLIT RINGS

Another arbor for long work is shown at *O*. This example consists of a center member *P* tapered at *Q* to fit the inside of the sleeve *R*. The other end of this sleeve has a tapered portion *S*, on which a spring sleeve *T* is located. The nuts at *U* and *V* are used to expand the two sleeves *T* and *R*. This design can be considerably improved by simply threading the end of the arbor *P* and carrying the nut *U* over in such a way that it would bear against the end of the bushing *T*. If this were done, one screw would be sufficient to tighten both members, and the equalizing action would doubtless be better than in the construction shown.

The use of compressed air as a medium for operating expanding arbors on chucks has a number of advantages, as the amount of pressure can be easily controlled and equalizing action determined with certainty. Many of the devices previously illustrated can be operated by means of compressed air if desired. The application is simple, and the installation can be easily made to conform to the conditions. Fig. 285 shows an expanding arbor intended to be operated by compressed air. The work *A* rests against the hardened ring *B* on the nosepiece *C*. There are eight pins *D*, four of which are at one end and four at the other end of the arbor. These pins are held in position against the taper sleeves at *E* and *F* by means of coil springs. The sleeve *F* is attached to the member *G*, which is hollow. The other taper piece *E* is operated by the bar *H*, which passes back through the spindle and is fitted with a piston against which the air operates. The sleeve *G* also has a piston, and between these two pistons the air pressure is exerted. As the air is turned on, the sleeve *F* moves forward and the sleeve *E* backward, the action being nicely equalized by the pressure of the air. The releasing of the arbor is easily accomplished by a reversal of the motions mentioned. A device of this kind can be operated mechanically if desired, by means of a right- and left-hand thread and a suitable handwheel at the end of the spindle. The principle shown here can be applied to many kinds of work, both rough and finished.

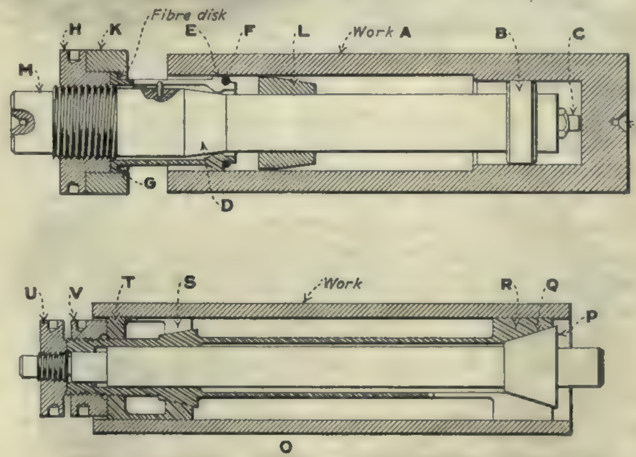


FIG. 284. TWO SPECIAL EXPANDING ARBORS

Another type of arbor having a series of equalizing expanding pins, and frequently used for the holding of automobile pistons is shown in Fig. 286. This chuck can be operated either by means of air or by a handwheel at the rear of the machine. The work *A* is held by means of three pins *B* at one end, while at the other end two pins are used, both of which may be like that shown at *C*. If the construction of the piston is such that there is very little room at this end, it is even possible to use pins like those shown at *D*. Another arrangement can also be made by using three pins at the forward end of the piston, and placing two of these pins at a suitable angle, as determined by the amount of space available.

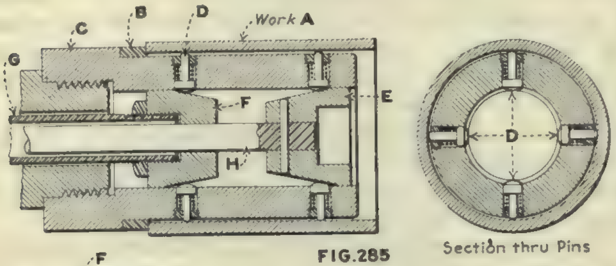


FIG.285

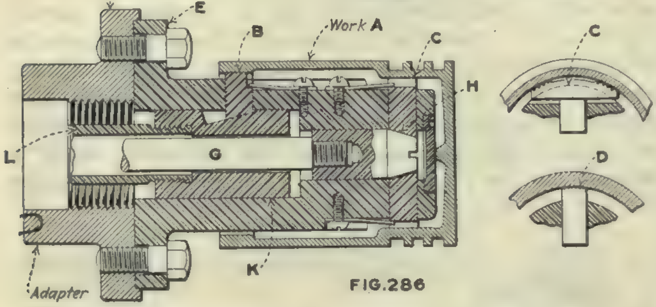


FIG.286

FIG. 285. AIR-OPERATED EXPANDING ARBOR. FIG. 286. ARBOR WITH EQUALIZING EXPANDING PINS

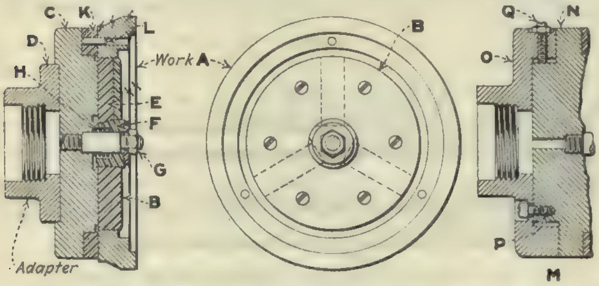


FIG 287. EXPANDING ARBOR WITH PROVISION FOR TRUING-UP

The body of the arbor *E* is fitted to an adapter *F* to which it is bolted, as shown. A rod *G* extends through the spindle of the machine and is used to operate the angular member *H*, which controls the movement of the forward pins. A bushing *K* controls the movement of the pins *B*, the operation being accomplished by its connection with the sleeve *L*. If the rod extends through the spindle and is shouldered at the other end, and if the sleeve *L* is threaded so that it fits the inside of a handwheel, a few revolutions of the latter will serve to expand and contract the pins readily. There is a very good equalizing action when operated in this way, so that the pins at the front and rear of the piston bear with a uniform pressure.

TRUING-UP DEVICE

When a piece of large diameter is to be held accurately by an inside finished surface, a device can be used like that shown in Fig. 287. The work *A* locates approximately on the outside diameter of the hardened member *B*, which is fastened to the faceplate *C*, the latter being screwed to an adapter *D*. The member *B* is slotted in three places to receive special hardened jaws *E*. These jaws are expanded and contracted by the movement of the bushing *F*, which is controlled by tightening or loosening the nut and washer at *G*. A coil spring at *H* assists in releasing the bushing when the nut is loosened. The work locates, in addition to the points mentioned, against the hardened ring *K*, which is provided with a driving pin at *L* that enters a previously drilled hole in the ring being machined. By using this driver much less pressure is required to hold the piece firmly on the arbor. The various surfaces which are to be machined in this operation are shown by the *f* marks.

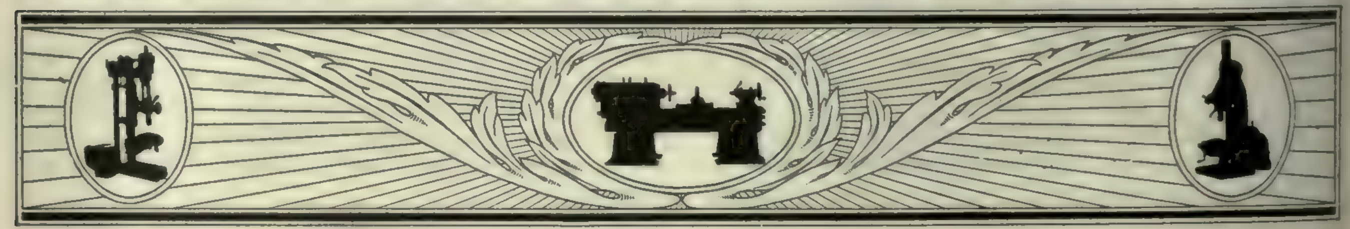
For very accurate work, it may be found a decided advantage to arrange arbors of this or other kinds in such a way that they can be trued up from time to time, if they should become slightly inaccurate. A method of making provision for this contingency is shown at *M*. The faceplate *N* is mounted on the adapter *O*, and held back by means of several screws *P*. It is also centered on the faceplate by other screws *Q* around the outside of the adapter. When it is necessary to true up the device, all these screws can be slightly loosened and adjustments made, so that the important points will run absolutely true. After testing with an indicator and making sure of the truth of the arbor, the various screws can be tightened, and the arbor is ready for work.

Schwab Speaks on Disarmament

Charles M. Schwab, at the dinner given to Marshal Foch by the American Iron and Steel Institute, said:

"I say to you from the bottom of my heart—and no one would suffer greater loss than I—that if the statesmen now assembled in Washington under the far-sighted leadership of our President and Secretary Hughes should find it possible to bring about disarmament and permanent peace, gladly would I see the great ammunition and shipbuilding plants of the Bethlehem Steel Corporation sunk to the bottom of the ocean.

"Let us say to the men gathered in Washington, let it go out from this gathering of men of the steel and iron industry, that we are solidly behind every effort they can make which will hasten the coming of the time when war shall be no more."



General Stagnation of Russian Manufacture

Russians Returned from America Fail as Model Workmen—Locomotive Repair Inefficient—Money Wasted in Ordering Locomotives—Brief Histories of Specific Plants

BY ROYAL R. KEELY

BEFORE going to Russia, Martens, then in New York, had approved Lomonossoff's invitation to me to visit Russia. Therefore I thought he might aid in getting me out of prison, and I wrote him several letters, but he did not have the courtesy to reply. Consequently I would not go to see him when I was released. One day, however, I met him accidentally on the street and he made a great effort to appear cordial, and asked why I was "working" in a small Russian-American factory. I replied that it was not my choice; that I was a prisoner and obliged to work where the government ordered. He told me that my abilities could be much better employed in the central office of the Supreme Council of National Economy, and asked me to call on him to discuss a plan which he had in mind.

A few days later, I visited his office and he outlined at some length his plan for conducting Russian emigrants from America. He said the experiment of having emigrants back from America had been successful and that he was organizing a department of American-Russian emigrants. He proposed to select certain factories to be set aside exclusively for employing them, the factories to be supplied with all necessary materials. His idea was that the returned emigrants would be fresh, with the American spirit and the American skill in efficiency and mass production. The plants would be the model and inspiration for other plants, and thus Bolshevik industries would be saved and the economic crisis passed.

RUSSIANS RETURNING FROM AMERICA HAVE FAILED

As I have already stated former professors, engineers, factory managers, railroad directors—able, honest and energetic men—were occupying themselves with electrification schemes (electric plows, electric transmission of power from the coal fields, etc.) plans for redistribution of the manufacturing industries according to an ideal plan, and in writing treatises on such subjects as the automatic coupler for railway cars and elaborately worked-out plans of standardization. They were impractical, visionary schemes, which for generations to come can be of no practical benefit to Russia. When the elaborate plan was made, the problem was 99 per cent solved and nobody worried about its realization in practical, every-day life. It was their work for the government and they could have some freedom in their theorizing, while if they had not been doing that, they would have been forced into some physical drudgery. It was just what Martens was doing in his plan for taking 100,000 Russian emigrants from America. It was an interesting theoretical toy which pleased the Bolsheviki and gave him some liberty.

I have heard that about 10,000 Russian emigrants have returned to Russia from America since the revolution—some because deported and some voluntarily. I am satisfied, from my own observations, that they are all unhappy under Bolshevism and are very sorry that they left America. I say "all"; that of course, is not strictly true. A few destructive agitators, too illiterate and indolent to earn a respectable living in the United States, are received by the Bolsheviki as heroes. In Russia they receive better houses, better food and better clothing than they ever had, and of course they are pleased, but their number is so small as to be negligible.

The Russian-American Instrument Co. attempted to take the emigrants into its factory, selecting the most promising. This arrangement failed, the company finding it better to take simple, untrained Russians—mostly women—and train them to operate machines and to do certain routine work.

In Petrograd, in February, 1920, I met a foreman of former days in the Arthur Koppel plant (England). In pre-revolutionary days, he had owned his own home and garden. At the time of my visit he was a member of the "Soviet" of the Koppel plant, and also member of the Petrograd "Soviet." He had not been disturbed in his little cottage. His wife kept house and raised the necessary vegetables for their year's keep. By energy and forethought, he secured wood for their winter's fuel during the spring and summer, when it was cheaper and easier to get. They were wearing their pre-revolutionary clothes and he complained that while he had it far better than the other men in his, and other Petrograd factories, he and his family lived only with the greatest difficulties and hardships.

His brother, who was a deportee from the United States, furnishes another typical example. The Koppel factory had, in the old days, owned its own restaurant which it operated at cost for the benefit of its force. Under the Soviet the restaurant was "nationalized" and operated by the Petrograd Central Food Department. The only food the employees got from the government was a noon lunch. The brother told me that, although he had been there over a month, and was hungry all the time, he was not able to eat the soup. He was mourning over the good life he had had in America, and his chief interest was in forming a plan of escape for himself and his brother. The former manager asked to have a meal served to me—the same that the men received—as a sample. When the soup was brought in he remarked to his companion, in Russian, "And still it is better than that served to the workmen." I tried to eat, but one wooden spoonful was all I could swallow of the soup made from bad fish, frozen potatoes and cabbage.

And so Martens' statement that the experiment of taking emigrants back to Russian factories had been successful—was absolutely false, and he must have known it at the time. He suggested that my "compulsory work" be the selection of certain factories for the 100,000 returning emigrants. Only by deception and fraud could he get them to come, and the result would be 300,000 (counting three to the family) disheartened, discouraged, miserable people. We had many discussions about whether or not I would accept work in his department but we came to no conclusions, and shortly afterwards I was enabled to leave Russia.

Nearly all the liquid wealth of Russia has been destroyed. But, fortunately, the greatest wealth is in the farms, forests and minerals, which are still there waiting development. The great problem is to find a means of stopping the destruction and arriving at the stage where reconstruction can begin. Since my first acquaintance with Russia in the summer of 1919, this destruction has gone steadily on. Personally, I am convinced that the rate of destruction is now greater than ever before. That is not hard to understand. Since the revolution, there have been no exports. As to supplying the demands of greater Russia, the imports have been infinitesimal and have consisted of only such things as could be paid for cash in advance. The cash with which they are purchased was inherited from the old government, or has been stolen from the private fortunes of the Russian people. All of the wealth that was confiscated the leaders have spent in riotous living and in enriching themselves. Large quantities have gone for propaganda at home and abroad.

Shortly after the blockade was raised the Bolsheviki placed some rather large orders with German firms for railway material. Twenty-five per cent of the contract price was paid with the order. Most of the contracts have been canceled and the deposit lost. The reason is clear. A German locomotive builder took a contract of approximately $50,000,000 for the delivery of locomotives to Russia. With the 25 per cent deposit which he received he went to Hamburg, bought a private yacht and started on a tour around the world. He was convinced that the Bolsheviki could not and would not keep their contract, so he made no effort to build. Since then the price of locomotives has gone down about 50 per cent and the Bolsheviki have, as he expected, canceled the contract, for it is easier and cheaper for them to lose the 25 per cent deposit than to lose 50 per cent of the cost price. I know of several manufacturers who had a similar experience.

One is surprised by the almost complete absence of traffic from the railroads, both passenger and freight. The commerce of the nation is dead. All the business houses of the cities are closed except the very small ones that have opened recently. The pavements and sidewalks are in painfully bad repair. The buildings are constructed of cheap, soft, brick with bad mortar, plastered over the outside. Now that they have been neglected for six or seven years, the plaster is falling off and the moisture and frost are doing their destructive work. Roofs are leaking. Machinery and equipment are in bad repair and getting worse daily. And what is especially discouraging is that no one has any interest in anything but seizing as best he can the daily necessities. There is the feeling among all the people that the experiment must sooner or later fail and that anything they do to support a system which is fundamentally wrong, is worse than useless.

Consider the big Amo automobile factory in Moscow, built by private capital under special encouragement from the old government. It is a fine factory with a complete equipment of the finest American machinery. There the Bolsheviki have a fine chance to succeed in factory organization and production, except that Russia does not need automobiles as badly as it needs simple farm machinery, clothing, fuel and general household supplies. But Bolshevism will always waste much of its time on some fantastical whim, rather than on practical necessities.

For full operation, the factory would require about 6,000 men. At the time of my first acquaintance with it, it had about 1,000 men, but only two or three skilled mechanics. There was no raw material and very little fuel; little repair work was being done. The old government had bought a lot of White trucks for the war. As they were disabled they were sent to the factory, dismantled and the good parts assembled into good trucks again. After a while, however, they ran short of motor parts and had some ninety bodies without motors. They decided to build a motor, and worked all winter trying to get one good motor cylinder casting. They failed every time, partly because of lack of skill and partly because of absence of proper material. The manager at that time was a rather able Russian engineer, who was hindered by a management committee of ignorant workmen who had authority over him. He had no power to hire, discharge or discipline without their consent. Also, he was given conflicting orders from the automobile building department in Moscow, the automobile repair department, the food operating department, the army repair and operating departments. All his holidays were spent at hard physical work with a gang of men about the factory on the theory that all should be made to do some physical work.

I saw the same factory again in June of this year. It has about the same number of men but no sign of improvement. There is no basis on which to build—no fuel, no material, no trained workmen, no adequate transport. The new manager was threatening to quit if he didn't get a proper place to live and better food. The factory has never been entirely completed and no one knows enough of the requirements of automobile building to be able to complete it. There is no incentive to work and pay is independent of production.

The Bromly Brothers and International Harvester Company Plants

The Bromly Brothers factory in Moscow, founded by an Englishman, is also worthy of notice. It possessed good and modern manufacturing methods before the revolution and never stopped work during the revolution, therefore having a chance to retain its old working force. It is not surprising then that it is still one of the best. In the fall of 1919, the entire supply of wood fuel, collected during the summer, was confiscated by the war department. It is such methods that have absolutely killed all initiative and thrift. If anyone, by energy and care and foresight, provides for himself it is taken away and given to the shiftless, the careless and the indolent.

Another comparatively "good" plant in Russia is that of the International Harvester Co., near Moscow. It is the only plant of which I have heard that has not been "nationalized." Because of the Bolshevik control of the labor, the material, the fuel, the transport and the product, it is practically no better off than other factories. The chief difference is that the old management has succeeded in retaining some measure of control of the production. Their "Soviet" has meddled in housing, in food, in social affairs, health, etc., but the old manager has insisted that technical matters of plant operation belong strictly to the technical staff. The factory has a fine little hospital that the village tried to "nationalize," but the manager managed to save it for his employees, who appreciate it. Had it gone to the village it would have been destroyed in a few weeks and no one would have profited.

The factory had a locker and washroom with an individual steel locker for each man and neat enamel wash basins with hot and cold water. The factory soviet began an agitation for individual wash basins as being more scientifically sanitary. This continued until the manager found a cure. One morning he stationed himself at the gate and grabbed each man who came in who had not washed since the previous day and said, "You did not wash last night." He found at least 75 per cent in that condition. After continuing such a shaming process for a few mornings the soviet dropped the individual basin fad.

All over Russia the oil, coke, coal and gas burning furnaces, as well as locomotives, have been converted for wood burning. In the International Harvester plant there was not room for the larger wood burning furnaces and the change would have completely upset the old arrangement and factory production system. The management insisted upon having coal and coke. Rikoff said, "We are unable to get coal and coke for you but we think you can get it for yourselves. We will give you trains and help and you can try. So in the spring of 1920 the manager's men made up a train and went south to the Donetz coal basin. It returned several weeks later with fuel enough to keep the furnaces running a few weeks longer.

One day I suggested to Lenin that better transport would mean better food and raw material; more food and material would mean better workmen; better workmen would mean better production; better production would mean better locomotives; and better locomotives would mean better transport; also that without better transport there could be no hope of industrial betterment, that better transport required better locomoives, and better locomotives again depended upon locomotive repair, so that the fundamental and first step in betterment should be locomotive repair. That, like "electrification" later, became a slogan of the administration. An order was issued that locomotives requiring repair should be taken into all factories, and that for every locomotive repaired the crew of workmen should receive a bonus in soviet cash and be permitted to take the locomotive for a trip into the country and bring food for themselves.

Repairing Locomotives Everywhere but in Locomotive Shops

As a result we had the strange spectacle of locomotive repairing shoved into all kinds of plants where previously there had been no spur tracks, no pits and no appropriate equipment or skilled workmen. At the same time, *all the locomotive building and repair plants of Russia were standing practically idle.* The order was that locomotive repairing should be taken only where it did not interfere with regular production. As there was no regular production worth mentioning, that was not a serious consideration, but if there had been it would have been destroyed by the upheaval. In sight of the bonus and the trip to the country, the locomotives got only "a lick and a promise" with the further advantage to the workers that they were soon back for a further bonus and another trip to the country. The proposal to take the locomotive repair into the International Harvester plant caused the manager and his superintendent three weeks of the hardest kind of fighting, for it would have destroyed the little nucleus he has preserved. He finally won. He used to say that the man won who could talk the longest, the fastest and the loudest. He used to laughingly remark that if his company ever returned it would fire him, saying, "We want work. You can do nothing but talk."

The production of the factory is painfully low. Fine large expensive automatic machines developed in the United States were standing idle for the want of competent workmen. Russian workmen cannot read drawings, therefore models have to be maintained for the worker. The workmen used to complain that they must work for wages only while in neighbor plants they drew wages and also attended to personal affairs. His workmen and foremen were constantly asking him for permits to leave. At first he granted their requests (it must be remembered that one cannot quit his job in Russia without an official permit); but then he saw that they were not bettering themselves, so he decided not to grant their discharges.

I dwell at length on the International Harvester factory for conditions were such that if, anywhere in Russia, success or production were possible, it was there. It only proves that factory production and success under Bolshevism are unthinkable and impossible at present.

An Example of Bolshevik Factory Management

Another factory that deserves attention is the Russian-American Instrument Co., looked upon as one of the most successful factories in Russia and pointed out with pride by the Bolsheviki as an example of what they can do in factory management. The driving force behind this factory is a group of mechanics who some years ago emigrated to America. There they learned American methods and organized a co-operative factory for toolmaking. They were in America during the war, were making $50, $60 and even $75 per week. Many of them had American wives. This co-operative group of sixty mechanics returned to Russia in 1918 because of patriotic motives. After many delays they found an idle spinning mill in Moscow. They took the spinning machinery out of the new concrete building and installed their American toolmaking machinery, completing the work in the fall of 1919. They were two years getting their little factory running, and beginning the production of taps, dies, reamers, drills, etc. But their difficulties were very great. To secure shafting, hangers, pulleys, belts, nails, screws, etc., required much time. Their difficulties are explained by the old story of material, food, fuel, transport, etc. The raw stock was from the old pre-revolutionary days, picked up from all over Russia. The quality was bad. They tried to increase their working force by taking some of the new Russian emigrants from America, but that proved a failure so they trained simple workers, many of them women, to operate machines which they themselves set up and tooled. In July of this year, they had a working force of about 350 persons. Each received a pound and one-half of bread daily which was more then employees in other factories got. At noon they got a little soup served at the factory. Once a month they got some vegetables and meat for home use. The sixty toolmakers made the highest wages, but none of them could live on the wages and food they received from the government. Each week they were selling clothing brought with them from America, safety razors and personal things to obtain the bare necessities in food. The shoes and clothing they were selling they would need badly in the coming winter, but they said they dared not think of the winter or of the future. They could consider only their present hunger.

Railroad Shop Operations and Apparatus

A "Home-Made" Acetylene Gas Generator—Cutting Continuous Threads on Stay-Bolts—Chucking Odd-Shaped Pieces—Systematic Arrangement of Tools

By FRANK A. STANLEY

THE halftone and line engravings herewith illustrate a variety of tools and methods applied to the handling of work in various departments of the Southern Pacific Railroad shop at Sacramento, Cal.

The jigs illustrated in Fig. 1 are used for drilling the holes in draw bar yokes, two types of which are shown in Fig. 2. It will be seen from the latter drawing that in the case of yokes of the type shown at *A*, there are four holes to be drilled in each arm, while in yoke *B* there are only three of these holes to be drilled.

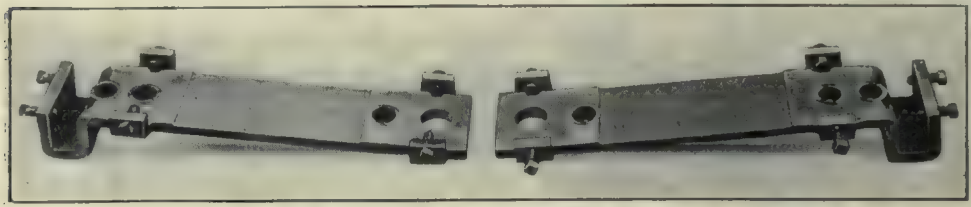


FIG. 1. JIGS FOR DRILLING HOLES IN DRAW-BAR YOKES

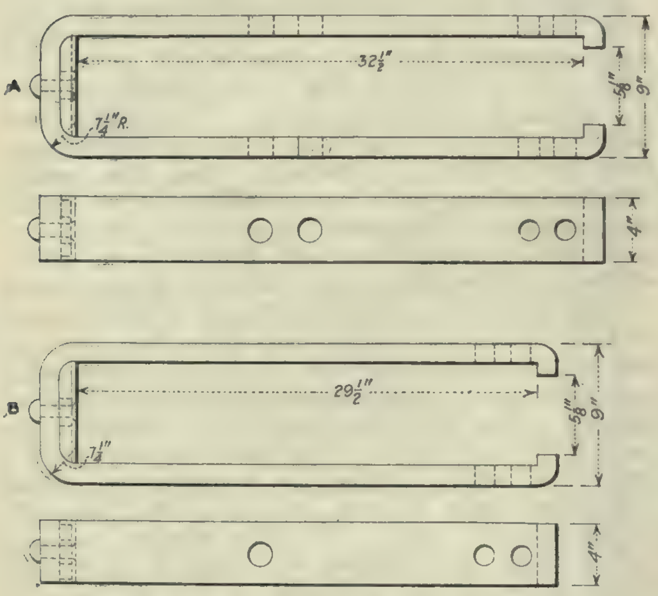


FIG. 2. DRAW-BAR YOKES

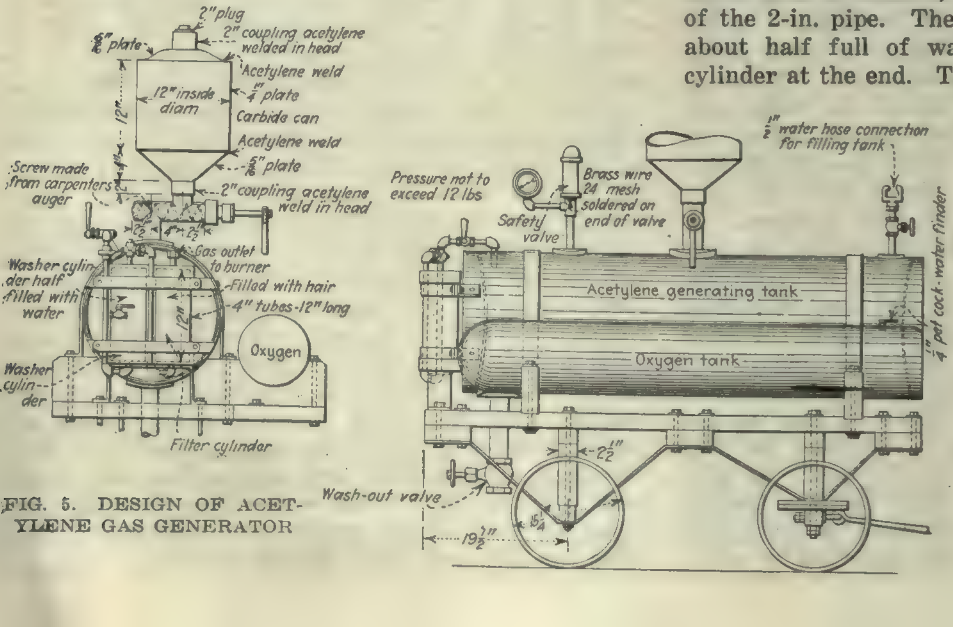
The jigs are made right and left hand, as shown in Fig. 1, each being in the form of a plate with one end offset to form a channel which permits that end to be placed over the end of the draw-bar yoke. The jig is then secured to the work by means of two screws tapped horizontally through the end of the jig plate. There are four lugs at the sides of the jig which are provided with screws for determining the side position of the jig on the work.

The halftone, Fig. 3, illustrates an attachment for the bolt cutter, with gages for cutting continuous threads on staybolts. The special jaws for holding the work are made as shown, with provision for end adjustment so that when a gage is placed in the jaws, the latter may be set properly to bring the opposite end of the continuous thread into the chasers in correct position, thus enabling the staybolt to be threaded properly when it is gripped in the jaws in place of the gage.

AN ACETYLENE GENERATOR

The halftone, Fig. 4, and the line drawing, Fig. 5, show a portable generator for acetylene welding operations. Fig. 6 illustrates the method of welding a cracked yoke under a locomotive by means of the acetylene torch. The generator, Figs. 4 and 5, may be made of a Pintsch tank or any other tank of suitable shape that will hold a pressure of 50 lb. In generating gas the pressure should not exceed 12 lb. per square inch.

On top of the generator there is a reservoir which is used for holding the carbide, which is fed into the lower tank as wanted, by a screw which fits the inside of the 2-in. pipe. The generating tank should be kept about half full of water as should also the washer cylinder at the end. The amount of water in each tank can be determined by the use of pet cocks. The filter cylinder should be filled with hair. The gas from the generator enters the bottom of the washer cylinder, comes out of the top and enters the bottom of the filter cylinder. The connection to the hose for supplying gas is at the top of this cylinder. The main tank should be washed out once a day. Care should be taken to keep the carbide dry until it is used for making gas.


2" plug
5/16" plate
2" coupling acetylene welded in head
Acetylene weld
12" inside diam
¼" plate
12"
Carbide can
Acetylene weld
4"
5/16" plate
Screw made from carpenters auger
2"
2" coupling acetylene weld in head
2½"
4"
2½"
Gas outlet to burner
Washer cylinder half filled with water
Filled with hair
4" tubes-12" long
12"
Oxygen
Washer cylinder
Filter cylinder
Pressure not to exceed 12 lbs
Brass wire 24 mesh soldered on end of valve
Safety valve
½" water hose connection for filling tank
¼" pet cock-water finder
Acetylene generating tank
Oxygen tank
2½"
Wash-out valve
15¼
19½"
FIG. 5. DESIGN OF ACETYLENE GAS GENERATOR

The piece of brass work

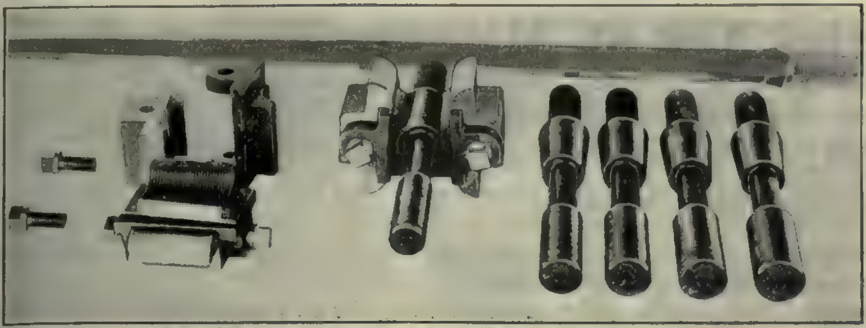


FIG. 3. BOLT CUTTER ATTACHMENT

shown in Fig. 7 is held in the two chuck jaws on the lathe by means of adaptors which are dovetailed into the jaw faces. These project from the jaws proper and form an adequate support for the brass casting that is to be machined. The special jaw faces also carry locating hubs upon which the work is placed so that its position is properly established when the jaws are closed, the work being thus held securely during the machining including the work on both of the opposite faces.

The drawer in Fig. 8 enables a large number of special brass-working tools to be conveniently stored. This type of drawer is used in cabinets and under the regular shop benches, it being arranged to carry a large number of tools which are kept within easy reach and can be readily selected when required for the job in hand. The false bottom of this drawer is provided with openings bored to suitable size for the tool shanks so that the tools stand upright as shown.

Other types of toolholding blocks are shown in Fig. 9. These are kept in a drawer or cabinet according to the requirements of the department where they are to be used. Flat cutters and tools of the character illustrated are awkward to store unless placed upright as indicated. In this position the maximum number of tools may be carried in limited space without danger of the edges injuring each other.

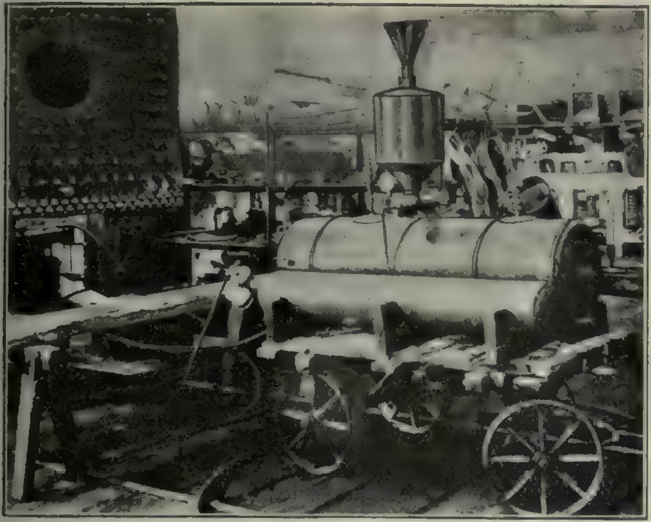


FIG. 4. PORTABLE ACETYLENE GENERATOR

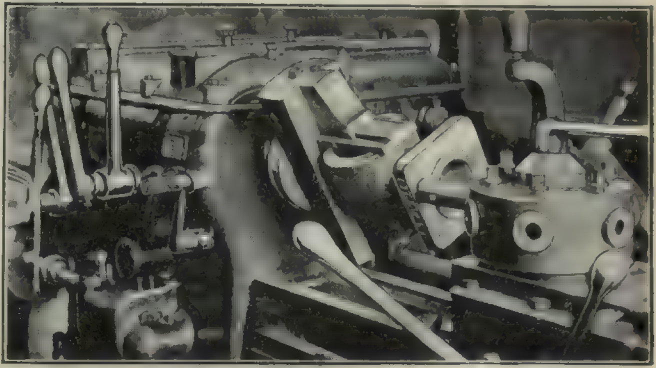


FIG. 7. HOLDING A PIECE IN THE BRASS LATHE

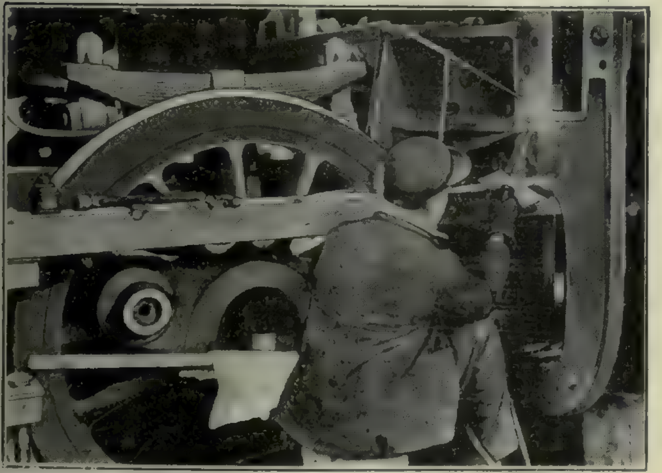


FIG. 6. WELDING A CRACKED YOKE

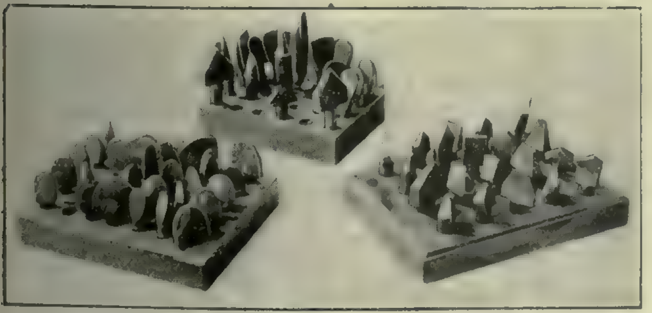


FIG. 9. BLOCKS FOR HOLDING TOOLS

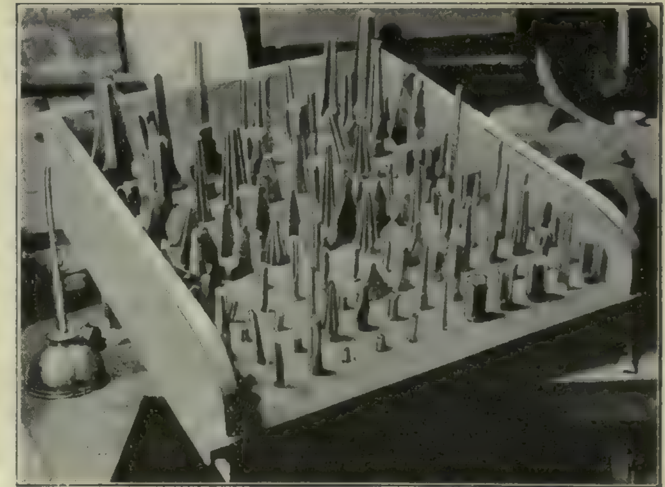


FIG. 8. DRAWER-RACK FOR TOOLS

On the Art of Milling

Studies of Single Tooth Action—Influence of Rake and Feed—Effects of Lubrication, Chatter, Clearance, Spiral—Shape of Tooth—Records of Experiments

By JOHN AIREY AND CARL J. OXFORD

THE industrial value of scientific analysis applied to basic shop processes appears to be little appreciated when that analysis is contrasted with investigations carried on to improve the design of the manufactured product. This is explained partly by the cleavage between the engineering department and the operating department in almost all plants. It is also partially explained by shrinkage in the significance of the term "engineering" until it means "design" only, when used in a quantity production atmosphere. This is either the cause or the effect of our engineering schools keeping out of touch with production proper and, consequently, research energy is lavished on all features of design, each minor side issue usually having its full quota of devotees.

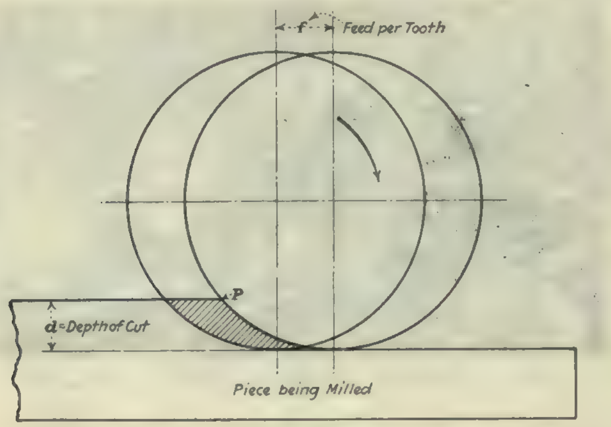


FIG. 1. SHAPE OF MILLING CHIP

In contrast to this, research endeavor covering basic shop processes appears to be badly neglected. Taylor, in this country, and Nicolson, in England, have done classical work in the field of lathe tool action. There is much to be done and many fundamental shop processes are yet untouched. A plea is here made that our engineering schools devote the same intensity of attention to shop processes that they now devote to design topics. The economic results to industry would be greater though not so spectacular. If a hole can be drilled more quickly or a surface can be milled more rapidly, then the cost of practically all classes of finished products is affected. This is true of improvements in all basic shop processes, whereas improvements in design benefit only a limited field—just one class of finished product. The economy accruing from improvements in shop processes being distributed over a larger territory makes it less spectacular and this, indirectly, might account for the decreased attention given it.

The practice of milling has, during the present century and the last decade of the nineteenth century, encroached decidedly on the field occupied by the shaper and planer. The action of milling possesses advantages over shaping; it also has its drawbacks. Much work must be done before we can state the relative merits or potentialities.

In the art of milling, the only published investigations have been handled by machine tool builders. Attention has in consequence been focused more on the machine than on the cutter. Further, in the investigations already made, the objects sought have usually had the defect of being too immediate. This paper describes an attempt to investigate the fundamental principles underlying the action of milling.

It is shown in the present investigation that metal is removed more efficiently with thick chips than with thin chips. It follows from this that, other conditions being equal, including speed and feed per minute, the cutter with the fewest teeth gives the greatest efficiency. However, it is evident that the efficiencies of two cutters with different numbers of teeth are equal provided the table feeds be adjusted so that the same feed per tooth is effected. This gives a definite working theory on the influence of spacing.

In addition to the present investigation, experiments published in substantiation of the advantage of wide spacing agree in confirming this theory. It is definitely established that for a given material, tooth shape and sharpness, thickness of chip is the sole criterion of the efficiency with which metal is removed in milling and that increase of spacing over that required for free cutting is a handicap. Present-day high powered cutters have several times the chip-space needed. Limitation of machine power has doubtless been the chief factor in giving a false bias to the influence of spacing.

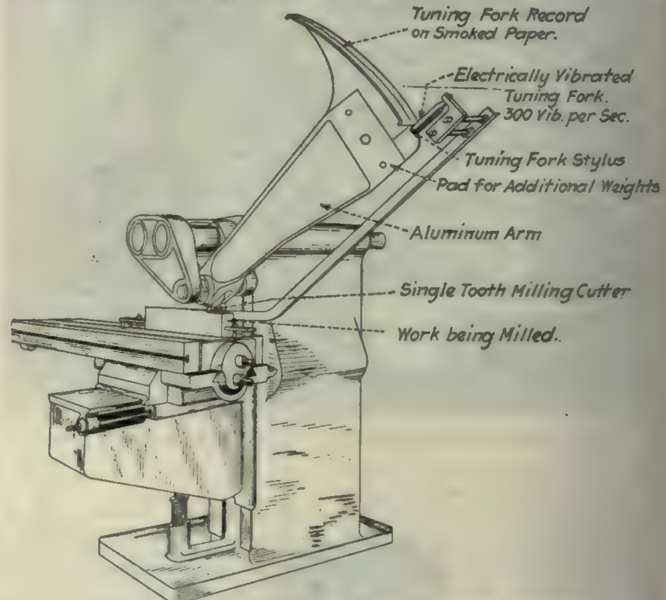

Tuning Fork Record on Smoked Paper.
Electrically Vibrated Tuning Fork. 300 Vib. per Sec.
Tuning Fork Stylus
Pad for Additional Weights
Aluminum Arm
Single Tooth Milling Cutter
Work being Milled.

FIG. 2. DIAGRAM OF CHIP INVESTIGATOR

The work described in this paper started in May, 1920, through a desire of the National Twist Drill and Tool Co. of Detroit, to find a rational basis for the action of a milling cutter so far as this could be removed from the region of empiricism. This company

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Presented at the annual meeting, Dec. 5 to 9, 1921, of the American Society of Mechanical Engineers.

furnished the financial support throughout. The experiments have been conducted in the engineering shops of the University of Michigan, at the National Twist Drill and Tool Co., the Lincoln Motor Co. and the Hudson Motor Car Co. The greater part of the work was done at the University of Michigan, viz., all experiments on chip investigator and on the thrust and torque measurer. The work on the machineability tester was done at the National Twist Drill and Tool Co. and the tests on endurance were run at the two automobile plants.

The writers take this opportunity to express their appreciation of the encouragement given throughout by Howard L. McGregor, of the National Twist Drill and Tool Co. Thanks are accorded to H. M. Leland, who willingly made the facilities of the Lincoln Motor Co. available, and to Roy D. Chapin, who similarly opened the extensive Hudson plant. Acknowledgment is also made of the unfailing courteous co-operation given by R. L. Welborn, of the Lincoln Motor Co., and by I. B. Swegles of the Hudson company. Lastly, acknowledgment is made of the invaluable assistance rendered throughout by Ingle B. Whinery, on whom the brunt of the work fell. Mr. Whinery was connected with this work from the start; first as a graduate student at the University of Michigan and later, throughout the year 1920-21, as holder of a National Small Tool Fellowship (awarded by the National Twist Drill and Tool Co.) and finally as an engineer with the company. Mr. Whinery, ably assisted in the troublesome development stage of equipment, later conducted most of the experiments personally and finally prepared all the data for this paper.

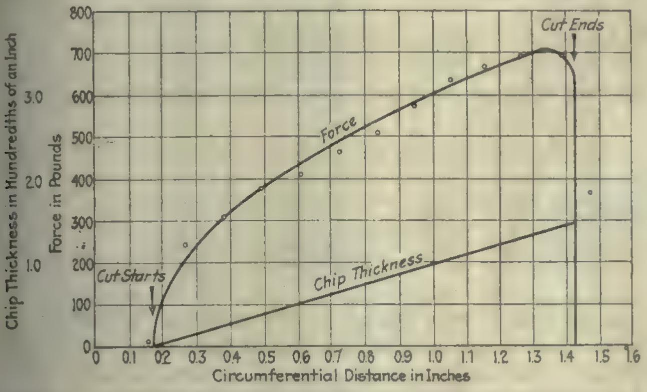


FIG. 3. FORCE-SPACE CURVE OF CHIP FORMATION

The chip taken by a plain slab mill is very different from the chip taken by a lathe or shaper tool. A milling chip is shown exaggerated in the shaded portion of Fig. 1. The two circles show the outline of the cutter at the beginning and at the end of the interval taken for the cutter to revolve through the angle subtended by one tooth. The shaded portion will therefore represent the material removed by one tooth and will have an area *fxd.*

The chip starts infinitely thin and its thickness gradually increases to a maximum just before the finish, from which point it quickly decreases. This decrease is practically instantaneous in an unexaggerated chip. The question arises, how does the force vary throughout the cutting of this chip?

The first problem is to find how the tangential force varies in relation to chip-thickness. For measuring this force while the chip is being formed under reasonable commercial velocity conditions, a dynamical measuring method is the only solution, as a chip is completely cut in about one-tenth of a second.

Description of Chip Investigator.—Fig. 2 is a diagrammatic representation of the apparatus here known as the chip investigator. A block of material is shown bolted to a milling machine table and a single-tooth cutter in place, the latter being rigidly attached to the sector-shaped arm. This arm can partially rotate about an axis at its lower end, and in so doing, it carries the cutter through an arc long enough to make a chip of the desired length.

If the arm be allowed to fall freely, the angular velocity will increase throughout the fall. If this be repeated after the table is adjusted so as to cause a cut to be taken, then the next fall of the arm will be retarded, because it must give up sufficient energy to do the cutting. Weights can be placed on the pad for additional weights (see Fig. 2), sufficient to secure a roughly uniform speed during cutting.

The investigation of the velocity at each instant is made by means of a tuning fork, which gives a record on smoked paper. The outer surface of the arm, remote from the axis of oscillation, is concentric: to this a glazed paper ribbon is attached and then smoked by a gas flame.

An angle iron bolted to the front face of the machine carries at its upper end a Koenig electrically driven tuning fork making 500 vibrations per second. As the arm falls, a wavy line is traced on the smoked paper by a stylus attached to one leg of the tuning fork. Each wave represents a definite interval of time, viz., two one-thousandths of a second. The smoked paper record is immediately dipped in thin shellac varnish and hung to dry.

The analysis and computation of smoked paper records is given fully in Appendix No. 1. An example of a chip study is given in Fig. 3, where it is very clearly shown that the force employed is not proportional to the chip thickness. In other words, material is removed more efficiently as the chip becomes thicker. This is confirmed later by experiments on varying feeds and furnishes the true explanation of the supposed advantages of coarse tooth cutters.

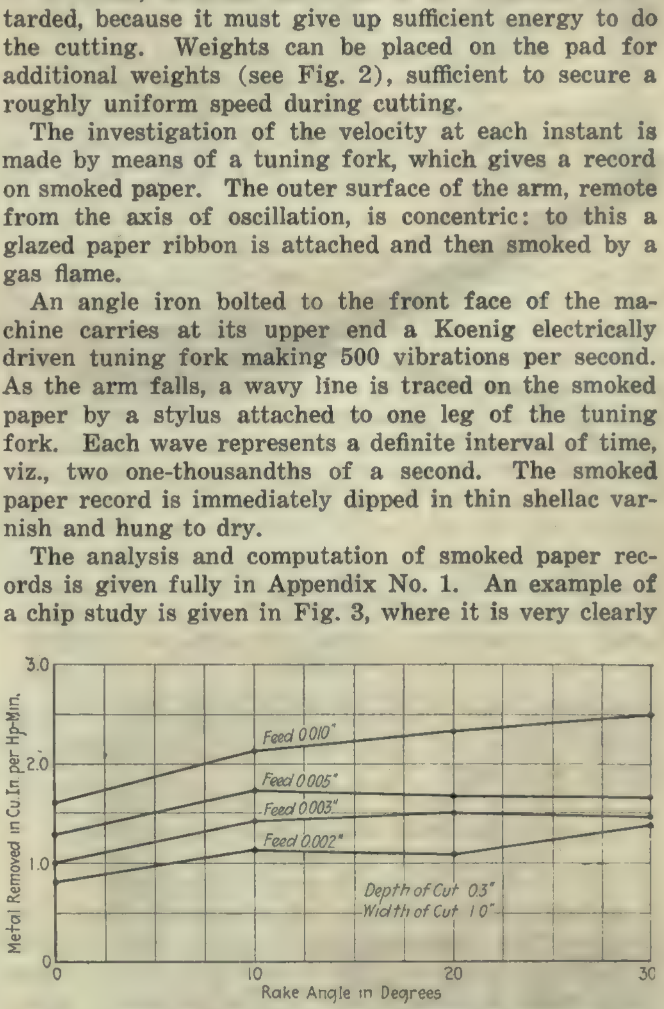


FIG. 4. CAST IRON: METAL REMOVED AS FUNCTION OF RAKE

Over twelve hundred chips were cut and the energy computed. These were taken at three different cutting speeds, viz., 17.5, 32 and 44 ft. per minute, respectively. The average of the energy required at different speeds was remarkably equal. If the energy used at lowest speed be taken as 100, the results are:

Speed in feet per minute.	17.5	32	44
Energy	100	101.8	97.4

As there appears no law in this and the variation is slight, presumably due to experimental error, the conclusion was reached that speed does not influence energy required.

Influence of Rake and Feed on Cast Iron.—The results of the analysis of sixteen sets of chip-formations in cast iron are given in Table I and shown graphically in Figs. 4 and 5. Each set consists of three chips formed at the different speeds, as stated in a previous paragraph.

The area under each curve gives a numerical representation of the average production of each tool over a certain region of chip weight. Taking the 0-deg. rake tool as 100 we have:

Production of 0-deg. rake tool = 100
Production of 10-deg. rake tool = 133
Production of 20-deg. rake tool = 138.4
Production of 30-deg. rake tool = 142.1

Influence of Rake and Feed on Bronze.—The results of the analysis of sixteen sets of chip-formations in bronze are given in the following table. As in the last section the consistent superior economy of heavy feeds is observed. This information is condensed as before and results in:

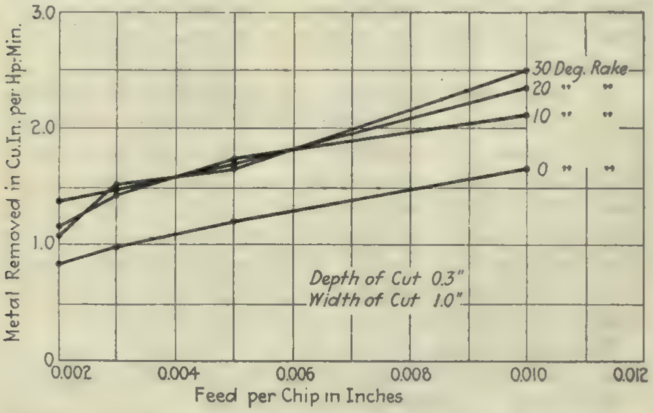


FIG. 5. CAST IRON: METAL REMOVED AS FUNCTION OF FEED

Production of 0-deg. rake tool = 100
Production of 10-deg. rake tool = 113.2
Production of 20-deg. rake tool = 123
Production of 30-deg. rake tool = 118

Influence of Rake and Feed on Machine Steel.—The results of the analysis of sixteen sets of chip-formations of machine steel are given in Table II and presented graphically in Figs. 6 and 7. The consistent superiority of heavy feeds is again noted. Again condensing the above information:

Production of 0-deg. rake tool = 100
Production of 10-deg. rake tool = 118.7
Production of 20-deg. rake tool = 157.2
Production of 30-deg. rake tool = 172

Influence of Rake and Feed on Carbon Tool Steel.—The results of the analysis of sixteen sets of chip-formations of tool steel are given in Table III, and graphically in Figs. 8 and 9. Again condensing the above information:

Production of 0-deg. rake tool = 100
Production of 10-deg. rake tool = 106
Production of 20-deg. rake tool = 112.2
Production of 30-deg. rake tool = 112.0

Effect of Lubrication.—Various experiments were run with lubricant. The results must be taken qualitatively rather than quantitatively. This topic offers an important field of investigation for future experiments.

In milling there is a decided influence entirely apart from heat-conducting properties. If the surface exposed by the last chip was very slightly smeared with an oiled finger (the oil film was scarcely discernible), the energy consumed in taking the next chip was from 10 to 25 per cent lower in nearly all cases.

On plotting batches of results, however, the surprising situation was found of oil proving advantageous with low rakes in bronze and detrimental with high rakes. The existence of some unknown varying factor was suspected and the result would have been rejected and forgotten but for the fact that the same effect showed up in experiments with machine steel made at a different time. The metal removed per horsepower-minute is shown plotted against rake for the two materials in Fig. 10.

TABLE I. INFLUENCE OF RAKE AND FEED IN CUTTING CAST IRON

Clearance angle, 2 deg.; spiral angle, 0 deg.; depth of cut, 0.3 in.; width of cut, 1 in.

Experiment No.	Rake Angle, Deg.	Feed in Inches	Energy in Ft.-Lb.	Cu.In.per Hp.-Min.
52	0	0.002	24.2	0.818
53	0	0.003	30.4	0.977
54	0	0.005	38.3	1.293
55	0	0.010	60.8	1.627
59	10	0.002	17.3	1.143
60	10	0.003	21.1	1.407
61	10	0.005	28.9	1.712
62	10	0.010	47.1	2.105
66	20	0.002	18.1	1.093
67	20	0.003	19.8	1.500
68	20	0.005	29.3	1.690
69	20	0.010	42.7	2.319
73	30	0.002	14.2	1.394
74	30	0.003	20.6	1.441
75	30	0.005	29.7	1.666
76	30	0.010	39.6	2.500

The authors hesitate to accept the foregoing unreservedly until further investigation sheds some light on its rationality. A study of the resultant force during the formation of a chip with reference to its changing magnitude and *direction* would give the needed explanation. This has not yet been undertaken.

Effect of Chatter.—When chatter occurs, violent fluctuation of energy results. The energy consumed was usually greater than with smooth cutting. The authors believe that, due to chatter alone, *increase* of energy invariably results and that, where a decrease appeared, it was caused by the cut being lighter than supposed to be. This can be brought about by the chatter causing an increase of force normal to the work and this in turn springing the work or cutter. A detailed study of chatter was not made but probably will be at a later date.

TABLE II. INFLUENCE OF RAKE AND FEED IN CUTTING MACHINE STEEL

Clearance angle, 3 deg.; spiral angle, 0 deg.; depth of cut, 0.3 in.; width of cut, 1.0 in.

Experiment No.	Rake Angle, Deg.	Feed in Inches	Energy in Ft.-Lb.	Cu.In. per Hp.-Min.
250	0	0.0025	45.1	0.549
251	0	0.0050	72.8	0.680
252	0	0.0075	94.3	0.787
253	0	0.0100	103.1	0.960
289	10	0.0025	38.8	0.638
290	10	0.0050	60.0	0.825
291	10	0.0075	76.8	0.967
292	10	0.0100	94.4	1.049
260	20	0.0025	25.0	0.990
261	20	0.0050	46.3	1.068
262	20	0.0075	59.9	1.240
263	20	0.0100	71.4	1.386
265	30	0.0025	25.9	0.955
266	30	0.0050	41.2	1.200
267	30	0.0075	55.0	1.350
268	30	0.0100	62.5	1.584

Effect of Clearance.—Clearance was found not to affect energy consumed. Chatter, wear of tool and liability of tool to snip are affected by clearance.

Effect of Spiral.—Experiments were carried out on the effect of spirals. The results were not sufficiently uniform to justify a conclusion on the influence of spiral angle on energy, beyond the fact that cutters with spiral angles of over 25 deg. certainly require more energy.

Method of Determining Machineability.—The word "machineability" is suggested to indicate the ease with which a given material can be machined. This, of course, presupposes standardized conditions of tool and size and shape of chip. If all conditions be standardized except the quality of the material being cut, then the machineability can be expressed in foot-pounds of energy required to remove 1 cu.in. of the material under investigation.

It is well known that machineability is a continual bone of contention in machining departments and that no accepted satisfactory way has yet been devised for its measurement. It is generally admitted that even though chemical analysis, tensile strength, elongation, Brinell hardness number and scleroscope hardness number are known, yet the machineability is an unknown factor. In fact, the War Department gave to the American Research Council as their major topic the development of some definite means of determining machineability.

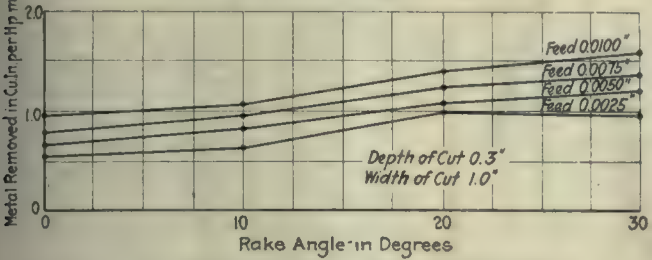


FIG. 6. MACHINE STEEL: METAL REMOVED AS FUNCTION OF RAKE

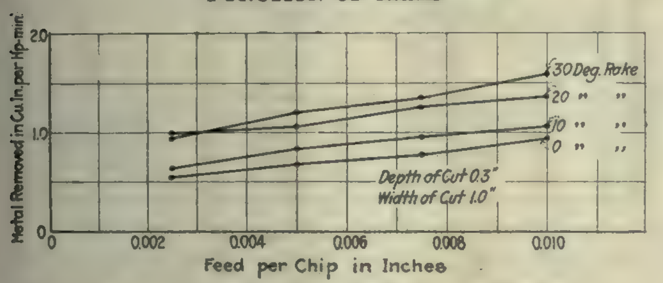


FIG. 7. MACHINE STEEL: METAL REMOVED AS FUNCTION OF FEED

A machine has been developed along these lines and is described later in the paper. For identification purposes, this is referred to as the "Machineability Tester." Experiments with this machine are presented at the end of the paper rather than here, because they were the last experiments to be performd.

To summarize: The authors had, at this state of development, no definite idea leading to a rational structure which would connect up the results. They regard the work in this section as useful in opening up territory, thereby enabling them to formulate more definite layouts for subsequent work and believe that broadly the following conclusions are justified: (*a*) As a chip thickens, metal is removed more easily per unit volume; (*b*) As rake angle is increased, metal is removed more easily per unit volume. Also this improvement is continuous but not uniform; (*c*) The advantage of rake depends on the material and is more pronounced with ductile materials; (*d*) The effect of lubrication proper (apart from cooling action) is decided, but the information available is inadequate to formulate it.

COMPLETE FORCE ANALYSIS OF CUTTER IN ACTION

Numerous experiments on power consumption have been made by different investigators, but the method employed has been to measure the electrical input required to drive the machine. This confuses the unknown action of the cutter with the unknown machine loss and has therefore been rejected for the present investigation.

TABLE III. INFLUENCE OF RAKE AND FEED IN CUTTING TOOL STEEL

Clearance angle, 3 deg.; spiral angle, 0 deg.; depth of cut, 0.3 in.; width of cut, 0.25 in.

Experiment No.	Rake Angle, Deg.	Feed in Inches	Energy in Ft.-Lb.	Cu.In. per Hp.-Min.
331	0	0.0025	39.6	0.625
332	0	0.0050	64.0	0.774
333	0	0.0075	89.5	0.830
334	0	0.0100	102.8	0.960
336	10	0.0025	43.1	0.575
337	10	0.0050	60.7	0.820
338	10	0.0075	79.5	0.924
339	10	0.0100	97.6	1.012
341	20	0.0025	38.8	0.639
342	20	0.0050	60.4	0.819
343	20	0.0075	73.7	1.005
344	20	0.0100	90.0	1.100
346	30	0.0025	37.6	0.659
347	30	0.0050	59.3	0.832
348	30	0.0075	76.1	0.972
349	30	0.0100	90.9	1.095

Features to be Measured. It was thought desirable to measure both the vertical and the horizontal components of the force exerted by the cutter. This necessitated developing an instrument that would measure both force and location, i.e., in all, three quantities—magnitude, direction and location. Or, which amounts to the same thing, the two components and the location may be measured.

Description of Equipment. The apparatus developed for force and power analysis is shown diagrammatically in Fig. 11, and is designated the "Thrust and Torque Measurer."

The angle plate (to which is bolted the material being cut) is carried on three knife edges, through which the forces are transmitted to pistons *A*, *B* and *C*. The double-knife-edge principle used transmits only a horizontal force to piston *A* and only vertical forces to pistons *B* and *C*.

TABLE IV. INFLUENCE OF RAKE IN CUTTING MACHINE STEEL

Number of teeth, 34; clearance angle, 5 deg.; spiral angle, 0 deg.; depth of cut, 0.3 in.; width of cut, 0.5 in.

Exp. No.	Date	Rake Angle, Deg.	Feed, in per Min.	Speed, R.p.m.	Vol. per Tooth, Cu.In.	Torque, In.-Lb.	Cu.In. per Hp.-Min.
1001	2-23-21	0	0.92	27.9	0.000145	693	0.448
1002	2-23-21	0	2.36	27.9	0.000375	1,390	0.585
1003b	2-23-21	0	3.10	19.3	0.000710	2,050	0.748
1004a	2-24-21	10	0.92	27.9	0.000145	455	0.685
1005	2-24-21	10	2.36	27.9	0.000375	980	0.830
1006	2-24-21	10	3.10	19.3	0.000710	1,710	0.896
1007	2-25-21	10	0.92	27.9	0.000145	488	0.637
1008	2-25-21	10	2.36	27.9	0.000375	1,040	0.781
1010	2-29-21	0	0.92	27.9	0.000145	618	0.504
1011	2-29-21	0	2.36	27.9	0.000375	1,260	0.645
1012	2-29-21	0	3.10	19.3	0.000710	1,954	0.783
1013	3- 7-21	20	0.92	7.9	0.000145	291	1.068
1014	3- 7-21	20	2.36	27.9	0.000375	740	1.100
1015	3- 7-21	20	3.10	19.3	0.000710	1,432	1.070

The fluid pressure under the pistons is transmitted through pipes and measured by means of mercury columns shown at the left of Fig. 11. As the table travels in feeding, the location of the downward thrust of the cutter in relation to cylinders *B* and *C* changes continuously. The table traveling from left to right results in the pressure decreasing on *C* and increasing on *B*. The readings of mercury columns must therefore be taken for known definite locations of table. Five marks were made in the table, and as these successively came into alignment with a zero mark on the saddle, the readings were taken.

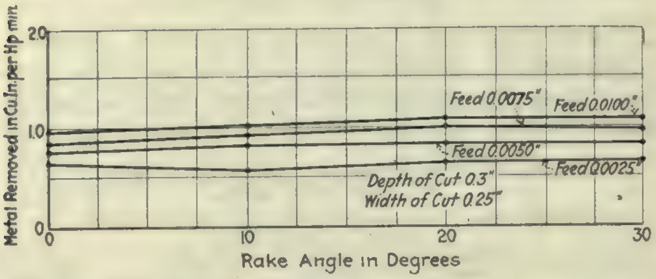


FIG. 8. TOOL STEEL: METAL REMOVED AS FUNCTION OF RAKE

Influence of Rake on Machine Steel. The results of fourteen experiments are shown in Table IV and graphically in Fig. 12. The noticeable consistency in the spacing of the pairs of values given as results of the zero rake cutter is due to the second three having been taken in a different part of the block from the first three. The results plotted in Fig. 12 show the decided advantage of rake. The advantage of heavy chips is also clearly shown except in the case of the 20-deg. tool.

The authors do not draw any conclusion regarding this exceptional case as the experiments available are too few. In general there is conclusive evidence that heavy chips are more economical of power than small chips, within the practical limits of present-day milling practice. The exact extent of this economy cannot be stated at the present state of the art. It is certain, however, that this condition is a function both of the material and of the rake. The influence of rake appears to depend largely on ductility.

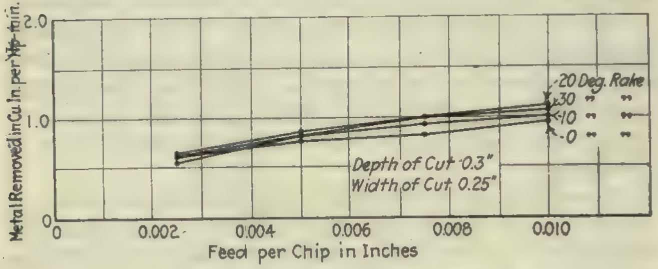


FIG. 9. TOOL STEEL: METAL REMOVED AS FUNCTION OF FEED

The area under each curve gives a numerical representation of the average production of each tool over a certain region of chip weight. Taking the 0-deg. rake tool as 100 we have:

Production of 0-deg. rake tool = 100
Production of 10-deg. rake tool = 130
Production of 20-deg. rake tool = 176

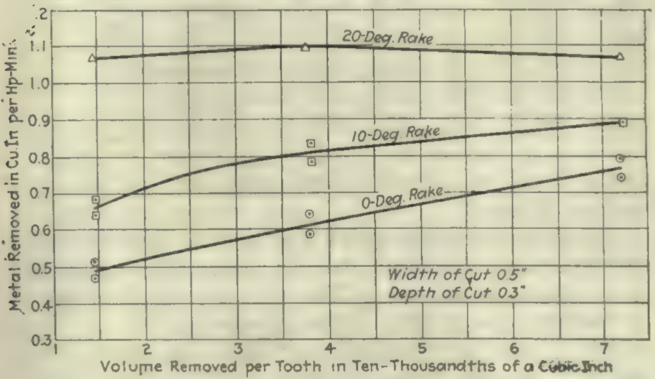


FIG. 12. INFLUENCE OF RAKE IN CUTTING MACHINE STEEL

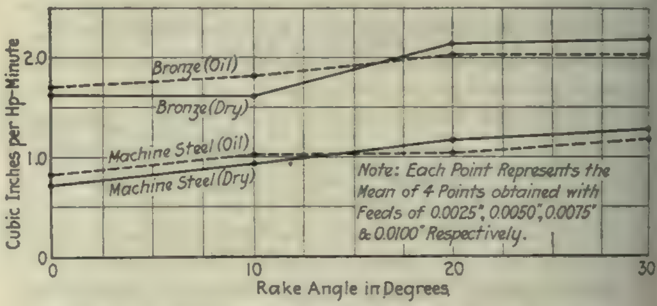
Influence of Rake on Alloy Steel. The results of twelve experiments are shown in Table V and in Fig. 13. Again taking the area under the curve to represent the productivity, we obtain:

Production of 0-deg. rake tool = 100
Production of 10-deg. rake tool = 130.5
Production of 20-deg. rake tool = 137.5

In this case the advantage of rake is not so decided as with the more ductile machine steel—particularly above 10 deg. In addition, the same tendency is observed to reduce the advantage of thicker chips with a high rake.

TABLE V. INFLUENCE OF RAKE IN CUTTING ALLOY STEEL
Number of teeth, 34; clearance angle, 5 deg.; spiral angle, 0 deg.; depth of cut, 0.3 in.; width of cut, 0.5 in.

Exp. No.	Date	Rake Angle, Deg.	Feed, in per Min.	Speed, R.p.m.	Vol. per Tooth, Cu.In.	Torque, In.-Lb.	Cu.In. per Hp.-Min.
1017	3- 8-21	20	0.92	27.9	0.000145	296	1.048
1018	3- 8-21	20	2.36	27.9	0.000375	818	0.994
1019	3- 8-21	20	3.10	19.3	0.000710	1,340	1.142
1020	3- 9-21	10	0.92	27.9	0.000145	334	0.930
1021	3- 9-21	10	2.36	27.9	0.000375	782	1.040
1022	3- 9-21	10	3.10	19.3	0.000710	1,392	1.100
1023	3-10-21	10	0.92	27.9	0.000145	363	0.856
1024	3-10-21	10	2.36	27.9	0.000375	803	1.010
1025	3-10-21	10	3.10	19.3	0.000710	1,505	1.020
1029	3-15-21	0	0.92	27.9	0.000145	429	0.706
1030	3-15-21	0	2.36	27.9	0.000375	1,045	0.778
1031	3-15-21	0	3.10	19.3	0.000710	1,930	0.795



Note: Each Point Represents the Mean of 4 Points obtained with Feeds of 0.0025", 0.0050", 0.0075" & 0.0100" Respectively.

FIG. 10. EFFECT OF OIL ON MACHINE STEEL AND BRONZE

Influence of Depth of Cut. Thirty-five experiments were run with various depths of cut, various feeds, and two different rakes. Analysis of these results gave rise to a belief that the block of material used was far from homogeneous. These experiments are not recorded in detail for this reason. It is advisable, however, to record certain impressions obtained and tentative conclusions.

If material removed per horsepower-minute be plotted on a chip-volume base, then a shallow cut gives a curve higher than a deeper cut. This is not surprising. It has been shown that, as a chip thickens, the material is removed with less energy per unit volume. If two chips of equal volume but of different depths of cut be taken, then the chip of the shallow cut is shorter and thicker.

It appeared probable that, with a given cutter and uniform material, if the feed per tooth and depth of cut were varied, the number of cubic inches per horsepower-minute would prove to be a definite function of maximum chip thickness. Experimental verification of this is given later in the paper.

Influence of Lubricant. The results of six experiments, which merely touched the fringe of the effect of lubrication, are given in Table VI. It is dangerous

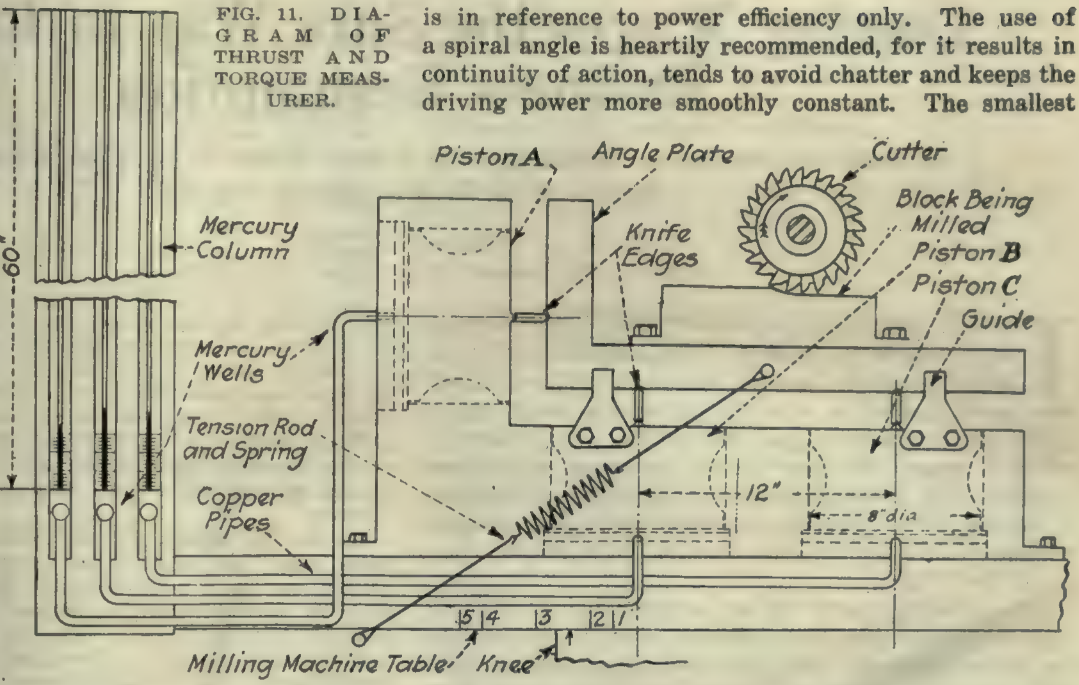


FIG. 11. DIAGRAM OF THRUST AND TORQUE MEASURER.

to generalize too broadly from a few results, but one can at least conclude that lubrication effects a reduction of energy and that this reduction appears more pronounced in light cuts. It should be again noticed that this is almost pure lubricating action and that the conduction of heat by the oil plays only an insignificant part.

Effect of Spiral. A 34-tooth non-spiral cutter, 6 in. in diameter and having a 10-deg. rake, was run in comparison with cutters similar in all respects excepting they possessed a 12½-deg. spiral angle. Two cutters with left- and right-hand spirals respectively were used in combination, thus eliminating end thrust.

TABLE VI. EFFECT OF LUBRICATION

Number of teeth, 34; clearance angle, 5 deg.; spiral angle,0 deg.; depth of cut, 0.3 in.; width of cut, 0.5 in.

Exp. No.	Date	Rake Angle, Deg.	Feed, in per Min.	Speed, R.p.m.	Vol. per Tooth, Cu.In.	Torque, In.-Lb.	Cu.In. per Hp.-Min.
1026 oil	3-10-21	10	0.92	27.9	0.000145	306	1.018
1026 dry	3-10-21	10	0.92	27.9	0.000145	364	0.855
1027 oil	3-10-21	10	2.36	27.9	0.000375	760	1.070
1027 dry	3-10-21	10	2.36	27.9	0.000375	875	0.930
1028 oil	3-10-21	10	3.10	19.3	0.000710	1,335	1.148
1028 dry	3-10-21	10	3.10	19.3	0.000710	1,430	1.071

Two different combinations of speeds and feeds were used. The material cut was machine steel. The results were as follows:

		Cubic Inches per Hp.-Min.		
R.p.m.	Feed, In. per Min.	0 Deg. Spiral	12½-Deg. Spiral	Lost Output of Spiral Cutter, per Cent
28.1	0.92	0.422	0.338	20
16.1	0.92	0.568	0.458	19.4

The authors are well aware that a general belief exists in the superior power efficiency of spiral cutters. Frequent statements to this effect can be found in the literature of the subject. In this investigation it has been impossible to substantiate these. It is difficult to understand the growth of the belief that spiral cutters are more efficient, because abstract analysis leads to the conclusion that spiral cutters must be inferior to straight cutters. By "inferior," the meaning intended is in reference to power efficiency only. The use of a spiral angle is heartily recommended, for it results in continuity of action, tends to avoid chatter and keeps the driving power more smoothly constant. The smallest angle consistent with smoothness of action should be used.

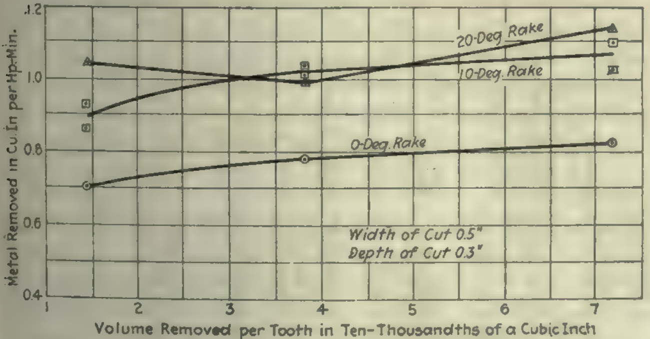


FIG. 13. INFLUENCE OF RAKE IN CUTTING ALLOY STEEL

(To be continued in next week's issue.)

Safety in Elevator Construction

Nearly three-quarters of the fatal elevator accidents that occur could be prevented if elevators and shaftway doors were equipped with well-designed interlocking devices. A survey and study conducted by the Bureau of Standards of the Department of Commerce has shown this to be true.

A large number of elevator fatalities occur at the shaft door, either through an open door which allows a person to fall down the shaft or it allows a person to step from a moving car and be crushed between the car and the door frame. An inter-lock prevents the shaft door from being opened except when the car is at rest in front of the door.

Elevator safety is declared to be as important as street car safety. The Bureau of Standards investigators have found that about as many ride on elevators as on all the city traction lines. Postmen, messengers, and others rely on them and their safety devices to a large extent.

In providing vertical transportation, elevators travel long distances each day and make many stops. For instance, an elevator in the Woolworth Building travels about 40 miles a day and makes 4,000 stops in that time.

A Question as to the Date of the First Pull Broach

BY FRANK G. STERLING

An article appearing on page 391 of the *American Machinist* states that it was not till 1901 that the pull broach was used.

I would like very much to see this statement corrected, for we have a pull broach, called a splining machine at the time, in our shops, which was bought new in 1884. How long before that date it was on the market I cannot say. It was made by the Knowles Loom Works, Worcester, Mass.

Cutting Wages the Sure Way to Retard Business Resumption

A Study of Business Conditions for Forty Years — Careful Management Makes High Wages Better for All

By E. W. HULET

Former Vice-President of Production, White Motor Co.

THERE seem to be two diametrically opposite views on the question of wages. Both, I believe, are wrong as both ignore the fact that it is not wages but the cost of production as related to buying power which counts in considering real prosperity. Too many do not look beyond the payroll—and the wage which they consider right depends largely on their own experience in bygone days. They do not consider all the changed conditions and thereby fail to study the matter from the proper angle.

The opposing views are well exemplified by the following extracts, the first from the *Wall Street Journal*, the second from the *New Republic*. It is well to read both carefully and to ask ourselves, "How much have high wages and salaries contributed to our prosperity?"

Do We Want To Go Back to a Lower Plane?

When we use that phrase, "The American standard of living" so dear to the Labor Department under the Wilson regime, and to others who measure by what they want rather than by what they need, it is as well to assure ourselves that what we mean is not the American standard of waste. An inquiring commission, chiefly composed of engineers, has easily discovered possible economies in production, which are most of them, as might be expected, conditional on the co-operation and good will of the producers.

Because the wish is father to the thought, we are authoritatively assured that wages will never again reach the level of 1913, nor will the necessaries of life be sold at the prices current then. But both wages and prices had then been steadily advancing for more than ten years previously. We may as well face the fact that with the now enhanced purchasing power of gold and the choice between commercial death and deflation, it is an economic possibility of the most practical kind that prices and wages may go back to the figure, not of 1913, but of 1901, when the reopening of the Transvaal gold mines gave the world more than it needed to back the world's credit at the beginning of the century.

We shall get back to a sound tax basis and a sound income basis when we have asked ourselves—laborer, artisan, professional man and capitalist alike—not what we can spend if even moderate indulgence in luxuries and leakage in waste are granted, but what we can save and do without. So far there has not been, anywhere, an honest facing of the facts.—*Wall Street Journal*, Aug. 25, 1921.

When profits disappear suddenly in the depths, business calls upon the wage earner to practice thrift and self denial. The exhortation is utterly wasted. Once having lived better, people will not go back. They cannot be reconciled to former conditions. The equilibrium has to be restored in another way. An examination of the statistics would lead us to infer that labor's share increases all the time, whatever happens to prices. And the implication is that labor will get everything and there will be no profit in business.

Not so. This has been going on for a very long time and the profit in business has not tended to vanish. Though labor's command over goods is increased, it does not follow that its share in the total product is greater. There are more goods to be shared.

The first thing created is a necessity and the necessity creates new wealth. The producer cannot bring wages

TABLE NO. 1—BUSINESS BAROMETERS USED AS A BASIS FOR DEDUCTIONS IN ARTICLE

	Population	Wealth per Capita	Money per Capita	Wage per week	Farms and Mines	Ratio to Population	Manufacturing	Ratio to Population	Total Farms and Mines Plus Manufacturing	Ratio to Population	Volume of Foreign Trade	Ratio to Population	Bank Clearings	Ratio to Population
1880	50,155,783	876.20	19.41	11.50	6,000,000,000	120	5,370,000,000	107	11,370,000,000	227	1,586,490,000	30	11,375,400,000 49,989,848,000	223* 1,000†
1890	62,947,704	1,035.57	27.82	12.50	6,000,000,000	95	9,372,000,000	148	15,372,000,000	243	1,680,900,000	26	23,370,482,000 60,829,090,000	370* 965†
1900	75,994,575	1,164.79	26.93	13.00	7,000,000,000	92	11,407,000,000	150	18,407,000,000	242	2,307,095,000	30	33,436,348,000 86,070,550,000	438* 1,130†
1905	82,000,000	1,318.00	.....	14.00	8,000,000,000	95	10,794,000,000	120	22,672,000,000	215	2,806,135,000	30	50,005,388,000 143,827,448,000	624* 1,764†
1910	91,972,266	1,800.00	34.33	15.00	10,000,000,000	108	20,672,000,000	225	30,672,000,000	333	3,429,163,000	37	66,820,730,000 164,095,230,000	726* 1,882†
1915	100,000,000	2,076.00	34.31	15.00	16,000,000,000	160	24,246,000,000	242	40,246,000,000	402	5,333,267,000	53	77,253,172,000 187,817,564,000	772* 1,878†
1920	110,000,000	3,600.00	57.09	34.50	37,500,000,000	340	62,500,000,000	568	100,000,000,000	908	13,950,125,000	145	208,132,574,000 451,272,242,000	1,900* 4,070†
1920 over 1915		....	.....	2.30	2.34	...	2.54	...	2.48	...	2.61		2.69—2.40	....

* Totals excluding New York. † Totals including New York.

					Manufacturing Only						Money Rates		Commodity Prices Average				
	Population	Wealth per Capita	Money per Capita	Wage per Week	Manufacturing	Ratio to Population	Invested Capital	Ratio to Population	Wholesale Price	Wg. per Week	Buying Power Dollar	Com'l Paper	Foreign Paper	Wheat, Bu.	Corn, Bu.	Cotton, Lb.	Iron, Ton	Copper, Lb.
1880	50,155,783	876.20	19.41	11.50	5,370,000,000	107	2,790,000,000	56	110	11.50	....	5¼	3	1.30	0.55	0.115	29.86	0.214
1890	62,747,714	1,035.57	27.82	12.50	9,372,000,000	148	6,525,000,000	103	80	12.50	....	6	4½	0.92	0.485	0.110	15.10	0.156
1900	75,994,575	1,164.79	26.93	13.00	11,407,000,000	150	9,813,000,000	128	70	13.00	....	5	4	0.804	0.453	0.092	17.04	0.166
1905	82,000,000	1,318.00	.....	14.00	10,794,000,000	120	12,676,000,000	154	85	14.00	....	4½	3½	1.028	0.593	0.098	15.57	0.156
1910	91,972,266	1,800.00	34.33	15.00	20,672,000,000	225	18,428,000,000	200	95	15.00	....	5½	3¾	1.118	0.668	0.151	15.16	0.129
1915	100,000,000	2,076.00	34.31	15.00	24,672,000,000	242	22,791,000,000	228	100	15.00	100	3¾	5	1.291	0.837	0.101	13.58	0.174
1920	110,000,000	3,600.00	57.09	34.50	62,500,000,000	568	50,000,000,000	455	245	34.50	45	7½	5⅝	2.65	1.669	0.346	44.03	0.175
1920 over 1915		....	.....	2.30	2.54	...	2.15	...	2.45	2.30	0.45	2.00	....	2.00	2,00	3.4	3.2	.....

** Wheat per bu: Corn, bu.; Cotton, lb.; iron, ton.

NOTE.—All figures are rough, but are within 5 per cent of being correct in all cases Aug. 26, 1921.

down to where they were before. But presently he discovers that he is not primarily interested in wages as such. His proper study is the labor cost of production.

The problem of business is not how to liquidate wages but how to liquidate labor costs which may be done by increasing the use and efficiency of high power tools, by improving its method of production and distribution and by eliminating innumerable forms of gross economic waste. Industry has faced this same problem before. If it had not been obliged to do so under pressure of rising wages many of the modern achievements would never have come to pass. And if it cannot face it successfully again, then it is bankrupt in imagination and we may as well know that the peak of American wealth is behind us. — *New Republic*, June 22, 1921.

A MODIFICATION OF TWO VIEWS

The above quotations, one taken from a very prominent financial paper and the other from a prominent progressive paper, are the two views taken on the wage adjustment, so called, that is in everyone's mind at the present time. I believe the two papers in question are sincere in their deductions and my only aim is to moderate, if possible, the sentiments of both.

TABLE II. DATA FROM THE WHITE MOTOR CO.

Year	Factory Value of Product	Average No. Men	Estimate Buying Power of $1.00	Average Weekly Warnings Based on 51 Weeks' Work	Hours' Work	Hours' Pay	Total Wages	Trucks per Man per Year	Factory Value of Trucks Produced per Man per Year*
1910	$3,836,290	1,072	....	$14.04	60	60	$767,496	2.290	$3,578.63
1911	5,097,523	1,419	....	12.82	59	60½	927,696	1.985	3,592.33
1912	6,739,756	1,852	....	13.53	59	61½	1,278,426	1.785	3,639.17
1913	6,795,196	1,964	....	13.45	59	61½	1,347,064	1.785	3,459.87
1914	9,023,172	2,202	$1.00	15.03	59	61½	1,688,467	1.924	4,097.72
1915	21,040,078	3,758	.90	16.51	54½	59½	3,163,857	2.460	5,598.72
1916	17,053,311	3,611	.86	17.34	54½	59½	3,186,921	2.082	4,722.60
1917	22,448,927	4,341	.72	20.94	54½	59½	4,637,105	2.040	5,171.33
1918	30,952.748	4,844	.55	27.07	54½	59½	6,688,051	2.720	6,389.91
1919*	35,356,000	5,475	.50	31.64	49½	52	8,835,000	2.751	6,456.62
1920	50,246,448	6,600	.40	37.87	49½	52	13,485,012	3.017	7,613.00

* December, 1919, estimated.

NOTE.—Trucks per man, 2.571; value, $6,456.62; average value, $2,347.00 per truck. Average truck price increased approximately 17 per cent over 1914.

I have submitted some information that has come to my attention on investigating these matters. I question whether the financier, business man and others realize how much the high wages, so called, and salaries paid in our country have helped, by raising the buying power of our masses, to contribute to our prosperity. This is particularly marked in 1920, as shown by Table No. 1. It also shows that the growth of 1920 over 1915 follows very closely the same ratios in all factors making up our business progress. Wages only follow the general trend. Consequently, in my mind, the wage earner is acquitted of the charge of taking too much of the fruits of our prosperity.

PRODUCT AND WAGES

I am also submitting a chart that is the operating chart of the firm of which I have been active executive in charge of production up to January 1, 1921. This chart is self-explanatory, I believe. It also bears out my contention that, under careful management, the wage earner nas maintained his efficiency. There are many examples in the country with a like showing, or even better.

The table given above by the White Motor Co. presents a comparison of production values, number of employees and wages paid, from 1910 through 1919, showing the growth of the company and the policy of a constantly increasing wage to meet the increasing cost of living.

The factory value of the trucks produced includes: Merchandise and supplies, etc.; labor; power and fuel; maintenance and repair; factory salaries and general administrative expense; insurance; federal, state and city taxes; plant extension; dividends.

The results shown by the tables are due to three reasons: One third due to ample capital and plant and methods of manufacture; one third due to management; one third due to the men voluntarily giving an honest day's work.

SOME INCOME STATISTICS THAT SHOW GREAT POSSIBILITIES IN BUYING POWER

The statistics shown in Table No. 3 make these figures even more impressive. It shows very clearly, I believe, the possible buying power of our people who have very moderate incomes. The class from $1,000 to $5,000 and up, applies of course to wage earners, salary earners and small business men. The table seems to be self explanatory and to need very little comment.

Another feature which should be noted is the enormous increase in invested capital, which jumped from under $23,000,000,000 in 1915 to $50,000,000,000 in 1920—about 2.15 times. It is a question as to how much this can be liquidated without heavy loss to the holders.

If wages, production, foreign trade, bank clearances, wholesale prices, commodity prices go down this figure must also take its proportion of drop. In other words, the question could be asked, how far can general prices and business drop without ruination to our capital account? At the present time, capital accounts and retailers are not following the general trend of prices in most cases. When statements are submitted this coming January, capital accounts, I believe, will be forced to follow.

THE FINAL ANALYSIS

The deduction from the information on these three tables would lead me to believe that the one sure way to keep business from coming back would be to cut wages and salaries and reduce forces.

TABLE III. STATISTICS OF INCOME

From Commissioner of Internal Income

1918

No. of Returns	Class	Income *	Per Cent
3,946,152	1,000 to 5,000	9,404,398,417	59
435,925	5,000 to 20,000	3,516,017,672	22
43,027	20,000 up	3,004,223,266	19
4,425,114		15,924,639,355	

Income Classes	Net Income	Wage and Salaries	From Business Partnerships Sales of Real Estate, Rents and Royalties, per Cent	Dividends and Interest on Investments, per Cent
1,000 to 2,000	2,232,354,577	74.67%*	17.48	7.85
2,000 to 3,000	3,626,824,833	65.42%*	26.89	7.69
3,000 to 5,000	3,535,219,007	48.56%	39.53	11.91
5,000 to 10,000	2,145,690,016	33.55%	44.86	21.59
10,000 to 20,000	1,370,327,656	33.10%	33.48	33.42
	12,920,416,089			
All others......	3,004,223,266			
	15,924,639,355	Total personal		
	8,361,511,249	Total corporation		
	24,286,100,604	Total income reported.		

In other words, to let the production force of our country take the brunt of the readjustment is sure to retard the return of good business.

How Work Goes Through the Shop

Studying the Passage of Work Through Different Departments—Following Orders Through the Shop—How the Data Are Charted and Arranged

SPECIAL CORRESPONDENCE

THE only way to thoroughly visualize the routing of work through a shop is to have it actually before you so as to see the exact relation of each department to the others. In order to do this easily and effectively, W. O. Sims, supervisor of tools of the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, uses the method illustrated herewith to study not only the routing of work, but the way in which orders are received and filled, and also to keep track of the duties of each member of the organization.

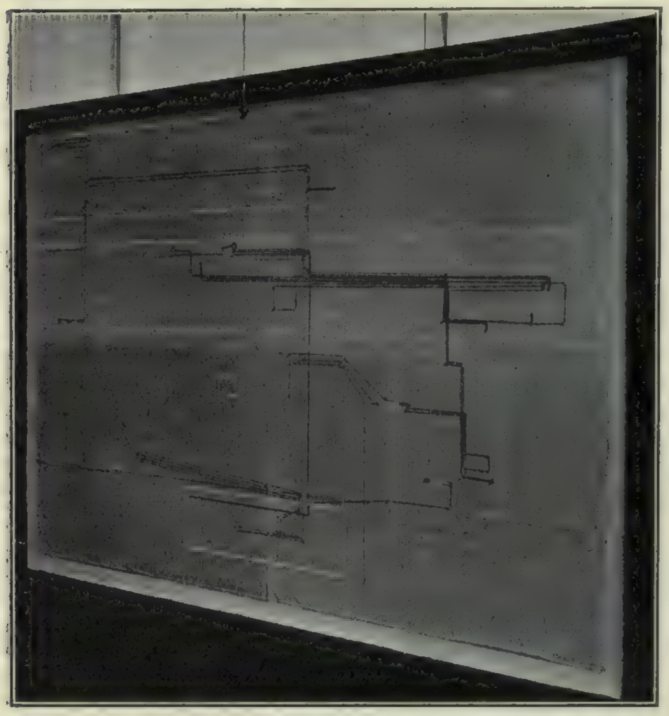


FIG. 1. GRAPHIC DIAGRAM OF WORK GOING THROUGH SHOP

In order to see just how the work goes through the shop a blueprint of the building is mounted on a large board, as shown in Fig. 1. In this case, routing of work as it passes through the shop from one department to the next, is traced by means of colored strings drawn around steel pins inserted at different points. This arrangement shows clearly the way in which the work passes through the shop and gives an opportunity to rearrange machines for operation, so as to eliminate crossing of the paths of travel and the moving of pieces unnecessary distances or more frequently than is necessary.

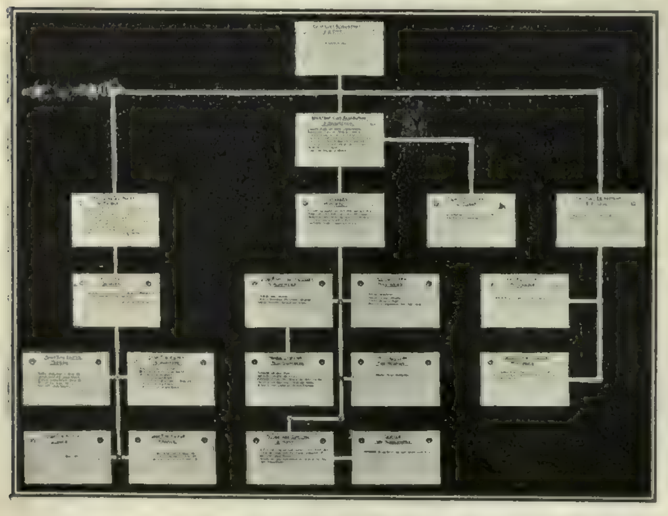


FIG. 3. DEPARTMENTAL PERSONNEL AND DUTIES IN GRAPHIC FORM

A different type of chart is illustrated in Fig. 2, showing the method of getting the customer's order to the shop order desk. This chart shows how the customer's order whether for a complete standard lathe or one involving changes, goes to the commercial order desk, and, through the proper channels, to the shop order desk. It also shows how the orders from here go to the stock control and the tracing department, as well as the distribution of the twelve copies of the order which are issued from the shop order desk.

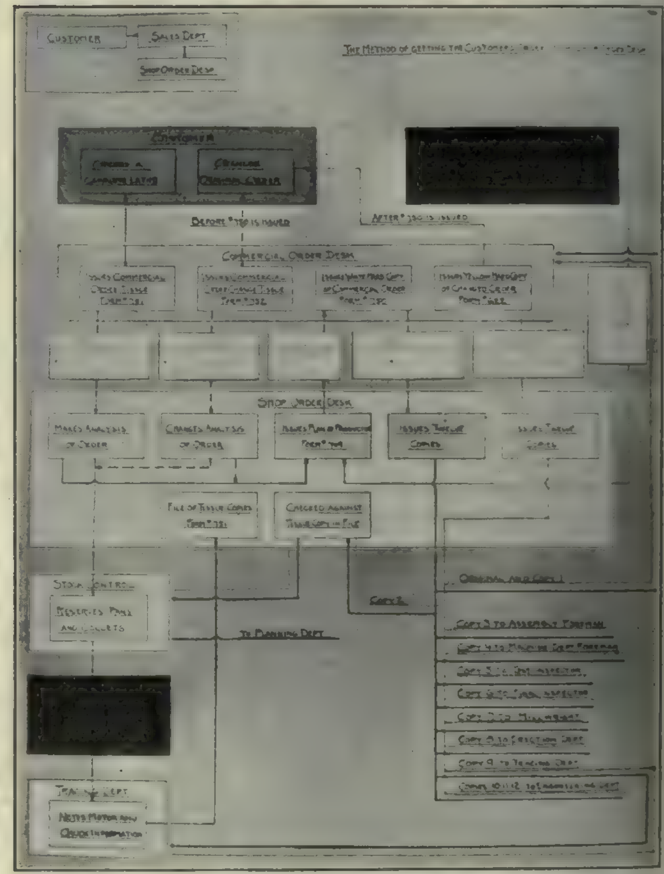


FIG. 2. HOW CONSUMERS' ORDERS REACH THE SHOP ORDER DESK

In order to make sure that the entire personnel of the executive department understands exactly what its duties are, as well as the duties of the others with whom they come in contact, the chart is made, as shown in

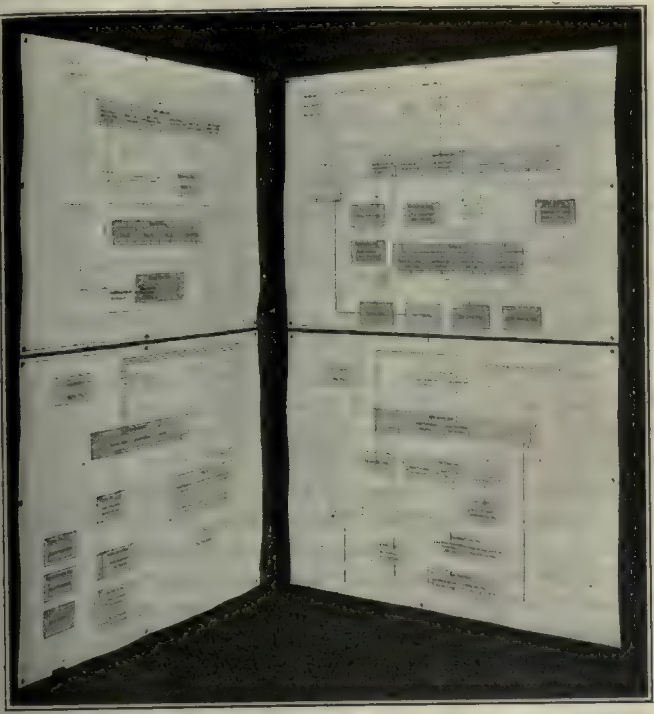


FIG. 4. KEEPING CHARTS IN LARGE BOOK FORM ON LEAVES THAT SWING AND ARE EASILY AVAILABLE FOR CONSULTATION

Fig. 3, containing the title, the name of the occupant of each position and the exact duties to be performed. The lines connecting the different parts show at a glance which executive each one reports to, and this effectually prevents overlapping or any doubt as to the authority of any individual. In order to have these charts available for consultation or for making any necessary changes, they are mounted on boards which swing like the leaves of a book, each leaf accommodating two of the charts. This arrangement is shown in Fig. 4, where the leaves are spread so as to show four of the charts. The chart shown in Fig. 5 indicates the method of tracing an order from the customer to the sales department through the different departments of the shop. Beginning at the upper left-hand corner, an order for a complete lathe can be traced through the sales department, shop order department, erection department and the finished stockroom to the other departments of the plant. Following the lines with the arrows, it is easy to trace the progress of the order, and a little careful study of this chart is almost an article in itself concerning the way in which material is purchased, manufactured or stored, and how it is handled from one department to another. With this chart as a basis, it should be easy to prepare similar charts to fit any particular business, and as such charts tend to prevent confusion they are well worth while.

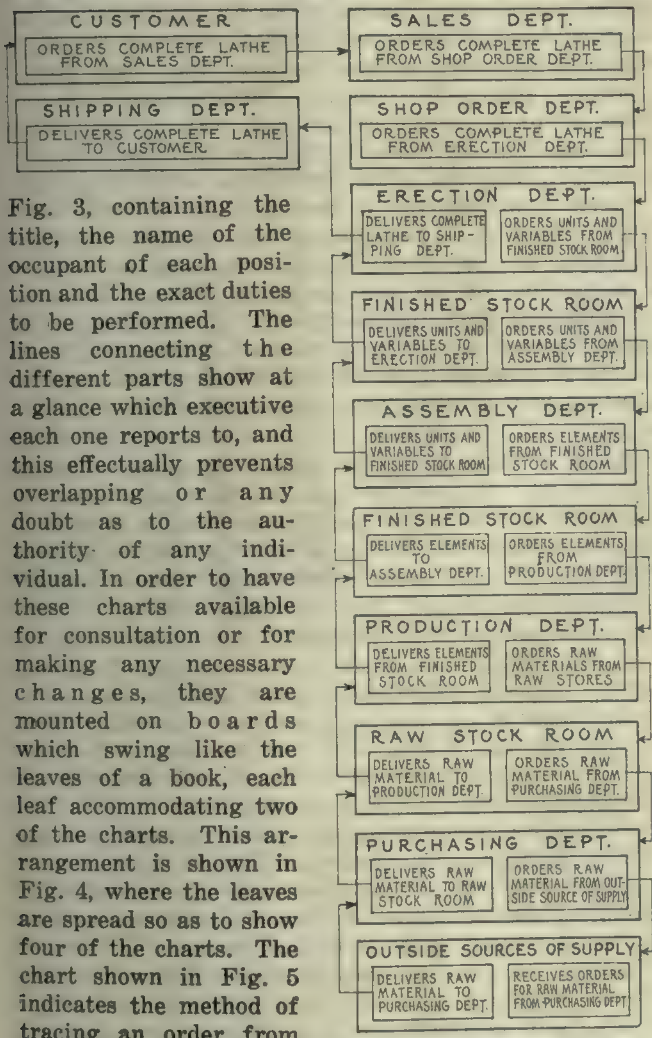

CUSTOMER
ORDERS COMPLETE LATHE FROM SALES DEPT.
SALES DEPT.
ORDERS COMPLETE LATHE FROM SHOP ORDER DEPT.
SHIPPING DEPT.
DELIVERS COMPLETE LATHE TO CUSTOMER
SHOP ORDER DEPT.
ORDERS COMPLETE LATHE FROM ERECTION DEPT.
ERECTION DEPT.
DELIVERS COMPLETE LATHE TO SHIPPING DEPT.
ORDERS UNITS AND VARIABLES FROM FINISHED STOCK ROOM
FINISHED STOCK ROOM
DELIVERS UNITS AND VARIABLES TO ERECTION DEPT.
ORDERS UNITS AND VARIABLES FROM ASSEMBLY DEPT.
ASSEMBLY DEPT.
DELIVERS UNITS AND VARIABLES TO FINISHED STOCK ROOM
ORDERS ELEMENTS FROM FINISHED STOCK ROOM
FINISHED STOCK ROOM
DELIVERS ELEMENTS TO ASSEMBLY DEPT.
ORDERS ELEMENTS FROM PRODUCTION DEPT.
PRODUCTION DEPT.
DELIVERS ELEMENTS FROM FINISHED STOCK ROOM
ORDERS RAW MATERIALS FROM RAW STORES
RAW STOCK ROOM
DELIVERS RAW MATERIAL TO PRODUCTION DEPT.
ORDERS RAW MATERIAL FROM PURCHASING DEPT.
PURCHASING DEPT.
DELIVERS RAW MATERIAL TO RAW STOCK ROOM
ORDERS RAW MATERIAL FROM OUTSIDE SOURCE OF SUPPLY
OUTSIDE SOURCES OF SUPPLY
DELIVERS RAW MATERIAL TO PURCHASING DEPT.
RECEIVES ORDERS FOR RAW MATERIAL FROM PURCHASING DEPT.

FIG. 5. DETAILS OF HOW ORDERS GO THROUGH THE SHOP

Comparison of American, British and German Machine Tool Exports

BY W. H. RASTALL
Chief Industrial Machinery Division, U. S. Department of Commerce

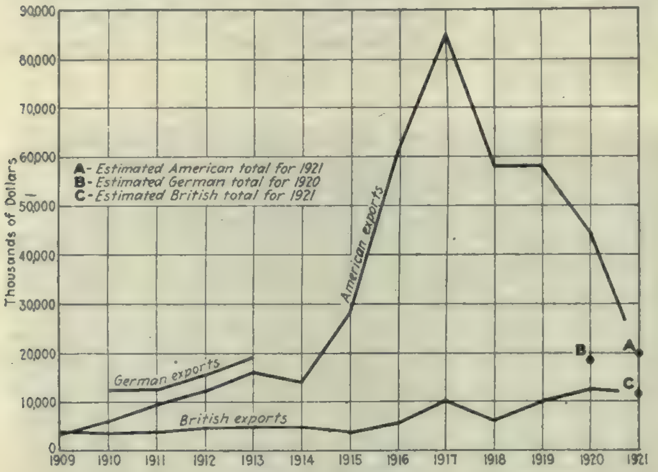
Returns of exports and imports of machine tools provide some interesting information as to the comparative position of American and British tools in the world's markets. Recent years have witnessed some abnormal conditions in the foreign demand for machine tools, and one feels considerable uncertainty on attempting to feel the way back to "normalcy," as there seems to be no such thing. The chart published herewith represents the position in the world's trade of the three most important producing countries during the past twelve years.

In 1913 the American position was rapidly improving, while the British trade made very little progress; the actual British figures being about $3,700,000 in 1909 and $4,900,000 in 1913, as compared with American exports of say $3,600,000 in 1909 and $16,000,000 in 1913. Such returns testify to the splendid engineering represented in American designs and the actual recognition of this superiority in all of the markets of the entire world. Plainly, American manufacturers and exporters have little to fear from foreign competition, because the differences in design, materials and workmanship frequently place the American product in a class by itself, far above all foreign tools.

The curve representing German exports is deceptive, because the classification employed by the German customs authorities includes all metal making equipment and machinery not included in the British and American returns, and the large bulk of the German totals suggests that its tool builders enjoyed a very large trade, which is not the case. Their best market, outside of Europe, during pre-war years, was South America, and their influence in that market was comparatively strong and yet, according to a survey made by one of our American publishing companies, British manufacturers had supplied about 42 per cent of the tools, American 39 per cent and German 12 per cent which represents more accurately the estimate one forms of the comparative trade of the several nationalities after traveling through overseas markets. Because of this difference in classification, it is important to note, not the value represented by the curves but their slope. The German trade increased from about $12,400,000 in 1910 to $19,500,000 in 1913, a gain of 57 per cent, while the American gain was 166 per cent during the same period. Obviouslv, American interests have every reason to be perfectly satisfied with this pre-war record.

Confusion resulting from the declaration of war in 1914 caused a temporary set back in American exports, and the German business was completely destroyed, not to revive until after the armistice late in 1918.

The present problem is introduced by the remainder of the chart. British tools usually differ greatly from the American types, and the world's markets for such equipment have been inadequately supplied for some years. Also the increase in cost per tool would cause the curve to rise, in spite of the fact that the values have been corrected for fluctuation in exchange and are expressed in dollars, not pounds. But at any rate the American curve is falling very rapidly; the British is rising; while the German return for 1920 is approximately the same as for 1913 and about $19,000,000. The probability is that the American total for 1921 will approximate $20,000,000.



AMERICAN, BRITISH AND GERMAN MACHINE TOOL EXPORTS

DECLINE IN BRITISH EXPORTS

British total exports are decreasing rapidly and for all of 1921 will approximate less than three million pounds or say twelve million dollars. This trend suggests that, although one would expect that the demands for British style tools had not been adequately supplied for years, and the corresponding market for American style tools had been over supplied, the influence of the latter is still powerful enough to prevent the development of the market for the former, viz., the simpler and less expensive types of equipment—a circumstance that encourages more aggressive selling on the part of Americans.

In considering the comparative position of American and British machine tools in the markets of the world, it should be remembered that for many years America has shipped great quantities of tools to the United Kingdom while the trade in the opposite direction has not exceeded a hundred thousand dollars in any one year—a condition that is not to be attributed entirely to the workings of the tariff. But following the armistice there has been a strong tendency for the British imports of American made tools to recede from the very high levels of war days. In August, 1920, British imports still exceeded their exports, but there has been a very rapid decrease in the volume of this business, and it has reached very low levels which in itself has a most important influence on the American returns; for even as late as 1920 the United Kingdom absorbed 25 per cent of the total American exports of metal working machinery.

Reminiscences of an Old-School Machinist

BY R. THOMAS HUNTINGTON

Being not particularly well satisfied with conditions in Philadelphia and perhaps imbued with a little of the spirit of wanderlust that sooner or later gets hold of pretty nearly all journeyman machinists, I decided to seek my fortunes elsewhere, and in 1870 went to Boston, where I entered the employ of Meade & Addy.

At the time I went to them they were making tools and machinery for the manufacture of a universal watch key, the property of a New York inventor.

The new key was made very much as spring collets are now made, the central part being drawn back into the shell by a spring and it could be pushed out by a pressure of the thumb, so that it would fit over the pivot of any watch.

Another little implement made by Meade & Addy, that goes to show the origin of some of our more modern tools, was the Salmon dental mallet.

The Salmon mallet had a moveable hammer that was thrown forward by the action of a spring, the spring being compressed and released by movement of the handle. Several years later I showed one of these mallets to Cyrus Carleton, of Brown & Sharpe, and he evolved the well-known automatic center punch.

Meade & Addy also made the first Peabody rifle, the parts being made by a man named Wakefield, who was a very fine workman. Mr. Wakefield showed me a set of taps made many years before by his father. The elder Wakefield had turned up the blanks to the exact diameter required; wound fine wire upon them, being careful to dispose the wire in a perfect helix of the desired pitch; blued the pieces; and then, removing the wire, had filed the thread to depth with a small saw file, being guided by the helical line of blue left on the blank.

Later I worked for a firm that made bank locks. There were dial, or combination locks then, and burglars had developed an uncomfortable propensity for rousing a cashier out of bed and compelling him, at the point of a gun, to go to the bank with them and open the safe. My new employers devised a lock, the outer parts of which could be taken off and distributed among five persons, each of whom took a piece home with him each night.

None of these five part holders knew the combination, so that burglars to open this lock would have to assemble all five of the part holders and a sixth man who knew the combination to assist at their exercises. The size of the parts might have discouraged the burglars and put a stop to their trade—if nitroglycerine had not been invented.

It was about this time that I discovered mushet steel. I do not know when Robert Mushet discovered it but none of us around there knew anything about it until one day a man blew into the shop with a bar ½ x 1¼ in. and about 3 ft. long. He wanted the privilege of forging a tool in our fire.

Permission being given, he started in and soon had a very cerditable diamond point, all the time keeping up a running fire of comment upon the properties of the steel and advice as to how it should be worked. As we had some work to do that was giving us a lot of trouble because of hardness, he succeeding in disposing of the balance of the bar. My employer and I worked all the afternoon at forging up a boring tool and when we finally got one finished there wasn't anything left of the bar.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

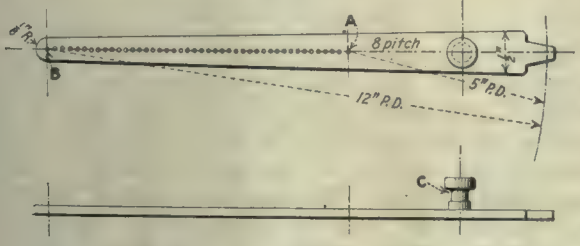
Drawing Gear Teeth Rapidly

By E. C. Barber

The article by Homer S. Trecartin under the above title, on page 481 of the *American Machinist*, brings to my mind a little tool that I have found useful and which I think superior to the one described by him. I saw one in a drafting room that I visited and copied it, so cannot claim it as my own idea.

The sketch shown herewith gives a clear idea of the tool. I laid out very carefully on a piece of an old triangle, a tooth for an 8-pitch gear, using a pitch diameter of 8½ in. as it was the mean diameter between two limits I had chosen—5 and 12 inches.

The tooth shape was formed by the use of a knife and a small file. A center line was scribed and holes drilled at B and at intervals of $\frac{1}{16}$ in. between *B* and *A*. With a needle point through the hole at *B* it would be right for drawing in the teeth of a gear having a 12-in. pitch diameter. By placing the needle point through other holes in the series, teeth can be drawn in gears down to 5-in. pitch diameter, varying by $\frac{1}{8}$ in. The knob *C* allows the templet to be readily moved from the center of one tooth to that of the next.



TEMPLET FOR DRAWING GEAR TEETH

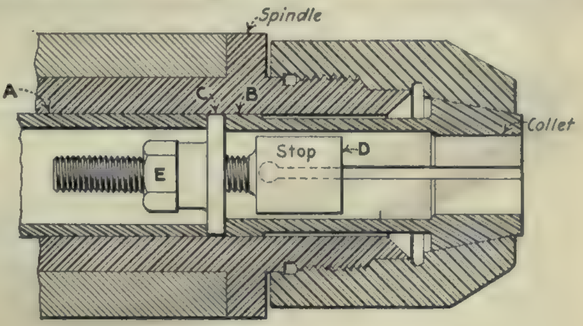
I made a set of six tools, two each for four, six and eight pitch. One covered a range from forty to ninety-six teeth, the smaller one from twelve to forty teeth. Each one was marked with its respective pitch. So far this set has covered most of my work.

Collet Stop for Short Work

By Gene Phelps

The ordinary type of screw machine equipped with a collet mechanism has no provision for handling short pieces of stock. There are several ways in which the work may be located properly but the most common method is by bringing the turret up to a pre-determined stop while the short piece of work is held in the collet jaws. The turret is used to push the stock back into the collet until the turret stop is reached, at which time the closing mechanism of the collet is operated and the work clamped firmly in place. This method is not very safe and it cannot always be used as all of the turret faces may be supplied with tools. It is possible to arrange a stop rod from the rear of the spindle and locate the work against it. An arrangement of this sort however is troublesome and usually not very satisfactory.

It is possible to make up a special stop which is self-contained and easily applied to the majority of turret lathe spindles. The sectional view shown here is taken through the center line of the spindle. The closer *A* is generally against the end of the collet at *B*. In using the stop the collar *C* is interposed between the closer and the end of the collet as indicated. The stop is made up from steel with an end on it as shown at *D*. The other end is threaded so that it passes through the collar and is held in position by means of a check nut at *E*. This arrangement provides a positive stop for short work and its advantages are that it can be easily applied to any standard type of screw machine.



COLLET STOP FOR SHORT WORK

Avoid Danger When Drilling in the Lathe

By G. E. Clifford

Where drilling is to be done in the lathe and the available equipment consists of the conventional "T" drill holder, there is danger lurking for the operator who does not take precautions.

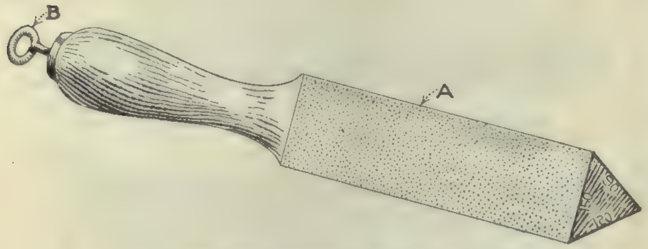
It is a matter of common knowledge that when a through hole is drilled the drill has a tendency to catch and draw in when pricking through the farther side of the work. This drawing-in effect may be, and often is sufficient to let the holder drop off the tail center, although the operator may be able to oppose this tendency by force. If, however, he is not able to do this, his hand is in a position to be badly hurt, which is of more importance than the breaking of the drill and the spoiling of work—the inevitable consequence.

All this is easily avoidable. Allow the handle of the drill holder to slide along the back of a tool secured in the toolpost, this latter acting as a limit stop for the holder handle. By moving the carriage the post may be kept in very slight advance of the handle as the drill is fed into the work. Then when the drill pricks through and starts worming in, the toolpost stops it and breaks off the chip before any damage may be done to tool, work, or man.

An Abrasive Block With Three Sides

By W. Burr Bennett

There have been many ideas advanced in the past for handy pencil sharpening blocks for draftsmen's use but practically all have involved the use of sandpaper or emery cloth and used only on one or at the most two sides of the block. The sketch herewith shows a block in successful use, made with three sides as shown at *A* and with a nicely rounded handle fitted with a hook or small eye as at *B*. The block is made out of any wood and can be planed and turned up by a patternmaker. Instead of using sand-paper or emery cloth glued to the side of the block, the block is prepared with hot pattern makers' glue and then three grades of Norton alundum, Nos. 90, 120, and 150 are applied to the hot glue the same as in setting up a buff. The numbers identifying the three grains are stamped on the end as shown as a little refinement. The device is very durable and cheap. Most all modern machine shops today are using buffing operations and therefore will have abrasive on hand.



THREE-SIDED ABRASIVE BLOCK

Aero Cylinder Depth Gage

By Douglas P. Muirhead
Glasgow, Scotland

The Aeronautical Inspection Department (British) never used a gage of the type described by Mr. McIntosh, on page 655, Vol. 54, of *American Machinist*, for inspecting aero cylinders. A sketch of the gage actually used is shown in Fig. 1.

A is a steel body containing the tapered plunger *B* which controls the movement of three plungers *C* set at 120 deg. to each other.

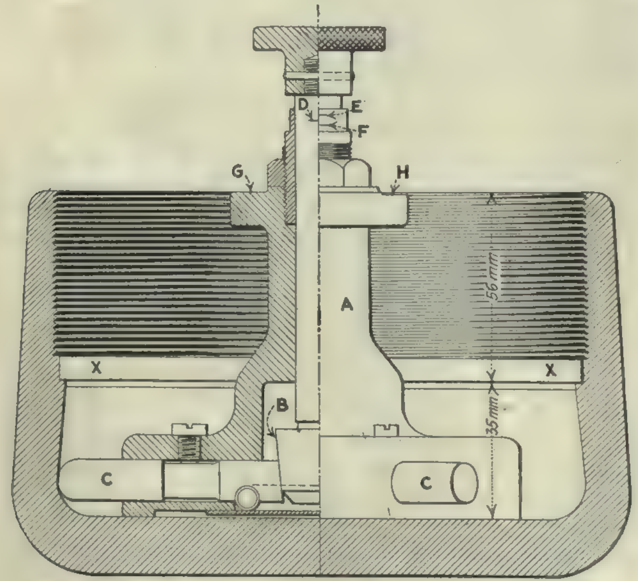


FIG. 1. THE DIAMETER GAGE IN THE CYLINDER

The high and low limit for chamber diameter is shown by the position of the line *D*, in relation to *E* and *F*. The 91-mm. portion is not important and was not held to fine limits; it was therefore found easy to check this by means of a straight-edge and the step portions at *G* and *H* when the gage was resting on the bottom of the combustion chamber. The particular dimension is the 35-mm. portion, which was checked by means of the gage shown in Fig. 2. This gage rested on the liner landing at *XX*, Fig. 1, on the ground surface *A* and the knurled head *B* could be partly rotated, the grub screw preventing further movement. The limits were marked by lines as at *C*, and a third line on the body completed the gage. The spring *D* tends to take up any slack in the screw.

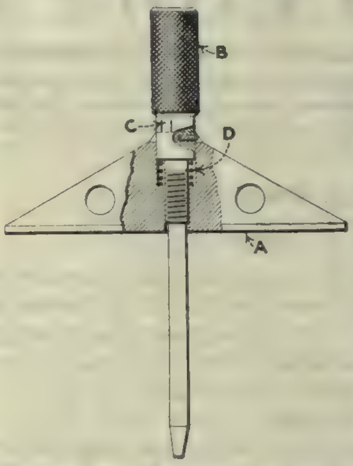


FIG. 2. THE DEPTH GAGE

Soldering Aluminum

By Elam Whitney

Many formulas for soldering aluminum have been published, but according to information which the writer has obtained from one who has done a large amount of this work and a great variety of experimenting, the majority of the methods used do not produce lasting results. The following method has proved very satisfactory and far superior and more lasting than any previously tried.

Use a pure aluminum soldering "iron" which can readily be made from a piece of ⅝ or ¾-in. round or square aluminum; tin the parts to be soldered with a composition of 81 per cent tin, 16 per cent aluminum and 3 per cent copper. This is not a new composition but in the proper method of preparing it lies success.

After fusing the copper add the aluminum a little at a time while continually stirring with a piece of iron, then add the tin and also a small portion of tallow; after the ingredients have all been added care should be used so as not to overheat.

Lubricating and Cooling Roll Journals

By M. E. Duggan

The method of lubricating roll journals is just the same as it was thirty years ago when I was employed at the old Bridgeport Steel Mills, with this one exception.

Thirty years ago, the lubricating grease was applied with a scoop shovel. The man who could hit the neck of the roll with a scoop full of grease at five paces, was considered to be a valuable employee and in line for promotion to the position of boss roller. Everything, including the operators, was covered with grease, excepting the roll journals, where it was intended the grease should be. There were several who received honorable mention, but only two were made boss rollers during the three years I was employed at the mills. Now a shingle is used instead of a scoop shovel.

In the Fig. 1 is shown a bearing fitted with two containers or drawers of cast brass. One is for grease for lubricating the neck or journal, the other for water for cooling the journal. The circular bottom of drawer *A* is perforated and through these perforations the grease is fed onto the roll journal. Drawer *A* has a cast cover *C*.

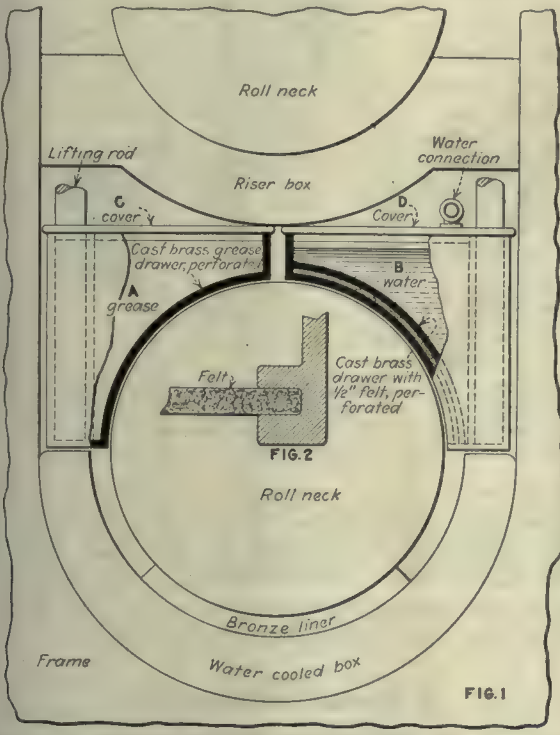


FIG. 1. BEARING FITTED FOR WATER COOLING AND LUBRICATION. FIG. 2. HOW THE FELT IS FITTED

The other drawer *B* is cast with sides and ends and has grooves in each side, as in Fig. 2, into which felt is fitted and securely held. The felt is perforated sufficiently to allow the water to pass through and onto the roll journal, at the same time serving as a screen to prevent, as much as possible, the sand in the running water from reaching the neck or roll journal.

The grease drawer *A* can be removed, cleaned, refilled and returned to its place. The water drawer *B* can be taken out, cleaned, and if necessary, the perforated felt strainer removed and a new one put in its place.

A rubber hose can be attached to the water connection in the cover.

Sheet Metal Work for Machine Designers

BY JOHN L. ALDEN

Sheet-metal work, or "tinsmithing," is something outside the experience of the average mechanical draftsman or machine designer. A knowledge of the possibilities of sheet-metal work and familiarity with the more common construction is often of the greatest practical value. At some time or other nearly every designer is called upon to lay out gear guards, tanks, drip pans, exhaust hoods, and other sheet-metal details. Unfortunately, a large number of otherwise capable men are unable to design economical pieces of sheet-metal work and are plainly unfamiliar with the relatively few and simple tools of the tinsmith.

Press-formed sheet metal parts are well understood by most draftsmen. A great many constructions are possible, however, which will accomplish the same results as a stamping, and yet be within the range of the hand tools of a tinshop. In this way, the advantages of lightness and strength of a stamping may be obtained when only small quantities of a part are wanted. Many times, a sheet-metal part is more suitable than a casting. It is usually lighter, and quite often cheaper, if only one or two pieces are needed. A very good example of the substitution of sheet metal for cast iron is the motor starting-switch bracket shown in Fig. 1. The bracket is suspended from the under side of a tank on the machine, and the switch is mounted on the face of the bracket by bolts through the four holes. No machine work is needed on either the bracket or the tank. The part is light, stiff, and strong and fulfills its purpose admirably. A bracket of this form has extraordinary strength when intelligently proportioned. Only a trial using, say, 16-gage steel, will serve to convince the skeptical of the rigidity gained by employing the proper flanges and angles. A demonstration is well worth the trouble; it will open the designer's eyes to a hitherto unsuspected field of application. To the student, also, such a demonstration is valuable evidence of the superior influence of form rather than weight on the strength and rigidity of a part. Correct form is vital.

A bracket of the form shown in Fig. 1 is weakest along the junction of the flange and shelf. It will fail under load, not by rupture of the metal, but by opening out the flange as at *A*, Fig. 2. It is therefore necessary to securely fasten the flanges to the supporting member carrying the bracket, placing screw heads in the flanges as near the shelf as possible. In Fig. 1, the side flanges greatly assist the crossflange at the top.

The scope of this article does not cover the tools for sheet metal work except to state their general purpose. A catalog of such tools will show their construction clearly, and a visit to a tinshop will give a better idea of their operation than would any description. Hand shears are either straight "snips" or "circle" shears with curved points. Power shears are slitting shears, circle shears, squaring shears, etc., and their functions are well described by their names. The hand or power brake is a machine for folding or turning a flange or edge on a straight sheet. The flange is usually not folded through a greater angle than 135 deg. The folder is a similar machine for narrow sheets and light work. Rolls are used for forming cylindrical work and parts of cylinders.

The materials most commonly employed are black and galvanized steel in 30 x 96-in. or 36 x 96-in. sheets. Tanks and other exposed work should be galvanized, both for durability and for ease in soldering. Guards, brackets and parts to be painted should be of black iron, as paint does not adhere well to galvanized metal. Sheet iron and steel are gaged by the U. S. Standard sheet metal gage, and the numbers most commonly used in mechanical work are those from Nos. 24 to 16, by even numbers. If much hand cutting and punching is to be done, it is well to avoid heavier gages than No 20. In specifying sheet metal, many firms employ the decimal equivalents of gage numbers to avoid confusion on the part of inexperienced mechanics and draftsmen.

Joints are made with black or tinned rivets, stove bolts, solder, or some method of seaming. Water-tight joints must always be soldered. Riveted and soldered joints are the rule for gages heavier than No. 16. Straight parts are flanged on a brake for riveting and curved parts are notched and bent for most heavy work, and hammer flanged on light gages. In this connection is should be said that a great deal of time and money can be saved by knowing when and how a piece should be flanged. Fig. 3 shows a worm guard about 8 in. high. A cheap construction is obtained when the ears for attaching the guard are flanged as at *A*. Since they do not extend past the straight part of the guard, they may be bent in a folder without stretching. The ears of form *B* must be attached as a separate piece or else the metal at *X* must be stretched by hand hammering on a stake to form the flanges. The construction shown at *C* is still cheaper, being bent on a brake without stretching or rolling.

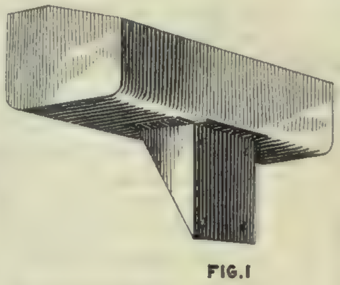


FIG. 1

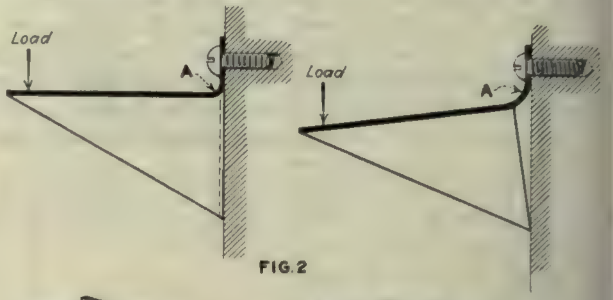


FIG. 2

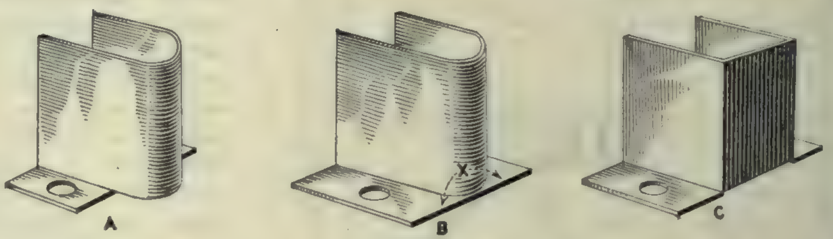


FIG. 3

FIG. 1. SHEET-METAL BRACKET FOR HOLDING A MOTOR SWITCH. FIG. 2. THE ACTION OF BENT SHEET METAL UNDER LOAD. FIG. 3. THREE METHODS OF CONSTRUCTING A WORM GUARD

For stiffening sheets, band iron or light rolled angles are used. Turned flanges, hemmed edges and wire edges are common constructions. The wire edge is often used for appearance and because of the smooth edge it presents. A "thick edge," or beading machine is usually used for forming the flange for a wire edge.

Before attempting the design of much sheet-metal work, the draftsman should spend several hours in an up-to-date tinshop. A little personal experimenting with the brake, rolls, and shears will teach the elements of sheet-metal working to any observant draftsman. If in doubt as to the forming of a piece, the making of a paper model will be found to be of the greatest help. Paper and sheet metal behave in much the same way and if a one-piece paper model can be made, its metal counterpart is almost certain to be capable of economical production. The draftsman will find it a valuable accomplishment to be able to make understandable freehand perspective or isometric sketches. Even the best sheet-metal drawing is hard to understand and a paper model, or a judiciously shaded perspective sketch is of great assistance to the mechanic.

Re-Turning the Pins of Multi-Throw Crankshafts

By R. McHenry

In the absence of special machinery the usual procedure in re-turning the throws of multi-cylinder engine shafts is first to make a pair of offset centers, which are clamped to the ends of the shaft; often entailing more time and labor than the job itself. A much simpler way, which has proved entirely practical is to hold one end of the shaft off-center in the lathe chuck and place one of the crankpins, near the opposite end, in the center rest. The work is then centered accurately by applying an indicator to the nearest parallel crank.

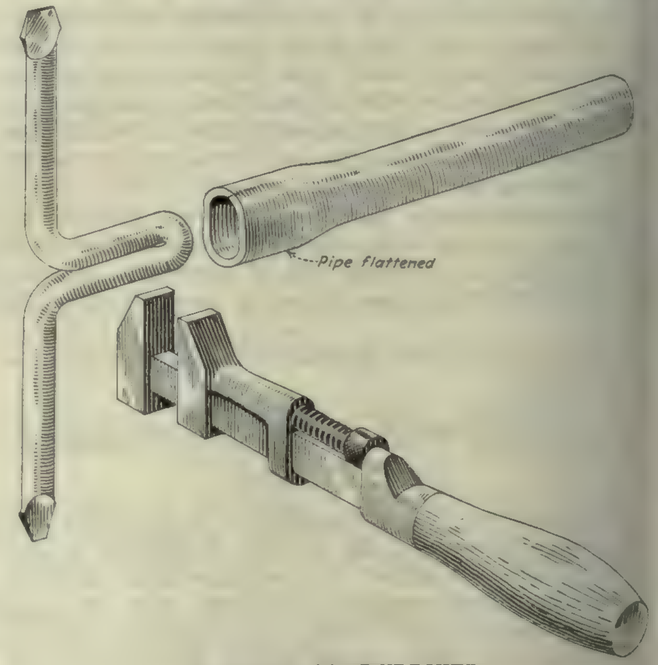
If the chucked part is not flanged, or is of small diameter, a collar or cast-iron block with hole and setscrew may be fitted over it to enable the chuck jaws to grip it properly.

With the crankpins worn badly out-of-round it is well to true them approximately with a file and micrometer before attempting to lay them in the center rest or to apply the indicator. By exercising a little care in setting up and keeping the supporting points close together a satisfactory job is obtained in quick time.

A Handy Screwdriver

By Charles H. Willey

From a piece of $\frac{3}{8}$-in. drill rod I have made a very handy double-ended screwdriver, having a large blade on one end and a smaller one on the other. The sketch shows how the tool is used. A piece of flattened pipe or a monkey wrench serves as the handle.



A HANDY SCREWDRIVER

EDITORIALS

After Naval Armament Limitation—What?

JAPAN'S acceptance of the Hughes 5-5-3 ratio assures the success of the first important step taken in the direction of universal peace. If Mr. Harding's conference does nothing more its achievement in thus reducing the tax burden of the world will be unparalleled in history. The American advisory committee calculates a saving to the United States alone of $200,000,000.

A much knottier problem has been tackled in the Far Eastern question, but surface indications are encouraging and point to an eventual agreement of some sort. Much of the mutual suspicion with which the countries involved have regarded each other in the past, seems to have been due to misunderstandings fostered in part by the jingo journalism of all of them. Now that representatives with an earnest desire to find means of gaining a common end have gathered around a table, the misunderstandings are dissolving like mist before a hot sun.

Here are two matters of transcendent importance to the world which are on the way to settlement, but is this all that can be accomplished? What of land armaments?

It is interesting to note that most of the continental European countries have been able to balance their budgets except for amounts on the wrong side of the ledger almost exactly equal to the expenses of maintaining their armies. If, then, these armies could be greatly reduced or dispensed with altogether, there would be a good chance of putting the greater part of Europe on a stable financial footing.

It seems unlikely that much progress in this direction will be made by the present conference, but if this surmise turns out to be correct, then by all means let us arrange for another one to be held soon at which the questions of land armament reduction and economic stabilization can be thrashed out. Think it over!

Poughkeepsie's Relief Work

ONE of the results of the unemployment conference is shown in Poughkeepsie, N. Y., which had 4,500 persons idle and found business slowing up. The Chamber of Commerce got busy and as a result nearly 3,000 of those idle from the shutting down of other plants, have been taken in by the shops now running.

This has been made possible by a stimulation of local business through a "no profit" sale of goods made in the city. The leading store conducted this sale which included clothing, agricultural implements, furniture, hardware, supplies, cigars, candies, textiles, automobile supplies, etc. Both manufacturers and retailers sacrificed all profit on the goods to stimulate buying and so enable the plants to operate.

Municipal work has also been ordered, which will help find employment for the remainder. The work of assisting where necessary can be centralized, using existing agencies so as to minimize overhead expense.

A joint note of $5,000, signed by fifty business men, has established a fund from which loans not exceeding $100 are made to essential breadwinners to enable them to maintain or rehabilitate homes. Every indication of charity has been removed from the relief work by placing orders for food, coal, clothes, etc., with local merchants to deliver in the usual manner.

An interesting feature is that the major number of cases of relief are in the white collar class. This is because their income did not increase so that they could save enough to carry them over the depression. The fact that the workers do not need help rather gives the lie to the statement that none of them saved when wages were high.

Poughkeepsie is to be congratulated in pointing out a way for other cities to follow. Co-operation between manufacturers and merchants, through the Chamber of Commerce, seems to be a logical first step in the work pointed out by Mr. Hoover.

Fitness for the Job

ONE of the great problems in running any kind of a business is to get the right man for each job. If the labor unions, in addition to or instead of being defensive and offensive organizations, would also become constructive to the extent of supplying men of the different grades needed, many of their troubles would disappear. If we could be sure of getting a good milling machine man when we asked for one, there would be much more hope of getting along without friction in the shop. This is being done to some extent in a few trades and is a step in the right direction.

Unfortunately, however, the need for suitable men is not confined to the shop, and we are all too apt to find misfits and incompetents in the manager's chair. As Ernest F. DuBrul pointed out in a recent article in the *American Machinist*, these men are more of a handicap to industry and to the community than the poor workman.

The day has gone by when a community or an industry can afford to have anyone who happens to have the necessary capital start a business. Unless the capital is managed by those who understand the business, who appreciate the responsibilities as well as the privileges of leadership, a new industry in a town may be a liability instead of an asset.

The successful manager of today must be far better equipped in every way than his predecessor of the past generation. He must not only understand business but he must understand the psychology of men and the methods of handling them. Real leadership must take the place of the driving tactics of a few years ago.

Management today is a real man's-size job in every particular. Those who are fitted for it secure real cooperation and economical production. Those who cannot meet this test must gradually drop by the wayside. Fitness for the job of managership does not depend upon family or financial resources but briefly on the ability to deal fairly and sympathetically with workers and customers alike. It is becoming a more difficult but a more necessary profession every year.

Shop Equipment News

Clay Automatic Machine Operator

The Key Boiler Equipment Co., 27th and McCasland Ave., East St. Louis, Ill., has recently placed on the market an air-operated automatic "operator" for bolt cutting and nut tapping machines.

As applied to a bolt cutting machine, the "operator" clamps the work, feeds it into the dies, opens the dies after the thread has been cut, returns the carriage to its starting position and closes the dies for the next cut, all by the movement of two levers, and during these operations no attention is necessary.

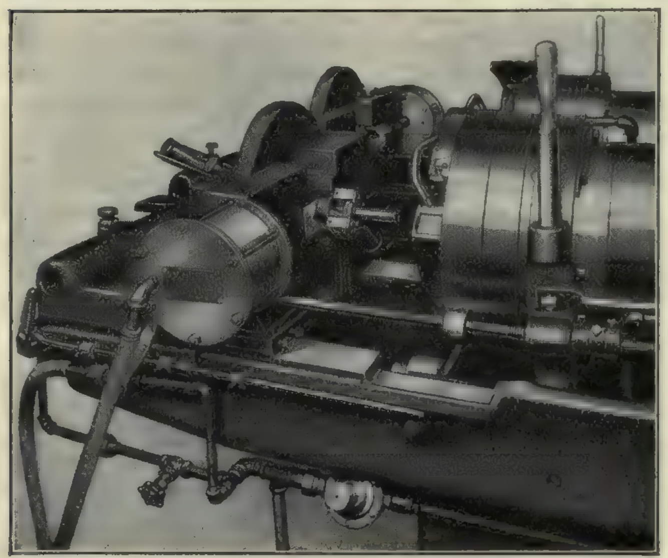


FIG. 1. MACHINE "OPERATOR" WITH FEED AND EJECTOR ON A BOLT CUTTING MACHINE

If the machine is provided with a lead screw, it is possible to cut a thread having a continuous lead on the opposite ends of a bolt, or if the part between the threads is of a diameter no greater than the root of the thread one end may be threaded, the nicked down part jumped and a thread of continuous lead cut on as much of the remaining part as protrudes from the jaws of the vise.

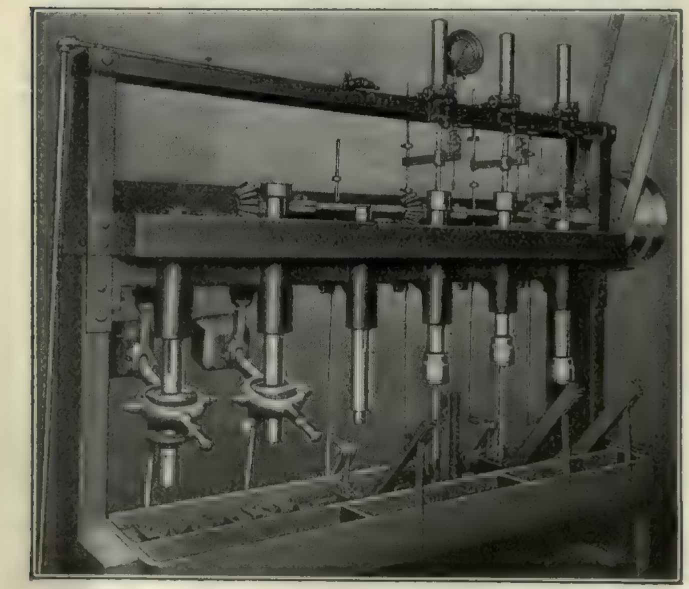


FIG. 2. MACHINE "OPERATOR" APPLIED TO A NUT TAPPING MACHINE

For threading ordinary square or hexagon head bolts from ⅝ to 1½ in. in diameter, a special feed and ejector as shown in Fig. 1 can be furnished.

In addition to the automatic motions above described the finished bolt is ejected from the holder and thrown clear of the machine. When another bolt is pushed in from the magazine and the starting lever pulled, the cycle of automatic movements is repeated.

In Fig. 2 is shown an automatic "operator" applied to three spindles of a nut tapping machine. An air operated piston holds the spindles up when the taps are full. Mechanism that controls the rise and fall of the spindles operates the device for feeding the blank nuts into the tapping position. As soon as a nut is tapped the spindle and tap are raised carrying the tapped nut on the tap. Another nut is fed into position and the tap lowered into it. When the shank of the tap is filled with tapped nuts the spindle rises and remains in the raised position ready for the attendant to remove and empty the tap and replace it.

The principal parts of the regulating and feeding mechanism can be arranged to take care of all sizes of nuts within the capacity of the machine.

Both the bolt threading and nut tapping attachments can be applied to practically all makes of machines.

United States Electric Company Rivet Heater

The United States Electric Co., New London, Conn., has placed on the market a portable electric rivet heater designed for use in shipyards, boiler and car works, steel building construction or wherever structural steel work is being done.

The machine is regularly built with two, four, or six electrodes for manual operation, and the larger sizes can be furnished when desired with an automatic movement for carrying the rivets between the electrodes and discharging them when heated.

The automatic movement consists of a pair of intermittently rotating skeleton dials so constructed as to carry the rivets forward in pairs, and cams for opening and closing the electrodes in conjunction with the movement of the dials; the whole being driven by a continuously running motor, so that all that is required of the operator is to see that the dials are kept filled with rivets to be heated.

Only the lower electrodes of each pair are connected with the terminals of the low voltage coil, the upper one being merely a connecting link between the two rivets, so that each pair of rivets in the machine is in series and current passes only when both rivets are in place.

In the manually operated machine the electrodes are opened by conveniently located pedals and are closed by the action of heavy coil springs; thus insuring proper electrical contact.

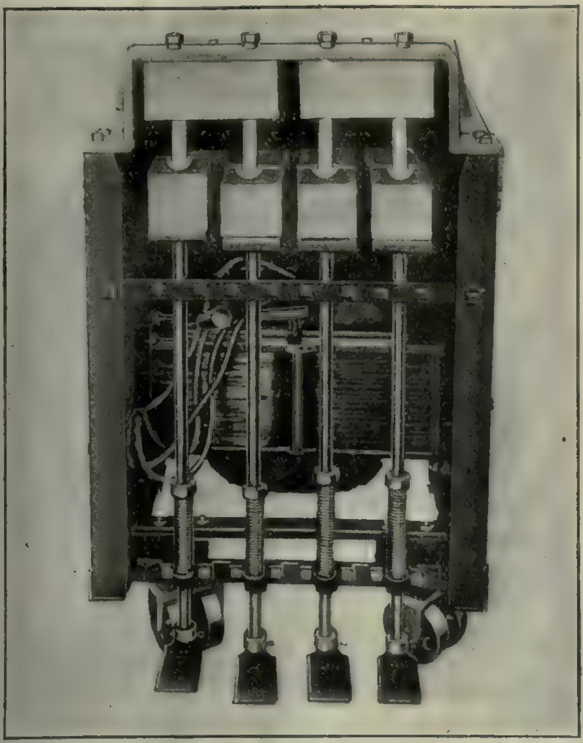


FIG. 1. FOUR ELECTRODE MANUALLY OPERATED MACHINE

The primary coil of the transformer is built up from flat strips of copper welded to the terminals, and the magnet core is of laminated soft iron.

The machines are strongly and compactly built and are provided with casters upon which they may easily be rolled from place to place as required, while eyebolts in the frame provide for picking them up with the yard or shop crane when that means of transportation is available.

They are regularly furnished for 220, 440, and 550-volt, 60-cycle, single-phase current, or may be specially constructed for other voltages and frequencies when so ordered. Only alternating current can be used.

The machines are 33 in. in height, 22 in. in length, and vary in width according to the number of electrodes.

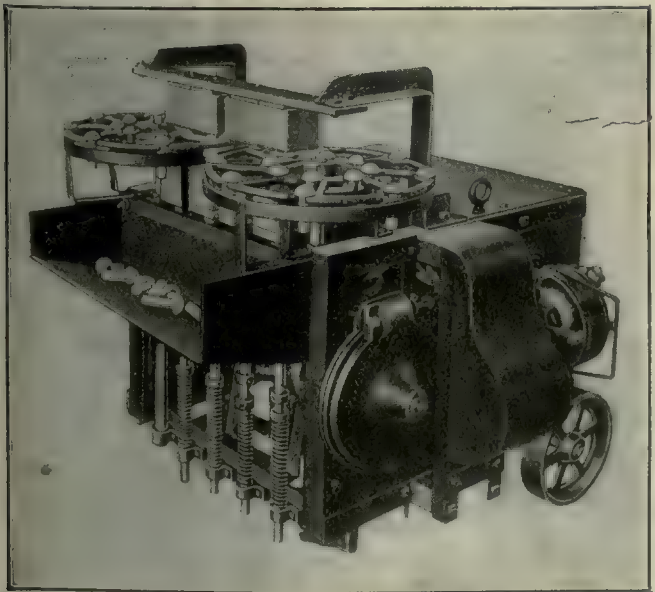
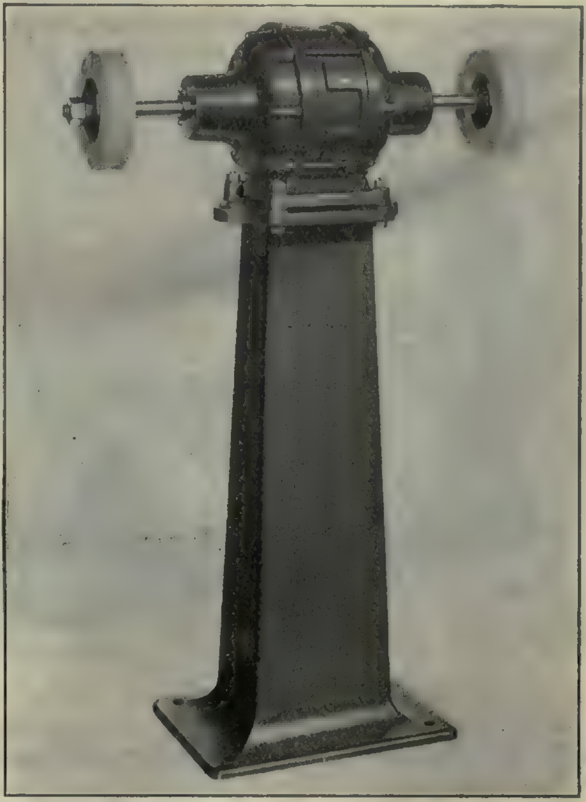


FIG. 2. FOUR ELECTRODE AUTOMATIC MACHINE

Dimo Electric Tool Grinder

The machine shown in the illustration is the Dimo electric tool grinder which has been placed on the market by the Luther Grinder Manufacturing Co., Milwaukee, Wis. This tool grinder is intended for use in manufacturing or repair shops where electric current is available. As the machine is motor driven, it can be placed in any desirable location. The motor is dust proof, and runs in S. K. F. bearings. The arbor is of rigid construction and is long enough to allow plenty of space between the bearings and the wheels. The wheels are Dimo-grit wheels made especially for use in this company's machines. The grinder may be furnished with either a high or low pedestal, as required, and can also be furnished with tool rack and guards at a slight additional cost.

The machine is built in five sizes with single phase motors for 110 or 220 volts and in five sizes with two or three phase motors for 110, 220 or 440 volts. The machines can be furnished for belt drive if desired.



DIMO ELECTRIC TOOL GRINDER

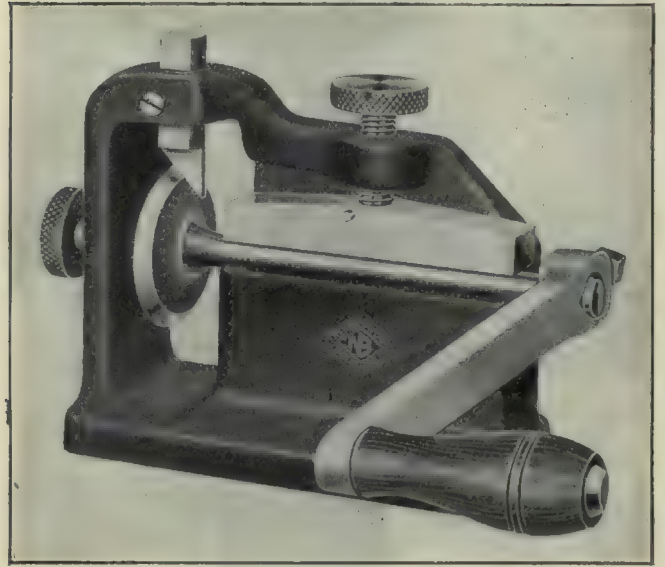
New Britain Adjustable Valve Facing Tool

The New Britain Tool and Manufacturing Co., New Britain, Conn., has placed on the market a device for resurfacing the valves of automobile engines. It is entirely self-contained, needing no accessory bushings or other losable parts. It will handle valves of any commercial size of stem without other adjustment than the turning of a screw, and is designed primarily for the use of the individual automobile owner who wishes to make minor repairs upon his car himself.

As may be seen in the illustration, the stem of the valve to be resurfaced rests in a long V-groove that is machined in the body of the device and is held down by a flat steel shoe that bears on top of the stem, thus holding it in a three-point bearing that extends nearly the full length. The valve is rotated by means of a crank handle which is setscrewed to the outer end of the stem. Pressure to hold the stem in the bearing is applied by means of the knurled screw above and may be nicely adjusted to allow the valve to rotate freely but without shake or chatter.

A fixed cutter of high carbon steel is held in a vertical position above the valve by means of a small headless setscrew. The edge of the cutting tool is accurately ground to the original angle of the valve to be resurfaced, and the tool may instantly be removed for resharpening or for the substitution of cutters of other angles.

The upper surface of the valve abuts against the point of the knurled screw to the left, by means of which the valve is fed to the cut. The device may be permanently fastened to a work bench by means of wood screws or, as is usually more convenient, grasped in the jaws of a bench vise whenever its service is required. When the job is finished, the device may be stowed away on the shelf.


THE NEW BRITAIN ADJUSTABLE VALVE FACING TOOL

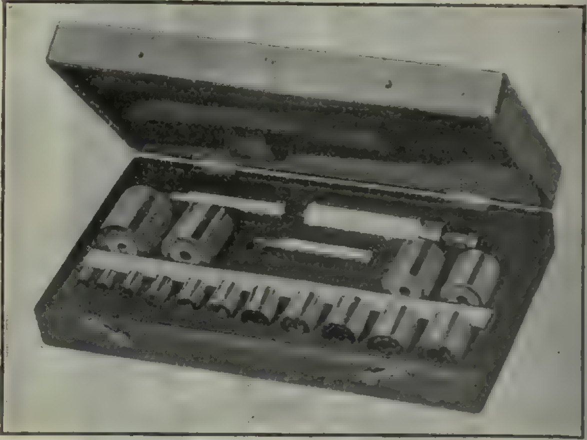
It is claimed that the time required to set up the device and true a set of valves is much less than would be needed to accomplish the result by any other method.

Coats "Leonard" Gages

The Coats Machine Tool Co., Inc., 110 West 40th St., New York, N. Y., is placing on the market a line of Leonard gages. The standard plug gages are fitted with renewable heads, making replacements possible at a minimum cost. They are made of hardened steel, and are guaranteed accurate to within 0.0001 in. of nominal size. They are put up in two sets, the No. 1 set being illustrated herewith.

The No. 1 standard set comprises 14 sizes from ¼ to 1¼ in. Any special combination of sizes can be supplied to order. The four smallest sizes are usually solid with the handle. The No. 2 standard set comprises the sizes from 1⅜ to 2¼ in. The plugs rise in size by 1/16-in. steps up to 1 in., by ⅛-in. steps from 1⅛ to 3 in., and by ¼-in. steps from 3 to 6 inches.

Limit plug gages of the renewable type can be supplied from stock in various sizes and limits. The gage consists essentially of three parts, the go-end, not-g end, and the handle, which may be either double o

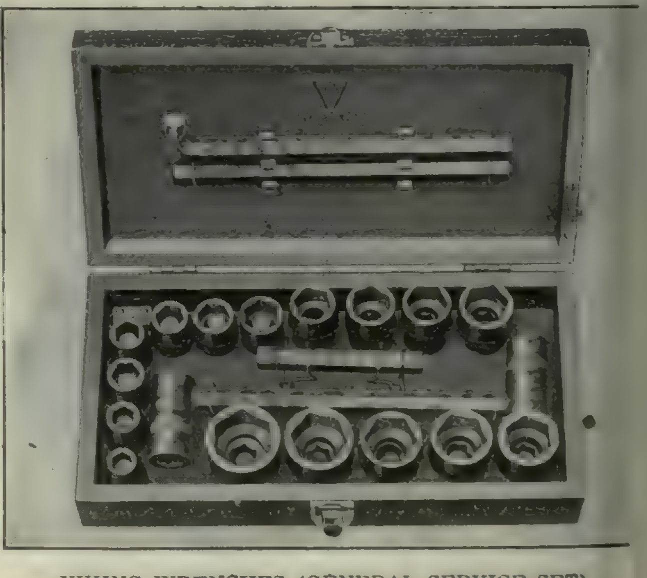

COATS "LEONARD" PLUG GAGE SET

single ended, as required. The handles are interchangeable, and one size will fit a range of plug sizes. Th plugs are stocked to Newall class A or B limits in th following sizes: ¼ to 1 in. in 1/16-in. steps, 1⅛ to 2 in. i ⅛-in. steps, and 2¼ to 6 in. in ¼-in. steps. It is possibl to supply any size in English or metric units to an given limits, the maker states. The gages can be supplied in sets in large cases, or singly in individual cases

Standard ring gages are made from ¼ to 6 in. in siz to cover the same range as the plug gages. In additio to the gages just described, the Leonard line embrace the following gages and tools: Standard taper ring an plug gages, plain and universal V-blocks, toolmaker' knees, taper test gages, measuring irons, adjustabl bevel-edge squares, hardened and ground steel parallel box parallels, adjustable-limit snap gages, and glas surface plates in two sizes. The latter do not warp a do steel plates, it is claimed.

Viking Wrenches

The Viking Specialty Co., 25 Bartlett St., Worceste Mass., has placed on the market a line of sock wrenches put up in sets of various combinations f

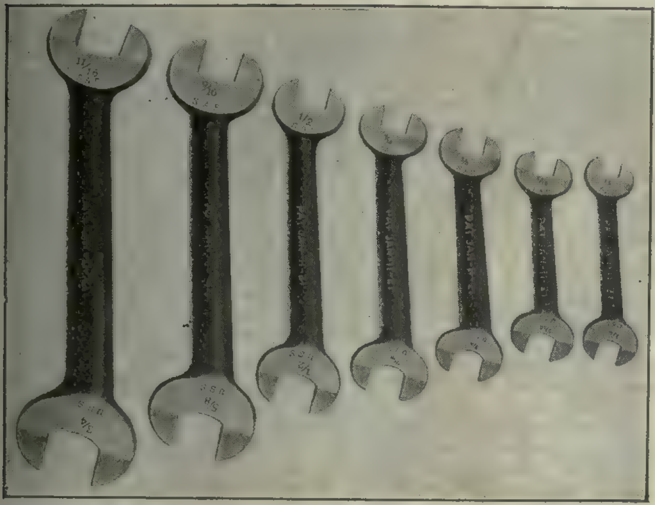

VIKING WRENCHES (GENERAL SERVICE SET)

automobile work. The general service set, illustrated herewith, comprises a double-end ratchet wrench, sixteen sockets for hex head screws and nuts, three extensions and a handle. The extensions and handle are fitted with ball frictions to hold the sockets from slipping off.

In addition to the set illustrated, the wrenches are put up in factory sets for shop assembling work and in owners' sets to fit the bolts and nuts on any particular make of car.

Mechanics Tool Co. Double End Wrenches

The accompanying illustration shows a set of double-end wrenches recently placed on the market by the Mechanics Tool Co., Rockford, Ill. These wrenches are drop-forged from tool steel and are oil tempered. The angle of the jaws makes it possible for the user to work in tight places and get a firm hold on the nut or screw head, and at the same time have full benefit of the leverage without danger of the wrench slipping and injuring his hand. The opening in the larger end of each wrench is of the correct size to fit a U. S. standard nut while the small end is made to fit an S. A. E. standard nut or bolt head. This feature is intended to make the wrenches useful for the automobile mechanic. The set covers fourteen sizes of openings without duplication. The wrenches are fully guaranteed by the manufacturer.



MECHANICS TOOL CO. DOUBLE END WRENCHES

New Britain Line Reamer for Ford Crankshaft Bearings

The New Britain Tool and Manufacturing Co., New Britain, Conn., has added to its products the line reamer shown in the accompanying illustration, and which is especially constructed for the purpose of reaming the crankshaft bearings of Ford automobile engines.

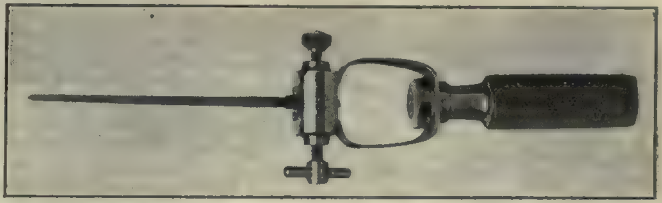
LINE REAMER FOR FORD CRANKSHAFT BEARINGS

The same principle of expansible diameters and pilot blades is applied to this reamer as to the regular line. The blades are ground to a true circle for a distance equal to about one-third of their length from the entering end. This diameter is so calculated as to follow the hole in the newly babbitted bearings, left by the babbitting fixture made by the same company.

The range of expansion is from normal to about $\frac{1}{8}$ in. oversize.

Coats Hand Pin Vise

The hand pin vise shown in the accompanying illustration has recently been placed on the market by the Coats Machine Tool Co., Inc., 110 West 40th St., New York, N. Y. The upper part consists of a flat lyre-shaped spring, the ends of which hold the two movable jaws. The jaws and the ends of the spring are held together by a frame, in which the clamping screw and the knurled adjusting screw are fitted. These screws are provided with hardened pin ends, which project into the jaws, preventing the latter from sliding. The handle is hollow to admit pieces longer than the depth of the spring, and a washer and nut are used to hold the spring to the handle.



COATS HAND PIN VISE

A piece, whether straight or tapered or of irregular section, is gripped along the entire length of the jaws when the clamping screw is tightened, due to the accommodating power of the springs. One of the jaws is slightly notched. The grip obtained on a taper, like that on the shank of a file or reamer, is very rigid. Long pieces extend through the hollow handle and are centered by means of the knurled adjusting screw. It will be noted that independent movement of each jaw in relation to the central axis is permitted.

Zahn Cycle Car

Word comes from H. W. Adams, representative of the Department of Commerce in Germany, that the Zahn Co. (Ltd.) has recently introduced a small two-seated, 4 to 9 horsepower cycle car. It is claimed to be cheap in price, cheap in upkeep, and simple in construction.

The car sells at retail in Germany for 40,000 paper marks (about $323, at exchange rate on Oct. 5, the date of report). It has a torpedo-shaped wooden body about 9 ft. long, with a maximum width of about 4 ft. The motor is of a two-cylinder air-cooled V-formed construction. The gas is regulated by foot pedal and hand lever. The car weighs about 300 kilograms, develops a speed of from 60 to 65 kilometers an hour, and consumes about 5 liters of gasoline and about one-half liter of oil per 100 kilometers.

The Industrial Machinery Division of the Department of Commerce

The Machinery Production and Trade of the United States—How the Department of Commerce Is Organized To Serve the Machinery Industry

By W. H. RASTALL
Chief, Industrial Machinery Division

IN ORGANIZING the commodity divisions in the Bureau of Foreign and Domestic Commerce it was found that, according to the 1919 census, there are more than 4,000 factories in the United States producing industrial machinery. The value of the products of these factories exceeds $2,200,000,000 per year, of which huge total about 17 per cent or nearly $400,000,000 is exported. Obviously this is a very large business, but it is also a very important business because these 4,000 plants have more than 400,000 employees whose income represents the livelihood of, say, 1,500,000 of our people, and the export business is of such volume as to represent the difference between profit and loss in the operation of many or most of these plants. It represents the difference between good times or depression, between a job and unemployment. The Industrial Machinery Division was developed in order to defend and promote this trade.

The figures given above are obtained by combining the returns of the census and the customs, and there are differences in the classifications which are apparent in the details as published in the accompanying table, but it is still felt that the general impression conveyed by these figures is substantially correct.

	Plants	Production	Exports	Per Cent
Air compressors	57	*57,454,000	3,761,200	6.5
Concrete mixers	62	9,579,000	246,631	2.6
Elevators and elevator mchy	195	54,052,000	2,601 543	4.8
Engines	371	464,770,000	48,370,483	10.4
Excavating machinery	34	6,641,000	1,165,763	17.5
Flour and grist mill machinery	86	16,366,000	2,375,802	14.5
Power laundry machinery	30	10,341,000	796,053	7.7
Machine tools	403	212,225,000	22,627,477	23.6
Metal working machinery (other than machine tools)	155	36,348,000	35,880,465	
Meters—gas and water	39	*20,572,000	763,691	3.7
Mining machinery—oil well	61	22,219,000	3,613,972	16.2
Mining machinery—other	124	43,028,000	9,265,319	21.5
Paper and pulp mill machinery	121	16,198,000	3,958,873	24.4
Printing presses	45	15,520,000	3,827,038	24.7
Pumps and pumping machinery	204	*65,360,000	9,067,458	13.9
Refrigerating machinery	84	29,901,000	2,141,110	7.1
Railway cars	121	403,517,000	60,748,946	15.0
Road-making machinery	43	13,915,000	987,912	7.1
Shoe machinery	58	7,459,000	2,839,828	38.0
Sugar mill machinery	49	13,249,000	13,805,940	....
Textile machinery	431	126,006,000	14,986,369	11.9
Typesetting machines	92	24,531,000	3,932,544	16.0
Sawmill machinery	69	10,046,000	1,141,248	11.4
Other wood-working machinery	172	19,536,000	2,603,407	13.3
Others	1,198	570,738,000	138,202,092	24.2
Total	4,304	$2,269,571,000	$389,711,154	17.2

*Includes value of all products of establishments engaged primarily in the manufacture of machines specified.

The Industrial Machinery Division has been instructed to give attention to industrial machinery, the kinds of equipment coming within this classification being suggested by the items given in the table which may be more generally described as including every kind of machinery used in any kind of a factory, power plant or mine; or that runs on a railway, or is used in the construction of engineering enterprises. Agricultural and farm machinery, including tractors, etc., is handled by the Implements and Vehicles Division; automobiles and aircraft by the Automotive Division; electrical equipment by the Electrical Division; plumbing supplies by the Specialties Division, etc. When a given problem seems to be on the border line the two divisions co-operate cordially, the organization being sufficiently elastic to meet all requirements.

The division aims to be of the greatest possible service to American manufacturers and exporters of machinery and feels that the best way to accomplish this is to establish close contact with these interests, hoping thereby to learn as much as possible about their particular export problems and the information manufacturers actually need regarding the various foreign markets. Having developed these problems it will be possible to secure help in their solution from the 600 representatives the Government maintains in foreign countries or, should circumstances justify, arrangement could be made to send special investigators into those fields and such tasks would be assigned to experts peculiarly qualified for the work. No problem is too large or too small for this service. Where practicable the division hopes to establish this contact with the manufacturers through committees appointed by their trade associations, or in some similar way.

Services the Division Offers

In the various markets of the world different sales methods are employed in marketing machinery, and the experts of the division are familiar with these methods. Where it is wisest to sell through agents or dealers, they have reasonably complete lists of all available candidates in each of the important cities abroad and these can be passed on to interested manufacturers when desired. In those cases where it is practicable to visit Washington, it is possible also to furnish a great deal of additional information.

Through the oversea representatives of our Government the division is constantly receiving word of new engineering enterprises and is notifying our manufacturers of the locations where business is developing. There is a good deal of this sort of information that is really important and ordinarily it is distributed to those firms that are listed in the bureau's "Exporters' Index," a compilation of those firms known to be American in their nationality. Manufacturers or exporters wishing to be placed on this index should communicate with the Industrial Machinery Division.

This division is also constantly making studies of the various foreign markets and export problems and these are published in *Commerce Reports*, the newspapers, or technical papers, as circumstances justify.

In cases where problems arise in connection with tariffs, foreign patents, trade marks, copyrights, agency agreements or other legal matters, a great deal of assistance can be furnished through the co-operation of the Commercial Laws Division and the Foreign Tariffs Division. In cases where disputes are involved, the bureau can frequently assist in the making of an adjustment.

The Industrial Machinery Division has just started to collect the laws and regulations of all foreign countries covering the inspection, construction and operation of steam boilers, air receivers and similar containers. In co-operation with the Electrical Division it plans to secure a similar collection of the electrical regulations of the whole world. These will be available for the use of American manufacturers and exporters of machinery, as circumstances show this is necessary. A general survey of the railway mileage and rolling stock of the world is in preparation, and an effort will be made to have this indicate extensions in prospect during 1922 and, if possible, 1923. In co-operation with the Automotive Division a similar survey of the highways of the various countries of the world is being made, including such returns as will indicate the prospective market for automobiles and trucks as needed by that division and the market for construction machinery as needed by the Industrial Machinery Division. A similar survey of the steam, water power and other electric stations of the world is being prepared in co-operation with the Electrical Division for similar purposes.

The Industrial Machinery Division is new and there is a great deal of important work to do, but in making plans for this work the division wishes to have the benefit of advice from manufacturers, in order to have the benefit of their contact with specific problems in the various foreign markets. The division will welcome advice and suggestions from interested manufacturers in preparing its plans and will make every effort to have the contact between the manufacturers and the markets abroad as direct and perfect as possible.

One such opportunity that will soon develop will be in connection with the Centennial Exposition to be held at Rio de Janeiro, Brazil, in September, 1922, which is to emphasize the possibilities of industrial development there, and in which a number of our manufacturers will undoubtedly wish to be represented.

NEWS SECTION

Tax Bill Only Temporary Measure

While the tax bill is admitted by its authors to be an imperfect measure, it does provide for a substantial reduction in the tax burden and greatly simplifies the administration of the law. The bill in its final form will require the payment of some $725,000,000 less during the first fiscal year that it is in full operation, than would have been raised had the law it supersedes remained in effect.

The repeal of the transportation and so-called nuisance taxes means a reduction of $326,630,266 during the fiscal year beginning July 1, 1921. That feature of the bill alone is held by many to justify its enactment. It was stated officially at the White House and by the chairman of the Finance Committee that the bill is intended as a temporary measure only.

In its final form the bill is expected to yield $3,216,100,000 in the fiscal year beginning July 1, 1922 and $2,611,100,000 in the fiscal year beginning July 1, 1923. For the fiscal year of 1922, the bill is expected to raise some $16,000,000 in excess of the government's requirements.

The Senate accepted the House rate of 12 and one-half per cent applicable to the corporation income tax. This reduction of two and one-half per cent from the rate proposed by the Senate will reduce by $110,000,000 the annual tax burden of business.

Bureau of Standards Wants Aids and Apprentices

The United States Civil Service Commission states that the Bureau of Standards at Washington, D. C., is in need of junior aids and laboratory apprentices.

The basic pay offered is $540 a year for apprentices and $720 to $840 a year for aids, to which salaries there is added the increase of $20 a month granted by Congress. Junior assistants at the Bureau of Standards are given opportunity to continue their college work at the universities in Washington, the courses of which are largely arranged to suit the convenience of persons in the government service.

Applicants are not required to undergo a written examination but are rated upon the subjects of general education and experience.

Full information and application blanks may be obtained by communicating with the United States Civil Service Commission, Washington, D. C.

Business Paper Editors Confer With Secretary Hoover

The regular monthly dinner conference of the editors of the business papers of the country with Secretary of Commerce Herbert Hoover, was held at the New Willard Hotel in Washington on Nov. 28. The main topics of discussion were the two departmental publications issued by the Bureau of Foreign and Domestic Commerce, *Commerce Reports* and the *Survey of Current Business.* Mr. Hoover had asked at the previous conference for careful study of these two periodicals and constructive criticism. A committee of the editorial conference to which the matter had been entrusted, reported the consensus of opinion and offered several suggestions which will be adopted.

Franklin Institute Awards Longstreth Medals

Acting through its Committee on Science and the Arts the Franklin Institute, of Philadelphia, has awarded the Edward Longstreth medal to Governor James Hartness, of Vermont, and to Thomas W. Hicks, of Minneapolis.

Governor Hartness won the honor through his invention of the screw thread comparator, which ranks high in the mechanical perfections of the present day.

Mr. Hicks' award is based on his invention of the "once-over" tiller, a machine that thoroughly pulverizes the ground ready for sowing of the seed. No further use of disks or harrows is necessary after the Hicks machine has done its work.

Dr. Walton Clark, president of the Institute, made the presentation address.

Manufacturers to Debate American Valuation

According to a Chicago correspondent, one of the big features of the annual conference of the Illinois Manufacturers' Association, to be held Dec. 13, at the Congress Hotel, will be a debate on the subject of American valuation as proposed in the Fordney tariff bill. George R. Meyercord, president of the Meyercord Co., formerly a director of the American Manufacturers' Export Association, will speak affirmatively, while William H. Mann, general manager of Marshall Field & Co., wholesale, will give the view expressed by importers and retailers.

Wetmore Reamer Co. Enters Combine

Two Milwaukee tool manufacturing companies—the Wetmore Reamer Company, making a line of expanding reamers including cylinder reaming sets, and the Wisconsin Tool and Supply Co., manufacturer of special tools, jigs, dies, fixtures and thread gages—have been consolidated and will hereafter be operated under the name of the Wetmore Reamer Company.

The new organization will specialize in the manufacturing of expanding reamers for high speed and quantity production work; also expanding machine reamers under 1 in. which have been developed within the last six weeks. The building of tools, dies, fixtures and special thread gages will be continued as the entire equipment of machinery is precision made.

The officers of the consolidate corporation elected at a recent reorganization meeting are as follows: President and general manager, Edward J. Waltzer; vice-president, Charles G. Forster; secretary, Charles F. Puls, Jr.; treasurer, Carl A. Forster; general superintendent, Edward D. Johnson.

Senator Kenyon's Bill to Stabilize Employment

To carry out the policy recommended by the President's Conference on Unemployment and to prepare in advance against future cyclical periods of business depression and unemployment, Senator William S. Kenyon, of Iowa, introduced a bill in the Senate, providing for the long-range planning of public works. This bill was referred to the Committee on Labor of the Senate.

The preamble of the bill states: "Whereas a sound economic policy requires that a larger percentage of the public works and projects of the United States be undertaken and prosecuted during a period of major industrial depression and unemployment, when labor and capital are not fully employed in private industry, that a smaller percentage of such works and projects should be undertaken and prosecuted during a period when private industry is active and competing for the same men and material with resulting business strain and over-extension, and that the prosecution of such works and projects should be utilized as a stabilizing force during a period of over-expansion as well as during a period of depression."

It is reported the bill is favorable to both houses.

A.S.M.E. Confers Honorary Membership on Towne and Herreshoff

At the Tuesday evening session of the annual meeting of the American Society of Mechanical Engineers, now being held in New York City (Dec. 5 to 9) two honorary memberships were conferred.

Henry R. Towne, president of the Yale & Towne Manufacturing Co., and Nathanael G. Herreshoff, marine engineer and boat designer, were the recipients of this high honor.

Henry R. Towne has been a member of the A. S. M. E. since 1882, serving as vice-president from 1884 to 1886, and as president in 1889. He is a life member of the society. Mr. Towne graduated from the University of Pennsylvania in 1862. In his early career, associated with Robert Briggs, he made a series of experiments with leather belting, the results of which were accepted as standard for twenty years. In 1868 he formed a partnership with Linus Yale, which later assumed the organization known as the Yale & Town Manufacturing Co. Mr. Towne has directed this company as president since 1869.

HENRY R. TOWNE

During thirty-six years of development he produced almost every improvement in locks or lock-making machinery. He also has contributed much to the development of Post Office equipment, chain hoists and all manner of art hardware.

Mr. Towne's unusual combination of business and mechanical ability and his untiring efforts to create and maintain a product of service and excellence, have made him a recognized factor in the growth and prosperity of the lock industry.

Nathanael G. Herreshoff graduated as a mechanical engineer from the Massachusetts Institute of Technology, in 1869. He had a natural inclination toward mathematics and possessed unusual ability as an engineer.

One of his first noteworthy accomplishments was the design and construction of a rotary engine which embodied many novel and ingenious features. In 1876 he erected the great Corliss engine which was exhibited at the World's Fair in Philadelphia. A few years later he designed some compound engines which were copied by many engineers. These engines were subjected to elaborate tests by B. F. Isherwood, then chief engineer of the U. S. Navy.

Mr. Herreshoff is credited with making the first torpedo boat designed for the Government and during the Spanish-American War built the "Porter" and the "Dupont," which far exceed their contract requirements. His work as a naval architect is known the world over. His design of hulls and ship rigging has been copied by all countries. It was he who designed the yachts which defended the America's Cup on numerous occasions. His contributions to the field of marine engineering have been greatly underestimated because of his failure to patent his designs.

NATHANAEL G. HERRESHOFF

American Trade in Argentine

The foothold which American business has gained in the Argentine is threatened by the apathy of American bankers and manufacturers, declares M. T. Meadows, manager of the Chamber of Commerce of the United States in the Argentine Republic. In a statement appealing to those interests in America which are yielding to unwarranted pessimism, he begs that they inform themselves correctly regarding what the chamber believes to be an unexcelled opportunity to build up a growing and tremendous trade with the South American republic.

The spirit of pessimism concerning the future of Argentine trade which has settled like a pall upon American bankers, manufacturers and exporters, is viewed with alarm by the American business community in Buenos Aires.

"Courage in the facc of odds is as essential to success in the Argentine business as it is in trade within the borders of the United States. Argentina has just passed through one of the most critical commercial crises in her history. Naturally those interested in trading with this country have felt pessimistic in the immediate past.

The internal conditions of the country are fundamentally sound. This statement has been repeated so often to the American public that it has now become trite. And yet it is only by dint of constant repetition that facts concerning Argentina are driven home to American bankers, manufacturers and merchants. It is also well to repeat that Argentina, with the fifth largest gold supply in the world, has the highest gold guarantee for paper circulation of any nation. This guarantee today stands at slightly over 80 per cent.

Indications of Business Improvement

Bits of news coming from various industrial centers indicate a gradual improvement in the complexion of the machinery industry.

The Chicago & Alton Railroad has awarded a contract for the repair work of 150 gondola cars to the Street Co., of Chicago.

The Burlington has awarded a contract to the General American Tank Car Co., of Chicago.

The operations of leading steel mills in the Chicago district continue at a new high capacity started about 10 days ago.

The Illinois Steel Co. and the Inland Steel Co. are operating close to 50 per cent of their capacity.

Two new automobile companies, Durant Motors, Inc., and the Rickenbacker Automobile Corporation, both of Detroit, have made purchases. Durant Motors, Inc., bought 30 turret lathes and other new and slightly used tools, while the Rickenbacker Corporation acquired several miscellaneous tools.

Railroad buying has been confined to small lots. The Virginia Railroad, which took 10 tools, was the largest purchaser. The Union Railroad, Pittsburgh, a subsidiary of the United States Steel Corporation, has bought a radial drill, lathe and planer. The New York Central has purchased two lathes from Government stocks at Hog Island, Philadelphia. The Santa Fe, Rock Island and the Illinois Central have also bought in a small way.

As a result of a general betterment in the automobile situation, which has brought increased shipping specifications for Jan. 1, the Electric Auto-Lite Corporation will increase its force to 2,100 employees after the turn of the year, C. O. Miniger, president of the company, announced Tuesday. Approximately 1,400 workers are now employed at the Auto-Lite.

The Toledo Bridge and Crane Co.'s plant in Toledo, Ohio, will go on full time soon, as the result of a several million dollar contract with the Brazilian government just closed by the Austin Machinery Corporation, of which the Toledo company is a subsidiary.

Rolls-Royce of America, Inc., Springfield, Mass., has resumed the operation of its machine shop and is now employing about 100 men in the various departments, producing at the rate of two chassis a week. It is planned to bring production to the normal rate of four to five chassis a week.

The Chapman Valve Manufacturing Co., Springfield, Mass., began operating on full time and with a practically full force beginning Nov. 28.

An official announcement on Nov. 28 from the master mechanics' office of the L. & N. R.R., at Evansville, Ind., states that practically all of the 200 men who have been out of service in the Howell shops since the first of the year, have been replaced in their various departments. This announcement seems to be indicative of a return to normal in all departments of the road. The men were notified to return to work and 25 boilermakers and machinists reported Monday morning. This leaves but a few yet to be replaced. The majority of these are machinists and it is expected that they will be reemployed within the next week or ten days.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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In almost every direction the effect of cheaper money and more abundant credit is becoming apparent. Even before the Disarmament Congress met in Washington the bond market had commenced to reflect the lower rates at which capital could be borrowed, but within the last week the demand for well secured obligations has been almost insatiate and an issue of $30,000,000 bonds offered by the New York Edison Co. on a basis that yields 6.10 per cent, is said to have been thirty times oversubscribed. The advance in Liberty Bonds has meantime continued. Victory Bonds paying 4¾ per cent have sold at par and the entire list of government war bonds shows an average advance of about 10 per cent from the low prices of the year. Experts claim that at current market quotations the American bond issues now outstanding are worth at least $5,000,000,000 more than they were six months ago.

But striking as it is the appreciation in bond values is not as important as the better feeling and upward tendency that is manifest in many commodity markets. The advance in petroleum is well maintained. Wheat is again higher. Corn is firmer. Copper is up to 13¾ cents. Silk has recently advanced about $1 per pound. Crude rubber is firm and higher. So is coffee, and while cotton is seemingly static it resists the attacks of those who think that the higher crop estimates now generally accepted justify a decline. In the case of these articles the improved demand or the lessened eagerness to sell will probably be attributed to special trade factors by those who deal in them, but in the larger view a general return of confidence is reflected by the stronger tone that is apparent in so many different markets.

Pervading them all is the consciousness of a change in psychological conditions which is due to the belief that when the capital, without which labor is almost impotent, can be hired at rates that are not exorbitant people will produce more, earn more and spend more, with the result that there will be more business for everyone.

This is almost an economic truism. I have urged its recognition ever since our bank reserves commenced to rise, but the public was slow to accept it and the conjunction of the Disarmament Congress with a reduction in interest rates was necessary to dissipate the clouds of pessimism that obscured the sunshine of normal hopefulness.

GOLD RESERVE RISES

The Federal Reserve statement for the week shows a further rise in the reserve ratio, which now stands at 72.7 per cent, and a gain of $14,000,000 in the gold held. These figures have led some to predict another reduction in the rediscount rate, but whether it is ordered or not they assure easy money for some time to come, and in that assurance men are willing to undertake new enterprises and adventures. Building is abnormally active for this season of the year. The steel industry is getting busier because the railroads and the oil companies are buying. The shoe factories and the textile mills are running nearly on full time and there is nowhere to be discerned the distressful unemployment that was generally predicted eight weeks ago.

Railroad net earnings for October will probably exceed $92,000,000 and the position of the roads is so much improved that the attempt to enact the refunding bill will be abandoned. It seems to be difficult nevertheless to get freight rates down, for the Interstate Commerce Commission has refused to sanction the proposed reduction of 10 per cent in the rates on agricultural products though it holds out the hope of a generally lower tariff later on. The Labor Board is concurrently deliberating upon another revision in wages, but the public is confused over the questions at issue and impatient at the delay in reducing the cost of transportation. Now that the hope of reduced taxation has been balked, people are wondering whether they are also to be denied the promised reduction in freight and passenger rates. It is the thing most needed to quicken the recovery in domestic trade.

EXCHANGE BETTER

In Europe, as in this country, a constructive policy seems at last to be in the ascendant. It is proposed to give Germany two years respite, euphemistically called a moratorium, in the payment of her reparations and the result has been a sharp advance in foreign exchange. Sterling has sold at 4.07½, francs are sharply higher and even the discredited mark is up to 56 cents a hundred despite the Reichbank's statement which shows that 96 billion paper marks were outstanding on Nov. 23, against which there was held only 993 million marks in gold. Unless the German chemists shall find a way to make synthetic gold it seems futile to expect that even at their present discount these paper marks will much longer be exchangeable for things of real value.

In Russia a new ruble is to be issued which will have a flat value that will make it worth 10,000 of the rubles now outstanding. By this plan Russia's millions of millionaires will be painlessly reduced to a lower financial status. It may be that something of the sort will be attempted in Germany, but unless one knows what will be the ratio between the old money and the new he cannot hope to profit by the change, and those who buy marks are playing with cards that will be stacked against them. The recent advance in exchange is, however, a fact that is of advantage to America, as it facilitates exports and for that reason it is to be counted as encouraging.

But from the optimism of the foregoing it is not to be inferred that the horizon is entirely cloudless. Overseas the unsolved Irish problem still taxes the seemingly inexhaustible patience of Lloyd George. In its involvements it has become almost incomprehensible to Americans.

In Portugal the spread of Bolshevism has so alarmed the neighboring governments that it is proposed that Spain, Italy and France shall jointly occupy and administer the country under a mandate from the League of Nations. In India there is still much unrest although news of it has been stifled while the Prince of Wales is there, and in Washington a discordant note is occasionally to be heard at the Disarmament Congress.

In so far as our domestic situation is concerned the one weak point is the farmer's predicament. In 1910 there were 12,659,082 persons or 33.2 per cent of the nation's workers, who were engaged in agriculture, forestry and animal industry. By Jan. 1, 1920, the number so employed had fallen to 10,951,074 or 26.3 per cent, and a report just issued by the census bureau shows that during the year 1920 no less than 7 per cent of those employed in rural pursuits had moved cityward.

There are some who are complaining that there is an agricultural "bloc" in Congress which concerns itself chiefly in protecting farmers.

But is this surprising? As I write I have before me a resolution passed by the board of supervisors of Pocahontas County, Iowa, in which the purchase of corn for "fuel to heat the Court House, County Home and Insane Asylum" is ordered because "the price of corn is less than one-third of a cent a pound while coal costs more than two-thirds of a cent a pound." This resolution states in succinct form a problem to which our economists and statesmen may well address themselves. If a solution for it can be promptly found we shall enjoy great and sustained prosperity.

Tests on Ball Bearings

At the suggestion of the Navy Department, the Bureau of Standards undertook to determine the maximum safe load and the static friction under load of ball and flexible roller bearings. Tests were made on balls and rollers of different sizes and with races having different radii. The hardness of the balls, rollers and races also varied.

The results of this work are described in Technologic Paper No. 201 of the Bureau of Standards, obtainable from the Superintendent of Documents, Washington, D. C., at 10 cents per copy. The methods of conducting the tests are described, and conclusions given which will be of value to any one interested in the design of ball and roller bearings.

Decision of Railroad Labor Board Establishes "Open Shop"

The decision handed down by the United States Railroad Labor Board, and which became effective Dec. 1, created considerable comment throughout the country. One of the most important things which the decision does is put the railroad shops on an "open shop" basis, by recognizing the right of minorities to present their grievances and request remedies or changes in certain conditions. At the same time the board recognizes the unions by upholding the right of collective bargaining.

Recognizing the "open shop" principle as applied to the railroads will mean an annual payroll saving to them of about $50,000,000. It will form the ground work on which the adjudication of all future wage disputes between the roads and their employees will be based. The new rules became effective Dec. 1, and will effect approximately 400,000 employees immediately. When normal conditions are restored more than 450,000 men will be affected.

UNIONS AFFECTED

Eight unions are affected by the decision, all affiliated with the railway employees' department of the American Federation of Labor. They are the Brotherhood of Railway Carmen, International Brotherhood of Blacksmiths, Drop Forgers and Helpers, International Alliance of Amalgamated Sheet Metal Workers, International Association of Machinists, International Brotherhood of Boilermakers, Iron Ship Builders and Helpers and the International Brotherhood of Electrical Workers.

Ben W. Hooper, vice-chairman of the board, announced that this decision will leave that body free to take up the consideration of further wage reductions or increases as soon as applications are made.

During the recent strike crisis the six shop crafts affiliated with the American Federation of Labor—the carmen, sheet metal workers, machinists, boilermakers, blacksmiths and electrical workers—voted not to walk out with the brotherhood but to await the Labor Board's decision on the working rules. Although the decision is considered highly favorable to the railroads and relieves them of most of the rules of which they complained under the national agreement, there is one fact that augurs for its acceptance by the unions.

NO DISSENSION IN BOARD

This is that the present decision is unanimous and is not accompanied by a dissenting opinion from the labor group on the board as was the former one revising twenty-four of the shop-craft rules. That one, handed down six months ago, also lopped $50,000,000 from the roads annual payrolls, according to the board's computation, and was opposed by A. O. Wharton, a member of the labor group. Representation of minorities in grievance cases is provided for, thus doing away with that part of the national agreement, criticized as forcing the "closed shop."

The principle of the "open shop" established by the new rules will, in fact, be more theoretical than practical at the present time, since a large majority of the railroad shops are unionized and the existing unions are recognized by the board and by the Transportation Act as representatives of the majority.

Most of the older working rules, sanctioned by the experience of years, are preserved in full effect. Many of the more rigid rules, however, are considerably relaxed in favor of the roads, although recognized rights of the men are fully protected and the principle of collective bargaining and union recognition is retained as contemplated by the Transportation Act.

Mechanical Engineering Leads

Of the 9,084 resident students enrolled in the University of Illinois this term, 1,892 undergraduates have registered in architecture and engineering in the college of engineering. Mechanical engineering leads with an enrollment of 418. The courses offered and the number of students in each, are as follows:

Architecture	112
Architectural engineering	129
Ceramic engineering	72
Chemical engineering	218
Civil engineering	336
Electrical engineering	415
General engineering	43
General engineering physics	2
Mechanical engineering	418
Mining engineering	86
Municipal and sanitary engineering	10
Railway engineering	51
Total	1,892

J. L. Blair, of Niles Tool Co., Dead

Joseph L. Blair, secretary and assistant treasurer of the Niles Tool Works Co., of Hamilton, Ohio., died at his home in that city on Nov. 18. He was 60 years old.

Mr. Blair entered the employ of the Niles company in 1878 and advanced rapidly through various positions to that which he held at the time of his death. He was at one time office manager of the Gordon & Maxwell Co., a subsidiary of the Niles company. In 1890 he was appointed purchasing agent for the Niles company. In 1888 he was elected secretary and in 1912 acquired the additional office of assistant treasurer.

JOSEPH L. BLAIR

Mr. Blair was greatly interested in welfare work in Hamilton, being a director in the Y. M. C. A. and a supporter of church and community activities.

His many friends in the machine tool industry have lost a true and brilliant friend and co-worker.

R. A. Feiss Elected to Presidency of the Taylor Society

Richard A. Feiss, of Joseph & Feiss Co., Cleveland, Ohio, was elected president of the Taylor Society at its annual meeting, held in New York City on Dec. 1, 2 and 3. Other officers elected were Robert B. Wolf and H. K. Hathaway, vice-presidents; E. W. Clark, treasurer, and H. S. Persons, managing director.

The board of directors for 1922 comprises Ida M. Tarbell, of New York; L. Herbert Ballou, of Boston; R. M. Hudson, of Peoria, Ill., and J. C. Heckmann, of New York.

The conference opened on Thursday with the regular business meeting, at which reports of committees and election of officers took place. In the evening the society heard a very interesting discussion on the technique of the appraisal of the efficiency of an industry. L. W. Wallace, executive secretary of the F. A. E. S., presided.

The meeting resolved itself into a spirited discussion of the valuation sheet devised and used by the engineers of the Committee on Elimination of Waste in Industry. C. E. Knoppel, of New York, explained the use of the sheet and the audience was asked to criticize or offer suggestions for improving the method.

On Friday morning W. E. Freeland, of the Winchester Arms Co., led a discussion on sales engineering. He presented a report, based on the answers to a questionnaire sent out by the society, and gave some excellent suggestions on sales research, sales promotion and merchandise control.

At the same session Charles F. O'Connor, of the Universal Winding Co., read a paper on production management. He discussed the abnormal conditions of the market, brought on by the war, and the change from a sellers' to a buyers' market.

The Friday afternoon session was devoted to a discussion of sales cost accounting by Charles P. Staubach, of the Burroughs Adding Machine Co. In the evening W. H. Leffingwell presented a paper on the principles of scientific management in the office.

Other papers read at the remaining sessions were: "General Control of Business," by John H. Williams; "Combination Routing," by D. J. Walsh, Jr.; "Formula for an Efficient Workman," by Boyd Fisher.

The meeting ended Saturday noon with a luncheon in honor of Henry R. Towne, honorary president of the society. Mr. Feiss, newly elected president, presided.

Auto Body Builders To Exhibit

The Twelfth Regiment Armory, New York City, has been selected for the first automobile body show, to be held on Jan. 9 to 14, 1922, under the auspices of the Automobile Body Builders Association.

The exhibits will be confined to commercial and passenger car bodies and to the materials and parts that are used in fabricating them. Bodies of every type will be shown. Some will be finished and trimmed, others will be in the "white" making possible an examination of framing, metaling and other constructive features.

The show is under the management of the Body Builders Exposition Co., Inc., 1819 Broadway, New York City.

Business Items

The Exeter Machine Works, Inc., of West Pittston, Pa., announces the appointment of the W. P. McKenzie Co. as exclusive sales agent for the Exeter rotary pump line in the Philadelphia and Baltimore districts. The MacKenzie company specializes in the marketing of pumping machinery, with offices in the Pennsylvania Bldg. in Philadelphia and in the Equitable Bldg. in Baltimore.

The Hicks-Crawford safety device for air hammers and drills was recently demonstrated at the Terre Haute boiler works, at Terre Haute, Ind., before a gathering of men interested in mechanics and in safety appliances. Encouraged by the approval of such men as Dr. Phillip Woodworth, president of Rose Polytechnic, E. T. Hazeldine, machine shop owner, and Harry Cliff, of the Terre Haute Boiler Works, the firm of Griffith, Hughes & Merrifield has organized a company of Terre Haute people for the manufacture and distribution of the device. The idea was perfected and the model made by D. M. Crawford, of the Crawford-McCrimmon Machine Co., of Brazil, Ind., and he is a partner in the patent rights on the appliance.

Loy & Nawrath Co., of Newark, N. J., manufacturer of presses and sheet-metal machinery, has opened offices at 30 Church St., New York City.

The J-B Engineering Sales Co., of Hartford, Conn., has moved into larger quarters at 54 Church St., in that city. Increase in the company's business made this change necessary. The company specializes in power-plant equipment and is a distributer for Sells roller bearings, Royersford products, Terry steam turbines, the Griscom-Russell Co., and the Conveyer Corporation of America.

The Welborn Corporation, of Kansas City, Mo., has acquired the patents, plant and equipment of the Coleman Tractor Co. The Welborn organization was recently incorporated with a capital stock of $4,000,000. Officers are: F. I. Welborn, president; A. Coleman, secretary; L. N. Burns, counselor.

The Pittsburgh Machinery Co., Pittsburgh, Pa., has been taken over by the Bradley Company. The old business will be continued along the same lines at 301 Jones Law Building.

A series of tests of semi-automatic rifles for Army use was begun Nov. 28 at the United States Armory in Springfield, Mass. Rifles were first submitted by the Colt Manufacturing Co. and the United States Machine Co. A testing board of the War Department, of which Gen. Samuel Hof is senior member, conducted the tests. Others present were Gen. Fred H. Phillips, secretary of the National Rifle Association; Col. Charles E. Stodter, director of civilian markmanship, Gen. William S. Pierce and Col. E. D. Bricker of the Ordnance Department.

It was recently announced by W. H. Sullivan, mayor of Bogalusa, La., that the Southern Lumber Co., will erect a new million-dollar paper making plant in Bogalusa. The plant will be equipped with the latest and most efficient machinery, and will be a duplicate of the present Bogalusa Paper Company's plant.

Through a complaint filed by the Warner & Warner Co., the Jersey City court has appointed E. B. Twardus, of Newark, as receiver for the Modern Tool and Machine Works, Inc., Newark.

The Milwaukee Tool and Forge Co. has moved to South Milwaukee, Wis. An increase of $50,000 in the capital stock of the company has been authorized.

The Karge-Baker Corporation, manufacturer of the Karge flexible couplings and transmissions, has moved its plant and main office from Phoenix, N. Y., to 658 Ellicot St., Buffalo, N. Y.

Personals

R. E. Chamberlain has been promoted to the position of general sales manager of the Packard Motor Car Co.

Arthur L. Stone, formerly sales manager of the Buffalo, N. Y., district for the Toledo Scales Co., has been transferred to the Atlanta branch as Southern district manager.

Josiah T. Rose, vice-president of the J. B. McCrary Co., industrial engineers of Atlanta, Ga., and formerly vice-president of the Atlantic Steel Co., of Atlanta, has been named collector of internal revenue for Georgia under the Harding administration.

D. J. Askew has purchased a site in Dothan, Ala., for the construction of a warehouse and machine shop.

C. W. Wrenshall, recently named general manager of the Pressed Steel Car Co., at Pittsburg, was formerly prominently identified with the iron and steel industries in the South, being manager of the Elliot Car Works, at Anniston, Ala., a plant formerly operated by the Pittsburg company.

Otto Agricola, head of the Gadsden, Ala., pipe manufacturing plant which bears his name, has been elected to the presidency of the Gadsden Chamber of Commerce.

H. P. Hoffstat, president of the Koppel Industrial Car Co., of Pittsburgh, Pa., has been elected vice-president of the Pressed Steel Car Co. He will retain his connection with the Koppel Company.

C. W. Wrenshall has been appointed general manager of the Pressed Steel Car Co., of Pittsburgh, Pa.

Charles M. Sullivan has joined the sales force of Manning, Maxwell & Moore, Inc., of New York, in charge of the Shaw crane department. He was formerly sales manager in the Pittsburgh district, for the Milwaukee Electric Crane and Manufacturing Co.

B. B. Evans has been appointed sales manager in charge of the Pittsburgh district of the Milwaukee Electric Crane and Manufacturing Co.

F. E. Cooper, of the Clark Equipment Co., gave an illustrated lecture on the manufacture of drills before the Purchasing Agents Association, of Pittsburgh, on Nov. 15.

H. M. Bush, of Columbus, Ohio, has been appointed sales representattive in central Ohio for the Diamant Tool and Manufacturing Co., Inc., manufacturer of standard punch and die sets. **Russell Propes**, of Norristown, Pa., has been commissioned in a similar capacity in the southeastern Pennsylvania district.

William M. Moody, formerly connected with Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, Pa., is now with Chas. C. Moore & Co., San Francisco, Cal. This is the Pacific Coast branch of the Babcock & Wilcox Co., manufacturer of water-tube steam boilers.

Harry W. Giffin has opened a consulting and general engineering office in Springfield, Mass.

William N. McMunn, previously with the Whitman & Barnes Manufacturing Co., Chicago., Ill., is now with the the Parish & Bingham Corporation, Cleveland, Ohio.

Charles A. Stoddard has been appointed superintendent of the Moore Shipbuilding Company at Oakland, Cal.

Stanley P. Rockwell, formerly vice-president of the Weekes-Hoffman Company, Syracuse, N. Y., and more recently metallurgist for the Whitney Manufacturing Co., Hartford, Conn., has opened offices in Hartford for the practice of consulting metallurgical engineering.

Charles Adams, formerly a sales engineer with the Standard Roller Bearing Co., of Philadelphia, Pa., is now identified with the Bearings Company of America as sales engineer in the Eastern territory.

C. A. Peckham, president of the Toledo Bridge and Crane Co., Toledo, Ohio, has been elected a director of Canadian Austin Machinery, Ltd., Woodstock, Ont., Canada, a new organization of which B. A. Linderman, president of the Linderman Steel and Machine Co., Muskegon, Mich., and John Ross Shaw, vice-president of the Canadian Linderman Co., Ltd., are president and vice-president respectively.

Obituary

John J. Edson, Jr., president of the Pittsburgh Water Heater Co., died at his home in Pittsburgh on Nov. 15. He was a son of John J. Edson, president of the U. S. Chamber of Commerce.

Walter H. Wesson, former president of Smith & Wesson, firearms manufacturers, died at his home in Springfield, Mass., on Nov. 29. He was 71 years old. He was born at Grafton, Mass., a son of Daniel P. Wesson, founder of the firm of Smith & Wesson. He entered the factory of his father's company in a minor capacity, later being advanced to the office of secretary. He also served as vice-president and treasurer of the company before being elected president.

Henry S. Hale for the last thtirty years connected with the Hale & Kilburn Manufacturing Co., died on Nov. 26 at Dixville-Notch, New Hampshire. Mr. Hale has long been identified with the manufacture of pressed steel products in the automobile trade.

James McCann, Sr., who for sixty years has been active in the management of the Henry Disston & Sons Co., manufacturer of saws, died at Glenolden, Pa., on Nov. 26.

Book Reviews

Waste in Industry. By the Committee on Elimination of Waste in Industry of the Federated American Engineering Societies; 409 pages, 6 x 9 in.; illustrated by tables and charts. Published by Federated American Engineering Societies, Washington, D. C. McGraw-Hill Book Co., Inc., 370 7th Ave., New York, sole selling agents. Price $4.

The preliminary report of the Committee on Elimination of Waste in Industry of the Federated American Engineering Societies was received by engineers with considerable criticism, which was undoubtedly justified to a certain extent, but which was partly due to the haste made necessary by the working schedule laid down for the industrial survey undertaken. The final report which has just appeared contains tabular matter some of which has little interest, but which includes material that should be vitally interesting to all those engaged in industry and to the public as well. It has been said that the conclusions reached could have been set down beforehand by any good economist. This may be true, but does it detract from the value of the dictates of common sense to have them corroborated by the figures obtained by an engineering survey?

Chapter I tells of the organization of the survey work and of the difficulties encountered. It also includes the remarkable calendar of the progress of the work which was instituted in January, 1921, and completed in July, when the final report was approved by the committee.

The second chapter is devoted to a summary of the various sources and causes of waste in the different industries studied, and the third to the general recommendations for their elimination. Even if little new material is offered here, it is worth while to have it in the form presented.

The following chapter gives the complete questionnaire used by the field investigators. This particular section is worth the price of the whole book to any manager who will take the questions and apply them to his own plant. He cannot fail to discover sources of waste that will repay in actual cash savings many times over. The average waste in the fifteen metal trades plants studied was 28 per cent, and the individual figures ranged from 6 to 56 per cent. It is a matter for congratulation that the average of efficiency for plants in the metal trades was apparently rather higher than those of the other industries studied, but there is still room for vast improvement.

Chapters V to X constitute Part II, which is headed "Engineers' Field Reports." The six industries included are the building industry, men's clothing manufacture, shoe manufacturing, printing, metal trades and textile manufacturing. The metal trades' report is naturally the only one of special interest to readers of the *American Machinist*, but the others are worth reading for general information.

As stated above, fifteen plants were studied in the metal trades group under the direction of Fred J. Miller, past president of the A. S. M. E., and former editor of the *American Machinist*. Among other things this report emphasizes the wastes involved in labor turnover, lack of standardization, lack of adequate cost control and cost systems and the shortcomings of management and labor.

Seven general reports are gathered together under Part III. They are not engineering reports nor are they new, but they serve to add digests of certain broad aspects of waste in industry to round out the whole report. The subjects covered are unemployment, strikes and lockouts, legal machinery for adjusting disputes, industrial accidents, health of industrial workers, eye conservation and purchasing and sales policies.

Annual Report of the Smithsonian Institute. Washington, D. C., 1919. Five hundred forty-six 6 x 9-in. pages, cloth board covers, illustrated.

This book describes the activities and condition of the institute for the year ending June 30, 1919. Its contents include chapters on the establishments of the institute, researches and explorations, National Museum, International catalog of scientific literature, and many scientific papers There is also an appendix containing eight reports, on such subjects as the "Bureau of American Ethnology," "National Zoological Park," etc.

Trade Catalogs

Thread Cutting Tools: Williams Tool Corporation, Erie, Pa. A 5 x 7-in. catalog, 60 pages, presenting an interesting subject in a most unusual way. It is a story, or rather a comparison, of a business and a pleasure venture, carrying through its pages, a very strong moral. Each phase of the story describing the successive incidents in the venture, are very correctly illustrated; each ends with a moral. The rest of the brochure is devoted to subjects relative to pipe threading, tooling, oiling, proper selection of dies and some descriptions of Williams patented machines.

Grinnell Oil Piping. Grinnell Company, Providence, R. I. October issue of the "Grinnell Bulletin," devoted to a description of the work of converting 20,000 tons of pipe and fittings into six distinct piping systems 69 miles long.

"Northern" Cranes. Northern Engineering Works, Detroit, Mich. Bulletin No. 517 illustrating the use of electric traveling "Northern" cranes in foundry service.

Baker Boring and Drilling Machine. Baker Brothers, Toledo, Ohio. Catalog describing and illustrating the No. 121 light heavy-duty boring and drilling machine, the latest product of the company. Photographs of parts and details are included as well as easily readable specifications.

Radial Wall Drills. Pawling & Harnischfeger Co., Milwaukee, Wis. Bulletin No. 206, describing and illustrating the latest perfection of P & H wall drill, the No. 6. It is particularly adapted for interior or exterior drilling of steel drums and drilling and reaming of structural material.

Dry Vacuum Pumps. Chicago Pneumatic Tool Co., Chicago, Ill. Bulletin No. 710, giving a detailed description, with illustrations, of pneumatic dry vacuum pumps. Several types are shown including steam, belt and motor driven.

Cylinder Refinishing Machines. Bridgeport Cutter Works, Inc., Bridgeport, Conn. An eight-page circular describing a newly designed machine for finishing automobile cylinders by the use of a herringbone reamer instead of the usual grinding operation.

Cylinder Planers. Morton Manufacturing Co., Muskegon Heights, Mich. Bulletin No. 7, describing the latest model traveling head, draw-cut cylinder planer, built in 40- and 60-in. stroke, for railroad work. Specifications and lists of standard equipment are included; illustrations show planers performing various operations on railroad equipment. Another bulletin, No. 8, describes the draw-cut, traveling head planers arranged for boring and milling. These are built in 48-, 60-, 72- and 84-in. stroke, any length of bed.

Pillar Shapers. Smith & Mills Co., Cincinnati, Ohio. Catalog No. 2, describing a line of plain or single geared crank shapers, pulley or motor driven shapers, automatic attachments, tables, feed attachments and vises.

Brown Pyrometer. Brown Instrument Co., Philadelphia, Pa., a four-page circular announcing two improvements in the Brown high-resistance pyrometer—an automatic cold junction compensation and means of zero adjustment.

Graham Grinders. Graham Manufacturing Co., Providence, R. I. Circular B describing the new Graham grinder for rapid and accurate production of flat surfaces.

Excavating Equipment. Pawling & Harnischfeger Co., Milwaukee, Wis. Bulletin No. 56 X, describing a comprehensive line of excavating tools including cranes, scoops, buckets, dredges, pile drives, shovels and many other machines.

Time Studies. Smalley General Co., Inc., Bay City, Mich. Series "C" giving the results of a time study on a Smalley General thread miller, No. 23, cutting a machine steel gage.

Precision Ball Bearings. The Norma Company of America, Long Island City, N. Y. A small circular covering a line of ball, roller, thrust and combination bearings.

"National" Hammer-weld pipe. National Tube Co., Pittsburgh, Pa. Bulletin No. 13, describing a new product which this company has added to its line—hammer-weld pipe. Detailed drawings of the way the weld is made, as well as illustrations of the machines used in bending and rolling the pipe are included. Several pages are devoted to charts and tables of specifications.

Catalogs Wanted

The National School of Arts and Trades, of Lima, Peru, would be pleased to receive catalogs and other literature on metal- and wood-working machinery.

The Monarch Machine Tool Co., Sidney, Ohio, would like to have catalogs from makers of combined milling and gear cutting attachments for application to lathes.

Fonias Guillein, P. O. Box 25, Tampico, Tamanlipas, Mexico, requests catalogs and other literature concerning the manufacture and sale of machines for making steel brushes used in sweeping machines.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A manufacturing company in Mesopotamia desires to secure the representation of manufacturers of copper and brass sheets. Reference No. 257.

A commercial agent in Cuba desires to secure the representation of firms for the sale of iron and steel. Reference No. 260.

A manufacturing company in England desires to purchase a machine for making motor-car radiator tubes. Quotations should be given c.i.f. English port. Terms: Cash on receipt of machine. Reference No. 261.

An agency is desired by a firm in Wales for the sale of motorcycles and side cars of every description, of 6 hp. for side cars, and 4 hp. and 2¾ hp. for single cycle work. Quotations should be given c.i.f. Swansea or Bristol channel ports. Reference No. 276.

A commercial agent from Australia is in the United States and desires to secure the representation of manufacturers for the sale of goods throughout Australia, particularly in general mechanical lines. Reference No. 278.

A merchant in France desires to secure an agency for the sale of metallurgical supplies, agricultural machinery, automobiles, and all articles of a mechanical nature. Quotations should be given c.i.f. French port. Correspondence should be in French. Reference No. 279.

A retail merchant in Chile desires to purchase hardware, machinery and automobiles. Quotations should be given c. i. f. Talcahuano or Corral. Correspondence should be in Spanish or German. Reference No. 172.

A merchant in France desires to secure an agency for the sale of automobiles, automobile accessories, hardware, tools, and specialty lines. Reference No. 368.

Forthcoming Meetings

American Engineering Council: Annual meeting Jan. 5 and 6, at Washington, D. C. L. W. Wallace, secretary.

American Institute of Weights and Measures: Annual meeting Dec. 9, Engineering Societies Building, New York City. C. C. Stutz, secretary.

Society of Automotive Engineers: Annual meeting Jan. 11 to 13, Engineering Societies Building, New York City. C. F. Clarkson, secretary.

American Society of Civil Engineers: Annual meeting Jan. 18 and 19, Engineering Societies Building, New York City. Charles W. Hunt, secretary.

United Engineering Societies: Annual meeting Jan. 26, Engineering Societies Building, New York City. A. D. Flinn, secretary.

American Institute of Electrical Engineers: Mid-winter meeting Feb. 15, 16 and 17. Engineering Societies Building, New York City, F. L. Hutchinson, secretary.

American Institute of Mining and Metallurgical Engineers: Annual meeting Feb. 20 to 24, Engineering Societies Building, New York City. B. Staughton, secretary.

NEW *and* ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Conn., Bridgeport—Crane Co., South Ave., manufacturer of valves, etc.—annealing furnaces.

N. Y., New York—The Amer. Locomotive Co., 30 Church St.—

One No. 3 La Pointe broaching machine.
One No. 4 Cincinnati vertical milling machine.
Two 6-A automatic chucking and turning machines.
One 2-X automatic tapping machine.
One No. 3 universal milling machine.
One 5 ft. and one 3 ft. radial drill.
Two 2-B two spindle column type high speed drills, maximum capacity ⅞ in. hole in steel, 15 or 21 in. overhang.
One Colburn D-6 drill, 37 in.
One 10 in. vertical tool room shaper.
One 24 in. and one 18 in. pillar shaper.
One 12 x 60 in. plain grinder.
One 8 x 18 in. plain grinder.
One Heald grinder No. 70.
One Besly 29-53 vertical grinder.
One Besly 6 x 20 in. grinder.
One Greenfield cutter grinder.
One 12 x 36 in. universal grinder.
One No. 2 surface grinder.
One Low-Swing lathe, 4 x 84 in.
One 38 or 42 in. vertical turret lathe.
One 18 in. x 5 ft. engine lathe.
One 16 in. x 8 ft. tool room lathe.
One 18 in. x 8 ft. tool room lathe.
One 50 ton Lucas geared press.
Three 22 in. lever drill presses.
One No. 31 Lucas precision horizontal boring mill.
One Whitney hand miller.
One Cochran-Bly saw, 7 or 8 in. capacity.
One Peerless saw.

Pa., Hamburg—The Hamburg Boiler Wks. Co.—radial drill for drilling tube holes.

Pa., Philadelphia—Fanning & Schuett Mfg. Co., 502 Ruscomb St.—boring machines, lathes and drills.

Pa., Philadelphia—The Longacre Park Ice Co., c/o S. L. Brumbaugh, 1427 Walnut St.—equipment for garage including, lathe, drill press, grinders, etc.

Pa., Philadelphia—O. J. Maigne Co., 202 South Hutchinson St., O. J. Maigne, Pres.—lathe, 16 to 18 ft. screw cutting gear, motor attached.

Pa., Philadelphia — Roth-Buick Co., Frankford Ave. and Oxford Pike—drills, small lathe, air compressor and motors for service station.

Pa., Pittsburgh—The Amer. Natl. Gas Co., Park Bldg.—equipment for machine shop at Vandergrift.

Pa., Pittsburgh—The Pressed Steel Car Co., Farmers Bank Bldg.—one grinder.

Ala., Birmingham—The Stewart Hilty Machine Co., 1st Ave., W.—one heavy duty drill press to take 2½ in. drill, 3 speed, to be used also for reaming, tapping, facing and countersinking.

Va., Richmond—H. R. Barr Co., 608 West Broad St.—one drill press and small lathe for auto repair work.

Va., Richmond—W. J. Harris Co., 820 West Broad St., W. J. Harris, Purch. Agt. —drill press and small lathes.

Va., Richmond—S. H. Long Co., 1011 West Broad St.—drill press and hand tools for auto repair work.

Ill., Chicago—C. Fuerman, 1532 Monroe Bldg.—one 9 in. bench lathe.

Ill., Chicago—G. Howe, 3656 North Francisan Ave.—spot welder for light gauge metal.

Ill., Chicago—The Underwriters Laboratories Inc., 207 East Ohio St.—one 2 to 3 ft. radial drill press, 2½ ft. preferred, arranged for or capable of being arranged for individual motor drive through gear box, or by variable speed motor.

Ill., Joliet—The Western Metal Products Corp., P. O. Box 1080, A. D. McIntyre, Pres. —One 3 to 10 ton traveling crane, 35 to 50 ft. span, 110 volt. One 2 stage air compressor about 4 in. x 8 in. and 4 in. x 4 in. Two centrifugal acid pumps, 3 in. x 4 in. discharge. One Kelly filter press, type 250, six leaves. Two centrifuges, large size, about 60 in. diameter bottom discharge.

O., Cleveland—The Co-operative Machine Co., 113 St. Clair Ave.—one 4-spindle 1¼ in. capacity automatic screw machine.

O., Youngstown—The Bd. Educ. 20 West Wood St.—tools for manual training schools, including 6-10 in. and 6-13 in. lathes.

Wis., Beloit—P. F. Mork, 94 State St.—lathe, vulcanizer and air compressor for auto repair work.

Wis., Clintonville—E. Heyer—special machinery for cylinder regrinding.

Wis., Janesville—C. E. Moore, 428 North Washington St.—lathe, drill press and grinder for small machine shop work.

Wis., Lancaster—Grant County, H. Mink, Highway Comr.—lathe, grinder, drill presses and electric motors, suitable for repairing road building machinery.

Wis., Milwaukee—The Backman Motor Co., 242 4th St. C. H. Backman, Purch. Agt.—drill press.

Wis., Milwaukee—The Eschenberg Sheet Metal Wks., 827 5th St., L Eschenberg, Purch. Agt.—One 8 in. gutter beater.

Wis., Milwaukee—The Federal Safety Mfg. Co., c/o J. E. Lee, 103 28th St.—drill press and motor.

Wis., Milwaukee—O. Herde, 191 23rd St. —one lathe.

Wis., Milwaukee—The Ideal Sheet Metal & Heating Co., 728 Pearl St., A. Schier, Purch. Agt.—one 10 in. gutter beater.

Wis., Milwaukee—The Poplar Garage, 6th and Poplar Sts., T. H. Merrill. Purch. Agt. —arbor press and power grinder.

Wis., Milwaukee—The Standard Sheet Metal Wks., 1184 24th St., J. Madis, Purch. Agt.—one square shear.

Wis., Milwaukee—The Wisconsin Sheet Metal & Furnace Wks., 636 12th St.—one 30 in. folder.

Wis., Sparta—The Atkinson Nash Co.—equipment for auto repair shop.

Minn., St. Paul—The Bd. Educ., L. G. S. Ferguson, Comr.—manual training and machine shop equipment.

N. Y., Buffalo—The Excelso Specialty Wks., 119 Clinton St.—one 12 x 15 printing press.

N. Y., New York—The Amer. Sugar Refining Co., 117 Wall St.—eight woodworking machines.

Pa., Fairchance—Wilson Bros. Coal Co., c/o C. Wilson,—belt and retarding conveyor for new coal tipple.

Pa., Norristown—Rambo & Regar, Main St.—knitting machines, reelers, spinners, etc. for proposed hosiery mill at Conshohocken.

Pa., Philadelphia—P. R. Devine Cut Stone Co., 2859 Tulip St., A. Devine, Mgr.—one double drum hoist and one portable forge.

Pa., Philadelphia—Farmers Cold Storage Co., c/o G. Sales, Liberty Bldg.—refrigeration machinery.

Pa., Philadelphia—Grubnau Bros., 2nd St. and Erie Ave.—carders, dryers, washers, looms, etc. for proposed wool factory.

Ala., Birmingham — The Birmingham Paper, 2101 Ave. E., T. M. McClellan, Pres. —complete machinery for the manufacture of corrugated paper boxes.

Fla., Archer—The Maddox Fdry. & Machine Co., Inc., H. Maddox, Pres. and Mgr.—one 5 to 6 ton compression ice machine, direct connected to a steam engine, with equipment for 2 cold storage rooms, 12 ft. x 24 ft.

Ky., Maysville—W. P. Farley Co.—complete machinery and equipment for bakery.

N. C., Sanatorium—H. Geiger—machinery for grinding sawdust for floor preparation.

Va., Ft. Royal—Gooney Manor Copper Co., Inc., H. E. Naylor, Vice Pres.—one Leyner water, air rock drill, steam driven air compressor of 150 cu. ft. per min. free air, 500 ft. ¾ in. or ⅞ in. wire cable for hoist, (must be in first class condition), also one 5,000 gal. tank for water reservoir, wood or steel.

Ill., Bloomington—Martens-Leary Co., manufacturer of vehicles, etc.—forge, vises and emery wheel.

O., Cleveland—E. S. Chamberland, 36 Murray St., New York, Purch. Agt. for the Natl. Tool Co. of Cleveland—several molding machines.

O., Columbus—The Gall Cure Collar Pad Co., 1675 South High St., D. S. Brown, Pres. —full line of machinery for the manufacture of horses collars and pads.

O., Orrville—The Sanderson Cyclone Drill Co.—one 10 ton crane.

Wis., Cudahy—Cudahy Bros., E. F. Lawler, Purch. Agt.—one nailing machine.

Wis., Hartford—The Church Hill Diary Co., c/o W. Hahn, Route 4—creamery machinery including separators, belt driven.

Wis., Milwaukee—G. O. Dallman, 375 Manitoba Ave.—one band saw and one circle saw.

Wis., Milwaukee—A. W. Schmidt, 997 Greenfield Ave.—mechanical baking equipment for proposed bakery on 23rd Ave.

Wis., Milwaukee—J. Schroeder Lumber Co., foot of Walnut St., E. J. Springer, Purch. Agt.—woodworking machinery to manufacture ice cream tubs and wooden pails, for plant at Two Rivers.

Wis., Plymouth—The Plymouth Weaving Wks., manufacturers of rugs, etc., W. F. Suckon, Purch. Agt.—weaving machinery and 4 looms.

Wis., Racine—The E. L. M. Tire Co., Deane Blvd. — special machinery and motors.

Wis., Wauwatosa—Modern Builders, Inc., Spring Ave. and Vliet St., R. Van Nostrand, Purch. Agt.—

One ¾ in. chisel mortiser, plunger type.
One 6 or 8 in. shaper.
One trim saw.
One 20 in. jointer.
One large band saw.
One 30 in. planer.
One sash sticker.

The Weekly Price Guide

This Week's Market

Blue annealed steel sheets, base size, are quoted at $3.28 as against $3.53 per 100 lb. in the New York warehouses. Reduction of 20c. also quoted on structural and cone head boiler rivets. Mill prices of structural steel still quoted at $1.50 for large tonnages; small lots $1.60.

Electrolytic copper is quoted at 14⅜c. as against 14¼c.; tin at 31⅜c. as compared with 30c. per lb. one week ago. Copper sheets are down ¾c.; copper bars and tubing up ¼c. and brass rods, sheets and tubing advanced ½c. per lb. in New York warehouses.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$22.50
Northern Basic	22.02
Southern Ohio No. 2	23.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	28.50
BIRMINGHAM	
No. 2 Foundry	18.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	23.26
Virginia No. 2	28.74
Basic	20.75
Grey Forge	22.50
CHICAGO	
No. 2 Foundry local	21.70
No. 2 Foundry, Southern, sil 2.25@2.75	24.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	22.46
Basic	20.96
Bessemer	21.96

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.25@2.50	3.28	3.10	3.38
No. 12	2.30@2.55	3.33	3.15	3.43
No. 14	2.35@2.60	3.38	3.20	3.48
No.16	2.55@2.80	3.48	3.30	3.58
Black				
Nos. 17 and 21.	2.60@2.85	3.80	3.55	3.95
Nos. 22 and 24.	2.65@2.90	3.85	3.60	4.00
Nos. 25 and 26.	2.70@2.95	3.90	3.65	4.05
No. 28	2.75@3.00	4.00	3.75	4.15
Galvanized				
Nos. 10 and 11.	2.75@3.00	4.00	3.75	4.15
Nos. 12 and 14.	2.85@3.10	4.10	3.85	4.25
Nos. 17 and 21.	3.15@3.40	4.40	4.15	4.55
Nos. 22 and 24.	3.30@3.55	4.55	4.30	4.70
No. 26	3.45@3.70	4.70	4.55	4.85
No. 28	3.75@4.00	5.00	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel			Iron		
BUTT WELD					
Inches	Black	Galv.	Inches	Black	Galv.
¾ to 3	68½	56	¾ to 1½	44½	29½
LAP WELD					
2	61½	49	2	39½	25½
2½ to 6	65½	53	2½ to 4	42½	29½
7 to 8	62½	49	4½ to 6	42½	29½
9 to 12	61½	48	7 to 12	40½	27½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
¾ to 1½	66½	55	¾ to 1½	44½	30½
2 to 3	68½	56			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59½	48	2	40½	27½
2¼ to 4	63½	52	2¼ to 4	43½	31½
4¼ to 6	62½	51	4½ to 6	42½	30½
7 to 8	58½	45	7 to 8	35½	23½
9 to 12	52½	39	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	63%	49%	60½%	47½%	60%	46%
3½ to 6 in. steel lap welded	54%	40%	58½%	44½%	57%	43%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	5.00	6.00	4.28
Spring steel (light) (base)	6.00	6.00	3.68
Coppered Bessemer rods(base)	8.00	8.00	6.03
Hoop steel	3.53	3.14	3.28
Cold rolled strip steel	6.25	8.25	6.75
Floor plates	4.85	2.64@2.80	5.23
Cold finished shafting or screw	3.88	3.50	3.83
Cold finished flats, squares	4.38	4.00	4.35
Structural shapes (base)	2.78	2.64	2.88
Soft steel bars (base)	2.68	2.54	2.78
Soft steel bar shapes (base)	2.68	2.54	2.78
Soft steel bands (base)	3.28	....	3.48
Tank plates (base)	2.78	2.92½	2.88
Bar iron (2.00@2.10 at mill)	2.68	3.52	2.78
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
3/32	8.50		12@13
1/8	7.15		11@12
5/32 to 1/4	6.75		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.37½
Tin, 5-ton lots, New York	31.37½
Lead (up to carlots), St. Louis, 4.60; New York	5.00
Zinc (up to carlots), St. Louis, 4.97½; New York	5.37½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.20	20.00	20.00
Antimony (Chinese), ton spot	5.50	6.50	6.00
Copper sheets, base	21.00	22.00	22.50
Copper wire (carlots)	16.50	17.00	15.75
Copper bars (ton lots)	19.75	24.00	19.00
Copper tubing (100-lb. lots)	21.25	24.00	22.50
Brass sheets (100-lb. lots)	16.75	17.00	18.25
Brass tubing (100-lb. lots)	18.50	19.50	20.00
Brass rods (1,000-lb. lots)	14.75	16.00	15.25
Zinc sheets (casks), (8% dis. carlots)	11.00	10.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ½), (case lots)	19.50	21.00	18.00
Babbitt metal (best grade)	22.00	39.75	34.00
Babbitt metal (commercial)	9.50	13.50	8.00

—Shop Materials and Supplies

MONEL METAL—Base price in cents per lb., f.o.b. Bayonne, N.J.:

Shot	35.00	Hot rolled machined rods (base)	53.00
Blocks	35.00	Hot rolled rods (base)	42.00
Ingots	38.00	Cold drawn rods (base)	56.00
Sheet bars	40.00	Hot rolled sheets (base)	55.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grades "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.75	10.25
Copper, heavy, and wire	9.50	10.75	9.50
Copper, light, and bottoms	8.00	8.25	8.25
Lead, heavy	4.00	3.75	3.75
Lead, tea	3.00	2.75	3.00
Brass, heavy	6.50	6.25	8.00
Brass, light	5.00	4.25	5.50
No. 1 yellow brass turnings	5.25	5.00	5.25
Zinc	3.00	2.00	2.75

TIN PLATES—American Charcoal Plates—Bright—Cents per lb

	New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:			
IC, 20x28, 112 sheets	20.50	19.00	18.50
IX, 20x28, 112 sheets	23.00	21.50	20.90
"A" Charcoal Allaways Grade:			
IC, 20x28, 112 sheets	17.50	16.75	17.00
IX, 20x28, 112 sheets	20.50	19.50	19.60
Coke Plates, Bright			
Prime, 20x28 in.:			
100-lb., 112 sheets	12.50	12.00	14.50
IC, 112 sheets	12.80	12.30	14.80
Terne Plate			
Small lots, 8-lb. Coating:			
100-lb., 14x20	7.00	6.10	7.25
IC, 14x20	7.25	6.35	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb.	.055@.09	.09	.10
Wiping cloths per M., 13¼x13¼	....	55.00	55.00
Wiping cloths per M., 13¼x20½	....	65.00	65.00
Sal soda, 100 lbs	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb	2.55	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.72	.77	.76
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 75 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville		per ton	$3.00@3.15
Coke, prompt foundry, Connellsville		per ton	4.00@4.50

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	—50%	—60%	60-10-10%
1⅛ and 1¼x3 in. up to 12 in.	—40%	-60-10-10%	-60-10%
With cold punched sq. nuts	—30%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	—40%	.....	..$4.00 off
Button head bolts, with hex. nuts	—20%	$3.90 net	.....
Hex. head and hex. nut bolts	—20%	....	-65-5%
Lag screws, coach screws	—50-10%	....	—60%
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	—50-10-10%	50-5%
Bolt ends, with hot pressed nuts	—50%	....	—55%
Tap bolts, hex. heads	—20%	....	.....
Semi-finished nuts all sizes	—70%	—75%	—80%
Case-hardened nuts	—60%	....	.....
Washers, cast iron, ½ in., per 100 lb. Off list	$5.00	$5.50	$3.50 net
Washers, cast iron, ⅝ in. per 100 lb. Off list	4.25	3.75	3.50 net
Washers, round plate, per 100 lb. Off list	3.00	....	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	2.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	2.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.50	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.50	3.00	4.00
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	-50-10%	60-10-10%	-65-5%
Rivets, tinned	-50-10%	60-10-10%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$3.50	3.50	3.43
Cone heads, ditto (net)	3.60	3.60	3.53
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅞ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$4.03 base
Copper rivets	—50-10%	—40-10%	—50-10%
Copper burs	—25-10%	—15%	—10%

	New York	Cleveland	Chicago
Lard oil, pure, (50 gal. bbl.) per gal.	$0.90	$0.85	$0.90
Lard cutting oil (50 gal. bbl.) per gal.	0.60	0.50	0.55
Machine oil, lubricating, per gal.	0.45	0.35	.....
Belting—Present discounts from list in fair quantities (½ doz. rolls)			
Leather:			
Light grade	50-5%	50-5%	50-5%
Medium grade	45%	40-10-2½%	.....
Heavy grade	40%	40%	.....
Rubber and duck:			
First grade	50-10%	50-10%	.....
Second grade	60-5%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	List $9.00 less 20-10-5%	50-10-5%'	-20-10%
Emery paper	List 11.00 less 20%	$11.00 net	-20%
Emery cloth	List 32.75 less 10%	32.75 net	-10%
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll	$4.50 net	....	list+10%
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	List $1.65 less 20%	.....	-10%
Cloth	List $3.55 less 10%	.....	-10%

Mo., Harrisonville—The Harrison Ice & Creamery Co.—$5,500 worth of ice manufacturing equipment including compressors, machinery, belts, boilers, etc.

Tex., Plainview—The Texas Utilities Co., B. Scott, Mgr.—machinery for proposed ice cream plant at Lubbock.

Ont., Chesley—The Northern Textiles, Ltd.—machinery and equipment for woolen mill at Wiarton.

Metal Working Shops

NEW ENGLAND STATES

Conn., Bridgeport—Crane Co., South Ave., manufacturer of valves, etc., has awarded the contract for the construction of a 1 story, 75 x 175 ft. addition to its factory. Estimated cost, $70,000. Noted Nov. 24.

Conn., Torrington—The Union Hardware Co., 535 Migeon Ave., will soon award the contract for the construction of a 1 and 2 story, 60 x 300 ft. addition to its factory. Private plans.

Mass., Haverhill—The West Realty Co. has awarded the contract for the construciton of a 2 story, 70 x 181 ft. garage on Water St. Estimated cost, $100,000.

Mass., Springfield—A. A. Geisel, Pecousic St., is receiving bids for the construction of a 1 story, 40 x 400 ft. addition to his plant for the manufacture of auto parts. E. C. and G. C. Gardner, 33 Lyman St., Archts.

MIDDLE ATLANTIC STATES

Pa., Ellwood City—The Ellwood Forge Co., 10th St., has awarded the contract for the construction of a 1 story, 98 x 120 ft. forge plant.

Pa., Philadelphia—Fanning & Schuett Mfg. Co., 502 Ruscomb St., will receive bids until Dec. 10 for the construction of a 1 and 2 story, 50 x 120 ft. machine shop on 3rd and Cayuga Sts. Private plans.

Pa., Philadelphia — The Philadelphia Realty Co., c/o P. Eckert, 111 West Mt. Airy Ave., will build a 3 story, 22 x 218 x 306 ft. garage and repair shop on 48th St. and Woodland Ave. Estimated cost, $150,000.

Pa., Philadelphia — Roth-Buick Co., Frankford Ave. and Oxford Pike, has awarded the contract for the construction of a 1 story, 58 x 87 ft. sales and service station at 4653 Paul St. Estimated cost, $40,000.

Pa., Washington—Tyler Pipe & Tube Co. is receiving bids for the construction of a 1 story, 20 x 50 ft. and 50 x 50 ft. producers house and boiler plant. Estimated cost, $50,000. Simplex Eng. Co., Washington Trust Bldg., Engrs.

Pa., Yeadon—The Longacre Park Ice Co., c/o S. L. Brumbaugh, 1427 Walnut St., Philadelphia, will build a 1 story 32 x 32 ft. and a 1 story, 32 x 164 ft. garage and repair shop. Estimated cost, $40,000. J. T. Hoekstra, 1730 Sansom St., Philadelphia, Archt.

SOUTHERN STATES

W. Va., Fairmont—The Marion Motor Co., 304 Jacobs Bldg., plans to build a 1 story auto machine and repair shop.

MIDDLE WEST STATES

Ill., Chicago—H. J. Westbol, 1559 North Halsted St., will soon award the contract for the construction of a 1 story, 140 x 180 ft. garage. Estimated cost, $45,000. A. Comm, 3227 West Division St., Archt.

Ill., Highland Park—M. Ringdahl has awarded the contract for the construction of a 1 story, 73 x 125 ft. garage. Estimated cost, $48,000.

O., Cleveland—H. Barth & Son. 8801 Clark Ave., have awarded the contract for the construction of a 1 story, 84 x 110 ft. addition to their garage on Clark Ave. Estimated cost, $40,000.

O., Cleveland—E. W. Bliss Mfg. Co., St. Clair Ave. along tracks of New York Central R.R., is having plans prepared for the construction of a 1 story forge shop. Estimated cost, $40,000. Private plans.

O., Cleveland—A. W. Emerick Garage. 16205 St. Clair Ave., will receive bids until about Dec. 15 for the construction of a 1 story, 55 x 150 ft. garage on St. Clair and Holmes Aves. Estimated cost, $50,000. H. W. Steffens, 13000 Forest Hill Ave., Archt.

O., Cleveland—Moody & Thomas Milling Co., 6312 Kinsman Rd., is receiving bids for the construction of a 1 story, 50 x 190 ft. warehouse and garage on Park Ave. and East 66th St. Estimated cost, $50,000. L. R. Walker, 1907 East 66th St., Archt.

O., Cleveland—F. S. Pievits, 6613 Denison Ave., has awarded the contract for the construction of a 2 story, 50 x 80 ft. commercial building and garage at 6601 Deneson Ave. Estimated cost, $40,000.

O., Cleveland—The Schwenger-Klein Co., 515 Woodland Ave., manufacturer of butchers supplies, has awarded the contract for the construction of a 1 story, 90 x 120 ft. factory at 5501 Davison Ave. Estimated cost, $60,000.

O., Cleveland—The Stone Improvement Co., Kirby Bldg., is receiving bids for the construction of a 1 story, 100 x 150 ft. office and garage on East 83rd St. and Carnegie Ave. Estimated cost, $50,000. P. Matzinger & Co., Caxton Bldg., Archts. Noted Nov. 17.

O., Cleveland—Terrill Bros., 1360 Giel Ave., are receiving bids for the construction of a 1 story, 49 x 140 ft. garage at 14325 Euclid Ave. Estimated cost, $40,000. Private plans.

Wis., Milwaukee—M. Tullgren & Sons, Archts., 425 East Water St., are receiving bids for the construction of a 1 story, 60 x 120 ft. garage on Bway., for the Alliance Investment Co., 115 Wisconsin St. Estimated cost, $40,000. Noted Nov. 24.

Wis., Neenah—The Tri-City Nash Co., 526 South Commercial St., is having plans prepared for the construction of a 2 story, 55 x 150 ft. garage on North Commercial St. Estimated cost, $60,000. Private plans. Noted Nov. 24.

Wis., Sparta—The Atkinson Nash Co. has awarded the contract for the construction of a 2 story, 50 x 88 ft. garage on Main St. Estimated cost, $50,000.

WEST OF THE MISSISSIPPI

Ia., Malvern—A. Hall has awarded the contract for the construction of a 1 story, 40 x 60 ft. garage. Estimated cost, $40,000.

Kan., Parsons—The Missouri, Kansas & Texas R.R., Railway Exch. Bldg., St. Louis, Mo., has awarded the contract for the construction of a 1 story machine shop, here. Estimated cost, $50,000. Noted Sept. 8.

Neb., Omaha—Bergman & Henkens have awarded the contract for the construction of a 2 story, 60 x 60 ft. foundry on 11th and Grace Sts. Estimated cost, $40,000.

CANADA

Que., Montreal—The Bramsons Auto Co., Phillips Pl., plans to construct a 3 story garage on Ontario St. Estimated cost, $80,000.

General Manufacturing

Conn., New Haven—The Hull Brewing Co., 14 Whiting St., has awarded the contract for the construction of a 3½ story, 31 x 60 ft. manufacturing plant, etc., on State St. Estimated cost, $40,000.

Me., Sanford—The Goodall Worsted Co. has awarded the contract for the construction of a 1 and 5 story, 235 x 274 ft. storage, combing and spinning mill. Estimated cost, $600,000.

Mass., Haverhill—C. M. Hilley Bros. Co., 30 Pleasant St., will build a 7 story shoe factory on Water, Chestnut and School Sts. Estimated cost, $500,000. Noted Nov. 17.

MIDDLE ATLANTIC STATES

N. J., Homestead—The Atlas Finishing Co. has awarded the contract for the construction of a 3 story factory on Paterson Plank Rd. for finishing dies, etc. Estimated cost, $100,000. Noted Nov. 10.

N. J., Linden—Warner, Quinlan Co., 79 Wall St. New York City, is having sketches made for an oil refinery and asphalt plant here. Estimated cost, $2,000,000. Gifford, Hintze & Baker Eng. Corp., c/o L. B. Walkers, 227 Fulton St., New York City, Archts. and Engrs.

N. J., Pleasantville—P. E. Flotron Co., Lafayette Bldg., Phila., Pa., has awarded the contract for the construction of a 3 story, 100 x 130 ft. ice factory here. Estimated cost, $150,000.

N. Y., Buffalo—The Natl. Lamp Co., Nela Park, East Cleveland, O., is having plans prepared for the construction of a 1 story, 40 x 80 ft. boiler house and gas plant here. Estimated cost, $75,000. G. H. Johnson, Nela Park, East Cleveland, O., Archt.

N. Y., New York—The Family Laundry Corp., 1471 Wilkins Ave., has awarded the contract for the construction of a 2 story laundry on 5th Ave. and 141st St. Estimated cost, $400,000.

N. Y., Rochester — The Pennsylvania Glass Sand Co., 493 West Ave., is preparing plans for the construction of a 1 story, 45 x 105 ft. grinding mill on West Ave. Estimated cost, $50,000. Private plans.

Pa., Philadelphia—P. Hauck & Sons, 1227 North 4th St., have awarded the contract for the construction of a 3 story, 41 x 88 ft. box factory at 1233-35 North 4th St. Estimated cost, $27,000.

Pa., Philadelphia—The Rogers Hosiery Co., has awarded the contract for the construction of a 1 story, 80 x 150 ft. hosiery mill on Wyoming and Germantown Aves. Estimated cost, $29,000.

Pa., Templeton—The Templeton Limestone Co., Kittaning, will build a 30 x 60 ft. crusher plant and a 25 x 25 ft. power plant near here. Estimated cost, $50,000.

SOUTHERN STATES

Ga., Atlanta—The Atlantic Ice & Coal Co., Washington St. Viaduct, has awarded the contract for the construction of a 2 story ice plant on Murphy and Benjamin Sts. Estimated cost, $150,000.

La., Kenner—The Natl. Petroleum Co., Hibernia Bank Bldg., New Orleans, is having plans prepared for an oil refinery and extensive improvements to its holdings here. P. A. Leslie, mgr.

MIDDLE WEST STATES

Ill., Joliet—The Flint Sanitary Mills Co., c/o G. and T. Flint, is having plans prepared for the construction of a dairy. Estimated cost, $150,000. H. A. Hahn, c/o Davis-Watkins Dairymans Mfg. Co., Davis and 23rd Sts., North Chicago, Archt.

Ill., Naperville—The Kroehler Mfg. Co. is having plans prepared for the construction of a factory at 250 Front St. for the manufacture of lounges. Estimated cost, $35,000. Private plans.

Ill., West Chicago — Reid, Murdock & Co., Clark St. Bridge, Chicago, will soon award the contract for the construction of a 1 story condensing plant here. Estimated cost, $40,000. E. C. Blake, 810 Davis St., Evanston, Archt.

Ill., Zeigler—The Zeigler Ice & Bottling Co. is having plans prepared for the construction of a 2 story, 93 x 105 ft. ice plant. Estimated cost, $50,000. Keunerly & Stiegemeyer, Title Guarantee Bldg., St. Louis, Mo., Archts. Noted Nov. 24.

Wis., Dundas—The Calumet Packing Co., c/o P. M. Peacock, Secy., 309 Michigan Ave., Sheboygan, purchased a site and plans to build a 2 story, 60 x 85 ft. canning factory here. Estimated cost, $40,000. Architect not selected.

Wis., Fond - du - lac — The Combination Door and Screen Co., 180 Ruggles St., is having plans prepared for the construction of a 3 story, 50 x 50 ft. factory. Estimated cost, $45,000. B. E. Mehner, 6 East Division St., Archt.

Wis., North Milwaukee—The Ebony Ink Co., 82 Mason St., Milwaukee, has purchased a site on Villard Ave., here, and plans to build a 1 story, 42 x 120 ft. factory. Estimated cost, $25,000. Architect not selected.

Wis., Owen—The E. Z. Box Co. has purchased a site and plans to build a 2 story, 60 x 200 ft. box factory on Main St. Estimated cost, $170,000. Address G. E. Anderson, c/o Owen Lumber Co., Pres. Architect not selected.

WEST OF THE MISSISSIPPI

Mo., St. Louis—The Hartenbach Carpet Cleaning Co., Grand and Clark Sts., c/o H. C. Hartenbach, will soon award the contract for the construction of a 3 story, 30 x 75 ft. factory. Estimated cost, $40,000. Ludwig & Drusoerner, 3545 Humphrey St., Archts.

Mo., St. Louis—The Natl. Biscuit Co., c/o W. J. Rainalter Mgr., Main and Jule Sts., has awarded the contract for the construction of a 2 story factory. Estimated cost, $35,000. Noted Nov. 24.

Mo., St. Louis—The Polar Wave Ice & Fuel Co., Grand and Olive Sts., will soon award the contract for the construction of an ice plant on Gravois Ave. and Decolsey St. Estimated cost, $500,000. H. G. Clymer, Wainwright Bldg., Archt. Noted Oct. 13.

CANADA

Ont., Acton — The Acton Tanning Co. plans to rebuild a portion of its plant which was recently destroyed by fire. Estimated cost, $25,000.

Ont., Kincardine—F. B. Coombe Furniture Co. plans to build a 3 story, 50 x 80 ft. addition to its factory. Estimated cost, $50,000. Private plans.

Ont., Port Elgin—E. Grandier, of Teasdall Hosiery Co., London, plans to construct a hosiery mill here. Estimated cost, $40,000.

American Machinist

Volume 55 NEW YORK, DECEMBER 15, 1921 Number 24

The Future of Bolshevik Russia

Examples of Bolshevik Mismanagement—The Weak Point in the Communist Theory—End of Bolshevism Certain, Either by Evolution or Revolution

BY ROYAL R. KEELY

NEAR Moscow at Podolsk a private company had almost completed a wire cable factory. The Bolsheviki decided to turn it into a locomotive plant for which it was suitable in just one respect—it was big. To appreciate this one must remember that Russia had several locomotive repair and building plants standing idle for want of raw material, workmen, fuel, food, clothing, transport, etc. But it was better propaganda to be able to say that they were building a new factory according to improved Bolshevik standards, than to let it become known that they were failing to operate the finely equipped existing factories. The new factory idea diverted attention and made the people think they were doing some real work. At the time of my first visit to the factory they had had a thousand men working for several months. They had developed highly theoretical plans for scientific management according to American standards—only improved—and production plans galore. A few weeks later they repaired their first locomotive and according to the locomotive repair decree then in force they took it with a train of cars, and went to the country for food.

How characteristically Russian! Think of it! A locomotive, a train of cars, a thousand men weighing each say four poods, going two hundred versts into the country, tying up railway equipment, and the whole factory idle for three days, each man bringing back an official allowance of two poods of flour. I admit that each man broke the law and brought more than his legal allowance, but it doesn't change my picture very much. And what happened in that case was happening in all plants where locomotive repair work was being done. As to the cause of such things I must refer later. But observing the facts one cannot be surprised at the result.

At Podolsk also is the big American Singer factory. It is cold and dead, except that it makes a few small locomotive parts for its neighbor, the locomotive repair factory referred to above.

How the Russians Made Scythes

In Moscow is another small factory where the conditions for success are very favorable to the Bolsheviki. It is a scythe factory. It must be remembered that the Russian farmer not only does not have the American mowing machine and reaper, but is extremely short of such simple instruments as scythes and sickles.

This factory had enough fine Swedish steel especially suited to scythe making to last it for several years. The steel was bought by the old government and therefore the Bolsheviki had no expense for material. Since there was an unlimited supply of material the Bolsheviki decided to supply the factory with plenty of fuel and power because it was so necessary to have scythes for the farmer. At the time I first visited the factory the workmen were getting a ridiculously low salary compared with the cost of living, and only five-eighths of a pound of bread daily with food cards calling for certain monthly supplies. The workmen could not live and the manager complained that he must close down if aid did not come. His skilled workers were constantly leaving. Their earnings were increased a little as in most other factories by systematic stealing. Power hammers were used but there were no dies and great skill was required in drawing out the slender blades. One false blow spoiled the scythe. A long time was required to train new workmen; because there were many new workmen the scrap was very great.

Conditions in Moscow

Much more might be said of the general factories in the Moscow district and the railroad shops which I saw. The chief impression gained is that there is no appreciable production or sign of life or improvement. In fact there is very little indication of continued destruction. Buildings are going to pieces and machines are suffering for want of repair. The production is infinitesimal compared with the requirements of great Russia, and the little that they do get is only at the expense of the stock of raw material inherited from the previous government. And what is said of Moscow may be said of all Bolshevik-Russia except that in no other city are the prospects and possibilities so favorable as in Moscow. Living conditions in general are better in Moscow and Petrograd than in any other part of Russia. If success cannot be attained there, no hope can be held for other sections.

Perhaps the most important factory in the Petrograd district is the large shoe factory employing at the time of my visit about 4,000 men, as compared with 5,000 before the revolution. The clumsy army shoes made there have the soles fastened on with wooden pegs and have no eyelets. The production is very low compared with that of pre-revolution days.

In the Baltic Ship Building plant only a little repair work is done, with a few hundred men instead of several thousand as in former days. When Petrograd was threatened much of the machinery was conveyed to other inland cities, but it was dismantled, the parts were not properly numbered or tagged, and different parts were sent to different places so that the task of reassembling is impossible.

The spinning industry, never big, is also dead. Russia has no cotton. Turkestan has wonderful cotton possibilities and some day when capital and executive ability and initiative have had a free hand, this desert land will bloom and produce the finest cotton, not only for Russia, but for all central and western Europe. Now the cotton has been shoved out by the grain crop, which the farmer finds it necessary to grow for self-preservation. This is another great economic waste, for the grain for all Russia ought to be raised on the great prairies where nothing else will grow, leaving the rich cotton and fruit land free for these valuable crops.

Personally, I believe in the principle of the republican form of government. I am a democrat by preference, believing in the rule of the majority. In the smoking room as I write are seven men. If four want to read quietly, I think the other three should be restrained from disturbance because they happen to want to sing and dance. If the present situation in Russia was due to the free choice of at least 51 per cent of the people then I would not have one word to say. But when one sees 95 per cent of the people persecuted, some of them imprisoned and shot, by a handful of adventurers wielding the autocratic power for their own benefit, then I must protest. If socialism could bring something better to Russia today I would favor it. If the idealistic principle of communism could better the life and standards of the average man then I should support it. But the fact, surprising as it may seem, is that there is neither communist nor socialist in Russia today. I say none, but this is not strictly true. Recently I met a lady who had been in the Bolshevik prisons and had experienced a world of most intense physical suffering at their hands. But she told me that she had been converted to the principles of communism. "Oh, yes," I said, "but that is a different thing from Bolshevism. Do you think there are any ideal communists in Russia?" She replied, "Oh, yes, I know two or three in Petrograd." "And how many," I said, "are there in Moscow?" She replied, "Oh, a great deal less in Moscow." One optimistically inclined can count all the real communists on the fingers of his two hands. The socialists are mostly in prison. The social democrats, the social revolutionaries, the anarchists, of all brands and every shade of political belief, are persecuted, hounded, imprisoned and shot, with a persistence only equaled by that against the former rich and well-to-do people, educated class and scientists. The Bolsheviki have shown a remarkable persistence in absolutely destroying all kinds of political parties that might grow to have any semblance of power against them. It does impress one in this so-called socialistic republic to find the socialists, and especially the strong men and leaders, in prison.

Five Divisions of Soviet Russia

For my purpose I divide the population of soviet Russia into five classes. The first class consists of the political idealists whom you could count, as I said before, on the fingers of your two hands. The second class numbers a few thousand, bold, unscrupulous, unprincipled bandits who are ruling with an iron hand and riding down all opposition. They are the ones who are shooting and murdering, who live better than they have ever lived before, who have the autos, the finest apartments, the best food, the best clothing, the power, the munitions and the nerve. In these two groups are not over ten men who dominate all and wield the power and shape the policy of the party. In these two groups I estimate fully 90 per cent are Jews.

The third class is composed of the balance of the Bolshevik party and numbers 90 per cent of the whole, or say 450,000. They are in the party because they are forced to be there by economic reasons. They see their neighbor party-member living well, and their own children hungry, so they decide to join the party. The fourth class is composed of the former wealthy people, the educated class, the artists and scientists and the "politicals" other than Bolsheviki. These the Bolsheviki are trying to exterminate. The fifth class is composed of the peasants, and numbers more than 90 per cent of the Russian population. They are in general "non-political" but at the same time are decidedly against the Bolsheviki. But they are an easy-going, gentle, non-resistant folk and the Bolsheviki have no trouble in dominating them and holding them in bondage to their dictatorship. They talk much of the "Dictatorship of the Proletariat." But why a dictatorship of any class? It will be seen by the above analysis that the percentage of the total population in the Bolshevik dictator class is very, very small.

Government Employees in Great Numbers

In Moscow, for the machinery of the government alone, there are about 230,000 employees getting an average wage of 40 to 50 roubles monthly, although a few get much more. It is interesting to note that in this worker's republic of equality for all and special privilege for none, 10,000 of these employees are classed as "Responsible Employees," i.e., those who are faithful, loyal servants of the Bolsheviki, and who get special food allowances and better wages. The Bolsheviki do not object to a mass of weak, starved, resistless working force so long as they can dominate and control it, and that is the object of the 10,000 faithful followers who are better fed, clothed and provided for.

Take for example the metal department, of which Martens is head. In the whole department only two people make any pretense of working—Martens and his chief assistant, Stunkle, a Finnish engineer. This chief assistant draws about 400,000 roubles monthly and small quantities of food, clothing and fuel. Even then the members of his family complain that they live only with the greatest difficulty and by drawing on their private means. He has a wife, two children and a mother. In a month he gets about twenty pounds of flour, two or three pounds each of butter and sugar, a little meat and a few vegetables. But think of the average employee, who gets but one tenth the wages and practically no food. The great difficulty is to understand how they live. It can be only by some form of private "speculation" or by selling the few personal things which they have saved from the revolution. The masses of these employees are always hungry. The Russian-American Tool Co. had sixty men who had been in America and they received better than average food, fuel and wage allowance. Their factory was looked upon as exceptional. Still these men in the summer were everyday selling their personal things, most of which they had brought from America, such as shoes, clothing, safety razors, raincoats, etc. They told me that in America the thought of being hungry was as foreign to them as the thought of wanting to breathe. One Sunday morning I called on the foreman of the Russian-American Tool Co. I found him busy cooking a meal. The previous day he had gotten his monthly allowance of a few pounds of meat and a few vegetables. He told me he was going to end everything with a "feast." I laughed, but he said he was really serious. He told me that he had sold all his personal things. He had no bread, so he had invited some of his friends to bring bread and have dinner. He was cooking his monthly ration at one time and they would eat it, and of the future, well, he could not think of that.

Such a thing as inviting a friend to dinner in Moscow is practically unknown. I know many of the former well-to-do families who sometimes when they go to drink "tea" with their friends, take their black bread with them and eat it, without butter. The "tea" consists of "sovietsky" coffee, consisting of burned sunflower seeds, grains and root, and is drunk without sugar.

The communist theory of economic control is in itself quite ideal, but its success presupposes 180,000 able, honest and efficient Russians, all working for the public good and not for their own gain. But all who knew Russia know how impossible of realization is this pre-requisite.

NATIONALIZATION

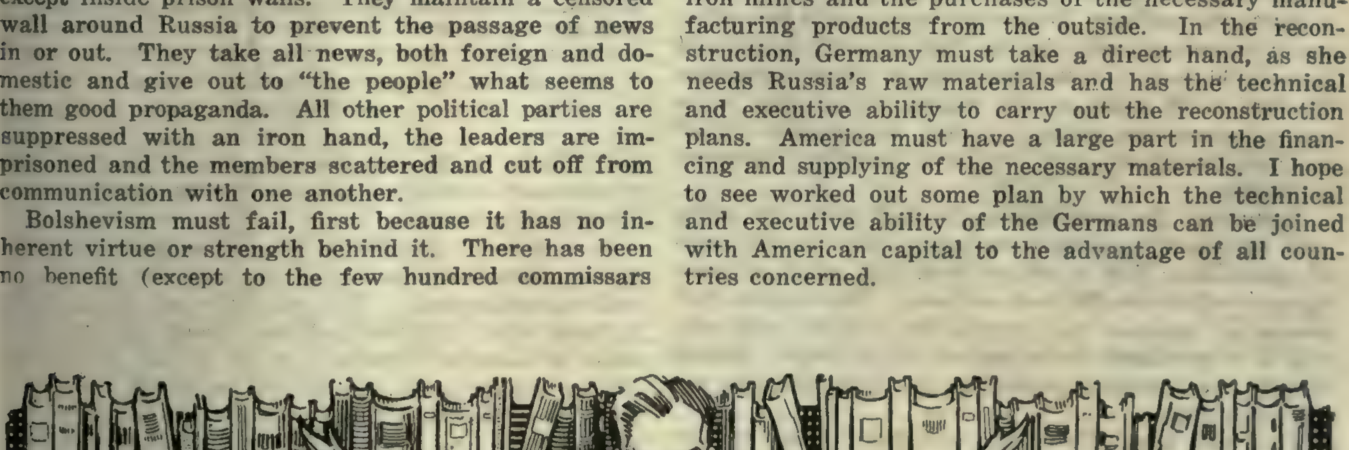
What a tremendous upheaval their wholesale attempts at nationalization have caused, it is hard to realize. In all Russia there are no public hotels, no private residences or apartments, no rooms for which one can bargain privately. Everything is in the hands of the government, including the entire means of production and ways of communication. It controls all the ammunition and arms and enough communist officers to control the soldiers. This is greatly in their favor now in holding the power. Their agents enter all buildings at will. They censor the mail and allow no private telegrams. They own the press and publish only what is good propaganda. No private meetings are allowed. There is no freedom of speech except inside prison walls. They maintain a censored wall around Russia to prevent the passage of news in or out. They take all news, both foreign and domestic and give out to "the people" what seems to them good propaganda. All other political parties are suppressed with an iron hand, the leaders are imprisoned and the members scattered and cut off from communication with one another.

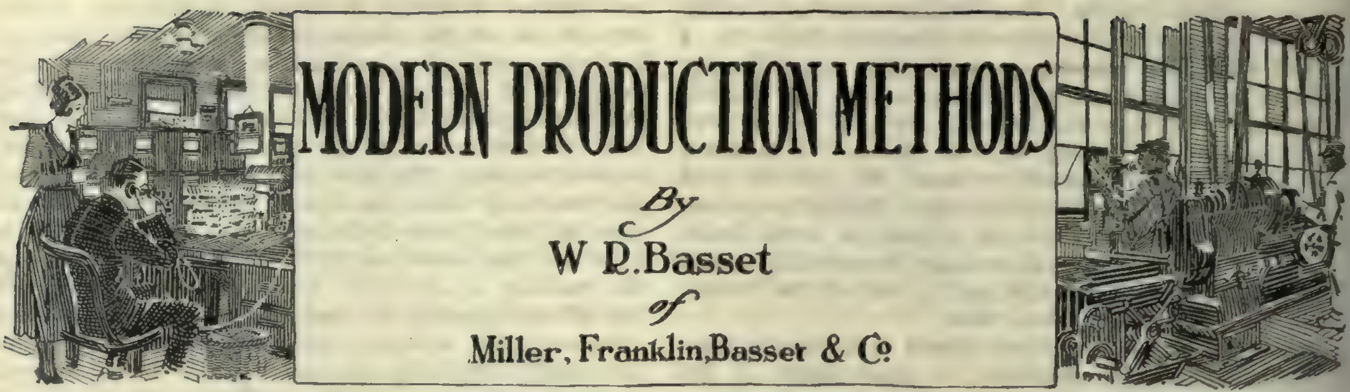
Bolshevism must fail, first because it has no inherent virtue or strength behind it. There has been no benefit (except to the few hundred commissars and leaders referred to above) to anyone. It has brought to all the people the greatest suffering and hardship, with no compensation or prospect of anything better. Second, it has destroyed or is destroying the last remnant of the civilization of Russia's past. This destruction must go on until the end of the present regime. The first step toward reconstruction can come only with the end of Bolshevism. The reasons for this I have indicated above. The Bolsheviki have not the executive ability, the technical skill or the stability of character to enable them to turn the tide of retrogression by their present plan of wholesale nationalization and centralized control. Third, public sentiment is decidedly against them. Nobody, not even the Bolshevik leaders, believes that they can succeed. Everyone thinks that anything done on this economic foundation will be wasted effort. No one therefore makes the slightest effort at real, conscientious work in support of the Bolshevik system—quite the contrary.

With the present generation, the moral foundation is undermined. The failure of the educational system is bringing no preparation for the future generation, and therefore most people think it will be two generations before much progress can be made.

On my first acquaintance with Russia, in 1919, the value of the rouble was 40 to the dollar. In May, 1920, it was 2,400; in May, this year, it was 34,000; and on Sept. 1, as I left Moscow, it was 54,000. Telegraph reports now give the exchange as 100,000 roubles to the dollar.

The destruction will go on until the end of the Bolsheviki. This will come either by evolution or revolution, but just when and how it is impossible at the present time to say. We must simply wait a little longer for developments. The Bolsheviki are now attempting to slide out from under their difficulties by evolution to the right, but this is far more difficult than appears on the surface. Private business has no foundation on which to build. With a new stable government, credits could be established and transports repaired which would make possible the opening of the coal and iron mines and the purchases of the necessary manufacturing products from the outside. In the reconstruction, Germany must take a direct hand, as she needs Russia's raw materials and has the technical and executive ability to carry out the reconstruction plans. America must have a large part in the financing and supplying of the necessary materials. I hope to see worked out some plan by which the technical and executive ability of the Germans can be joined with American capital to the advantage of all countries concerned.





MODERN PRODUCTION METHODS

By
W R. Basset
of
Miller, Franklin, Basset & Co.

XXIV. Setting Piece Rates

Incentive Factor as Important as Securing Results for Wage Given—Some Examples of Rate Derivation—Why Piece Rates Should Not Be Cut

WHEN the standard time for an operation has been determined, there is no mathematical difficulty in setting a piece rate from it. We simply set such a price as, at the standard hourly production, will give a predetermined hourly earning. As an example, we are choosing figures which will give even results:

Standard time per part	55	sec.
Fatigue and tool allowance	5	"
Total	60	" per part

Hourly production = 3600 ÷ 60 = 60 parts per hour.

Basic rate per hour (amount which it is desired workman should earn) = $.60.

Rate per piece = $.60 ÷ 60 = 1 cent each.

The only chance to go wrong is in assuming the basic hourly rate which the workman is to earn on piece rates. Remember that the standard we have arrived at is *not* the production which the average workman is likely to give, but that which can be reasonably expected of the 100 per cent skilled workman. Therefore, if we took the hourly rate commonly paid to the run of workmen as a basis, the ordinary 70 per cent man would be suffering a 30 per cent cut, and the 100 per cent man would have little chance of earning more on piece rates than the dub could make on day wages. Now, piece rates are installed, not primarily that management "shall pay only for what it gets" but as an *incentive* to greater production.

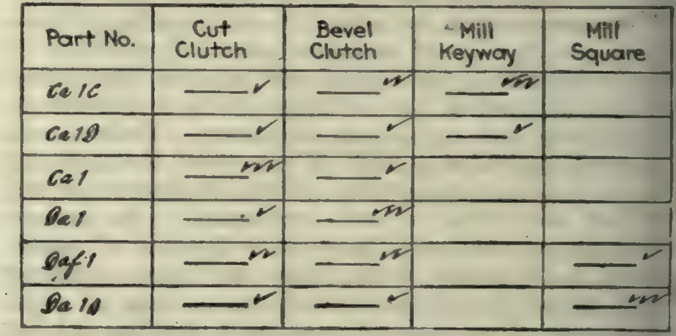
Therefore, the best plan is to start with the going rate for the 70 per cent workman. Say for the sake of convenience that to attract even that grade of man, we must offer him 70 cents an hour. That means that merely on payment for results, the 100 per cent man will be a profitable investment at $1 an hour. Divide that by the standard production per hour and you get the piece rate.

Then you have offered an incentive to both the 70 per cent and the 100 per cent men. The 70 per cent man knows that others are easily attaining the standard and are earning around 50 per cent more than he, so he strives to get the extra money. The 100 per cent man knows that he can easily keep up the standard, so he strives—successfully if the standard is correct—to beat it. Production increases, and the management profits through having more output to spread the overhead over.

Just one word of warning; never cut a piece rate unless the method of performing an operation is actually changed—when, in fact, a new operation demands a new rate—or, and this comes but once or twice in a generation, when the entire wage scale throughout the country is seeking a new level after inflation, as in 1921.

Otherwise a cut in rates is a confession that the rates were incorrectly set in the first place. Make sure your standards are correct before you set rates, and then guarantee your rates.

It is often desirable to set a rate for a new part without delaying to take time studies. This occurs particularly in the so-called job shop where new work is constantly coming up and where long, repetitive runs are almost unknown.



Part No.	Cut Clutch	Bevel Clutch	Mill Keyway	Mill Square
Ca 1C	—— ✓	—— ✓✓	—— ✓✓✓	
Ca 1D	—— ✓	—— ✓	—— ✓	
Ca 1	—— ✓✓✓	—— ✓		
Da 1	—— ✓	—— ✓✓✓		
Daf 1	—— ✓✓	—— ✓✓		—— ✓
Da 1D	—— ✓	—— ✓		—— ✓✓✓

FIG. 108. DIAGRAM FOR KEEPING TRACK OF TIME STUDIES

It is entirely possible so to set standards on fundamental operations that rates for any new job can be built up synthetically. This has value not only in deriving new rates. It makes possible a great saving in tim when it becomes necessary to set a rate for a par similar except as to size to one on which a rate ha been set. This is the most complicated phase of rat setting once the elementary time studies have bee made.

THE FUNDAMENTALS OF TIME STUDY

In discussing the fundamentals of time study I men tioned that in making the original analysis the tim study man should bear in mind that his studies migh ultimately be used in deriving the rates. It is therefor desirable that before rate setting is begun in a depart ment, a survey of the work be made to determine th extent to which derived rates may be used, so tha studies on the same class of operations will not necessarily be duplicated and yet that no operation of importance be overlooked.

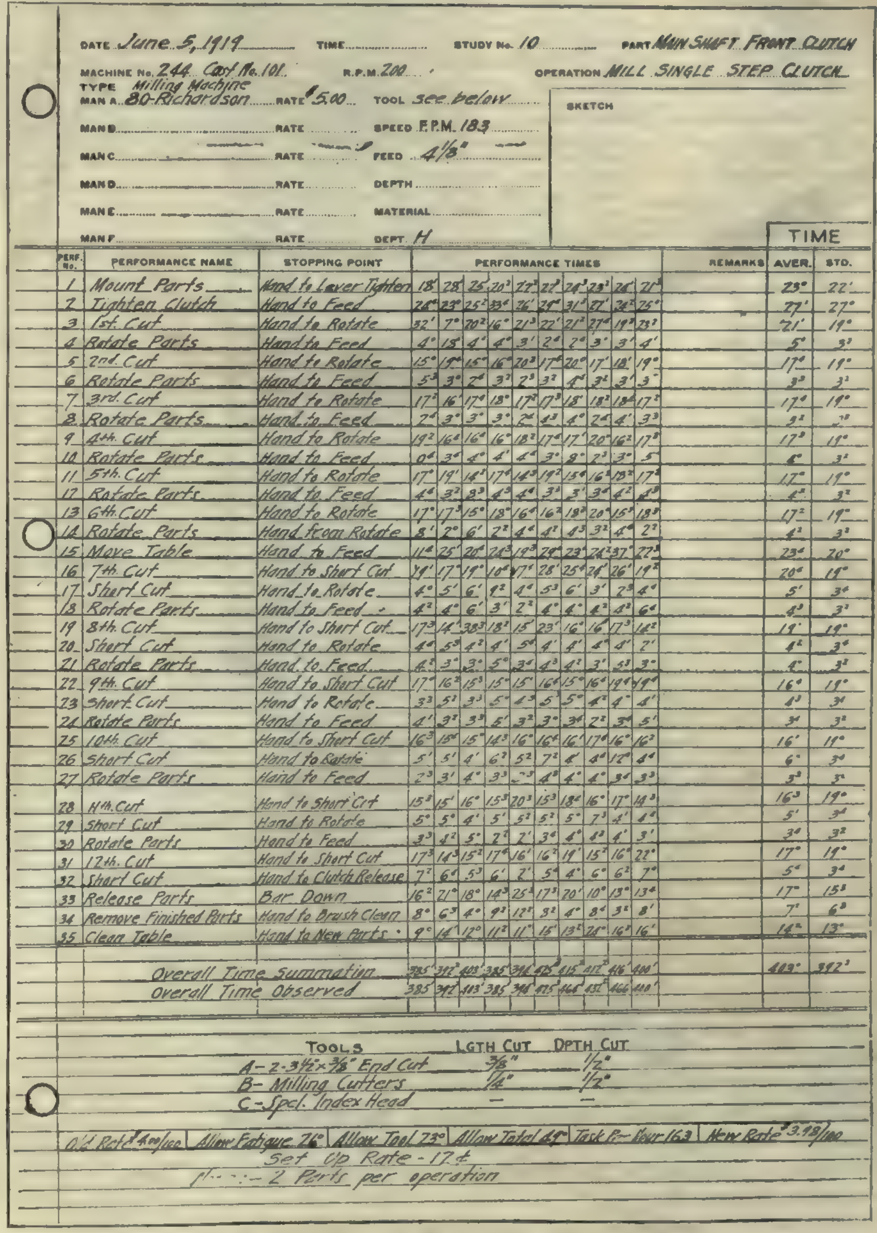
In a shop departmentalized on the "battery system" there are two methods of attack which might be used in extending the rates. The first is to follow a part through its entire machining and then attempt to extend the standards set for this part laterally to similar operations on other parts. Sometimes this plan is not advisable because it results in duplication of studies. If but small quantities are put through, it requires considerable time to take the studies, for the observer must be on the alert to catch the beginning of each operation on a lot and this prevents using the time between operations to any advantage on other studies.

Therefore it develops that the plan most often used is to take the work by departments, segregating all operations within a given department. These operations are grouped, first by similar parts, and then by operations, from the data shown on the route sheets which were described in article IX on planning. A diagram showing this information is given in Fig. 108.

When a study is taken, that fact is indicated by placing three check marks at the operation on the diagram. The unchecked studies are needed to complete the skeleton of observed performance for the entire department. As rates are derived, the operations are checked on the diagram with a single check. Actual observations to verify derived standards are indicated by a second check. The diagram reveals at any time the status of the original studies, of the derived studies and of the verification of the derived studies.

For a specific example in rate derivation, we will consider the cutting of clutches. Rates for the milling of all clutches were secured from but two studies—those on parts CA19 and BA37—shown in Figs. 109 and 110. The analysis includes mounting the parts, securing them in position, and then a series of six cuts, one for each tooth. Since the teeth are identical, the cuts are identical. After completing a cut, it is necessary to position the clutch so as to oppose the next tooth to the cutter and this is done in the performance "rotate parts." The teeth are equally distanced and therefore the performances, "rotate parts," are identical. A sketch of the part is shown in Fig. 111.

At the conclusion of the six cuts with their intervening rotations, one side of each of the six teeth has been formed. The six cuts are known as forming cuts. For forming the other side of the teeth, the clutch is displaced laterally so as to bring the opposite side of the tooth into position before the cutters. This is done in the performance "move table."



DATE June 5, 1919 TIME STUDY No. 10 PART MAIN SHAFT FRONT CLUTCH
MACHINE No. 244 Cost No. 101 R.P.M. 200 OPERATION MILL SINGLE STEP CLUTCH
TYPE Milling Machine
MAN A. 80-Richardson RATE $5.00 TOOL see below
MAN B. RATE SPEED F.P.M. 183
MAN C. RATE FEED 4/8"
MAN D. RATE DEPTH
MAN E. RATE MATERIAL
MAN F. RATE DEPT. H
SKETCH

PERF. No.	PERFORMANCE NAME	STOPPING POINT	PERFORMANCE TIMES										REMARKS	TIME AVER.	TIME STD.
1	Mount Parts	Hand to Lever Tighten	18	28	25	20^3	22^3	22	24^3	23^3	26	21^3		23^0	22^1
2	Tighten Clutch	Hand to Feed	26^4	23^0	25^2	33^4	26^1	29^0	31^3	27^1	34^2	25^0		27^1	27^0
3	1st. Cut	Hand to Rotate	32^1	7^0	20^2	16^0	21^3	22^1	21^2	27^4	19^3	23^3		21^1	19^0
4	Rotate Parts	Hand to Feed	4^0	18	4^1	4^0	3^1	2^4	2^0	3^0	3^1	4^1		5^0	3^3
5	2nd. Cut	Hand to Rotate	15^0	19^4	15^0	16^0	20^3	17^4	20^0	17^1	18^1	19^0		17^0	19^0
6	Rotate Parts	Hand to Feed	5^3	3^0	2^4	3^3	2^3	3^3	4^3	3^2	3^1	3^0		3^3	3^3
7	3rd. Cut	Hand to Rotate	17^2	16^1	17^4	18^0	17^2	17^3	18	18^2	18^4	17^2		17^4	19^0
8	Rotate Parts	Hand to Feed	2^4	3^0	3^0	3^0	2^4	4^3	4^0	2^4	4^1	3^3		3^2	[illegible]
9	4th. Cut	Hand to Rotate	19^2	16^4	16^4	16^0	18^2	17^4	17^1	20^0	16^2	17^3		17^3	19^0
10	Rotate Parts	Hand to Feed	0^4	3^4	4^0	4^1	4^4	3^0	8^0	2^3	3^0	5		6^0	3^2
11	5th. Cut	Hand to Rotate	17^0	19^1	14^3	17^4	14^3	19^2	15^4	16^3	18^2	17^2		17^0	19^0
12	Rotate Parts	Hand to Feed	4^4	3^2	8^3	4^3	4^4	3^3	3^1	3^4	4^2	4^3		4^2	3^2
13	6th. Cut	Hand to Rotate	17^0	17^3	15^0	18^0	16^4	16^2	18^3	20^0	15^3	18^3		17^2	19^0
14	Rotate Parts	Hand from Rotate	8^1	2^0	6^1	2^2	4^4	4^2	4^3	3^2	4^4	2^2		4^2	3^3
15	Move Table	Hand to Feed	11^4	25^1	20^4	24^3	19^3	29^4	23^4	24^2	37^0	27^3		23^4	20^0
16	7th. Cut	Hand to Short Cut	19^1	17^0	19^0	10^4	17^1	28^1	25^4	24^1	26^1	19^2		20^4	19^0
17	Short Cut	Hand to Rotate	4^0	5^1	6^1	9^2	4^4	5^3	6^1	3^1	2^3	4^0		5^1	3^4
18	Rotate Parts	Hand to Feed	4^2	4^0	6^1	3^1	2^2	4^0	4^0	4^2	4^2	6^4		4^3	3^2
19	8th. Cut	Hand to Short Cut	17^3	14^1	38^3	18^2	15	23^1	16^0	16	17^3	14^2		19^1	19^0
20	Short Cut	Hand to Rotate	4^4	5^3	4^2	4^1	5^4	4^1	4^1	4^0	4^1	7^1		4^2	3^4
21	Rotate Parts	Hand to Feed	4^3	3^0	3^0	5^0	3^4	4^3	4^2	3^1	5^3	3^0		4^0	3^2
22	9th. Cut	Hand to Short Cut	17^0	16^2	15^3	15^0	15^1	16^4	15^0	16^4	19^4	19^4		16^4	19^0
23	Short Cut	Hand to Rotate	3^3	5^2	3^3	5^0	4^3	5^1	5^0	4^2	4^0	4^1		4^3	3^4
24	Rotate Parts	Hand to Feed	4^1	3^2	3^3	5^1	3^2	3^0	3^4	2^2	3^4	5^1		3^4	3^2
25	10th. Cut	Hand to Short Cut	16^3	15^4	15^0	14^3	16^0	16^4	16^1	17^4	16^0	16^2		16^1	19^0
26	Short Cut	Hand to Rotate	5^1	5^1	4^1	6^3	5^2	7^2	4	4^4	12^0	4^4		6^0	3^4
27	Rotate Parts	Hand to Feed	2^3	3^1	4^0	3^3	[illegible]	4^3	4^0	4^0	3^4	3^3		3^3	3^0
28	11th. Cut	Hand to Short Cut	15^3	15^1	16^0	15^3	20^3	15^3	18^4	16^0	17^0	14^3		16^3	19^0
29	Short Cut	Hand to Rotate	5^0	5^0	4^1	5^1	5^2	5^2	5^0	7^3	4^1	4^4		5^1	3^4
30	Rotate Parts	Hand to Feed	3^3	4^2	5^0	2^2	2^1	3^4	4^0	4^2	4^1	3^1		3^4	3^2
31	12th. Cut	Hand to Short Cut	17^3	14^3	15^2	17^4	16^1	16^2	19^1	15^2	16^0	22^0		17^0	19^0
32	Short Cut	Hand to Clutch Release	7^2	6^4	5^3	6^1	2^1	5^4	4^1	6^0	6^2	7^0		5^4	3^4
33	Release Parts	Bar Down	16^2	21^0	18^0	14^3	25^3	17^3	20^1	10^0	13^0	13^4		17^0	15^3
34	Remove Finished Parts	Hand to Brush Clean	8^0	6^3	4^0	9^3	12^3	8^2	4^0	8^4	3^2	8^1		7^1	6^3
35	Clean Table	Hand to New Parts	9^0	14^1	12^0	11^3	11^0	15^1	13^2	26^0	16^3	16^1		14^3	13^0
	Overall Time Summation		385^1	392^2	403^1	385^1	346	475^3	415^3	412^2	416^1	400^1		403^0	392^3
	Overall Time Observed		385	392	413^1	385	346	475	465	431^2	466	400^1			

TOOLS	LGTH CUT	DPTH CUT
A-2-3½"×⅜" End Cut	⅜"	½"
B- Milling Cutters	¼"	½"
C-Spcl. Index Head	—	—

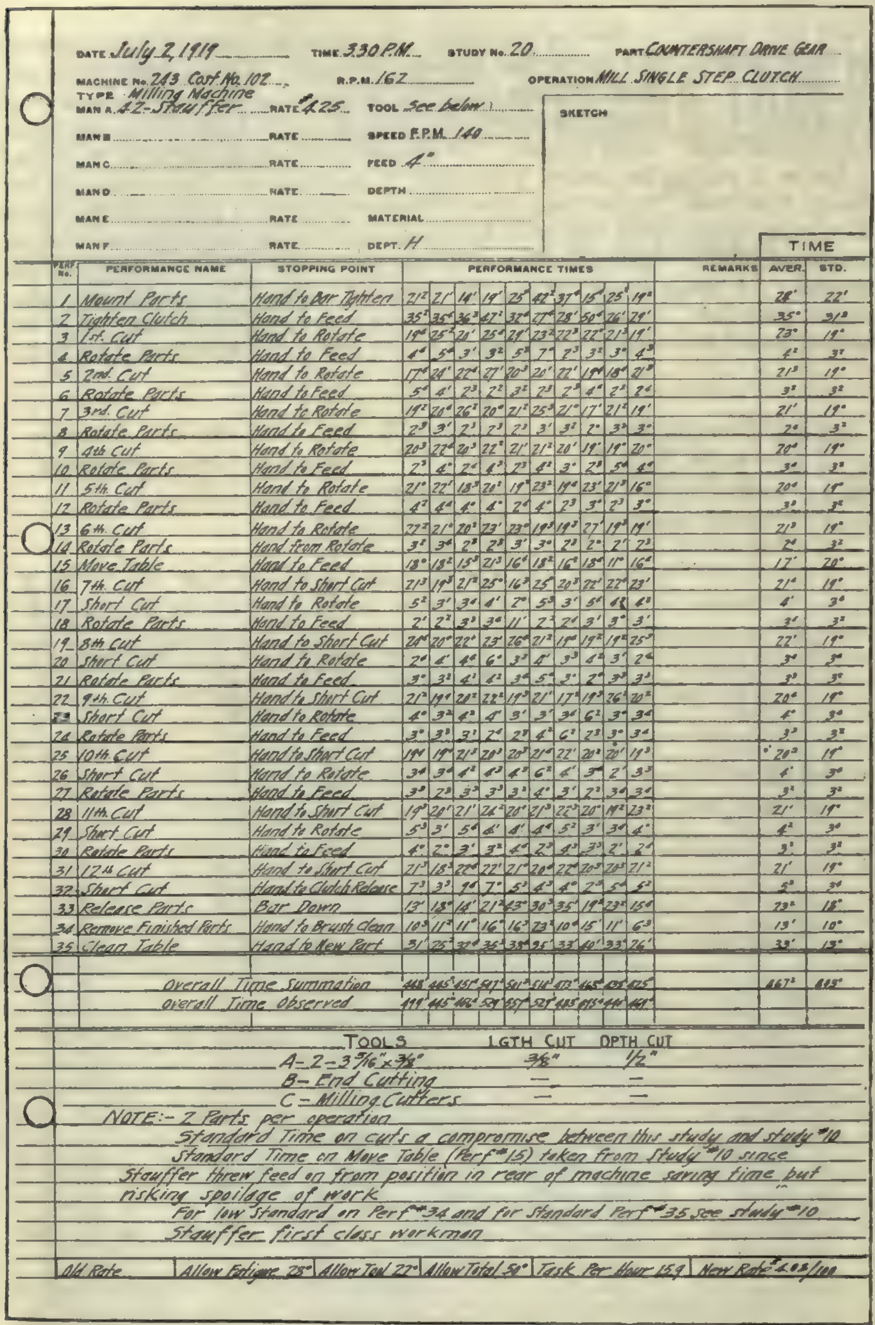
Old Rate $4.00/100	Allow Fatigue 26°	Allow Tool 23°	Allow Total 49	Task Per Hour 163	New Rate $3.48/100

Set Up Rate - 17¢
[illegible] - 2 Parts per operation

FIG. 109. TIME STUDY SHEET ON CLUTCH

Having displaced the table laterally by the required distance, the second series of forming cuts is begun with performance 16. This cut leaves a small quantity of dead stock between the adajacent tooth faces that have been formed. To remove this, the index head is turned backward a portion of a turn and the clutch is run under the cutter. The operator then positions the clutch for the next forming cut, in the performance "rotate parts." The cycle for each tooth is therefore, on the second series of forming cuts, (1) the forming cut itself, (2) the dead stock cut or "short cut," and (3) the performance "rotate parts." There being six teeth, this cycle is repeated six times except that after completing the last short cut, there is no need to rotate the parts, since they are completed and ready to be removed. The operation is accordingly concluded by the performances, "release parts," "remove finished parts" and "clean table."

This is the operation in complete detail. The performances which comprise the operation may be built into other operations of a similar character by re-



DATE July 2, 1919 TIME 3.30 P.M. STUDY No. 20 PART COUNTERSHAFT DRIVE GEAR
MACHINE No. 243 Cost No. 102 R.P.M. 162 OPERATION MILL SINGLE STEP CLUTCH
TYPE Milling Machine
MAN A. 42-Stauffer RATE #4.25 TOOL See below
MAN B RATE SPEED F.P.M. 140
MAN C RATE FEED 4"
MAN D RATE DEPTH
MAN E RATE MATERIAL
MAN F RATE DEPT. H
SKETCH

PERF. No.	PERFORMANCE NAME	STOPPING POINT	PERFORMANCE TIMES										REMARKS	TIME AVER.	TIME STD.
1	Mount Parts	Hand to Bar Tighten	21^2	21^1	14^1	19^1	25^0	42^2	37^4	15^1	25^4	19^2		28^1	22^1
2	Tighten Clutch	Hand to Feed	35^2	35^4	36^3	47^2	32^4	27^4	28^1	50^4	26^1	29^1		35^0	31^3
3	1st. Cut	Hand to Rotate	19^4	25^2	20^1	25^4	29^1	23^2	22^3	22^0	21^3	19^1		23^0	19^0
4	Rotate Parts	Hand to Feed	4^4	5^4	3^1	3^2	5^3	7^4	2^3	3^2	3^0	4^3		4^2	3^2
5	2nd. Cut	Hand to Rotate	17^4	24^1	22^4	27^1	20^3	20^1	22^1	19^4	18^4	21^3		21^3	19^0
6	Rotate Parts	Hand to Feed	5^4	4^1	2^3	2^2	3^2	2^3	2^3	4^0	2^2	2^4		3^2	3^2
7	3rd. Cut	Hand to Rotate	19^2	20^4	26^3	20^0	21^2	25^3	21^0	17^1	21^2	19^1		21^1	19^0
8	Rotate Parts	Hand to Feed	2^3	3^1	2^3	2^3	2^3	3^1	3^2	2^0	3^3	3^0		2^0	3^2
9	4th Cut	Hand to Rotate	20^3	22^4	20^3	22^2	21^1	21^2	20^1	19^1	19^0	20^0		20^4	19^0
10	Rotate Parts	Hand to Feed	2^3	4^0	2^4	4^3	2^3	4^2	3^0	2^3	5^4	4^0		3^4	3^3
11	5th. Cut	Hand to Rotate	21^0	22^1	18^3	20^3	19^0	23^2	19^4	23^1	21^3	16^0		20^4	19^0
12	Rotate Parts	Hand to Feed	4^2	4^4	4^0	4^0	2^4	4^0	2^3	3^0	2^3	3^0		3^0	3^2
13	6th. Cut	Hand to Rotate	22^2	21^0	20^3	23^1	23^0	19^3	19^3	27^1	19^3	19^1		21^3	19^0
14	Rotate Parts	Hand from Rotate	3^2	3^4	2^3	2^3	3^1	3^0	2^3	2^0	2^1	2^3		2^4	3^2
15	Move Table	Hand to Feed	18^0	18^2	15^3	21^3	16^4	18^2	16^0	18^4	11^0	16^4		17^1	20^0
16	7th. Cut	Hand to Short Cut	21^3	19^3	21^2	25^0	16^3	25	20^3	22^1	22^0	23^1		21^4	19^0
17	Short Cut	Hand to Rotate	5^2	3^1	3^4	4^1	2^0	5^3	3^1	5^4	4^2	4^0		4^1	3^0
18	Rotate Parts	Hand to Feed	2^1	2^2	3^3	3^4	11^1	2^3	2^4	3^1	3^0	3^1		3^1	3^2
19	8th Cut	Hand to Short Cut	24^4	20^0	22^0	23^1	26^4	21^2	19^4	19^2	19^2	25^5		22^1	19^0
20	Short Cut	Hand to Rotate	2^4	4^1	4^4	6^0	3^3	4^1	3^3	4^2	3^1	2^4		3^0	3^0
21	Rotate Parts	Hand to Feed	3^0	3^2	4^3	4^2	3^4	5^4	3^0	2^4	3^3	3^3		3^3	3^0
22	9th. Cut	Hand to Short Cut	21^2	19^4	20^2	22^2	19^3	21^1	17^2	19^3	26^2	20^2		20^4	19^0
[illegible]	Short Cut	Hand to Rotate	4^0	3^2	4^2	4^1	3^1	3^1	3^4	6^2	3^0	3^4		4^0	3^0
24	Rotate Parts	Hand to Feed	3^0	3^3	3^1	2^4	2^3	4^2	6^3	2^3	3^0	3^4		3^3	3^2
25	10th. Cut	Hand to Short Cut	19^4	19^0	21^3	20^3	20^3	21^4	22^1	20^3	20^1	19^3		20^3	19^0
26	Short Cut	Hand to Rotate	3^4	3^4	4^2	4^3	4^3	6^2	4^1	3^0	2^1	3^3		4^1	3^0
27	Rotate Parts	Hand to Feed	3^0	2^3	3^3	3^3	3^3	4^0	3^1	2^3	3^4	3^4		3^3	3^2
28	11th. Cut	Hand to Short Cut	19^4	20^1	21^1	24^2	20^0	21^3	22^3	20^0	19^2	23^2		21^1	19^0
29	Short Cut	Hand to Rotate	5^3	3^1	5^4	6^1	4^1	4^4	5^2	3^1	3^4	4^0		4^2	3^0
30	Rotate Parts	Hand to Feed	4^0	2^0	3^1	3^2	4^4	2^3	4^3	3^3	2^1	2^4		3^3	3^2
31	12th Cut	Hand to Short Cut	21^3	18^3	22^4	22^1	21^0	20^4	22^4	20^3	20^3	21^2		21^1	19^0
32	Short Cut	Hand to Clutch Release	7^3	3^3	9^4	7^0	5^3	4^3	4^0	2^3	5^4	5^2		5^0	3^0
33	Release Parts	Bar Down	13^1	18^0	14^1	21^2	43^0	30^3	35^1	19^2	23^2	15^4		23^2	18^0
34	Remove Finished Parts	Hand to Brush Clean	10^3	11^2	11^0	16^0	16^3	23^2	10^4	15^1	11^1	6^3		13^1	10^0
35	Clean Table	Hand to New Part	31^1	25^2	32^4	36^2	35^4	25^1	33^1	40^1	33^3	26^1		33^1	13^0
	Overall Time Summation		448	445^2	451^4	517^4	501^2	510^3	473^0	465	435	475		467^2	405^0
	Overall Time Observed		444^4	445^0	462^4	524	557^4	525^0	485	475^4	440	461^0			

TOOLS	LGTH CUT	DPTH CUT
A-2-3 5/16" x 3/8"	3/8"	1/2"
B-End Cutting	—	—
C-Milling Cutters	—	—

NOTE:- 2 Parts per operation
Standard Time on cuts a compromise between this study and study #10
Standard Time on Move Table (Perf #15) taken from Study #10 since Stauffer threw feed on from position in rear of machine saving time but risking spoilage of work
For low Standard on Perf #34 and for Standard Perf #35 see study #10
Stauffer first class workman

Old Rate	Allow Fatigue 28^0	Allow Tool 22^0	Allow Total 50^0	Task Per Hour 15.9	New Rate #4.03/100

FIG. 110. ANOTHER CLUTCH TIME STUDY SHEET

arranging them and by using more or fewer as needed.

The first consideration is to standardize the performances, which is done for each study separately by the method described in the preceding article. Since, in the two parts studied, we have similar operations, we must reconcile the standards of one study with those of the other. This gives the proof that the performances are interchangeable.

On the first performance, "mount parts," we find an exact coincidence. On the second performance, "tighten clutch," there is a considerable discrepancy. Investigation shows that part BA37, being a gear, has a round bore, and the other, CA19, being a clutch, has its center broached out square. The difference in time is allowable because it is much easier firmly to fix the square centered clutch than the smooth round bored gear. Here is an essential difference in the two performances, which dictates that one be used on gears bearing clutches and the other on the simple clutches.

Next we examine the first series of forming cuts on the two parts. The conditions under which the cut is made, its length and depth, its speed and feed, indicate that the times should be the same. Investigation shows that the variation is due largely to differences in the skill of the operators, to accidental variations in the hardness of the metal and so on. Therefore it seems best to reconcile and remove the time variation in the standard, which is done by adding to the smaller of the two standards two-thirds of the difference between them and accept the result as the common standard which holds for all twelve of the forming cuts of both series. A common standard can similarly be found for the "rotate parts" performance, and for the "short cut" performance.

As the standard for the "move table" performance, we chose the higher of the two because the method by which the operator No. 42 reduced the time unduly jeopardized the accuracy of the work. His practice was to throw on the feed for the seventh cut from his position beneath the table after he had finished moving it. If he had accidentally omitted to rotate the parts before moving the table, the cutter would tear into the tooth and ruin the part. The standard method requres the operator to return to his position in front of the machine before throwing on the feed.

More discrepancy was noted in the performance "release parts" and two standards were maintained for this performance on the reasonable supposition that if it took longer to secure one part it should take longer to release it.

Similarly, a difference was allowed between clutches and gears on the performance "move finished parts," for the reason that the clutches are so

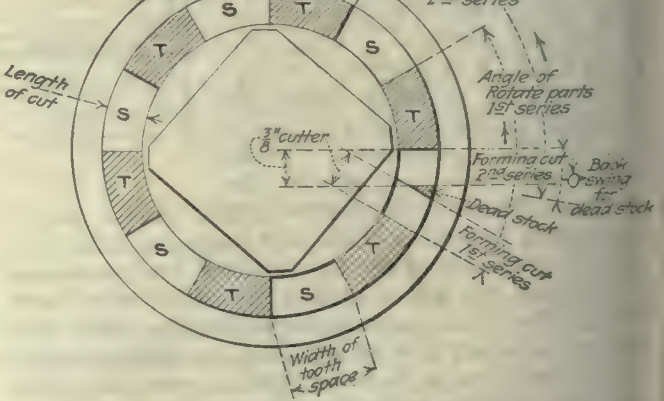
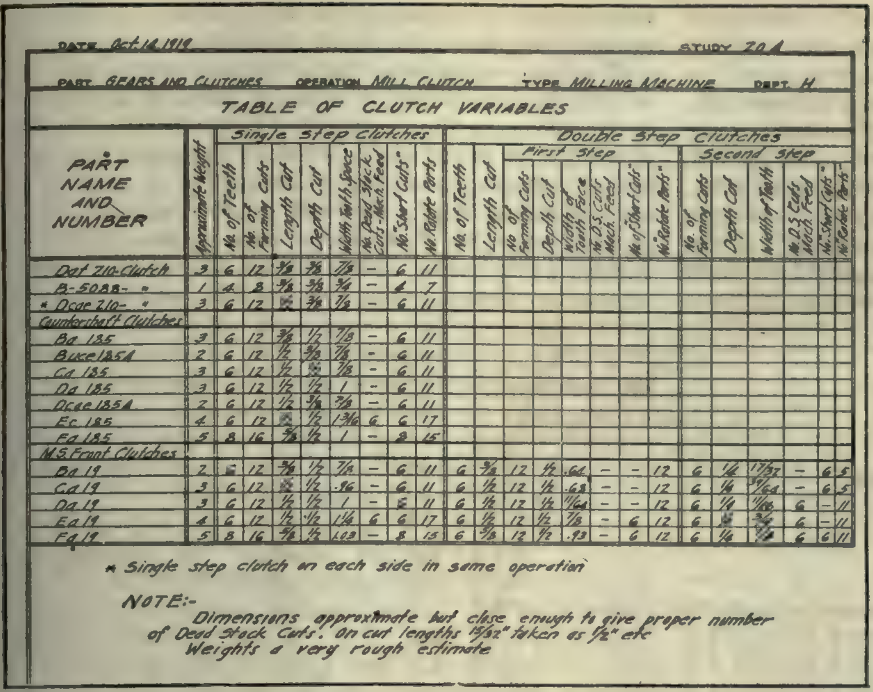


FIG. 111. THE PART IN QUESTION



DATE Oct. 14, 1919 STUDY 20 A

PART GEARS AND CLUTCHES OPERATION MILL CLUTCH TYPE MILLING MACHINE DEPT. H

TABLE OF CLUTCH VARIABLES

		Single Step Clutches								Double Step Clutches													
												First Step						Second Step					
PART NAME AND NUMBER	Approximate Weight	No. of Teeth	No. of Forming Cuts	Length Cut	Depth Cut	Width Tooth Space	No. Dead Stock Cuts-Mach. Feed	No. "Short Cuts"	No. Rotate Parts	No. of Teeth	Length Cut	No. of Forming Cuts	Depth Cut	Width of Tooth Face	No. D.S. Cuts Mach. Feed	No. of "Short Cuts"	No. "Rotate Parts"	No. of Forming Cuts	Depth Cut	Width of Teeth	No. D.S. Cuts Mach. Feed	No. "Short Cuts"	No. "Rotate Parts"
Dot 210-Clutch	3	6	12	3/8	3/8	7/8	—	6	11														
B-5088- "	1	4	8	3/8	3/8	3/4	—	4	7														
* Dcae 210- "	3	6	12	[illegible]	3/8	7/8	—	6	11														
Countershaft Clutches																							
Ba 185	3	6	12	3/8	1/2	7/8	—	6	11														
Bxce 185A	2	6	12	1/2	3/8	7/8	-	6	11														
Ca 185	3	6	12	1/2	[illegible]	7/8	-	6	11														
Da 185	3	6	12	1/2	1/2	1	-	6	11														
Dcae 185A	2	6	12	1/2	3/8	7/8	—	6	11														
Ec 185	4	6	12	[illegible]	1/2	1 3/16	6	6	17														
Fa 185	5	8	16	5/8	1/2	1	—	8	15														
M.S. Front Clutches																							
Ba 19	2	[illegible]	12	3/8	1/2	7/8	—	6	11	6	3/8	12	1/2	.64	—	—	12	6	1/4	17/32	—	6	5
Ca 19	3	6	12	[illegible]	1/2	.96	—	6	11	6	1/2	12	1/2	.63	—	—	12	6	1/4	39/64	—	6	5
Da 19	3	6	12	1/2	1/2	1	—	[illegible]	11	6	1/2	12	1/2	11/64	—	—	12	6	1/4	11/16	6	—	11
Ea 19	4	6	12	1/2	1/2	1 1/4	6	6	17	6	1/2	12	1/2	7/8	—	6	12	6	[illegible]	[illegible]	6	—	11
Fa 19	5	8	16	5/8	1/2	1.03	—	8	15	6	5/8	12	1/2	.93	—	6	12	6	1/4	[illegible]	6	6	11

* Single step clutch on each side in same operation

NOTE:-
Dimensions approximate but close enough to give proper number of Dead Stock Cuts. On cut lengths 15/32" taken as 1/2" etc
Weights a very rough estimate

FIG. 112. TABULATION OF VARIABLES

shaped as to permit them to be removed one in each hand, whereas the gears must be removed singly.

Since the variation on the final performance, "clean table" was due solely to the methods of the two operators, the lesser of the two was taken as the standard.

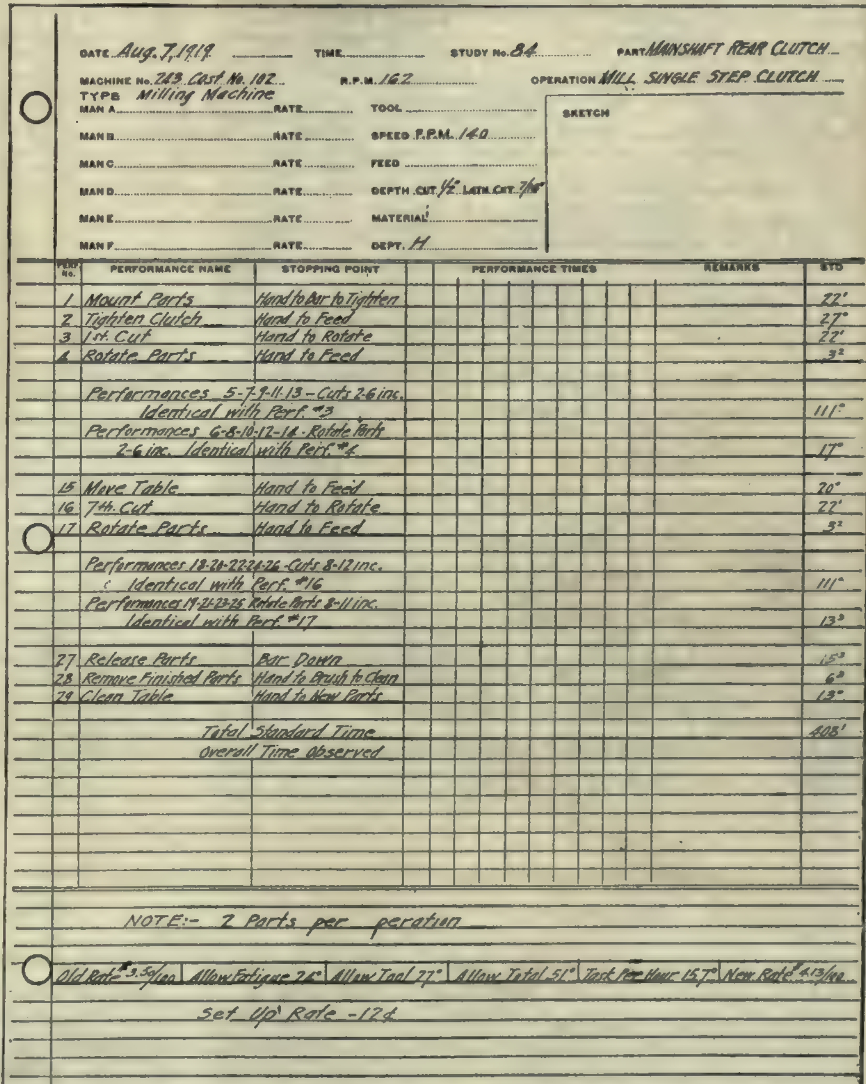
It is next necessary to consider the variables which enter into the operations. All clutches were found to fall into two general divisions, single step and double step clutches. We will take up first the single step class, since both of the studies are of that kind of clutches.

The first variable is the weight of the parts, which affects the ease with which they can be handled. While the simple clutches are uniform in weight, the gears vary in weight from 5 to 20 lb. or more. This must be taken account of in performances 1 and 34. Both gears and clutches show a variation in the height of the clutch boss which determines the length of cut; and in the width of the space between teeth, which determines the amount of dead stock that is left to be removed. The width of the tooth space is a function of the outside diameter of the clutch stock. The variation in weight affects only performances 1 and 34, for the parts are rotated by an index head which can swing a heavy gear as easily as a light one. The "move table" performance is a constant.

The number of forming cuts—but not their duration—is determined by the number of teeth. The duration of the cuts will vary. At a constant depth of cut, the cutting time will vary as the thickness of the stock, in other words, in proportion to the length of cut. For a constant length of cut, the greater the depth the greater the cutting time, and the smaller the depth the less the cutting time. The cutting time for varying lengths of cut is computed by direct proportion—half the cut length, half the cutting time.

The variation in time due to the depth of the cut is not direct. It takes effect through a decreased drag on the machine feed and the hand feed. It seems best to compensate for it in the few cases in which variation occurs by an arbitrary estimate; on most clutches it remains a constant.

Obviously, if a clutch has six teeth there must be twelve forming cuts, and if there be eight teeth there must be sixteen forming cuts. The number of cuts in excess of the number of



DATE Aug. 7, 1919 TIME STUDY No. 84 PART MAINSHAFT REAR CLUTCH

MACHINE No. 243 Cost No. 102 R.P.M. 162 OPERATION MILL SINGLE STEP CLUTCH

TYPE Milling Machine

MAN A RATE TOOL

MAN B RATE SPEED F.P.M. 140

MAN C RATE FEED

MAN D RATE DEPTH CUT 1/2" LGTH. CUT 7/16"

MAN E RATE MATERIAL

MAN F RATE DEPT. H

SKETCH

PERF. No.	PERFORMANCE NAME	STOPPING POINT	PERFORMANCE TIMES	REMARKS	STD
1	Mount Parts	Hand to Bar to Tighten			22'
2	Tighten Clutch	Hand to Feed			27°
3	1st. Cut	Hand to Rotate			22'
4	Rotate Parts	Hand to Feed			3^2
	Performances 5-7-9-11-13 – Cuts 2-6 inc. Identical with Perf. #3				111°
	Performances 6-8-10-12-14 - Rotate Parts 2-6 inc. Identical with Perf. #4				17°
15	Move Table	Hand to Feed			20°
16	7th. Cut	Hand to Rotate			22'
17	Rotate Parts	Hand to Feed			3^2
	Performances 18-20-22-24-26 - Cuts 8-12 inc. Identical with Perf. #16				111°
	Performances 19-21-23-25 Rotate Parts 8-11 inc. Identical with Perf. #17				13^3
27	Release Parts	Bar Down			15^3
28	Remove Finished Parts	Hand to Brush to Clean			6^3
29	Clean Table	Hand to New Parts			13°
	Total Standard Time				408'
	Overall Time Observed				

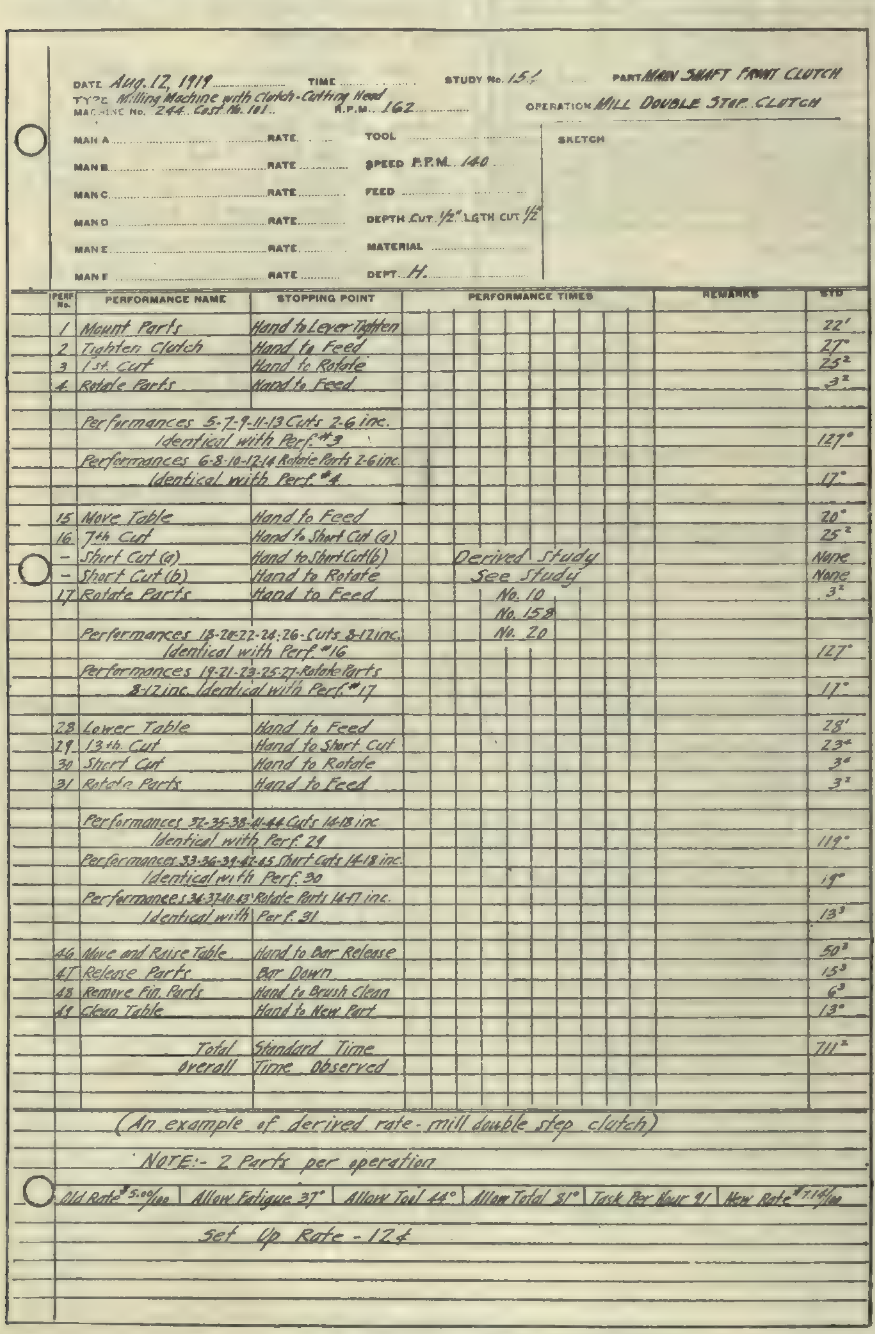
NOTE:- 2 Parts per peration

Old Rate $3.50/100 | Allow Fatigue 24° | Allow Tool 27° | Allow Total 51° | Task Per Hour 15.7° | New Rate $4.13/100

Set Up Rate -12¢

FIG. 113. DERIVED TIME STUDY FORM

forming cuts is determined by the width of the space between teeth. The cutters used have a ⅜-in. cutting edge. The amount of dead stock remaining after the forming cuts depends upon the difference between the two ⅜-in. forming cuts and the total width of the space between teeth. If twice three eighths of an inch from the width of the tooth space leaves a positive remainder, dead stock must be removed. Observations indicated that where the amount of dead stock is less than ⅔ of the cutting edge, namely, ¼ in., it can be reemoved by a short cut. Beyond this amount, an extra machine feed cut just like the forming cuts is necessary. When the dead stock exceeds the amount that can be removed by a machine feed cut—that is, when it is greater than the width of the cutting edge—it can be removed by a machine cut plus a short cut up to the point when this short cut would increase to more than two-thirds the width of the cutting edge. We are thus able to determine from the drawings of the various clutches the number and the character of the dead stock cuts.



DATE Aug. 12, 1919 TIME STUDY No. 151 PART MAIN SHAFT FRONT CLUTCH
TYPE Milling Machine with Clutch-Cutting Head
MACHINE No. 244 Cost No. 101 R.P.M. 162 OPERATION MILL DOUBLE STEP CLUTCH
MAN A RATE TOOL SKETCH
MAN B RATE SPEED F.P.M. 140
MAN C RATE FEED
MAN D RATE DEPTH CUT 1/2" LGTH CUT 1/2"
MAN E RATE MATERIAL
MAN F RATE DEPT. H.

PERF. No.	PERFORMANCE NAME	STOPPING POINT	PERFORMANCE TIMES	REMARKS	STD
1	Mount Parts	Hand to Lever Tighten			$22'$
2	Tighten Clutch	Hand to Feed			27°
3	1st. Cut	Hand to Rotate			25^{2}
4	Rotate Parts	Hand to Feed			3^{2}
	Performances 5-7-9-11-13 Cuts 2-6 inc. Identical with Perf. #3				127°
	Performances 6-8-10-12-14 Rotate Parts 2-6 inc. Identical with Perf. #4				17°
15	Move Table	Hand to Feed			20°
16	7th Cut	Hand to Short Cut (a)			25^{2}
–	Short Cut (a)	Hand to Short Cut (b)	Derived Study		None
–	Short Cut (b)	Hand to Rotate	See Study		None
17	Rotate Parts	Hand to Feed	No. 10		3^{2}
			No. 158		
	Performances 18-20-22-24-26-Cuts 8-12 inc. Identical with Perf. #16		No. 20		127°
	Performances 19-21-23-25-27-Rotate Parts 8-12 inc. Identical with Perf. #17				17°
28	Lower Table	Hand to Feed			$28'$
29	13th. Cut	Hand to Short Cut			23^{4}
30	Short Cut	Hand to Rotate			3^{4}
31	Rotate Parts	Hand to Feed			3^{2}
	Performances 32-35-38-41-44 Cuts 14-18 inc. Identical with Perf. 29				119°
	Performances 33-36-39-42-45 Short Cuts 14-18 inc. Identical with Perf. 30				19°
	Performances 34-37-40-43 Rotate Parts 14-17 inc. Identical with	Perf. 31			13^{3}
46	Move and Raise Table	Hand to Bar Release			50^{3}
47	Release Parts	Bar Down			15^{3}
48	Remove Fin. Parts	Hand to Brush Clean			6^{3}
49	Clean Table	Hand to New Part			13°
	Total	Standard Time			711^{2}
	Overall	Time Observed			

(An example of derived rate - mill double step clutch)

NOTE:- 2 Parts per operation

Old Rate $5.00/100 | Allow Fatigue 37° | Allow Tool 44° | Allow Total 81° | Task Per Hour 91 | New Rate $7.14/100

Set Up Rate - 12¢

FIG. 114. ANOTHER DERIVED TIME STUDY

Observation indicates that with the increase in width of the dead stock to be removed there is a variation in the short cut time amounting to but little more than a second. It is not worth while to complicate the problem by introducing so slight a variation in view of the extended overall time required for the operation. Note that if the width of the tooth space be exactly ¾ in. we should, using perfect cutters, remove all of the stock in the two forming cuts. As a cutter wears, however, there may be a very thin strip left between the cuts. It is not necessary to allow for this, because it can be removed while the table is being positioned for the next cut by turning the index head back and running it backward under the cutters.

With these facts in our possession we can tabulate the variables and build up a proper standard for each clutch. Such a tabulation is shown in Fig. 112. On performances 1 and 34 for the gears, arbitrary allowances are made to cover increased or decreased weight as compared with part BA37. If a clutch is being rated, we take the time for these performances without change from study No. 10. We determine the duration of the forming cuts from their dimensions compared with the observed standard in accordance with the principles of proportion for length and of allowance for height as set forth above, and put down the number of them which is indicated by the number of teeth. We next enter the "rotate parts" performance which is a constant, in accordance with the number of forming cuts. We put in the constant "move table" performance. From the tooth space we determine whether we shall omit all dead stock cuts, or add a series of constant short cuts one per tooth, or add a dead stock machine feed cut per tooth, or add a dead stock machine feed cut plus a short cut per tooth. The "release parts" constant is taken from study 10 or study 20, depending upon whether a clutch or a gear is being rated. Similarly with the "remove finished part" performance which if indicated we adjust for weight as was done for performance No. 1. The addition of the "clean table" constant completes the standard except for the summation of the performances. A derived time study built up in the fashion just described is fully detailed in Fig. 113.

Double-step clutches are cut in much the same way as single-step clutches. The process is first to cut a single-step clutch with wide teeth out of which is later cut the second step. The first part of double-step clutch cutting is therefore precisely as for single-step clutches; except that after having completed the single-step cutting, we interpose the performances necessary to produce the second step between the last dead stock cut on the single-step clutch, and the performances "release the parts." Observation indicates the detail of the second step to be as follows:

After the last dead stock has been made on the single-step clutch, the operator lowers the table to a point which would place the cutter at the height of the second-step teeth, and takes a series of forming cuts. Only one forming cut is necessary since the second-step teeth have one side of each tooth in common with the first-step teeth. After the one forming cut has been taken, therefore, there remains only the removal of the dead stock, the amount of which is determined by the width of the lower tooth. The considerations which apply to the dead stock cuts on single clutches hold for removing the dead stock on the second step. Forming and dead stock cuts having been taken, cutting of a double-step clutch has been completed, and it becomes necessary to position the table for the initial performance on the next clutch. This consists of moving the table laterally and raising it—in other words, that the two performances of "move table" and "lower table" that have previously been made be reversed in a single performance. The clutch is then released and the table cleaned as for a single-step clutch.

Thus, we have all of the data needed to build up the operation for the double-step clutch except the performances "lower table" and "move and raise table," which are secured by separate studies.

The forming cuts on the double-step clutches have only half the depth of the single-step cuts and compensation must be introduced for this. In Fig. 114 is shown a derived study for double-step clutch milling.

Eliminating Industrial Waste Caused by Tuberculosis

The lives of one million Americans are being wasted every year: This sounds like an exaggerated statement, but it is not. Why? Because one million persons in the United States have active tuberculosis, and tuberculosis is a preventable disease. Moreover, 70 per cent of this million persons are between the ages of 15 and 45, the age period when they are wage-earners and producers. Last year 132,000 persons died from this preventable disease and there will be very nearly that many deaths in 1922. When these facts are realized we are not surprised at the statement, "industrial waste because of tuberculosis is enormous—it must be eliminated."

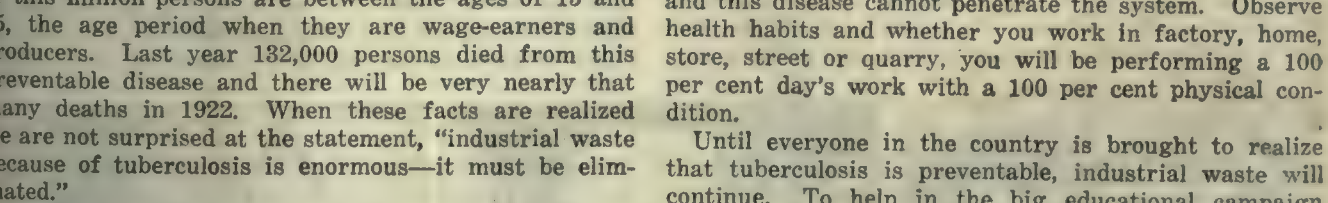
When we realize also what this means in suffering and sorrow for friends and family we are even more anxious to help in stamping out tuberculosis. It has been found that somebody dies every four minutes from tuberculosis, fifteen die every hour and 362 every day. Two-thirds of these deaths are among wage-earners. They are men and women who can ill be spared.

Through the efforts of the National Tuberculosis Association and its affiliated agencies, investigations have been made which prove conclusively that the productivity of one million workers can be conserved. As a matter of fact, in the past fifteen years, since the association began its work, the death rate has fallen from 200 to 120 per 100,000 population. Statisticians have estimated that this is a clear saving of 75,000 lives a year.

Moreover, the saving in dollars and cents has been estimated. At Framingham, Mass., the world-famous health town, where the entire population co-operates in keeping down the mortality rate, it has been shown that if a community is willing to pay two dollars per capita per year for health work over a period of from ten to twenty years, it may count on reducing preventable disease to almost a negligible minimum. Now, if tuberculosis were removed as a cause of death an average of two and a half years would be added to the mean life-time of every individual in the United States. This would result in a gross saving of at least twenty-five billion dollars to the industries and the people in a generation. During the same period the investment in health at the two dollar rate would cost over seven billion dollars. Thus, there would be a net saving of about eighteen billion dollars. Industry, with such a saving in happiness as well as in money, may well take steps toward helping to wipe out tuberculosis.

The best method of reducing the number of cases of tuberculosis and thereby decrease the death toll is through education. Men and women in industry are exposed daily to health hazards. If they can be taught, however, to realize that tuberculosis may be prevented through observing certain health habits they will be helping not only themselves as individuals, but the country in general. Five ways of conserving health and industrial productivity are through: (1) plenty of sleep; (2) good nourishing food; (3) fresh out-door air day and night; (4) regular exercise, and (5) watchful knowledge of one's physical condition, through having periodic examinations by a physician. Build up the powers of resistance from childhood to manhood, and this disease cannot penetrate the system. Observe health habits and whether you work in factory, home, store, street or quarry, you will be performing a 100 per cent day's work with a 100 per cent physical condition.

Until everyone in the country is brought to realize that tuberculosis is preventable, industrial waste will continue. To help in the big educational campaign against the "Great White Plague" the National Tuberculosis Association and its 1,200 agencies are opening the Fourteenth Annual Christmas Seal Sale in December. Buy seals and help eliminate the enormous yearly industrial waste.



Making a Crankpin Turning Tool

Special Fixtures Used in Producing an Accurate Tool in Moderate Quantities — Grinding and Milling Devices for Securing Duplication and Accuracy

SPECIAL CORRESPONDENCE

THE making of the Weber crankpin turning tool at the shop of the Sawyer-Weber Tool Manufacturing Co., Los Angeles, Cal., involves a number of interesting fixtures and operations, some of which are illustrated herewith. The main or active portion of the tool itself is shown in Fig. 1, where the crankpin or main bearing being turned is represented by the bar *X* which is held in and guided by the right angle jaw *A*, having two hardened and ground steel surfaces which guide the work and hold the tool firmly in position while cutting.

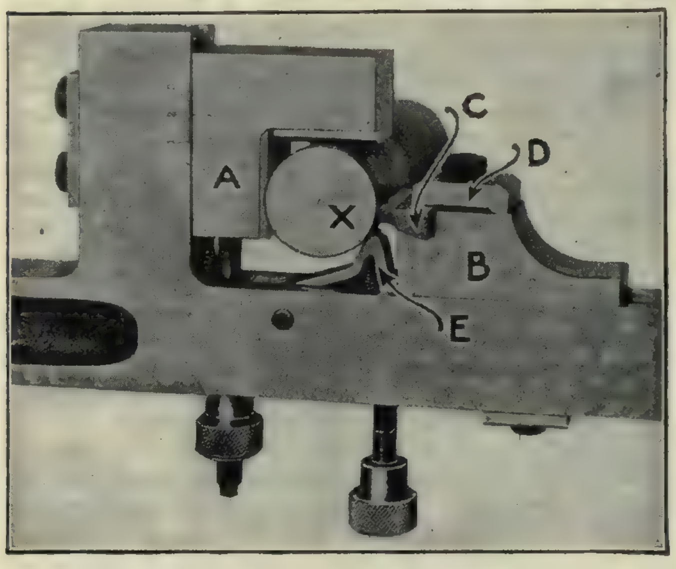


FIG. 1. HOW THE CRANKPIN TURNER WORKS

The jaw *A* is adjusted vertically according to the graduation shown and in accordance with the diameter of the pin being turned. The position of the toolblock *B* determines the diameter of the pin as it carries the tool *C* into the work and holds it while the pin is being turned. The tool is held by the clamp *D* while the swinging jaw *E* is adjusted by the screw beneath so as to form a third guiding point on the pin being turned.

The grinding of the right-angle supporting jaw *A* is shown in Fig. 2 in which the jaw is clamped in the simple fixture shown and both the faces ground at the same setting by means of a cup wheel. By traversing the table for the surface being ground as shown and then lowering the knee the vertical surface can be ground at the same setting and with the same wheel.

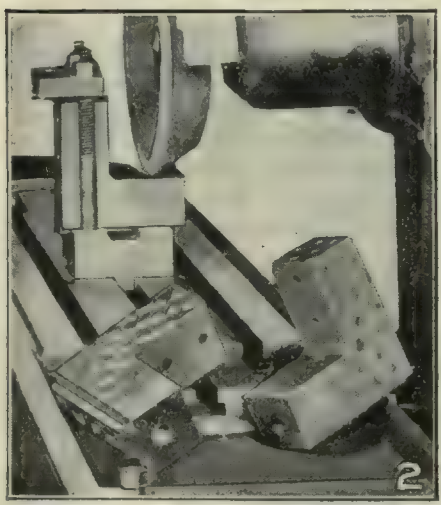
Milling the Cutters

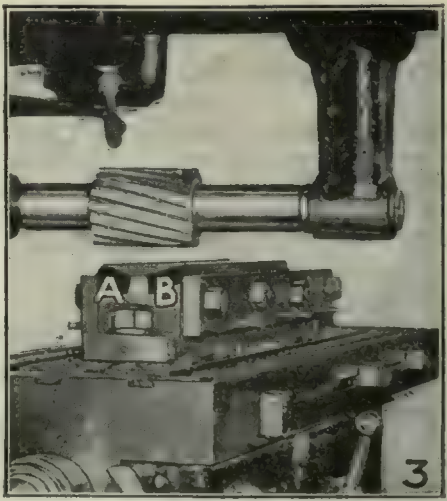
The first operation in machining the cutters is shown in Fig. 3 where the two strips *A* and *B* are being milled for the base or bottom angle. This operation mills cutters in pairs at one setting. The kind of clamp used and the simple construction of the fixture itself is also shown. Fig. 4 shows the next step where the cutters have been reversed in a different fixture and both cutter strips are being milled in order to present a proper top rake to the work. One of the completed cutter strips is shown at *A*.

After cutting up the strips to the desired length and hardening them, they are ground in the fixture shown in Fig. 5. Each cutter has its own independent clamp, as will be seen and the fixture holds seven cutters. The independent clamping allows for any slight inequalities which might exist in the various pieces.

In order to secure the proper clearance angle on the cutting tools a special grinding holder is used as shown in Fig. 6. This locates the cutter in the proper position and insures uniformity which assists in the proper action of the tool on the crankpin.

In Fig. 6 is shown the manufacturing method of grinding the cutter clearance, while Fig. 7 shows the way in which the clearance can be ground by the user. Here the cutter holding stand *A*, which is fastened to the toolblock holder, and a small portable electric grinder *D* are clamped to the angular supporting jaw. This





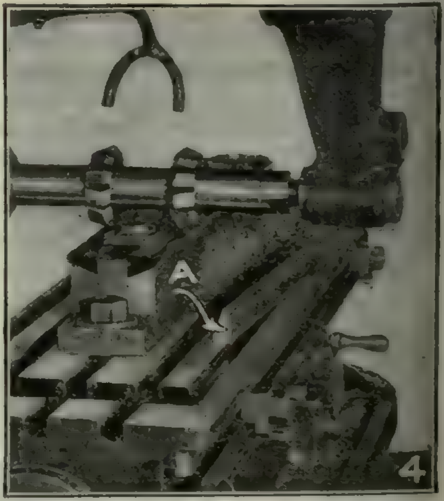


FIG. 2. GRINDING THE ANGULAR SUPPORT. FIG. 3. MILLING UNDER SIDE OF CUTTING TOOL. FIG. 4. CUTTING THE TOP RAKE

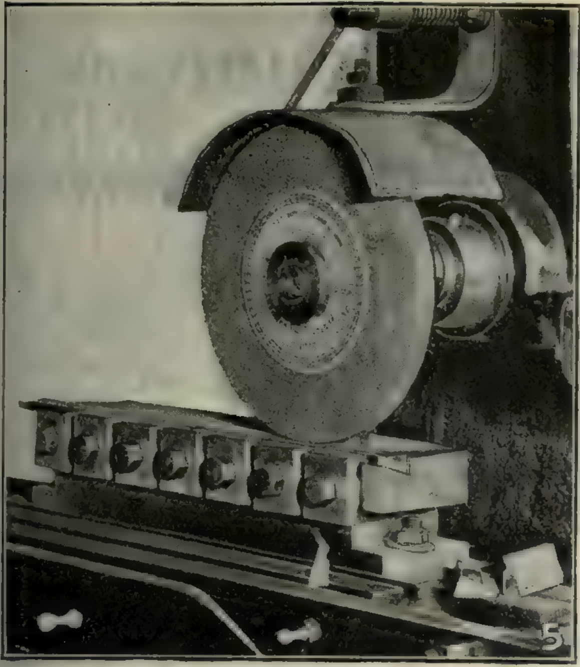


FIG. 5. GRINDING CUTTERS AFTER HARDENING.

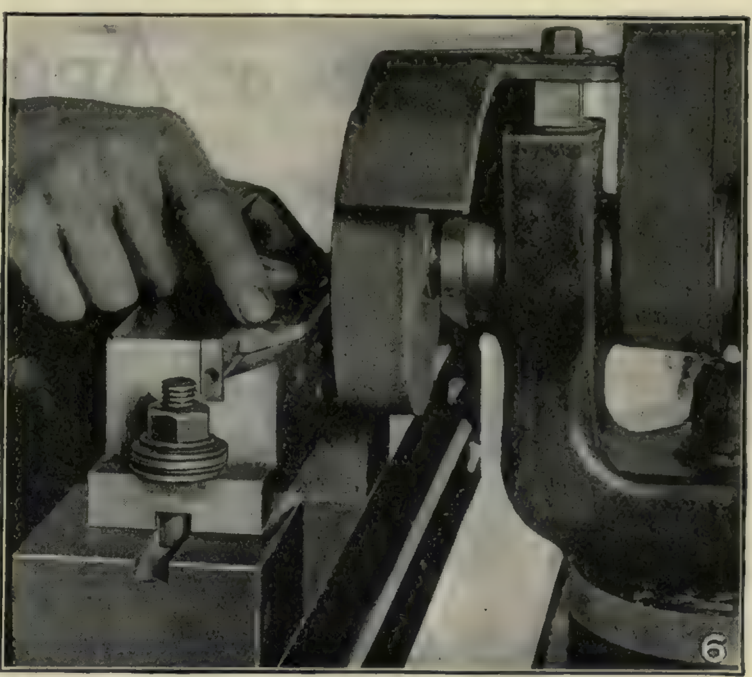


FIG. 6. GRINDING THE CUTTING CLEARANCE

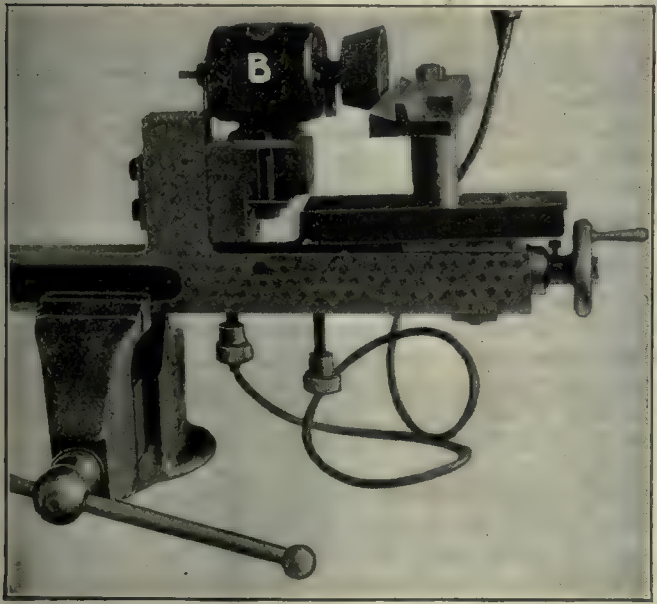


FIG. 7. UTILIZING A PORTABLE GRINDER

sharpening device is supplied when desired and enables the user to keep his various cutters in good condition and to be prepared for any kind of work which may come along. Very accurate grinding of the cutter is necessary to have it remove only the amount of metal necessary to true up the pin. Experience has shown that a pin which is 0.003 in. out of round can be trued up to a diameter only 0.0035 to 0.002 in. smaller than before.

Is There Business For All?

By John R. Godfrey

I've been reading the articles on management by E. W. Leach with much interest. Not because I'm a manager, but because I want to be. And I've learned a lot from them. But where he says, on page 754, that there is "business for all," meaning I take it, all the shops now in existence, I'm afraid he has let Polyanna hopefulness run far away with his own better judgment.

The war demand made necessary a great increase in machine shop capacity of various kinds. The question of economical manufacturing and marketing was not a factor. We now find ourselves with no likelihood of a return of this demand but with a capacity far beyond our needs.

Why shouldn't we consider the machine shops as soldiers who volunteered or were drafted for the war. Now that their services are no longer needed they must disband and find some other job. Of course it isn't easy, but some of the boys who gave up good jobs to fight overseas are not finding it easy either. But we would be foolish to tell them there was plenty of room in the Army if they only get out and hustle for a place.

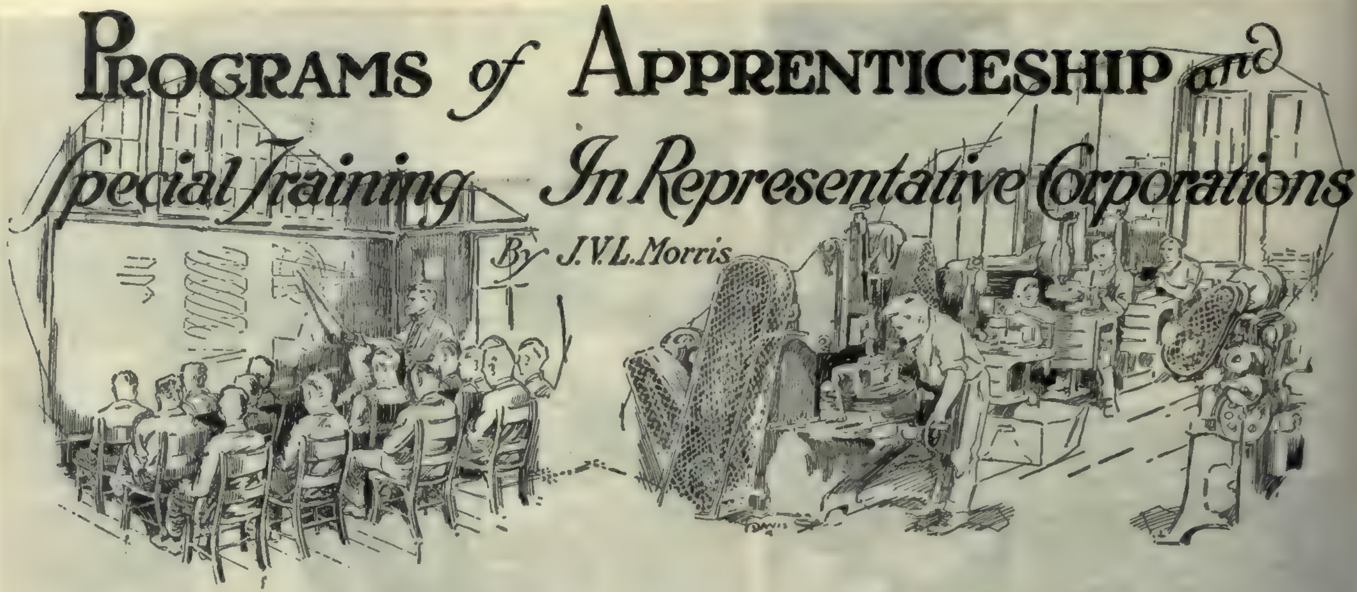
Here the simile ends, for there is a place for every man, soldier and otherwise, when proper economic adjustments are made. But this very economic adjustment means that many firms, large and small, which played a valiant part in the machine business, must find other fields of activity now. They must turn their capacity for shells into making printing presses, plows and other articles which are not over supplied with capacity.

The best thing from an economic standpoint and the kindest thing from a humanitarian standpoint is to make the machine shops of the country see that some of them have got to hit the trail. If they can find some other line of work, well and good. But don't encourage them to hang on until the overhead eats the shirt off their backs, when it would be better for them to go out and help raise hens and potatoes and to tuck a few dollars in a savings bank while they still have it.

It's a bad time to "kid" anybody on the business situation—even ourselves. Business is coming back, the country is going to prosper as in the past, but liquidation also means elimination in many cases. So lets face the music—study our own case honestly—and if we're elected to dig potatoes, do it with as cheerful a grin as possible.

Programs of Apprenticeship and Special Training In Representative Corporations

By J.V.L. Morris



XVII—Yale & Towne Manufacturing Co., Stamford, Conn.

Traditional Form of Apprenticeship Modernized—Separate Shop for Training Apprentices—Apprenticeship Offered in Various Trades—Broad Experience Provided

THE Yale & Towne Manufacturing Co., Stamford, Conn., maintains an apprentice training school and a training school for productive employees, both being under the supervision of the director of training schools. The apprenticeship system was established upon the present well-organized basis in 1908. There were in the employ of the company at the time this investigation was made about 5,500 persons, of whom a large proportion were, of course, specialist operatives on the various products of the company, chief among which being the locks and builders' hardware for which the company is so well known.

Due to the extensive mechanical equipment required for the work there is offered a large opportunity for training in the tool and diemaking trades. This has occasioned the equipment of separate tool shops for training apprentices, these separate training shops offering the distinctive feature of the apprentice department.

More than one hundred apprentices are at present in training, most of them in the toolmaking and diemaking courses. Those in other trades include metal patternmakers, product draftsmen, power and plant draftsmen, tool designers, electricians, screw machine operators, and specialists in the heat-treatment of steel.

The courses in screw-machine operation and the heat-treatment of steel cover three years, all other courses being of four-year duration. There is an apprentice agreement entered into between the boy's guardian and the director of the school as representative of the company.

Training an Apprentice

As nine-tenths of the apprentices are in the toolmaker's and diemaker's course, their training will first be considered. During the first three or four months a very commendable attempt is made to provide a real trial course, and to that end the work is as varied as it can well be made for beginners. There is much elementary instruction in the care and handling of machine tools and the grinding of cutting tools. With this is provided a varied experience in roughing out of regular stock tools and some operations in the manufacture of small machine parts, upon which an estimate can be made of the mechanical capacity of the potential apprentice.

If the young man proves acceptable, the next fifteen months are spent on tool work, which has been graded into three classes for lathes, three for milling machines, two for grinders, and one for planers and shapers. Each apprentice covers a definite amount of work in each class, but does not cover two classes on the same machine in succession. The purpose of this intermittent training on the various machine tools is to give the apprentice, during the early part of his course, a thorough training in the handling of the machines used in his trade. To provide valuable experience in other types of work, each apprentice from this room also completes one month in the millwright department, two weeks in the belt room, two weeks on steam fitting and five weeks in the production grinding department.

Special Apprentice Courses

The next sixteen months are in a separate training shop at more advanced tool work on stock tools. Here the apprentices carry each job through all operations to completion. The work is graded into six classes, and an apprentice is advanced from class to class as rapidly as his ability warrants. During this stage of his training the apprentice has the very valuable experience of one month in the hardening room.

Having thus concluded the time assigned to separate training shops, during the final year of apprenticeship the young man is sent into either the main toolroom or dieroom, where he works under the shop foreman. A record of each apprentice's performance is kept on the progress report shown in Fig. 70, which report is filled in with ratings of both school and shop work.

In metal patternmaking the practical experience must, of course, be gained in the patternshops. However, for at least one month, the apprentice is assigned to the iron foundry, and likewise to the brass foundry.

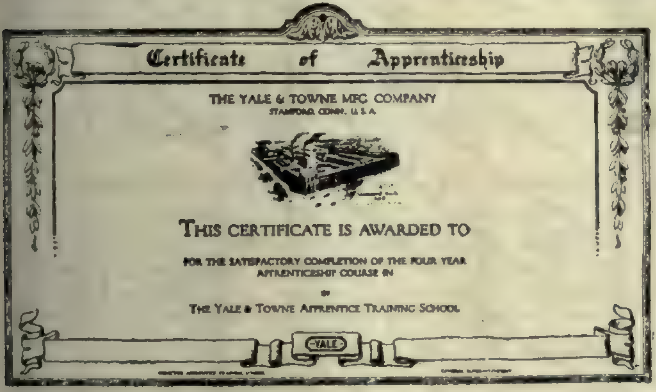
For the draftsman there is a differentiation into machine and tool design, product designing, and power and plant drafting. Apprentices in machine and tool design are selected from the toolmaking and diemaking course, because of their special talent for this work. These apprentices and also the apprentices in product design receive special training in patternmaking, foundry work, and product assembling. The apprentices in the power and plant drafting course receive training in all branches of the power and plant maintenance departments, including millwrighting, steam fitting, power plant operating, electrical construction, and building layouts.

This varied basic training is in all cases supplemented by four to five hours per week of technical instruction on the company's time.

The following subjects are scheduled, with the subject matter varied as much as possible to suit the special requirements of each group:

Mathematics
Mechanical drawing
Mechanics
Business English
Talks on subjects of general interest
Machine and tool design
Design of screw-machine cams
Shop talks
Metallurgy
Chemistry of Iron and Steel
Electricity

Training in the regular departments must, of course, be by the shop foremen of those departments, but in the special training departments it is given by five especially selected instructor-foremen.


Certificate of Apprenticeship

THE YALE & TOWNE MFG COMPANY
STAMFORD, CONN., U.S.A.

THIS CERTIFICATE IS AWARDED TO

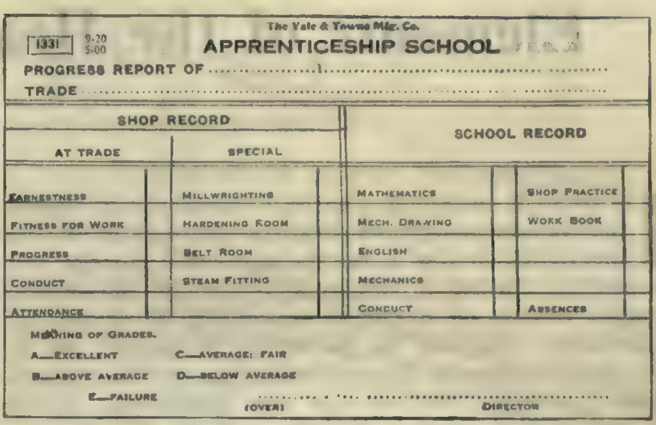
FOR THE SATISFACTORY COMPLETION OF THE FOUR YEAR
APPRENTICESHIP COURSE IN

THE YALE & TOWNE APPRENTICE TRAINING SCHOOL

FIG. 71. CERTIFICATE OF APPRENTICESHIP

Apprentices' pay is now at the following wage rates: 19, 20, 22, 24, 27, 30, 33, and 40 cents per hour, respectively, for each of the six-month periods into which the course is divided, the rates for the three-year courses ranging from 22 to 40 cents per hour. At the conclusion of the course the usual hundred-dollar bonus is paid, and a certificate of apprenticeship is conferred. Fig. 71 shows the certificate, a miniature copy of which is also given each graduate to carry in his card case.

For the training of both women and men as specialists in the production departments there has been some development of the vestibule school idea. This course is naturally varied in length to correspond to the difficulties of the particular operation to be learned, and to the capacity of the learner in acquiring the necessary skill. During this learning period a fixed minimum wage is paid, until standard production is reached and the worker is transferred to regular production at the established piece-rate wages.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The Yale & Towne Mfg. Co.
APPRENTICESHIP SCHOOL

PROGRESS REPORT OF ....
TRADE ....

SHOP RECORD				SCHOOL RECORD			
AT TRADE		SPECIAL					
EARNESTNESS		MILLWRIGHTING		MATHEMATICS		SHOP PRACTICE	
FITNESS FOR WORK		HARDENING ROOM		MECH. DRAWING		WORK BOOK	
PROGRESS		BELT ROOM		ENGLISH			
CONDUCT		STEAM FITTING		MECHANICS			
ATTENDANCE				CONDUCT		ABSENCES	

MEANING OF GRADES.
A—EXCELLENT C—AVERAGE; FAIR
B—ABOVE AVERAGE D—BELOW AVERAGE
E—FAILURE ....
(OVER) DIRECTOR

FIG. 70. PROGRESS REPORT OF APPRENTICE

Co-operation in Foreign Trade

By W. H. Rastall

Chief, Industrial Machinery Division, Department of Commerce

My attention has been called to the article entitled "Co-operation in Foreign Trade" that appeared on page 846 of *American Machinist*.

We here in Washington appreciate very much the spirit of co-operation shown in your article, and feel the need of establishing closer contact between the manufacturer of machinery and his market overseas. The remarks that you published describing the work of this bureau and the American consuls abroad, seem to overlook changes made by Secretary of Commerce Hoover when he recently reorganized the bureau, at which time he established the Industrial Machinery Division with instructions to do everything possible to provide manufacturers with the information they might require in promoting their foreign trade. Secretary Hoover has placed the division in the hands of men who have actually sold machinery in Asia and South America for a considerable number of years, and are thoroughly familiar with all practical details of the problem of marketing American machinery abroad, and have a personal knowledge of the conditions existing in most of the important cities on those continents. In addition, the division is provided with a great deal of information regarding the markets in other sections of the world, and holds itself ready at all times to assist the American manufacturer and furnish him with the information that he needs, not only as described in your article, but in those having to do with all problems concerning foreign trade.

The division will be very glad indeed to receive from manufacturers and exporters information indicating what particulars they would like to receive from any and all foreign markets.

Elements of the Heat-Treatment of Steel

By H. J. FRENCH
Metallurgical Engineer, Bureau of Standards, Washington, D. C.

(Continued from last week's issue.)

IN ORDER to harden steel it is necessary to exceed the transformation temperatures represented by the line *GOSK* in Fig. 2, for the aggregate (ferrite and cementite) formed in slow cooling through the critical ranges cannot be hardened materially, if at all, by quenching. Heating for hardening is carried out in the same manner as that for annealing and the precautions previously outlined are also applicable. Baths of molten lead, barium chloride, sodium chloride, etc. are sometimes used where it is desired to minimize oxidation. They have a decided advantage of ease of temperature control, but decarburization will result from too long heating in salt baths.

Too high a temperature is also to be avoided, as a coarsened structure, accompanied by an increased brittleness and a greater tendency for the material to warp and crack in cooling will result. On the other hand, a temperature too close to the critical ranges may in practice result in only partial hardening and will thus produce inferior results. As an example of the effects of different quenching temperatures on the properties of steel, there are given in Fig. 11 results of tests on an alloy containing about 1 per cent carbon.

It is not good practice to place steel in an extremely hot furnace and depend upon the furnace cooling to the desired temperature by the time the steel reaches this same point, both because of the heating rate which results and also because of the possibility of the steel becoming over-heated. As the grain size is dependent upon the maximum temperature obtained, "quenching on a falling heat" should not be used, as obviously the coarsened structure will not be obliterated in this procedure.

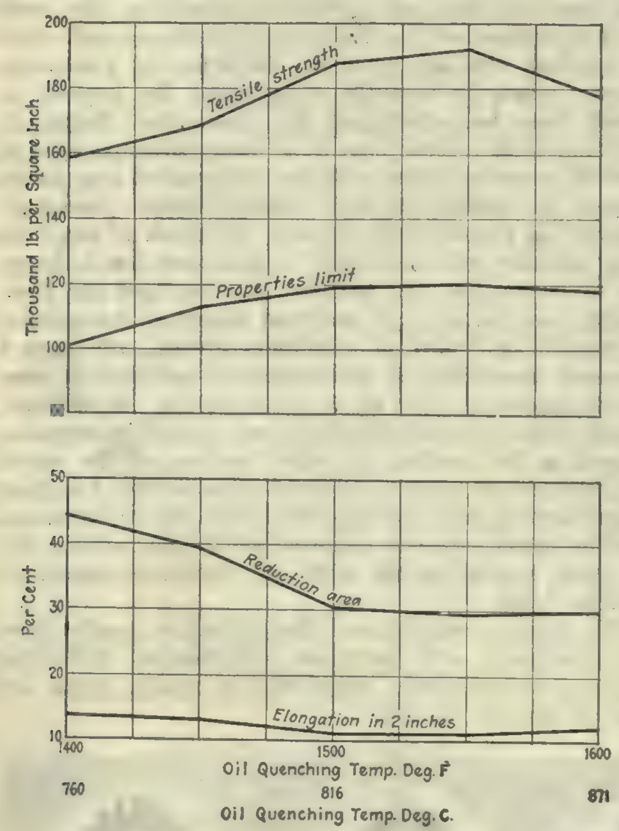

FIG. 11. EFFECT OF VARYING OIL-QUENCHING TEMPERATURES ON THE TENSILE PROPERTIES OF 1 PER CENT CARBON STEEL. HALF-INCH ROUNDS QUENCHED IN OIL FROM TEMPERATURES SHOWN AND TEMPERED AT 538 DEG. C. (1,000 DEG. F.)

Under otherwise similar conditions the properties of quenched steel depend upon the cooling medium. Different liquids have different cooling properties and so impart different degrees of hardness to the metal. In Table 5* is given a comparison of the more commonly used oils, brine and other media with water. The data given illustrate roughly the relative hardening that may be expected and show that with increase in temperature, the rapidity of cooling by water diminishes considerably. A change in cooling properties of various quenching oils is also found, but to a much smaller degree. The need of an adequate supply of the liquid and a circulating system such that the temperature of the bath will not rise materially with the continued introduction of hot steel is at once evident.

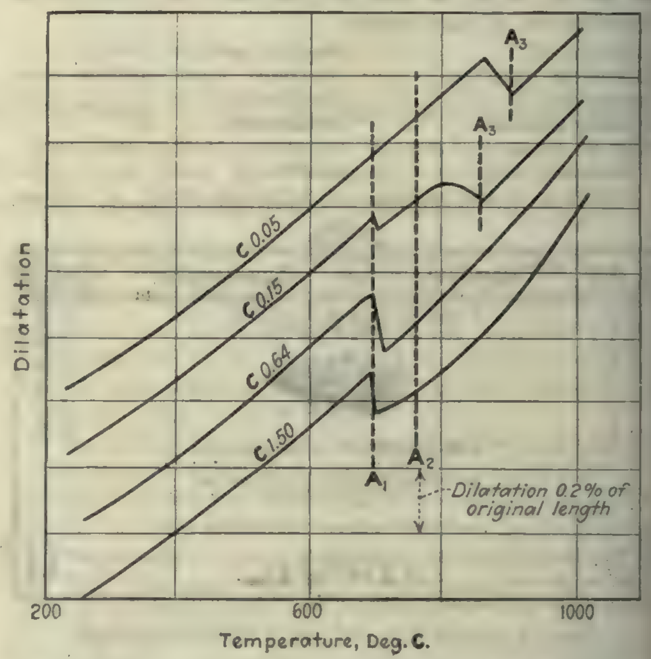

FIG. 12. DILATATION OF CARBON STEELS (SAUVEUR)

QUENCHING OPERATIONS

The method of introducing the metal in the quenching bath is of considerable importance in successful hardening. The minimum time should be allowed between removal from the furnace and its introduction into the cooling liquid. Particular care in this respect is required for small pieces which lose their heat rapidly. Long thin pieces are preferably introduced axially while irregular sections should, as far as possible, be introduced with the long dimension at right-angles to the surface of the liquid.

Difficulty is frequently encountered in hardening medium- and high-carbon steels when immersed in rapid cooling media such as water or brine. In cooling from a high temperature steel contracts, as do other metals and alloys, until the critical ranges are reached, when the steel not only ceases to contract with further decrease in temperature but actually expands a considerable amount. This phenomenon called "dilatation" is represented graphically in Fig. 12 and it is not difficult to visualize what happens in rapid cooling. The surface of the metal almost immediately becomes cold and "rigid" while these dimensional changes are going on in the interior of the mass. Stresses are set up which cause distortion, and in cases of brittle alloys, often fracture.

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*Prepared by M. A. Grossman, Electric Alloy Steel Co.

In hardening, as in annealing, the previous history of the material is of importance. For example, parts such as crankshafts, connecting rods and gears will in most cases show much less distortion in hardening if properly normalized or annealed after forging than if quenched without such preliminary treatment, which in the particular cases mentioned is essential.

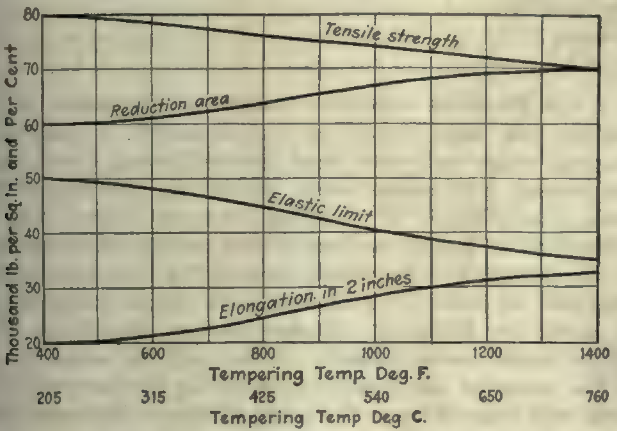


FIG. 13. TEMPERING OF 0.20 PER CENT CARBON STEEL. ABOUT 1-IN. ROUNDS, OIL QUENCHED, FROM 885 DEG. C. (1,570 DEG. F.) TEMPERED AS SHOWN. (DATA OBTAINED FROM S. A. E. HANDBOOK)

In general, low carbon steels are not subjected to quenching and tempering as are the higher carbon alloys since the benefits derived are not commensurate with the cost of these operations for quite evident reasons. Occasionally, however, such steel is water quenched for increased stiffness. As mentioned previously it is the condition of the cementite which determines the properties of the steel. Low carbon alloys, because of their relatively small proportion of carbide are not expected to be, and are not, as susceptible to variations in rate of cooling as are those steels having a large proportion of the controlling constituent. Comparative values for steels of various compositions are given in Table 6 to show the effects of quenching on the properties of rolled carbon steels.

Tempering

Quenched carbon steels, except for those quite low in carbon, are generally too brittle for most purposes and often harder than necessary. In order to reduce brittleness and relieve the internal strains caused by the previous sudden cooling, a reheating to temperatures below the critical range is resorted to and this process is called "tempering" or "drawing." The magnitude of the effect depends largely upon the temperature, which is generally between 205 and 677 deg. C. (400 and 1,250 deg. F.), but also somewhat upon how long the temperature is maintained.

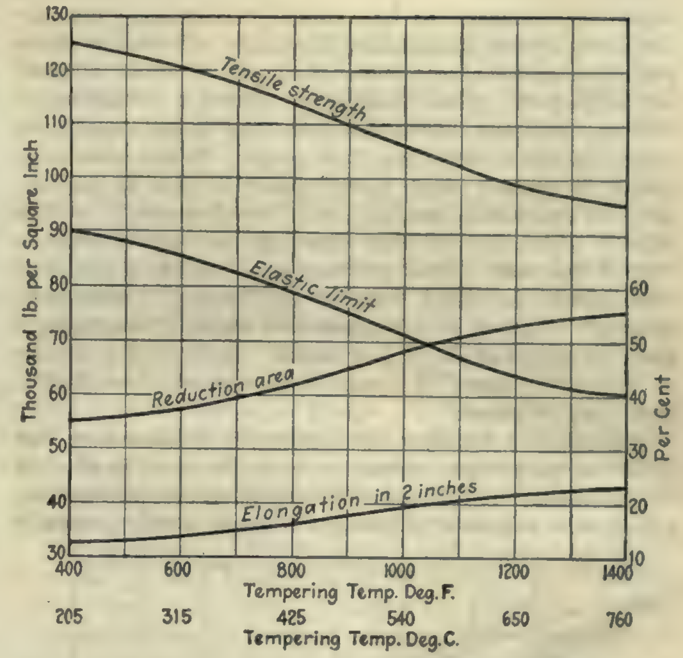


FIG. 14. TEMPERING OF 0.45 PER CENT CARBON STEEL. ABOUT 1-IN. ROUNDS, OIL QUENCHED FROM 816 DEG. C. (1,500 DEG. F.) TEMPERED AS SHOWN. (DATA OBTAINED FROM S. A. E. HANDBOOK)

It would of course be desirable to control the properties of steel in a single operation by varying the rate of cooling in quenching, thereby eliminating the tempering. However, in practice it is not feasible to have an infinite variety of cooling media so that the steel is first thoroughly hardened and then tempered to the desired degree.

Hardened steel is in an unstable condition at room temperature but owing to its rigidity a return to its more stable form in a reasonable time is not possible. With the greater plasticity resulting from heating, this transformation gradually takes place and the structures martensite, troostite and sorbite are obtained in the order named as the temperature is increased. In practice, hardened carbon steels are rarely austenitic for it requires exceedingly high carbon, a high quenching temperature and very rapid cooling of small pieces to produce this structure. Therefore the question of whether the austenite is transformed on tempering directly into troostite will not be discussed. On tempering martensitic steels troostite and sorbite are produced and likewise, under suitable tempering, a steel which is troostitic is changed into sorbite. These structural transformations are, of course, accompanied by changes in physical properties as is shown in Figs. 13 to 15, inclusive, for low, medium, and high-carbon steels. Quenched low carbon steel is affected to a relatively small degree by tempering while the changes become more marked with increase in carbon content.

In tempering as in other heat-treatment operations the time-temperature relations are of importance. Long time at a given temperature will in practice produce about the same physical properties as a somewhat shorter time at slightly higher temperatures. However, the first relationship is much to be preferred because of the greater uniformity obtained and because of the slightly superior physical properties frequently produced.

In general the rate of cooling from the tempering temperature is of secondary importance. Too rapid rates are, however to be avoided for reasons already discussed under hardening, especially where low tempering temperatures in the range of "temper colors" are employed. Steel frequently shows a tendency to develop minute cracks which later may result in failure when rapidly cooled from this range. It has also been found in certain alloy steels that the rate of cooling may, in individual heats, have a marked effect on the impact resistance without affecting the tensile properties of the steel. This phenomenon (which is not well understood) is called "temper brittleness," "blue brittleness," etc., and it is claimed that similar results have been encountered in carbon steels. Such effects, as far as the latter class of steels is concerned, have rarely been met however.

The relation between the tempering temperature and previous quenching operation is to be considered. In the treatment of a given steel a higher tempering temperature is required to produce a given tensile strength after water quenching than when oil is used. Whether it is beneficial to use a drastic cooling and higher tempering temperatures or a slower cooling is open to discussion. As far as the tensile properties of structural carbon steels are concerned, slightly better results are obtained after water quenching. There is, however, greater danger of producing quenching cracks (especially in irregular sections) and of encountering greater distortion.

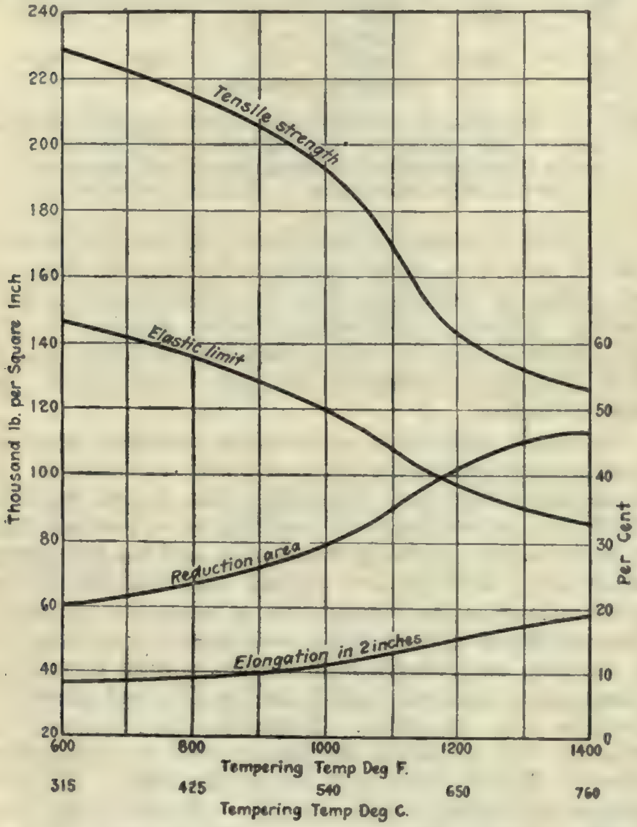


FIG. 15. TEMPERING OF 1 PER CENT CARBON STEEL. ABOUT ¼-IN. ROUNDS OIL QUENCHED FROM 843 DEG. C. (1,550 DEG. F.). TEMPERED AS SHOWN

The average heating furnaces used in annealing, normalizing and hardening are not well adapted to accurate control at the lower temperatures used in tempering. Molten baths are therefore more often employed because of the ease of temperature control and the fact that they minimize oxidation. A partial list of baths frequently encountered is given in Table 7.

TABLE V. APPROXIMATE INDICATION OF THE RELATIVE HARDENING POWER OF QUENCHING MEDIA

Quenching Medium	Time of Cooling Specimen from 800 to 250° C. (1472 to 482° F.)
Water at 20° C	1.0
Water at 50	1.2
Water at 80	1.4
Water at 100	3.0
Brine at 20° C	1.0
Brine at 60	1.0
Brine at 80	1.2
Alcohol at 20° C	1.0
Corn oil at 20° C. to 75° C	1.3
Fish oil	1.5 to 1.9
Lard oil	1.6 to 1.8
Sperm oil	1.7
Linseed oil	1.8
Cottonseed oil	1.9
Mineral oils, 20° C	1.3 to 2.5
Mercury, 20° C	2.5
Glycerine, 20° C	3.0
A 2r0i, °C	15.0

While the most desirable method of treatment is to harden and then temper at the required temperature various short cuts are used in combining these two operations. In some cases, as in the treatment of tools, use is made of so-called "temper colors" which appear on a bright surface of the metal when heated in an oxidizing atmosphere, due to the formation of a thin film of oxide. An approximate temper color scale is given in Table 8. Under certain conditions the colors tested are a measure of the surface temperature of the material but their occurrence in the temperature scale will depend upon the composition of the steel and the time at the given temperature.

In the heat treatment of chisels the following procedure is sometimes employed: The tool is heated throughout to the desired temperature for hardening and the point is then immersed in the quenching liquid until cold. It is then removed and the heat contained in the body of the tool is allowed to "creep" to the point which is gradually heated and so passes through the range of various temper colors. When the desired color appears the entire tool is quenched. When the treatment is carried out by an experienced operator excellent results are obtained and in addition to a hard, slightly tempered point, the body remains tough, having been slowly cooled through the transformation ranges.

Large masses are sometimes hardened and tempered in one operation by immersion in the quenching liquid for a given time, which will leave sufficient heat in the metal to effect the desired tempering. However, such procedure is controlled with difficulty so that uniform properties may not be always obtained in production. In some instances a similar procedure is employed

TABLE VI. EFFECTS OF QUENCHING ON THE PROPERTIES OF STEELS OF VARIOUS CARBON CONTENTS

Per Cent Carbon	Treatment	Tensile Str. Lb. per Sq.In.	Yield Pt. Lb. per Sq.In.	Per Cent El. 2 In.	Per Cent Red. A.
0.14	As rolled	59,500	45,000	37.5	67.0
	866° C. water	90,000	....	21.0	67.0
	866° C. oil	71,500	56,500	34.0	75.5
0.46	As rolled	86,500	52,500	22.5	30.7
	819° C. water	220,000	....	1.0	0.0
	819° C. oil	126,500	87,500	20.5	51.9
0.57	As rolled	106,500	57,000	19.0	27.4
	809° C. water	215,000	....	0.0	0.0
	809° C. oil	152,000	105,000	16.5	40.3
0.71	As rolled	128,000	66,000	15.0	20.5
	800° C. water	....	....	....	....
	800° C. oil	184,500	100,000	1.5	0.0
1.01	As rolled	152,000	86,000	9.5	13.3
	790° C. water	153,000	....	0.0	0.0
	790° C. oil	192,500	127,000	10.5	34.0

From "The Effect of Carbon on the Physical Properties of Heat-Treated Carbon Steel," by J. H. Nead. T.A.I.M.E., 1915, p. 218.

where a drastic quenching is used and the material removed from the bath before cold to prevent cracking. It is immediately placed in a furnace at a higher temperature for tempering. There is more reason for following this procedure than the previous one, which should not be used if some other method can be employed.

As previously mentioned, hardened steel is in an unstable and internally strained condition as a result of rapid cooling, but because of its rigidity at room temperature it is not capable of transforming into its stable form. That there is a tendency for a readjustment and relief from its strained condition is evidenced by the gradual dimensional and other physical changes observed over long periods of time. The exact nature of these changes is obscure but where constancy is desired either a long time must pass between the hardening and use of the material or methods of treatment which will hasten their completion must be used.

TABLE VII. MOLTEN BATHS FOR TEMPERING

To about 260° C. (500° F.)	Heavy oils such as fresh cottonseed, mineral oil, etc.
260° C. to about 538° C. (500 to about 1,000° F.)	Mixtures of salts such as sodium and potassium nitrates.
Above about 538° C. (1,000° F.)	Molten lead, and salts, such as barium chloride, sodium chloride.

It is not the purpose of this paper to outline fully the various manifestations of changes as observed by different investigators, but merely to point out that changes do occur in quenched steels with time and that they may be hastened anl possibly brought to practical completion by suitable treatment. Such methods when used are called "artificial seasoning," "aging," et cetera.

Probably the oldest method aside from the natural aging produced by time, consists in immersion of the hardened steel in boiling water (100 deg. C. 212 deg. F.) for varying periods. Under such treatment the changes which occur in months and even years are brought about in days and even in hours. Heating to somewhat higher temperature but not high enough to produce tempering, usually in oil baths for convenience, has likewise been used. Repeated alternate heating and cooling to temperatures respectively above and below room temperature has been tried in the seasoning of gage steels with varying degrees of success. This latter method may or may not involve a change in state of the material whereas the other treatments referred to depend for their effects upon the time-temperature relationship.

TABLE VIII. TEMPER COLORS

Faint yellow	1 hr. at 188° C. (370° F.)	8 min. at 238° C. (460° F.)
Light straw	199° C. (390° F.)	265° C. (510° F.)
Dark straw	210° C. (410° F.)	293° C. (560° F.)
Brown	221° C. (430° F.)	321° C. (610° F.)
Purple	232° C. (450° F.)	337° C. (640° F.)
Dark blue	254° C. (490° F.)	349° C. (660° F.)
Light blue	265° C. (510° F.)	376° C. (710° F.)

Values obtained from the catalog of the Midvale Steel Co.

There is generally little exact information available along these lines and, as mentioned above, the changes are not well understood.

The operations encountered in the case hardening of steels may be grouped under two classes as follows: (a) Carburization, often called concentration or carbonization, whereby the carbon content of the surface of low carbon steel is materially increased so that it may be hardened by quenching from above the critical range, and (b) subsequent treatment for hardening.

The result of such treatment is to produce a material of dual nature having a very hard wearing surface supported by a tough, resilient interior for withstanding shocks such as are encountered in gears, cams, pins, etc.

Steels which are to be case hardened, whether plain carbon or alloy, generally contain in the neighborhood of 0.20 per cent carbon, as obviously a medium or high carbon interior would not meet requirements for toughness and resiliency of the core and in addition the higher carbon content would retard effective carburization.

In practice, carburization may be carried out in either liquids, solids or gases. In all cases the material is heated under the action of the re-agents for definite periods of time at definite temperatures, which are usually above the critical ranges of the base steel, though in some cases lower ones are used.

The most common method in which molten re-agents are used is that known as "Cyanidation" or "Cyanide Hardening." The steel is immersed in molten potassium cyanide, or sodium cyanide, sometimes mixed with chlorides for from 1 to 15 minutes at about 800 to 900 deg. C. (1,472-1,652 deg. F.) and then quenched.

A more recent method invented by Porter W. Shimer, of Easton, Pa., makes use of fused salts which do not possess case hardening properties, such as sodium, calcium or barium chlorides or mixtures of these, into which is introduced fresh calcium cyanimide which imparts active case hardening properties to the bath. As soon as a lively evolution of gas is obtained the steel is introduced for a short time and then quenched in the usual manner.

Carburization by means of solid re-agents is the most widely used where a hard, wear-resisting surface and tough interior is required. The steel is placed in a closely covered box of steel, cast iron or other suitable material which is filled with the re-agent and is heated for from 5 to 20 hours at temperatures between about 875 to 950 deg. C. (1,607 and 1,742 deg. F.). The characteristics of the "case," both as to depth and distribution of carbon, will depend upon the carburizing re-agents used, the original composition of the steel, the temperature, and the time of heating and cooling. The method of packing the boxes and position of the steel is of great importance in obtaining uniform results. Mixtures of charcoal, charred leather, bone, etc., with barium carbonate or other carbonates are widely used as carburizing re-agents.

Carburization is also carried out under the direct action of carbonaceous gases, which are particularly applicable when considerable depth of carbon is required. One method is to heat the work in a slowly revolving retort into which gas is introduced under pressure. A number of gases or mixtures may be used including carbon monoxide and hydrocarbons such as ethylene, methane, etc. The carburized steel is then hardened according to one of the following methods:

Quenching from the carburizing heat is the method almost universally employed after cyanidation. In this process a very thin high-carbon case is obtained in a relatively short time, so that there is not much coarsening of the structure. It is applicable when the more complicated treatments would not give improvements commensurate in value with the work involved.

When using solid re-agents such procedure results in a brittle product of lowest strength, for the coarsened structure in both core and case, which comes from long heating at high temperatures, is not refined. Allowing the steel to cool to slightly above the critical ranges of the high carbon case before quenching minimizes the danger of distortion, but the structure of the steel is still coarsely crystalline and only slightly increased strength is obtained. Both of these methods are unpleasant to carry out, due to the release of the gases contained in the pot and the difficulty of preventing small particles of hot compound from spreading all over the hardening room. Cooling the carburized steel in the pots and treating by either of the following methods is much to be preferred.

Where the material is not subjected to the most severe service and only a hard surface is required a single reheating to a temperature just above the critical ranges of the case and subsequent quenching for hardness is often used. With this treatment the core remains coarsely crystalline, but refinement of the case has been effected.

In order to develop the best properties a so-called "double" treatment is the one recommended and widely used. The carburized steel is reheated to a high temperature for refinement of the core and then cooled (most often quenched). A second reheating to a somewhat lower temperature, but above the critical ranges of the high carbon case is then carried out for grain refinement and the steel quenched. With such treatment a tough close-grained core with a refined and hard case are obtained and the steel will develop higher strength with greater toughness than can be obtained by any of the previous treatments.

At times a third reheating to about 180 deg. C. (356 deg. F.) is used for reducing the strains set up in hardening, and this results in increase in toughness of the product without any material decrease in hardness of the case.

It must be quite evident that in carrying out these operations a large number of variables will be encountered, which for satisfactory results must be under control

Effect of Oxy-Hydrogen Cutting on Locomotive Rods

Unusual Examples of Rapid Cutting Together with Data as to Its Effect on the Steel Used in Locomotive Connecting Rods

By ARTHUR F. PITKIN
Assistant Superintendent, Schenectady Works, American Locomotive Co.

IN VIEW of the great progress made in oxy-hydrogen gas cutting in the past few years, it is interesting to note the results now being obtained as well as the effect that the intense heat has on the metal being cut.

In Figs. 1 and 2 are shown the front and back ends of a locomotive main rod after the cutting has taken place. These ends were originally solid slab forgings, $5\frac{3}{4}$ in. thick, laid out and marked for cutting. The illustrations indicate the cutting time as well as the lineal inches covered and give detailed data as to the section of material and the speed of the work. It will also be interesting to observe the cutting time and realize how long it would have taken to rough out this work on a machine in the usual manner.

In order to determine the exact condition of the steel adjacent to the cut edge, compared to that of the original forging, one test piece was taken from near the cut edge and one from the center of the forging.

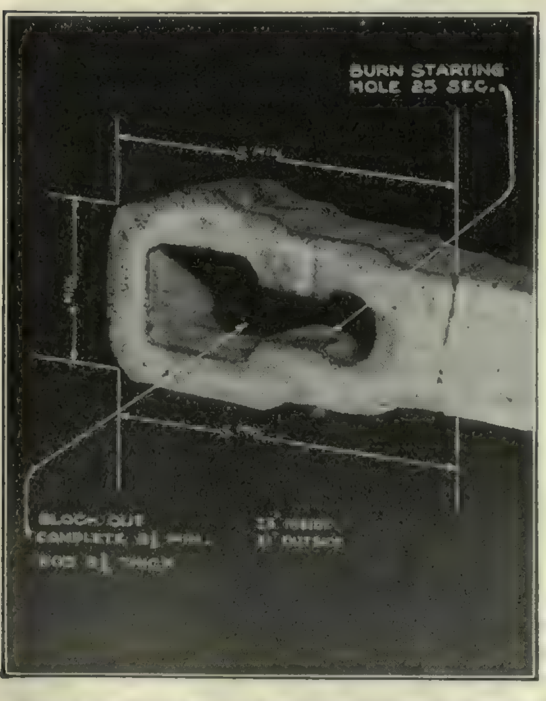


FIG. 1. SOLID END OF ROD ROUGHED OUT WITH TORCH.

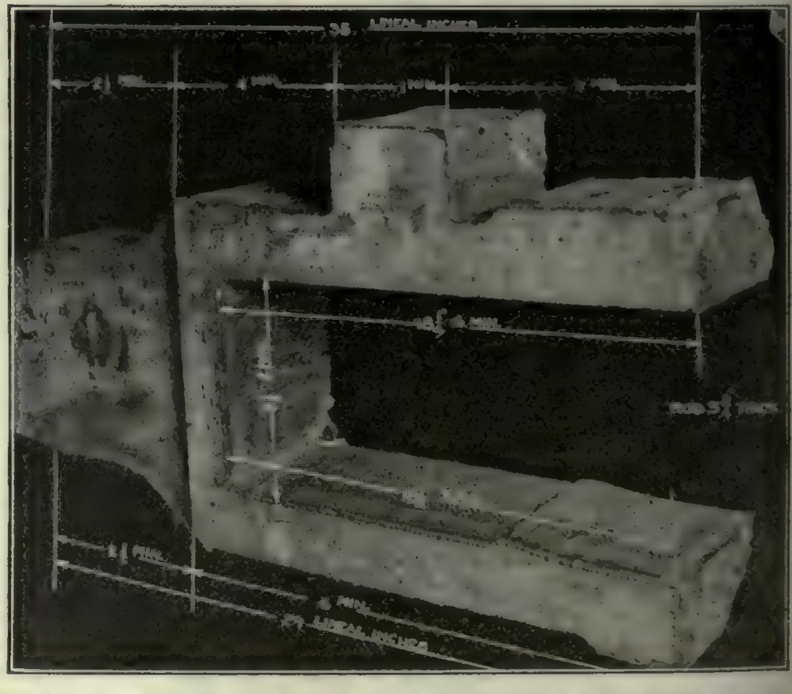
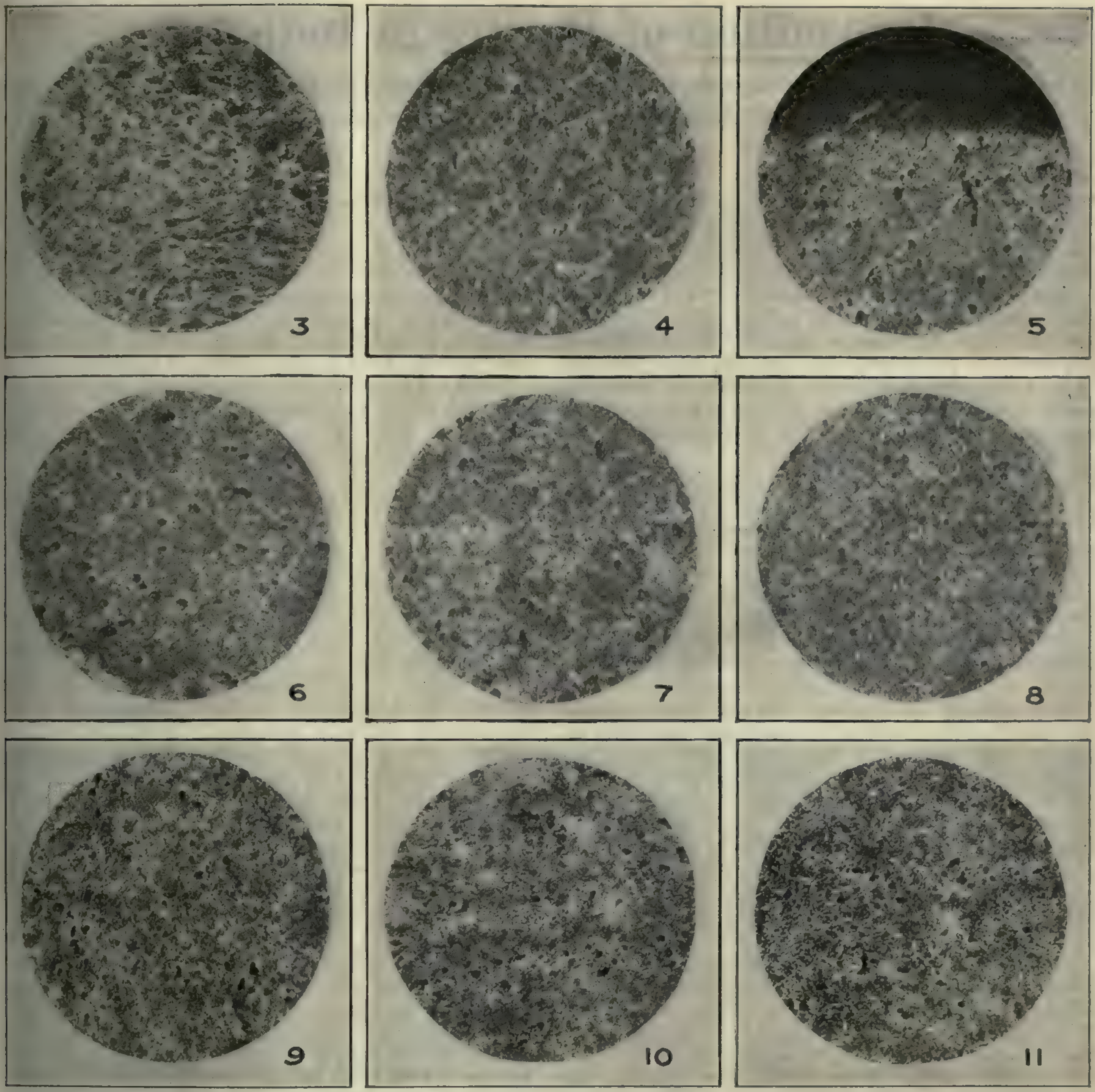


FIG. 2. BACK END OF MAIN ROD AS CUT WITH TORCH



FIGS. 3 TO 11. MICRO-PHOTOGRAPHS OF METAL NEAR THE CUT SURFACE

The physical tests on these pieces showed such a slight difference that it could not be attributed to any heating action from the gas cutting.

Drillings were taken in the same manner and there was practically no difference on analysis.

Micro-photographs were then taken of each test piece, magnified 100 diameters and are shown herewith. The first photograph, Fig. 3, was from the test piece taken near the center of the rod, while Fig. 4 was from a piece near the cut edge.

To ascertain the exact depth to which the heat penetrated, similar micro-photographs were taken from the cut edge as follows:

Fig. 5 was taken directly on the cut edge and clearly shows the excessively large crystals due to the intense heat.

Fig. 6 was taken ½ mm. (0.0197 in.) from the edge and shows practically the same structure although the crystals are slightly smaller than the ones in Fig. 5.

Fig. 7 was taken 1 mm. (0.0394 in.) from the edge and shows still smaller crystals.

Fig. 8 was taken 1½ mm. (0.0591 in.) from the edge and shows very decidedly smaller crystals.

Fig. 9 was taken 2 mm. (0.0787 in.) from the edge and practically duplicates Fig. 3 which was taken from the center of the rod.

Figs. 10 and 11 were taken 2½ mm. (0.0984 in.) and 3 mm. (0.1181 in.) from the cut edge and are the same as Fig. 9, from which it will readily be seen that the structural change does not extend beyond approximately $\frac{1}{16}$ inch.

With this point determined it is readily seen about how much stock should be left on forgings which are roughed out in this manner. With $\frac{1}{16}$ to $\frac{3}{32}$ in. left for finishing, the quality will be the same as the solid metal of the original forging.

Prevention of Wastes in Industry

Defective Administrative Methods the Major Cause of Waste in Manufacturing—Discussion of the Reward Class of Incentives for the Prevention of Wastes

By FRED J. MILLER*

THE Committee on Elimination of Waste in Industry devoted most of its attention to wastes of time and effort because these are far more important than wastes by direct loss of materials. I think I need not discuss the grosser forms of industrial wastes that come from loss, in various ways, of supplies and materials. Such losses are relatively unimportant and means of preventing them are now very generally understood, and are in use in practically all establishments in which it is realized that the safe-guarding of such things that cost money is as important as the safe-guarding of money itself.

I am asked to discuss, not simply wastes in industry, but incentives for the prevention of such wastes and here we are confronted with the anomaly that those who would be supposed to have the greater incentive for the prevention of industrial wastes, are found to be responsible for the major portion of the wastes that occur. Responsible I mean in the sense that they, the owners and directors of industries, are the ones and the only ones, who can adopt effective means to stop these wastes.

This seems to indicate that, not only must there be incentives for the avoidance of waste, but there must be, also, a clear realization that preventable wastes are occurring and a general understanding of the reasons for them and the means by which they may be prevented.

It is natural for the normal man to be active in some way—either mentally or physically or both. There is scarcely a greater punishment that can be inflicted upon him than complete, enforced idleness, such as results from solitary confinement in a dark cell.

It is perhaps industry's chief problem to conserve, develop and make use of the natural desire of the normal individual to be accomplishing something, and further to relieve workers, so far as possible, from such conditions of work as are deadening to ambition, to initiative and to the creative instinct. Far more can be done along that line than may seem possible at first sight and the results of even the simplest efforts in that direction have, in many cases, been very excellent for all concerned.

In a recently published magazine article, the difference was clearly shown between having a foreman tell a group of workers that they must work overtime, and, on the other hand, allowing the workers themselves to pass to each other and read a letter from a customer saying that unless his order was shipped by a certain date, he would consider himself at liberty to cancel it. The workers themselves decided to work overtime to prevent cancellation of the order. And in all such cases, the more ambitious workers can exert an influence upon the others far more effective than any other influence than can be brought to bear upon them.

Incentives may be grouped in two general classes which may be called the penalty class and the reward class. The penalty incentives, in the form of the lash or other gross physical punishments were more common in slave times than they are now; but the penalty incentive still persists here and there in various forms and there are still too many in our industries who seem to recognize no other kind, not knowing it is still true that, "he who owns a slave is himself in chains."

Incentives of the penalty class make people afraid not to do the things they are ordered to do. Incentives of the reward class tend to make people want to do the things that are expected of them. These two classes of incentives, of course, differ widely in their nature, but they differ no more than the results that are obtained by them.

I do not know what course the discussion of this question may take here today, but I prefer to confine myself to discussion of the reward class of incentives as being the only one worthy of consideration in connection with industries carried on in an enlightened age and in dealing with free men.

The reward class of incentives may be divided into two sub-classes that may be called respectively group rewards and individual rewards.

Profit sharing, group insurance, employee representation or participation in management, most of the so-called welfare work, general or so-called "horizontal" increases in wages, bonuses paid to all employees alike etc. are, and are intended to be, group incentives; while individual increases of wages, piece work, bonuses to individuals for specific individual attainments are, of course, individual incentives.

Whether group or individual incentives should be employed in a given case depends upon the circumstances of that case; but my own experience and observation lead me to the belief that, after we have established good working conditions, such as well-lighted, heated and ventilated work places; done what we can to keep them in good sanitary condition and as free as possible from danger of accidents; and have foremen and other executives who have been selected and trained to take an enlightened and "human" attitude toward employees, the rest of the way to the best possible general results is through individual reward incentives, which may take the form of higher hourly wages paid to individuals for individual attainments, a bonus paid for definite attainment, advancement from the ranks to successively higher executive positions, or, all of these together, with, so far as I have been able to perceive, about equally good results when applied intelligently. And they can be applied intelligently only when means are provided for having a continuous record of every employee's performance with reference to established standards; so that reward incentives will not be based upon any executive's prejudices or whims but upon actual and demonstrated service rendered in doing the work for which the plant is operated.

As a consequence of the acute situation and the very troublous times we have been and still are passing

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Address delivered before the American Society of Mechanical Engineers at its annual meeting, Dec. 5 to 9, 1921.

*Past-President of the American Society of Mechanical Engineers and Member of the Committee on the Elimination of Waste in Industry of the American Engineering Council.

through, there has been, I think, some tendency to overelaboration in certain of the measures taken to overcome our industrial difficulties. As for me, I still have faith in the comparatively simple means of enlisting the enthusiastic co-operation of minor executives and employees and an essential part of this is to give them such treatment as every man likes to receive from those with whom he comes in contact; always remembering that work-people are not, after all, essentially different from other people; are at least as readily responsive to candid, fair and courteous treatment as are other people, and also as well able to judge whether or not they are receiving it.

And along with this there must be avoidance of the large industrial wastes that come from overloaded inventories; slow movement of materials through the successive operations of manufacturing; unskilled, because inadequately studied, and developed manipulation of materials; inability to definitely and promptly place responsibility for delays; failure to clearly distinguish between those things which are the workers' responsibility, the foreman's responsibility, the superintendent's responsibility, and the owner's responsibility.

That all these, as well as the designer engineer, have their separate responsibilities is, in a general way, well recognized; but in our manufacturing establishments, there is usually no means for definitely assigning responsibility in such manner that a record is made, clearly showing to all concerned where the responsibility lies and whose duty it is to take steps to correct the defect, assuming it to be remediable. Such a record does away with arguments and the attempts to shift blame from one to another until finally it rests upon the man who cannot "talk back" or is canny enough not to do so and must bear it, smarting under the belief that he is unjustly blamed, and being disheartened and perhaps alienated by what he regards as being grossly unfair to him.

Blame Lies with Administration

The major cause of waste in manufacturing lies in defective administrative methods, for which, in general, no one is to be seriously blamed, for they are the methods that have the sanction of long usage, and by them, or rather in spite of them, many successful enterprises have been, and are being, conducted.

Certainly owners and managers are not to be blamed in the moral sense for following well established methods and practices, and of course, they *should* follow them until they become convinced that there are better methods and practices that are open to them. On the one hand, we see employees who are too easily prevailed upon by charlatans to take up methods that are little better than a group of unrelated "stunts," and on the other hand those who always delay progress along new lines until pretty nearly everyone else is far in advance of them.

Engineers Should Educate

It is the work of engineers to educate and to show the better ways, and I predict that, as time goes on, our industries will be more and more directed by engineers who know how to direct them for production and who will regard production and service as the prime object to be obtained by an industrial organization. When this change has been effected, one of the greatest causes of waste will have been removed.

I could mention entire industries that are in the control of men who are little if at all interested in production, but devote their entire attention to high finance, too much of which is also crooked finance.

All signs point to new conditions under which our industries must be conducted. Improved methods of administration may go very far, but along with them, and an essential part of them, if we are to attain the highest immediate success and prepare for still further progress in the future, must be full recognition of the transcendent importance of the human element in our industries. Means must be found to remedy and avoid the condition into which so many of our industries have fallen, and in which the attitude of employers and employees toward each other ranges from indifference or suspicion to more or less open and avowed hostility and a keen desire for revenge of wrongs, real or imaginary.

Ambitious men must be expected to have ambition for the welfare of their families, and from the social, political and industrial standpoints, this is desirable and indeed necessary if our industries are to thrive by rendering service to society.

Foremen must be looked upon and must regard themselves as leaders, inspirers and teachers of their men rather than mere drivers; means must be provided by which the value of workers with respect to a fair standard can be indubitably ascertained and each should be unfailingly rewarded in proportion to his attainments.

The Taylor Experience

Numerous examples, some from my own experience, might be given of the successful working of these principles, but as an illustration of what I mean, I prefer to go back to an incident related by Frederick W. Taylor, mainly because it is exceedingly plain and simple and also exceedingly enlightening to those who will study its full significance.

You will remember that at Bethlehem, Taylor, by patient, careful and really scientific study determined the best type of men, tools and methods for unloading ore from railroad cars. As a result, the men were paid considerably higher wages than before; the cost of unloading cars was materially reduced; the men were not worked too hard for their physical well being; and all concerned were satisfied.

An establishment located elsewhere learned of this and hired some of these trained men, Taylor consenting to their going and at the same time telling them he would be glad to have them return if, for any reason, they were not satisfied in their new place.

The men went to work there, working as they had been trained to work, but found they could make no showing because they were only a few working with many others; their contribution to the total work done being, therefore, relatively small and indistinguishable from the work of the group. In other words, they could make no showing of their abilities.

They asked that they be assigned to definite cars which they could unload by themselves, as they had been accustomed to do at Bethlehem, and were brusquely told to mind their own business and work as directed.

They quit and went back to Bethlehem, and thus the effort to transplant the methods that had been so carefully developed there failed.

And it failed simply because the human nature of these ore shovelers had been ignored; the management did not do its part by establishing the conditions that had been found necessary to success. It was a clear example of the old idea that industrial efficiency is to be secured by simply hiring the best workers available at as low a wage as they feel compelled to accept and then driving them as hard as possible. There may have been also a thought of the pace making game which has been so much employed, and which is still believed in by some employers, though it is extremely crude and the workers have very generally taken such measures as they can to protect themselves against it.

It must be recognized that, even in the simplest work, pride of achievement can usually be developed, and that often men will work their best only when they are not hampered by conditions that limit their achievements or that prevent them from being credited with their achievements, especially when they know, or believe, that these hampering conditions can be removed.

It would, I think, surprise a great many of us if we could know just how much of the wastes of industry that are caused by careless and inefficient work, have a deeper underlying cause in a feeling created by the conditions under which men work, that make them believe they cannot do what they should do, and for reasons entirely beyond their control.

In a certain government establishment to which many good workers came during the war, quite a number of these men quit because conditions there were such that they could not do a fair day's work no matter how much they might try. They did as much as was customary there, but so much less than they had been accustomed to do that they became disgusted and could not bear to remain.

It is by no means always easy to say where the blame lies for industrial wastes that come from slackness of workers and executives. Take the case of a machine shop in which it is apparent that not much more than half the work is turned out that should be done. In many such cases the work has been brought up to the full standard by a change in the management, with or without a change in staff personnel, but employing the same workers as before.

Too many there are who would, with all the assurance in the world, blame the previous inefficiency entirely upon the employees, but the hard fact that such inefficient establishments have been, in many cases, vastly improved by change of management or of management methods, must be squarely faced if we are to comprehend our problems, or succeed in materially improving conditions.

Especially do we need to adopt such methods of management as will enable the facts to be fairly presented to both sides in every difference that arises between employer and employee; and experience shows that when we have done that, both the employer and the employee are far more reasonable and considerate than either usually imagines the other to be.

HARMONY NECESSARY FOR ECONOMY

It is at least as important that all the elements of an industrial organization should work together harmoniously and without friction as that the different parts of a finely designed and constructed machine should do so. When either does not function properly, it is a case for the use of intelligent discrimination in finding out the real cause of the trouble and the proper remedy. Usually the bludgeon treatment only makes things worse, no matter which side resorts to it.

Production has been and is restricted by workers, both organized and unorganized, and most of such restriction is of course wrong, from the economic standpoint, if not ethically.

In most industries, however, I think it can easily be shown that restriction of production by workers is insignificant compared with the restrictions caused by financial juggling of one kind or another; by avoidable irregularity of employment of labor and of plant by presidents or managers who are temperamentally unable to make decisions and then stick to them, or are unable to do so because they are under the control of men "higher up" who know nothing of industrial science, or even that there is any such thing. Also by unnecessarily large inventories and consequent tying up of capital that could be otherwise usefully employed; by inadequate control of the movement of material through the works from one operation to another and from one department to another; inadequate, or entire absence of provision for teaching or training operators, and minor executives and by absence of effective means of recording attainments of workers, foremen, etc., so that their standing does not so much depend on actual performance as upon other things, some of them little if at all related to the work, such as nationality, religion, membership in secret organizations or fraternities, and sometimes plain graft.

WORKING TOWARD THE BRIGHTER SIDE

When we set out to discuss an acknowledged fault, our picture is necessarily rather a dark one. There is, of course, a bright side. We must work to make that bright side still brighter.

The greatest and most effective incentive for the prevention of industrial wastes is disarmament, so to speak; the cultivation of friendly relations between all those concerned in industrial enterprises; and the maintenance of such a system as will enable every man, from the highest to the lowest, to know what he is responsible for, to whom he is responsible, and that he, personally, will be credited and rewarded in proportion to service rendered.

Spain Furnishes Own Rail Equipment

Bids were recently called on behalf of the railway from Leon to Matallana, for 700,000 kilos of 32.2-kilo 12-meter rails, 30,000 kilos of fishplates, 62,000 kilos of metal ties, 38,000 kilos of spikes, and 6 switches complete (1 kilo = 2.2046 pounds; 1 meter = 39.37 in). The material is to be used mostly in the strategic section from Figaredo to Leon. Foreign companies were not invited to bid; but in case the offers of local concerns are considered too high, foreign companies will be invited to submit propositons later.

By a royal order of Sept. 12, the Ministry of Fomento recently called for bids among Spanish construction houses for supplying four coaches of mixed first and second class; six coaches of third class; twenty-five platform cars with low sides of 30 cm.; fifteen platform cars with high sides of 65 cm.; thirty-five closed vans; four baggage cars; four trucks for the transportation of rails or lumber; and fifteen cattle cars for the transportation of live stock, destined for the Ferrocarril de Ripoll a Puigcerda.

The directorate general of public works by the same royal order called for bids among Spanish companies for the construction of four motor cars and six locomotives, destined for the same railway.

On the Art of Milling

BY JOHN AIREY AND CARL J. OXFORD

(Continued from last week's issue)

OPINIONS differ on the influence of tooth spacing or, in other words, the relative merits of coarse-tooth compared with fine-tooth cutters. Many cutter manufacturers standardize two types, the fine-tooth cutter and the "high-powered" cutter. Experiments have been published purporting to show the advantage of coarse-tooth cutters. Possibly many others have been made and have probably convinced the experimenter that the claims made were justified.

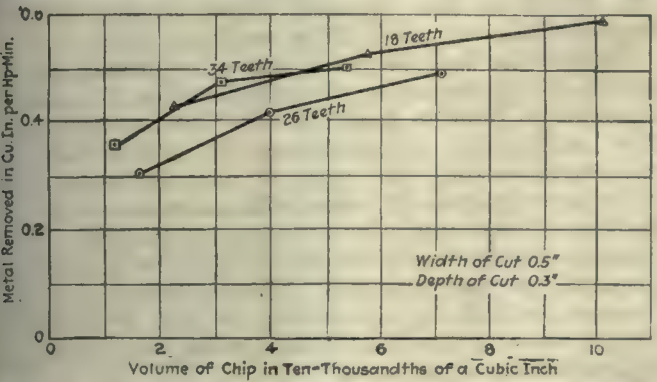

FIG. 14. EFFECT OF VARYING SPACING: ALLOY STEEL

THEORY OF TOOTH SPACING

There is an interesting delusion in this subject and it is unfortunate that it has held sway for so long, for it has resulted in inefficient types of cutters being used. Most of the so-called high-powered cutters on the market today would be improved if more teeth were given.

It has been demonstrated earlier that the force required to remove metal does not increase in proportion to the chip thickness. It follows directly from this (and has been independently demonstrated by the thrust and torque measurer) that as feed is increased the force will not increase in proportion.

Another way of stating the last paragraph is that the heavier the chip, the more metal removed per horsepower-minute. If one were to make a comparison of two cutters with different numbers of teeth but run at the same speed and feed per minute, then obviously the cutter with fewer teeth would remove the metal with less power *because the chips are thicker*, there being fewer teeth cutting per minute for the same amount of metal removed. It appears illogical, *a priori*, to suppose that the force action of a single tooth under any given set of conditions should be influenced by the location of neighboring teeth, *if free cutting is in operation.* This view is fully substantiated by experiment.

Referring to the preceding paragraph, if the feed has been increased with the fine-toothed cutter in the ratio of the number of teeth in the two cutters (thereby making a chip of the same thickness as with the coarse-tooth cutter) *then exactly the same cubic inches per horsepower-minute would have been removed as were removed with the coarse-tooth cutter, and more actual cubic inches of material would have been removed per minute, provided the limit of machine power had not been reached.*

If comparative tests had always been analyzed from the point of view of *chip volume* (or maximum chip thickness, if the depth of cut varies), then the unmerited virtue of wide spacing would never have been recognized.

Three 6-in. diameter side mills were taken, 0.5 in. thick and with 10-deg. rake. They had respectively 34, 26 and 18 teeth. Various tests were run in alloy steel and in machine steel. The results of these experiments are presented in Table VII, and are plotted in Figs. 14 and 15.

Experiments with the same cutter are joined by a line. In both figures the 34-tooth line and the 18-tooth line came superposed within experimental error. The 26-tooth line came roughly parallel but lower in both cases. This appeared to establish the equality of cutter efficiency in the case of the 34- and 18-tooth cutters with different tooth spacings when given equal chip volume. The distinct inferiority of the results with the 26-tooth cutter to the results of both the others suggested some defect in the cutter. It was found that the side clearance was almost nil[1]. This was remedied and the tests were repeated in machine steel with the result that the 26-tooth line coincided on the left with the two others. On the right there is a slight separation due to experimental error but no consistency can be traced. The experiments with the 26-tooth cutter were not repeated in alloy steel, as that particular block was not available.

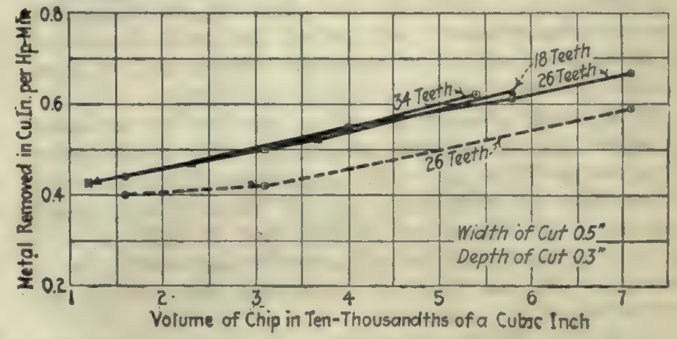

FIG. 15. EFFECT OF VARYING SPACING: MACHINE STEEL

In a paper presented at the 1911 spring meeting of the society by A. L. De Leeuw[2], claims were made regarding the superiority of wide spacing. This publication caused coarse-tooth cutters to increase in favor. If the experiments there recorded were to be compared on a chip-volume basis, the different cutters would doubtlessly lose their separate identity from an efficiency standpoint. As the speed of cutting is not recorded in these tests, it is not possible to find the chip volume, and so effect this comparison.

It is equally effective, however, to analyze data ex-

Presented at the annual meeting, Dec. 5 to 9, 1921, by the American Society of Mechanical Engineers

[1] Most of the tests in the present section consisted in cutting grooves 5 in. wide and 0.3 in. deep with a side mill. It was repeatedly shown that power consumption was not affected whether the cut happened to be a groove or a land, except in this one case of side-clearance trouble.

[2] Milling Cutters and Their Efficiency, Trans. Am. Soc. M. E. Vol. 33, p. 245.

tracted from "A Treatise on Milling and Milling Machines," issued by the Cincinnati Milling Machine Co. On page 147 of that work results are given of tests with cutters of 22, 16 and 10 teeth, respectively.

TABLE VII. INFLUENCE ON TOOTH SPACING

Exp. No.	Date	Material	No. of Teeth	R.p.m.	Feed, In. per Min.	Vol. of Chip, Cu.In.	Torque, In.-Lb.	Cu.In. per Hp.-Min.
1110	7-8-21	Alloy St.	26	33.7	0.92	0.00016	840	0.306
1111	7-8-21	Alloy St.	26	33.7	2.36	0.00040	1,600	0.412
1112	7-8-21	Alloy St.	26	19.3	2.36	0.00071	2,360	0.487
1116	7-20-21	Alloy St.	34	33.7	0.92	0.00012	720	0.357
1117	7-20-21	Alloy St.	34	33.7	2.36	0.00031	1,400	0.472
1118	7-20-21	Alloy St.	34	19.3	2.36	0.00054	2,300	0.500
1119	7-20-21	Alloy St.	18	33.7	0.92	0.00023	610	0.421
1120	7-21-21	Alloy St.	18	33.7	2.36	0.00058	1,250	0.528
1121	7-21-21	Alloy St.	18	19.3	2.36	0.00102	1,930	0.595
1122	7-28-21	Mach. St.	18	33.7	0.92	0.00023	550	0.467
1123	7-28-21	Mach. St.	18	33.7	2.36	0.00058	1,040	0.636
1125	8-2-21	Mach. St.	34	33.7	0.92	0.00012	610	0.422
1126	8-2-21	Mach. St.	34	33.7	2.36	0.00031	1,310	0.504
1128	8-2-21	Mach. St.	34	19.3	2.36	0.00054	1,850	0.621
1129	8-4-21	Mach. St.	26	33.7	0.92	0.00016	650	0.396
1131	8-4-21	Mach. St.	26	23.3	1.23	0.00030	1,210	0.412
1132	8-4-21	Mach. St.	26	19.3	2.36	0.00071	1,970	0.584
1133	8-5-21	Mach. St.	18	57.1	0.92	0.00013	350	0.434
1134	8-5-21	Mach. St.	18	27.8	1.23	0.00037	800	0.521
1136	8-5-21	Mach. St.	26	33.7	0.92	0.00016	590	0.435
1137	8-6-21	Mach. St.	26	33.7	2.36	0.00040	1,190	0.555
1138	8-6-21	Mach. St.	26	19.3	2.36	0.00071	1,710	0.672
1139	8-6-21	Mach. St.	26	23.3	2.36	0.00058	1,560	0.615

These results are submitted as establishing conclusively the superiority of the coarse-tooth cutter. The data in question are reproduced in Table VIII, the chip volume being calculated for 0.5 in. width of cut, to make the results comparable with the others in this paper.

These results, shown graphically in Fig. 16, are seen to follow the same basic law as others already given. To summarize: Material and depth of cut remaining constant, the efficiency with which the metal is removed is determined solely by the chip volume and is independent of the number of teeth in the cutter.

If, in using a fine-tooth cutter, the feed be increased in order to give the same weight per chip as was given in a comparative test with a coarse-tooth cutter (and so equality of efficiency), one of three things might happen: (*a*) Chips might clog due to lack of chip room; (*b*) the limitation of power of machine might be reached; (*c*) the limit of structural strength of the cutter might be reached.

Condition (*a*) is very apparent, for the efficiency rapidly drops to zero as soon as chip room becomes too small. This is proof that the spacing is inadequate, a condition which no doubt frequently existed formerly. Condition (*b*) is probably the indirect cause of existing opinions regarding wide spacing of teeth. If in given tests, equal chips are taken, then the cutters will remove metal, the volumes of which per minute will be in the ratio of the numbers of teeth, and will of course call for correspondingly more power. Condition (*c*) would occur in the case of exceptionally thin cutters or of unusually deep cuts.

TABLE VIII. CINCINNATI MILLING MACHINE COMPANY'S EXPERIMENTS

No. of Teeth	Speed, R.P.M.	Feed	Volume of Chip	Cu.In. per Hp.-Min.
22	80.4	11.7	0.00062	0.442
22	80.0	14.8	0.00079	0.484
22	80.0	18.5	0.00099	0.577
16	82.0	11.9	0.00085	0.522
16	68.0	15.1	0.00130	0.631
16	67.0	18.6	0.00163	0.674
10	69.0	11.9	0.00162	0.625
10	68.0	15.1	0.00208	0.684
10	68.0	18.8	0.00259	0.731

As many teeth as possible should be put into a cutter consistent with sufficient chip clearance. It is evident, of course, that sufficient excess chip space must be provided in a new cutter to allow for a reasonable amount of grinding. As soon as the necessary chip clearance is exceeded, possible economy is forfeited. A glance at existing high-powered cutters is sufficient to show that several times the necessary chip clearance is nearly always furnished.

The cuts taken in our experiments are throughout in an everyday production region. The thrust and torque measurer was not capable of carrying spectacular cuts. However, that the same law holds in the region of heavier cuts, is proved by the experiments plotted in Fig. 16, as they form a similar curve. Further, a study of these curves shows that chip congestion did not play any part with even the finest toothed cutter, for this would have resulted in the last spot falling below the general trend of the combined curve.

Considering that the whole subject of milling action centers about the action of a single tooth, it appears desirable to think in terms of this. The authors take this opportunity of suggesting to milling-machine manufacturers that this point of view be encouraged in supplying instruction data with machines. As it is, the feed is invariably given in inches per minute.[1] This is useful in checking up the time required to do a given job after the feed is known. It is of no direct value, however, in checking up whether the feed is adequate for the work, because this is determined fundamentally by a definite feed per tooth.

Further, the feed per tooth is a function of the material and of the depth of cut. Data should be arranged so far as possible to focus attention on the maximum chip thickness. This is the basic criterion of effort from the cutter standpoint.

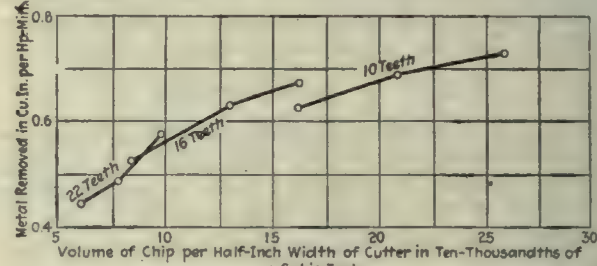

FIG. 16. CINCINNATI MILLING MACHINE COMPANY'S EXPERIMENTS

The authors believe that, in a few years, by co-operation between milling-machine and milling-cutter manufacturers, data and practice will have evolved so that a set-up man will determine the appropriate chip thickness and then, by reference to tables, will set the speed and feed to give this. The feed per tooth for a given cutter determines the feed per revolution of spindle. If a chart were supplied giving the feed per revolution for all possible combinations of speeds and feeds, then this would be of direct use in working from a feed per tooth starting-point and would constitute the first step in the suggested direction.

General Consideration of Removing Metal by Milling. It is an interesting and profitable line of thought to consider, in its broadest phases, the problem of removing metal by milling. The first factor to be considered is chip thickness. In order to remove the maximum amount of metal per horsepower-minute, the chips should be as thick as possible.

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[1] The present practice is to give feed in inches per minute with machines having a constant-speed feedshaft. Feeds are given in inches per spindle revolution with machines having the feed train driven from spindle. Recent literature indicates that doubt exists regarding the relative merits of the two systems. The problem is purely and simply that of obtaining the greatest range with the simplest mechanism. The authors believe that the constant-speed feedshaft is unqualifiedly the better of the two systems. They further believe that this lends itself to a demonstration as rigorous as a proposition in Euclidean geometry does. For discussion of this, see letter to *Mechanical Engineering*, by John Airey, on Milling-Machine Feed Systems, March, 1921, p. 207.

The chip weight is limited by the endurance properties of the cutting tool, as is also the cutting speed, which is the second factor to be considered. Various experimenters in lathe tool action have shown that, for a given tool, the chip weight and the cutting speed are interrelated. It should be remarked here that the degree of bluntness permissible in a milling cutter is very slight, when compared with the allowable bluntness of a continuous-cutting tool.

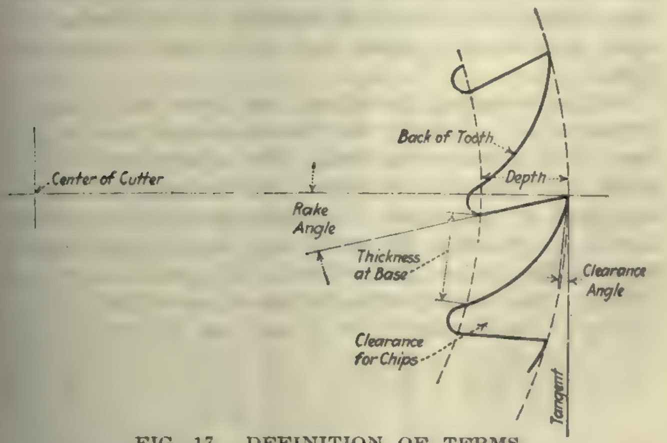

FIG. 17. DEFINITION OF TERMS

The greatest metal-removing capacity occurs when the product of chip-volume and cutting speed is at a maximum. Let us assume that the most advantageous combination of speed and thickness is known for a given tool and material, so that these factors may be kept constant. It then follows that the closer the teeth are together, the more metal will be removed per minute, provided, of course, that the spacing of the teeth is not so far reduced that clogging of the chips takes place. Since power efficiency is determined by chip thickness only, it is evident that this is not altered by varying the tooth pitch.

If it is possible to keep the feed per tooth constant and decrease the tooth-spacing, without exceeding the power of the milling machine, the ideal conditions are achieved, i.e., the maximum volume of metal is removed per minute with the expenditure of the least possible power. Suppose, however, that the limit of the machine's power is reached before the minimum possible tooth spacing is obtained.

The problem now assumes a different aspect. We have already obtained the maximum power efficiency by virtue of using the thickest possible chip. If the tooth-spacing is to be decreased, the power of the machine will be exceeded unless some of the other factors are changed. If the feed be reduced, the chip becomes thinner. This results in a decrease in the power efficiency coupled with a decrease in the amount of metal removed per minute.

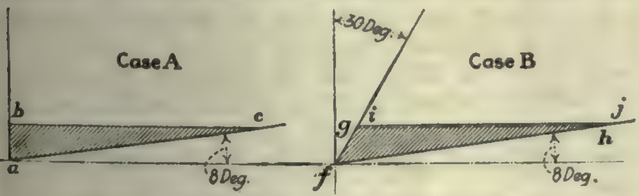

FIG. 18. INFLUENCE OF RAKE ON WEAR

Suppose that we leave the feed constant, decrease the tooth spacing, and, at the same time, reduce the spindle speed so that the feed per tooth remains the same. The power efficiency will then remain constant, as will the amount of metal removed per minute. Furthermore, the decrease in peripheral speed will result in a lengthening of the life of the cutter between grinds.

We have thus demonstrated *a priori* that fine spacing is superior to coarse spacing, regardless of whether the cutting speed or the power of the machine be the limiting factor. In the first case, the fine-toothed cutter will remove more metal per minute. In the second case, the fine-toothed cutter will wear longer between grindings, due to the decrease in cutting speed.

SHAPE OF TOOTH

The following six features of a tooth will be discussed: (*a*) Clearance, (*b*) rake, (*c*) shape of back, (*d*) depth, (*e*) thickness at base, (*f*) clearance for chips. These features are defined in Fig. 17.

Clearance.—Excessive clearance does not reduce the cutting force, does not appreciably affect the life of the tool in normal wear but *does* tend to chattering action; also it weakens the cross-section near the cutting edge and increases liability to snip. Clearance should therefore be kept to a minimum. Three degrees was found to be ample but 5 deg. was usually used. In many toolcribs it might be desirable to standardize at 8 deg., due to the possibility of an error of a few degrees. In practice it is customary to speak of clearance in thousandths of an inch at the heel of a land. This is obviously a safer method, as the heel might bind for any given clearance angle if the land were sufficiently extended. However, for scientific analysis it is better to use degrees.

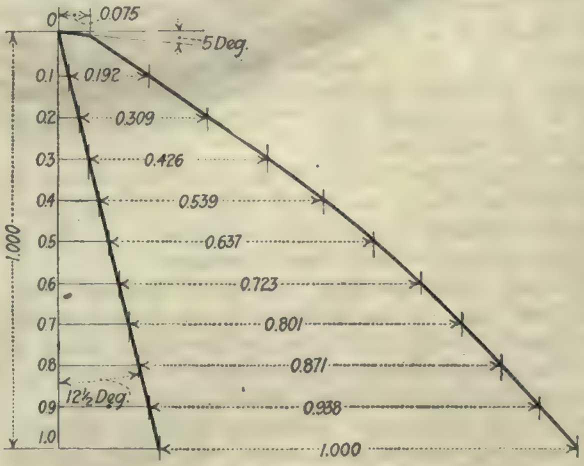

FIG. 19. IDEAL SHAPE OF TOOTH

Rake.—From a power consumption standpoint, rake is increasingly beneficial as it becomes greater. The advantage of rake, though, does not increase at so fast a rate after about 15 deg. is passed. Further, this is influenced by the kind of material being cut. On the other hand, the life of the cutter might be influenced disadvantageously by excessive rake.

It is believed that the greater the rake, the longer the life, from a simple abrasion standpoint. An increase in rake, however, necessitates a decrease in the heat conductivity of the tooth, as a consequence of which increased wear due to rising temperature is more likely to occur. A compromise can be obtained only by experiments on endurance which is treated later.

In substantiation of the theory regarding simple abrasion action, consider the two examples of tooth, *A* and *B*, given in Fig. 18. *A* has no rake and *B* has 30 deg. rake. Wear will take place parallel to the direction of cutting. The point will be eventually worn down to line *bc* in case *A* and to *gh* or *ij* in case *B*. It seems reasonable that the width of the abraded surface is a measure of the difficulty of forcing the tool into the work, and therefore of bluntness. Further, it seems reasonable that the volume of the tool abraded is a measure of the time required to bring the tool to that degree of bluntness.

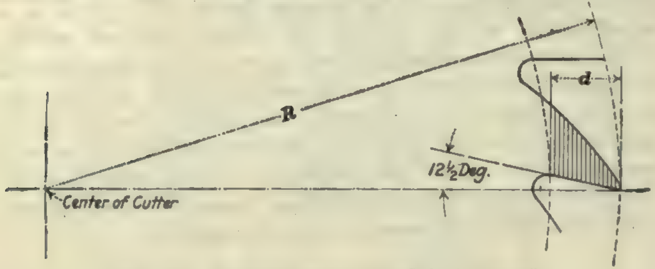

FIG. 20. TOOTH FOR A 6-IN. CUTTER

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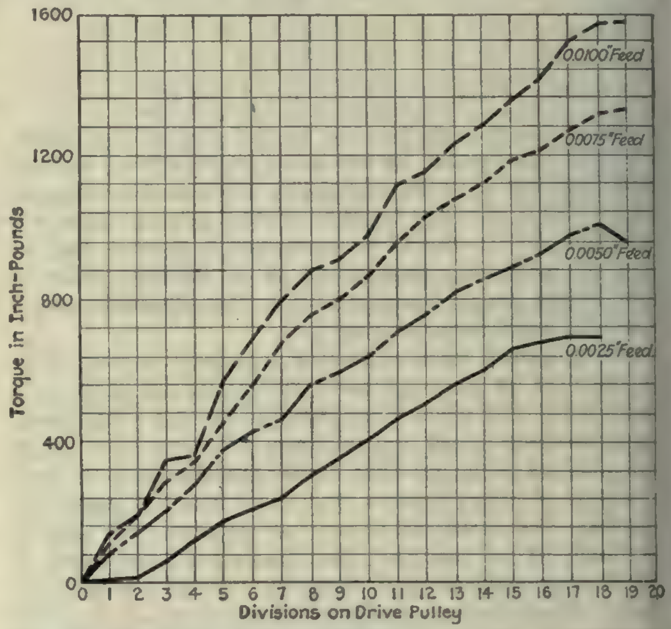

FIG. 21. STATICAL EXPERIMENTS ON FOUR DIFFERENT CHIP THICKNESSES

Due to the questionable legitimacy of the engineer's theory of bending when applied to short cantilevers (as in this case), conclusions derived therefrom can only be taken as a guide for experimental investigation. Twenty-four tools of high-speed steel were therefore shaped in accordance with above analysis and hardened. These were tested to destruction, and it was found that they broke with a sufficient variety of planes of weakness to justify the belief that the proposed shape has no serious place of consistent greatest weakness. In some cases the break was by snipping, in others in the body of the tool, again in others, cleavage occurred roughly parallel to the back and finally, some broke in several places at once. The last is of course the ideal case.

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Thickness at Base.—For a given depth, the thickness at the base is controlled by the ability of the tooth to resist fracture. This is, in turn, dependent on the quality of steel. Thickness at the base is taken as equal to depth in the recommendations here given. This is fairly consistent with present practice and gives an ample factor of safety for cuts that are customarily employed.

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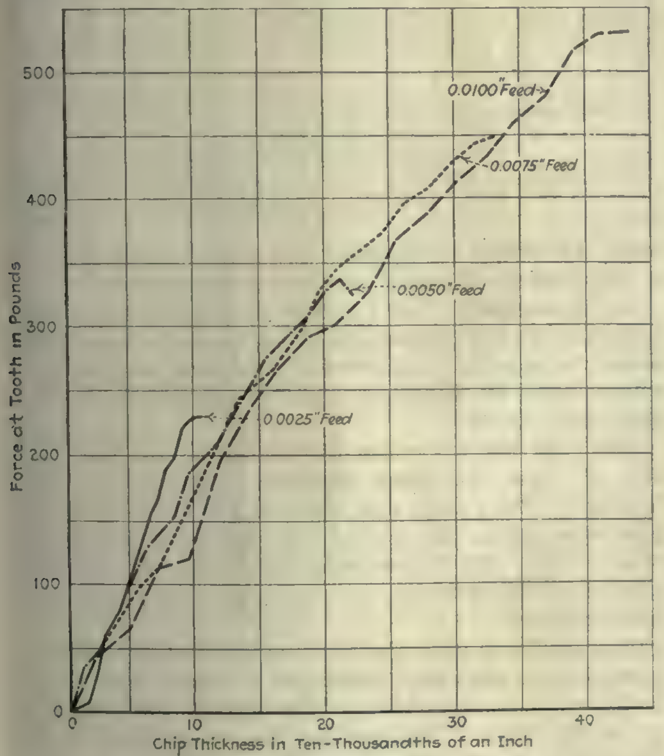

FIG. 22. FOUR STATICAL EXPERIMENTS SUPERPOSED

Design Formulas.—Formulas for determining the number of teeth for a known diameter of cutter and for determining the depth are given below, and a geometrical construction for obtaining shape of tooth has been given in Fig. 19. The arguments demonstrating the rationality of these are given in Appendix No. 2.

Let n = number of teeth;
R = radius of cutter in inches;
d = radial depth of straight face in inches.

Then

$$n = 19.5\,R^{\frac{1}{2}} - 5.8 \qquad (1)$$

$$d = 0.215\,R^{\frac{1}{2}} \qquad (2)$$

An example is given in Fig. 20 of a 6-in. cutter.

The foregoing is for cutters 0.5 in. thick and upward. For cutters narrower than this, the number of teeth could be increased somewhat. Further, it is possible that if spiral is excessive, say over 20 deg., the quicker clearing action would make more teeth possible.

A STATICAL STUDY OF SINGLE-TOOTH ACTION

Objections will doubtlessly be raised to the use of statical experiments, due to the supposed discrepancy between cutting action at a dead slow speed, or in installments, and cutting action at a customary speed. The writers believe this discrepancy to be more imaginary than real and that considerable information can be obtained by statical studies which is not obtainable by other methods.

Method of Experimenting.—The driving belt was removed, a pair of long clamps were bolted to the hub of the pulley and the pulley was divided circumferentially into fifty equal divisions by center-pop marks and numbered; also a zero pointer was attached to a stationary part. The driving pulley could then be turned by hand. By means of the fifty subdivisions on the pulley and the gearing of the machine, the spindle could be turned through any desired small fraction of a revolution. The formation of a chip was divided into a convenient number of equal intervals and readings of the mercury columns were taken at each interval. The cut was therefore taken in a number of very small movements, the cutting stopping while a reading was taken. The results obtained were the same as would have been obtained by dead-slow continuous cutting. There was no observable change in the mercury columns when motion ceased.

The only object aimed at in this statical work, complete results of which are at hand, was to find if instantaneous chip thickness is the sole criterion of force at a given instant. In the early part of this work the habit was formed of thinking in terms of chip volume. It was believed that this was the basic starting point for correlation of results; and so long as depth of cut was kept constant, there was no reason to question the legitimacy of this viewpoint.

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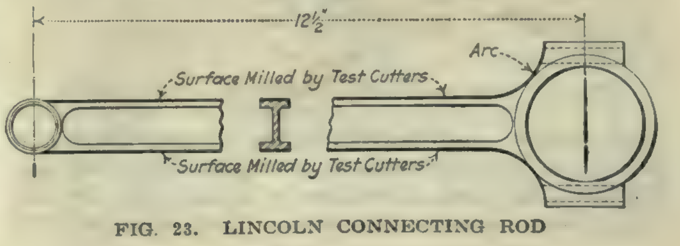
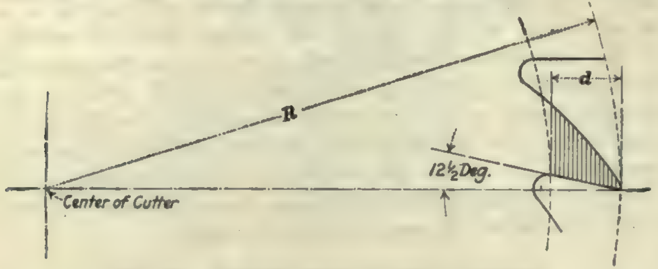

12½"
Arc
Surface Milled by Test Cutters
Surface Milled by Test Cutters

FIG. 23. LINCOLN CONNECTING ROD

abrasion action, consider the two examples of tooth, *A* and *B*, given in Fig. 18. *A* has no rake and *B* has 30 deg. rake. Wear will take place parallel to the direction of cutting. The point will be eventually worn down to line *bc* in case *A* and to *gh* or *ij* in case *B*. It seems reasonable that the width of the abraded surface is a measure of the difficulty of forcing the tool into the work, and therefore of bluntness. Further, it seems reasonable that the volume of the tool abraded is a measure of the time required to bring the tool to that degree of bluntness.



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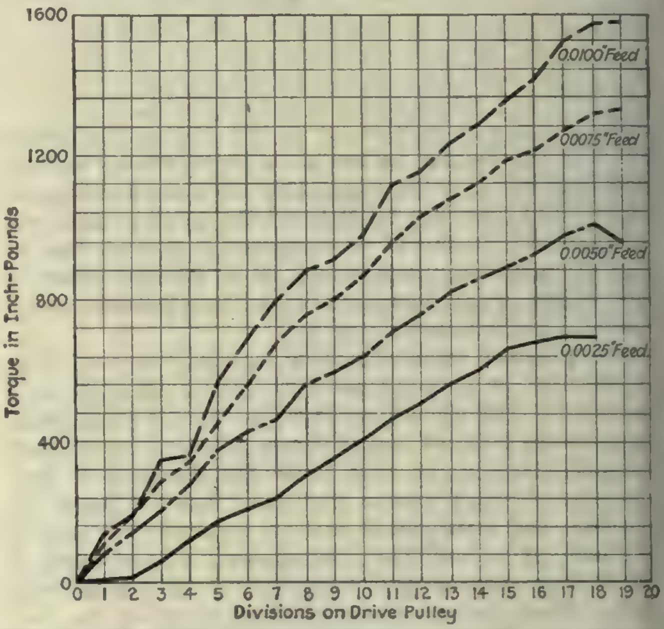

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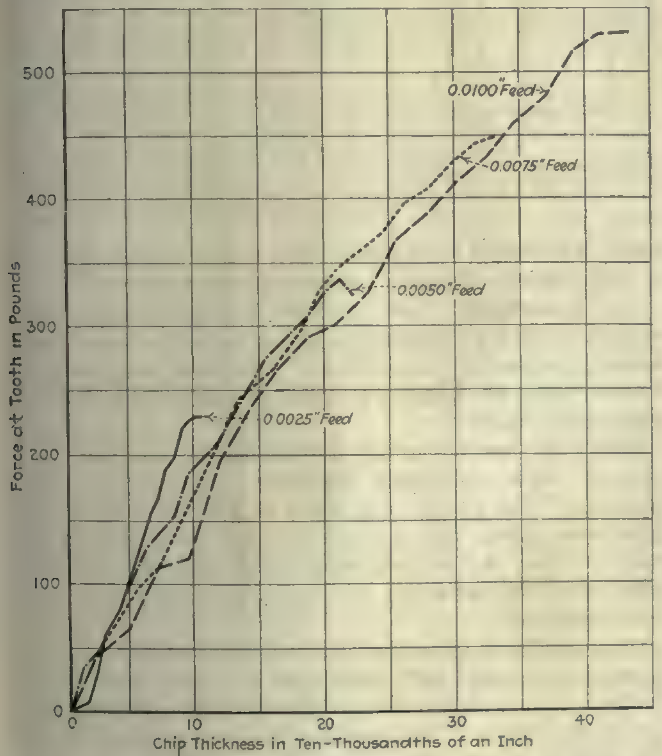

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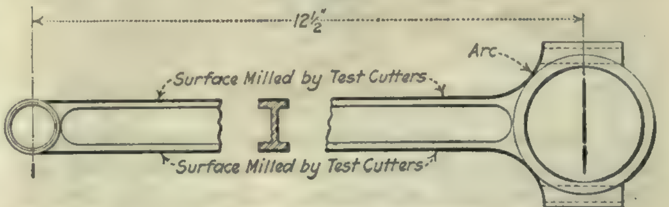

12½"
Arc
Surface Milled by Test Cutters
Surface Milled by Test Cutters

FIG. 23. LINCOLN CONNECTING ROD

but maximum chip thickness was the feature of basic interest.

The truth of the above statement seems so obvious when the action of milling is carefully considered, that the fact would not be elaborated on, were it not that months of experimental work had been done before this idea developed. All chips, to within a small error of mathematical interest only, increase uniformly from zero thickness to a maximum. As any given instantaneous thickness of chip connotes a certain force-action at that instant, and as the increase in thickness is uniform, it follows that the maximum chip thickness is a unique criterion of the material removed per horsepower-minute for a given cutter and material.

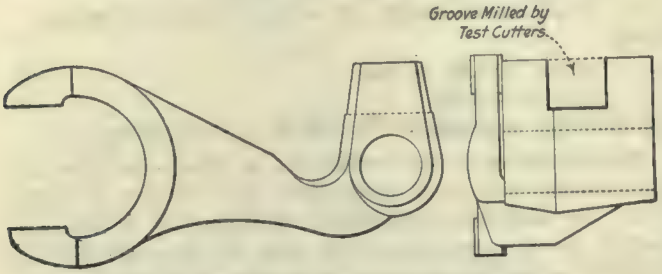


FIG. 24. HUDSON GEAR-SHIFT FINGER

On this assumption a miscellaneous set of experiments with constant material and constant shape of cutter tooth would fall on one curve, if metal removed per horsepower-minute were plotted against maximum thickness. The variation in depth of cut and varying tooth spacing would have no influence.

Comparison of Four Chips of Varying Feed.—A cutter of 10-deg. rake was used, the depth of cut taken was 0.3 in. and the feed was taken successively as 0.0025 in., 0.005 in., 0.0075 in. and 0.010 in. The feed was obtained by carefully moving the table by hand and then locking the gib screw. The rotation of cutter necessary just to take one chip was divided into 20 equal parts and readings were taken.

The results are shown graphically in Fig. 21, the torque being plotted against divisions of the driving pulley. The same general shape is observed except in the case of the 0.0025-in. chip. Several attempts were made to obtain consistent results with this without much success. A little reflection on the probable distortion of results produced by the knee bracket being, say, 0.0002 in. too high or too low, on a thin chip like this will account for this difficulty. These curves are rearranged in Fig. 22 to give tangential force plotted against chip thickness.

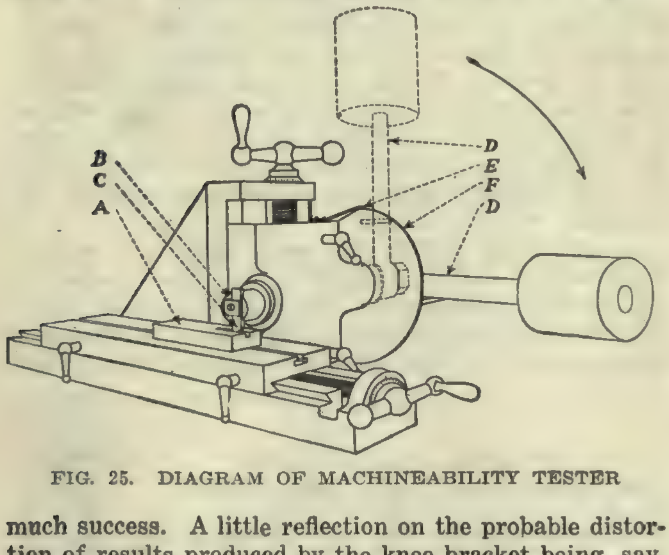


FIG. 25. DIAGRAM OF MACHINEABILITY TESTER

The finest chip again is somewhat irregular. Apart from this the chips are identical in force requirement for equal chip thicknesses. After all, it would be difficult to understand, if a condition other than this were apparent.

Continuing the above point of view, it is seen that cutter efficiencies for two distinct jobs should be compared on the basis of equal maximum chip thickness instead of metal removed per minute. The latter is too crude and might give equality of performance when in reality the cutters are being far from equally punished. Further, to compare metal removed per horsepower-minute in two cases where thickness of chip is not identical, is grossly unjust and will lead to fallacious conclusions, e.g., the present superiority claimed for wide spacing.

ENDURANCE TESTS UNDER COMMERCIAL CONDITIONS

Although increasing the rake angle is unquestionably beneficial from a power standpoint, the same is by no means obviously true from the standpoint of endurance. In fact, it is apparent that a continuous increase of rake must ultimately jeopardize endurance.

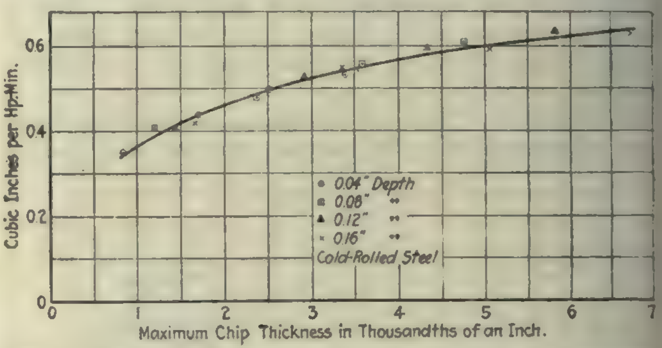


FIG. 26. METAL REMOVED AS A FUNCTION OF MAXIMUM CHIP-THICKNESS

To investigate this, numerous experiments were necessary and arrangements were made to make them under commercial conditions. Two jobs were experimented with, the Lincoln connecting rod and the Hudson gear-shift finger.

The only feature under consideration was the influence of rake. All other features were therefore kept constant. The speeds and feeds in regular use on both jobs were taken, but the cutters used were of different rake values. All cutters used were made at the same time from the same bar of steel and received the same heat-treatment.

Lincoln Connecting-Rod Job.—Fig. 23 shows this connecting rod, the part machined in these tests being indicated by a heavy line. The cutters used were 2 in. in diameter. This enables the cutter to form-mill the radius at the big end of the rod. The operation of the fixture is such that the work is fed vertically into the cutter until cutting is taking place over the full arc. When the proper depth is obtained, the longitudinal feed is put in and the length traversed.

Starting in the rough over the full extent of the curved part is particularly severe on the cutter. This job is unusually well fitted for testing any tendency of a cutter to hog in. No trouble was encountered in this respect. The carbon content of the steel averaged about 0.50 per cent. The average depth of material removed was $\frac{3}{32}$ in., at a spindle speed of 125 r.p.m. and a feed of 6⅛ in. per minute or 0.0041 in. per tooth.

In all, 901 rods were milled under observation. This furnished five grinds with the 0-deg. and 15-deg. rake cutter, eight grinds with the 10-deg. rake cutter, and two grinds with the 20-deg. rake cutter. The regular operator determined when the cutter was "blunt," this being judged by the roughness of the finish. The following results were obtained:

TABLE IX. ENERGY AS A FUNCTION OF MAXIMUM CHIP THICKNESS

Material, cold-rolled steel; radius of cutter, 1¾ in.; width of cut, ⅛ in.

Depth of Cut, In.	Feed per Chip, In.	Maximum Thickness, In.	Energy, Ft.-Lb.	Cu.In. per Hp.-Min.
0.04	0.004	0.000849	1.5	0.352
0.04	0.008	0.001697	2.4	0.440
0.04	0.012	0.002546	3.2	0.494
0.04	0.016	0.003395	4.0	0.528
0.08	0.004	0.001194	2.6	0.406
0.08	0.008	0.002389	4.4	0.480
0.08	0.012	0.003583	5.7	0.555
0.08	0.016	0.004778	7.0	0.604
0.12	0.004	0.001455	3.9	0.406
0.12	0.008	0.002910	6.0	0.529
0.12	0.012	0.004366	8.0	0.594
0.12	0.016	0.005821	10.0	0.634
0.16	0.004	0.001670	5.1	0.414
0.16	0.008	0.003338	7.8	0.541
0.16	0.012	0.005028	10.8	0.587
0.16	0.016	0.006677	13.5	0.626

Rake angle, deg.	0	10	15	20
Average number of rods per grind	11.8	58.1	50.6	62.0

The 20-deg. cutter snipped in two teeth after the second grind. Ten to twenty times the number of experiments would be required to state with any reliability the quantitative relations between rake and endurance. It is apparent though that for this material the influence of rake on endurance is at least beneficial up to between 10 deg. and 15 deg.

Hudson Gear-Shift Finger.—The results of this job are unfortunately almost valueless. Due to a change in design, the part in question ceased to be manufactured after 2,125 had been machined. The number machined by one cutter without grinding was unexpectedly large. This resulted in only one grind being possible with a 5-deg., 10-deg., and a 15-deg. rake cutter. Fig. 24 shows the finger with the part machined in heavy line. The results were as follows:

TABLE X. COMPUTATION OF FORCE-SPACE CURVE

Experiment No. 32, on cast iron; feed, 0.016 in.

No.	Reading	Velocity	Acceleration	Dynamic Force	Static Force	Total Force
1	172	403	....	.....	...	...
2	575	414	11	—355	372	17
3	989	418	4	—129	374	245
4	1,407	420	2	— 65	376	311
5	1,827	420	0	0	378	378
6	2,247	419	— 1	32	379	411
7	2,666	416	— 3	97	380	477
8	3,082	412	— 4	129	380	509
9	3,494	406	— 6	194	379	573
10	3,900	398	— 8	258	378	636
11	4,298	389	— 9	291	376	667
12	4,687	379	—10	323	374	697
13	5,066	369	—10	323	372	695
14	5,435	369	0	0	369	369
15	5,804	381	12	—388	366	—22
16	6,173	...	....	.....	...	...

Rake angle, deg.	5	10	15
Number of fingers per grind	700	800	625

As a result of these experiments it may be said that from an endurance standpoint rake is certainly increasingly beneficial up to 10 deg. and probably is up to 15 deg. This statement is made definitely for steel up to 0.50 carbon and it is believed that it will be found true for all metals.

The machineability tester was designed, as stated earlier, for measuring quickly the machineability of different metals. This machine is shown in Fig. 25.

In principle it is of course identical with the chip investigator, so far as measuring the integral effect of the action is concerned. Within its limitations, however, it is a much more efficient instrument than the chip investigator, as no calculation is necessary. If the weight be allowed to fall freely from the top position, it will rise almost to the same height. A pointer indicates the highest position to which the weight rises and this is taken as the zero reading. If, in a subsequent fall, a chip be formed then the weight will not rise as high. This change in height is a measure of the energy given up in forming the chip. The same principle is used in impact-testing machines.

One group of experiments run on this machine is recorded, as it was carried out to emphasize the analysis brought out previously that maximum chip thickness is the sole criterion of efficiency for a given tool and material. Four different depths of cut and four different feeds were taken, giving sixteen differently shaped chips in all.

The results of these sixteen experiments are given in Table IX and Fig. 26, in which cubic inches per horsepower-minute are plotted against maximum chip thickness. It is seen that efficiency is a function of maximum chip thickness alone.

The importance of the above point of view cannot well be over emphasized. In arranging instructions for the operation of milling machines, in compiling speed, feed and depth-of-cut data, or in comparing different jobs, the fact should be kept in mind that maximum chip thickness is the true criterion of cutter-tooth punishment.

APPENDIX NO. 1

CHIP INVESTIGATOR—METHODS OF COMPUTING

The record shown in Fig. 27 is analyzed by means of a traveling microscope using a foil templet to catch three points on a wave. There are two cases to consider: First, an analysis leading to a force-space curve; second, an analysis giving the energy absorbed, which, of course, is really the area under the first curve.

The longitudinal position of every fifth wave was noted by means of a microscopic analyzer, which happened to read in centimeters. Referring to Table X, we have:

Column 1, Serial number of point observed.
Column 2, Position in tenths of a millimeter.
Column 3, Successive differences.
Column 4, Second differences; i.e., acceleration.
Column 5, Dynamic force at the tool. This is equal to angular acceleration (reduced to proper units) multiplied by the moment of inertia of the oscillating mass.
Column 6, Force required at tool to hold the arm statically.
Column 7, Combined static and dynamic tangential force.

If column 7 be plotted against column 2, the units of the latter being suitably modified, a force-space curve is obtained.

Energy Analysis.—This requires a knowledge of the angular velocity of the arm at the beginning and at the end of a cut but not at intermediate positions. These points on the smoked record are marked and the pitch of the waves there measured. Five wave lengths are usually taken, straddling the point being investigated. These readings are then noted on a form, one of which is shown completely worked in Fig. 28. In changing from $(V_2^2 - V_1^2)$ to kinetic energy given up in foot-pounds, a constant is involved which includes the amount of inertia and the change of units.

APPENDIX NO. 2

DESIGN OF CUTTERS

A semi-rational theory is here given for the design of cutter teeth. As a cutter increases in diameter, it is likely to take heavier cuts; a small-diameter cutter cannot be expected to carry the feed per tooth carried easily by a large slab mill.

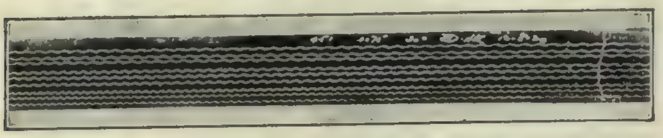


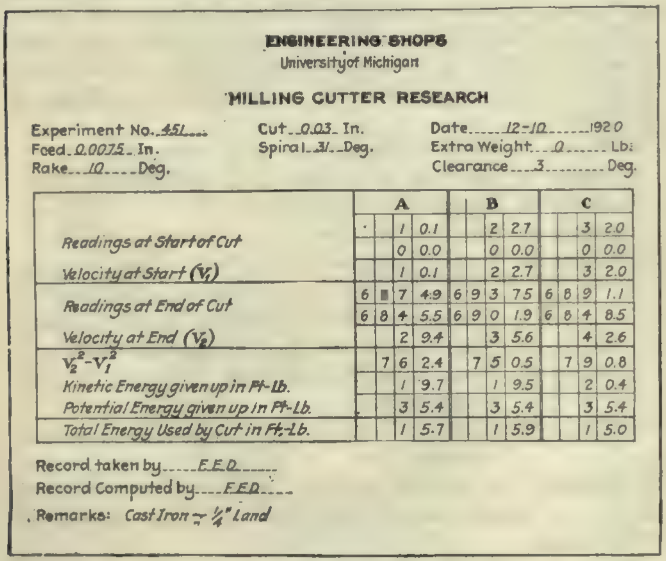
FIG. 27. EXAMPLE OF SMOKED PAPER RECORD

If the reasonable assumption be granted that maximum chip thickness is proportional to the radius of the cutter, then the foundation is laid for a satisfactory theory of spacing.

Assume also that the force required to remove a chip is proportional to the square root of the thickness. This is equivalent to saying that a parabola can be fitted to the force-space curve of Fig. 3. Also

Let R = radius of cutter in inches;
n = number of teeth;
F = maximum tangential force;
d = depth of tooth;
t = thickness at base of tooth;
f = maximum fiber stress permissible.

The length of chip increases with an increase of radius, and as chip thickness has already been taken proportional to radius, the chip volume will vary as the radius raised to a power higher than unity. However, as the radius increases, the material becomes more compact for a given volume, due to the thickening of the chip, so chip clearance necessary may be taken as proportional to radius simply.



ENGINEERING SHOPS
University of Michigan

MILLING CUTTER RESEARCH

Experiment No. 451
Feed 0.0075 In.
Rake 10 Deg.
Cut 0.03 In.
Spiral 31 Deg.
Date 12-10 1920
Extra Weight 0 Lb.
Clearance 3 Deg.

	A				B				C			
Readings at Start of Cut			1	0.1			2	2.7			3	2.0
			0	0.0			0	0.0			0	0.0
Velocity at Start (V_1)			1	0.1			2	2.7			3	2.0
Readings at End of Cut	6	[illegible]	7	4.9	6	9	3	7.5	6	8	9	1.1
	6	8	4	5.5	6	9	0	1.9	6	8	4	8.5
Velocity at End (V_2)			2	9.4			3	5.6			4	2.6
$V_2^2-V_1^2$		7	6	2.4		7	5	0.5		7	9	0.8
Kinetic Energy given up in Ft-Lb.			1	9.7			1	9.5			2	0.4
Potential Energy given up in Ft-Lb.			3	5.4			3	5.4			3	5.4
Total Energy Used by Cut in Ft.-Lb.			1	5.7			1	5.9			1	5.0

Record taken by E.E.D.
Record Computed by E.E.D.
Remarks: Cast Iron – ¼" Land

FIG. 28. COMPUTATION OF ENERGY PER CHIP

Since the shapes of the spaces between adjacent teeth are similar in cutters of different diameters, chip space is proportional to d^2, and as chip space is also proportional to radius as explained above, it follows that:

$$d \propto \sqrt{R} \tag{1}$$

$$\text{also } F \propto \sqrt{\text{Chip Thickness}} \propto \sqrt{R} \tag{2}$$

Therefore

$$d \propto F \tag{3}$$

Assume for simplicity unit thickness at base of tooth. By the theory of bending,

$$Fd \propto t^2 f \tag{4}$$

Therefore, by (3),

$$d \times d \propto t^2 f \tag{5}$$

$$t \propto d \tag{6}$$

Also, by the properties of similar shapes,

$$n = \frac{2\pi(R - d)}{t + Kt} \tag{7}$$

where K is a constant.

Or, by (1) and (6),

$$n = \frac{2\pi(R - K_1 R^{\frac{1}{2}})}{K_2 R^{\frac{1}{2}}(I + K_1)} \tag{8}$$

$$= K_3^{\frac{1}{2}} - K_4 \tag{9}$$

where K_1, K_2, K_3 and K_4 are constants.

The constants K_3 and K_4 have been determined by observation of spacing in cases where chip room appeared adequate. This gives:

$$n = 19.5\,R^{\frac{1}{2}} - 5.8 \tag{10}$$

Also a relationship of

$$t = d \tag{11}$$

is simple and accords well with proportions repeatedly used and found amply strong.

Modification of K_5 in the relation,

$$t = K_5 d \tag{12}$$

affects the strength of the tooth in general. For instance, if a new superior steel were discovered, then K_5 could be decreased. Changing K_5 in no wise affects the rationality of Equation (10), but would indirectly influence the constants, leading to a greater n for a given R if K_5 be reduced.

Since, by (1), $d \propto R^{\frac{1}{2}}$, we find the following relation to give satisfactory results:

$$d = 0.215\,R \tag{13}$$

Combinations in the German Machine Industries

The second largest German ammunition works (Reinische Metallwarenfabrik, in Dusseldorf) has lately experienced strong financial difficulties owing to the enormous cost of changing from war production to production of peace commodities. The Krupp Works, which owns the majority of the stock in the above-mentioned company, has not been in a position to furnish any financial assistance. For that reason the Reinische Metallwarenfabrik was forced to make a combination with the well-known iron works of Otto Wolf, in Cologne, and the large machine manufacturing concern, Linke-Hoffmann and Algemeine Elektricitats Gesellschaft, in Breslau.

This combination will undoubtedly be of great importance to all interested parties; the Reinische Metallwarenfabrik seems to have overcome all financial difficulties. The combination will be the largest machine constructing concern on the European continent and will probably be able to monopolize the whole German machine industry.

This new combination has lately received large orders for locomotives from Rumania.

The plans for electrifying the German railways may be considered one of the main reasons for Algemeine Elektricitats Gesellschaft forming this combination.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

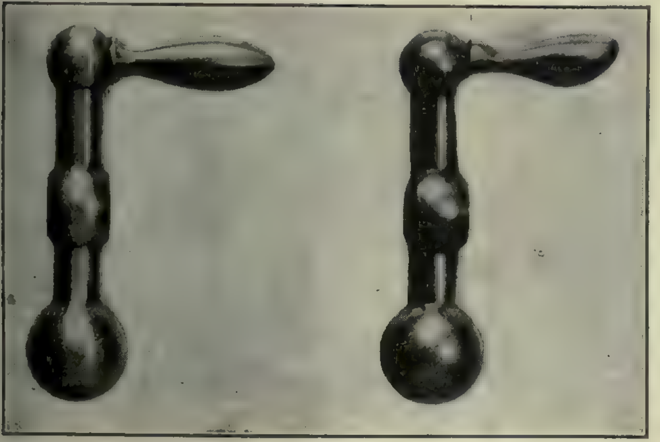
A Worn Crank Handle

By Luther D. Burlingame

It is evident that the question, "Are Hollows Worn in Hammer Handles" has proved one of interest to your readers, as shown by the various communications which you have published. These show conclusively that the friction of a hand may wear away a wooden handle to a surprising extent.

It is not alone wooden handles that are affected by such wear. The writer's attention was called to the steel handle of a ball crank used on a Brown & Sharpe four and three-quarter inch index center which has long been in use on a surface grinding machine. The long-continued operation of the handle by the workman has worn it away as shown at the right in the illustration. The ball crank at the left shows the appearance of a similar handle when new.

While it may seem that a steel handle would be more resistant to wear than a wooden one, the evidence is conclusive that neither can resist the friction from the hand resulting from continued use.



A NEW AND WORN CRANK HANDLE

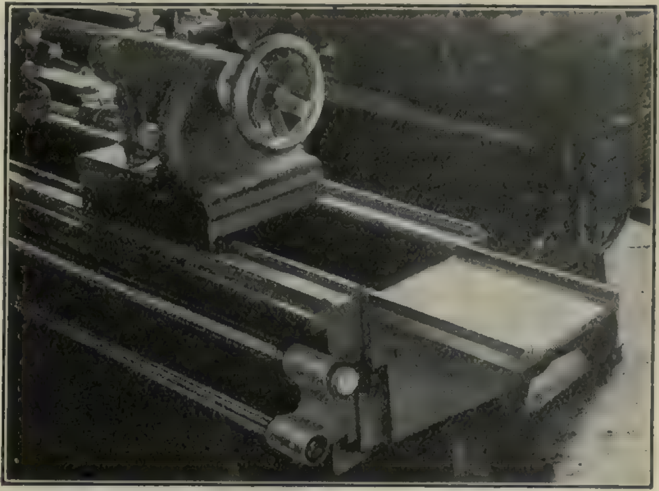
It is said that the great toe of the statue of Saint Peter, in Rome has been worn away from being kissed by the multitude of pilgrims who passed by.

Increasing the Distance Between Centers of a Lathe

By Thomas Brown

Having occasion to turn a number of shafts, the length of which was somewhat in excess of the distance between centers of any lathe that was conveniently available, we adopted the expedient shown in the illustration and it worked out so satisfactorily that the addition has since been left in place, giving us a lathe capable of handling work 8 or 10 in. longer than it was originally designed for.

An angle iron casting of suitable size and shape was machined upon one surface to correspond with the inner V-s upon which the tailstock bears. The other surface was bolted to the end of the lathe bed with the extended shears carefully aligned with the original ones. The tailstock may now be moved back until two thirds of its length overhangs the lathe bed and still be rigidly supported.



EXTENDING A LATHE BED

Independent Support for Planer Drive

By Milton Wright

Individual motor drive for large planers and other tools is very convenient and saves a lot of overhead machinery in the shop, but when mounted upon the housings of a planer, as is the usual practice, it is liable to introduce an undesirable element in the vibration quite apt to result from any machinery running at comparatively high speeds, as well as the added disturbance caused at the instant of reversal by the sud-

INDEPENDENT SUPPORT FOR MOTOR DRIVE

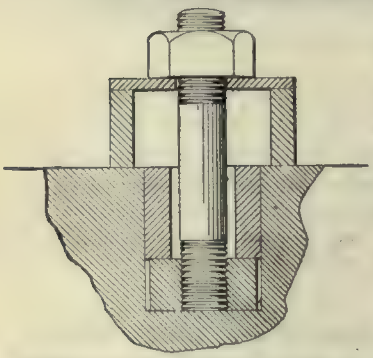
den shock upon the belts. To avoid this inconvenience all of the large planers at the plant of the Universal Boring Machine Co. have been equipped with the special motor and countershaft support shown in the accompanying illustration.

The brackets which formed the original supports were removed from the housings and an independent platform of structural iron erected to receive the shelf upon which the motor and countershaft stand. The uprights are beams of I-section set into the concrete flooring and bridged across at the top with smaller beams of similar section. The uprights are braced against lateral deflection by diagonal braces between them.

All of the desirable features of the original design are retained without there being any metallic connection between the machine and its overhead works and the disagreeable jar is thus eliminated. The outer support with its diagonal bracing also forms an effective guard around the pulleys and gears of the reversing mechanism and occupies little if any more space than would be required by the wire guards which it replaces.

Bushing a Blind Locating Hole

By Charles Reimschissel



REMOVABLE BUSHING FOR A BLIND HOLE

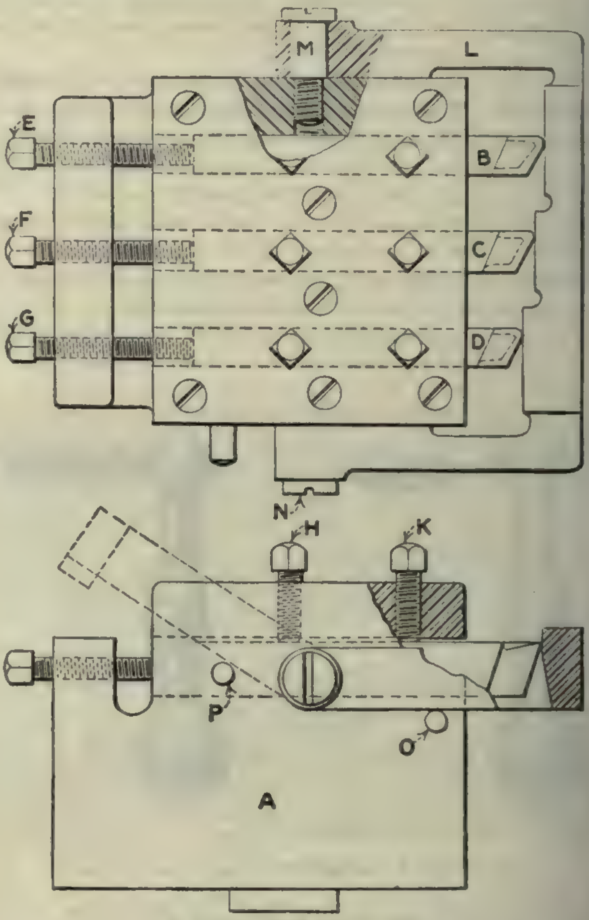
In bushing a blind locating hole the hole should be drilled about ⅜ in. deeper than the length of the bushing and a nut placed in the bottom as shown in the sketch. If at any time it is necessary to remove the bushing, a stud can be screwed into the nut and a larger bushing placed on top of the working surface. A washer and nut on the upper end of the stud will complete an arrangement by which the bushing can be easily withdrawn from the hole.

Tool Set-Up Gage

By Gene Phelps

When several tools are used at one time for turning different diameters and these diameters must be kept closely to size, considerable trouble is often experienced in setting the tools correctly. If these tools are set in a block on the cross-slide of a lathe the method for determining diameters is a "cut and try" proposition. The various tools are set forward a little at a time until a measurement of the work shows that the correct diameter has been attained. Very often the tools are set in a holder in such a way that there is no fine adjustment possible and they must be tapped forward a little at a time until the desired accuracy is reached. When some tools are set at an angle and others are straight, considerable more difficulty is experienced.

Sheet-metal gages or plugs of various diameters set in the spindle of the machine are troublesome and cannot always be relied upon to produce accurate work. A method however which can be applied to nearly all toolblocks of this kind is shown in the illustration. The block *A* is mounted on the cross-slide of the lathe and the tools *B*, *C* and *D* are arranged according to the nature of the work. The form of the toolblock is such that it permits adjusting screws to be placed at *E*, *F* and *G*. The tools are held in the toolblock by means of setscrews shown at *H* and *K*. A setting gage is made in the form of a hinge as shown at *L*, being pivoted on two shouldered screws at *M* and *N* on each side of the toolblock. In adjusting the tools for diameters it is only necessary to drop the gage down until it strikes the stop pin at *O* and then set up the screws *E*, *F* and *G* until the tools project sufficiently to strike the various shoulders on the gage as indicated. After this has been done the holding screws *H* and *K* can be tightened and the gage thrown back against the pin at *P* so that it takes the position as indicated by the dotted lines. The tools are then ready for work.



A TOOL SET-UP GAGE

Cutting Index Marks in Handbooks

By H. C. Card

On page 691 of the *American Machinist* appeared an article under the above title by John S. Carpenter. He described a method of making a tool for cutting semicircular index marks in the edge of a book.

As a suggestion to those who do not have the facilities for making such a tool, I have found a 12-gage wad cutter to be an efficient substitute. Using a hardwood block to cut on, a slight blow with a hammer will cut 50 to 75 leaves. This cutter can be purchased from any gun or ammunition dealer for about 35 cents.

EDITORIALS

The Elimination of Waste in American Industry—A War Measure

A MEMBER of Mr. Hoover's engineering committee on the elimination of waste in industry said at the recent annual meeting of the A. S. M. E., that no other body of engineers had ever received so much publicity and support for their work. Just why should this be? Has the country finally awakened to the real worth of the engineer's contribution to society, and are all his future undertakings to receive deserved recognition?

Perhaps; but we are frankly skeptical, although it would be a real pleasure to be proved wrong in our skepticism. There is no question that the American engineer came into his own in the World War. Without him we should have cut a sorry figure.

But the war is over, we are at peace with all the world and the Washington conference bids fair to make the possibility of future wars remote. Why, then, should the elimination of waste be called a war measure? Simply because it is a vitally necessary factor in preparedness for the economic war which has but just begun and which will call for a co-ordinated national effort that will surpass that of the dark days of 1917 and 1918.

If there is any doubt that a real struggle is ahead of us, one has but to examine the field against us. England has suffered tremendous losses from the war, but she has centuries of experience in world trade to guide her and the very real necessity of earning her living by commerce. France has large devastated regions and is carrying a staggering load in her standing army, but she has never been afraid of work and is favored in trade as against the United States by a 3 to 1 exchange ratio. Add to this the fact that the occupation of her northern industrial region by the Germans forced her to build new plants in the south, near her big water powers, which have brought her production up to more than eighty per cent of the prewar figures, and it becomes clear that she must be reckoned with.

As to Germany, her competitive threat has probably been over-estimated in some quarters but it is nevertheless a very real one. She can easily undersell any other exporting nation of any consequence and her people are working with the zeal of desperation and on a much lower scale of living than our own. The reparations question is still unsettled, but from present indications the most likely means of payment is in goods which will certainly not help us any in markets where our goods compete with them. The Germans have also embarked on a campaign of standardization of product which cannot fail to reduce production costs already low.

How then can we meet our competitors? We certainly do not want to lower our living standards, nor can we do much to alter the exchange relations; they will take care of themselves eventually. We can, however, eliminate much of the waste in our industrial processes and distribution systems and thus bring down our costs to a more reasonable figure as compared to the costs of similar products abroad. There is also much to be done in standardization as pointed out in the report of Mr. Hoover's committee.

It should be a matter of pride to engineers that a representative group of their leaders are the ones to point the way in which we must travel if we are to have an even chance in the struggles for world trade. Unfortunately they have not the power to enforce their findings—they have made their investigation and presented their report and the rest is up to the men who direct industries. The way is clear.

Exceeding the Useful Cost Limit

WE ARE always looking for ways and means to improve our machinery. New details of designs and better materials, largely copied from the automobile engines, have become common in modern machine tools. Forced lubrication, either direct to bearings or splashed or cascaded over them, has become standard in many shops. Centralized control is now a necessity in any machine used on high production work. And yet there is another side to the story.

All the features mentioned are highly commendable and are without question a necessity in shops where intensive production with highly specialized labor is employed. Anything which saves time and labor has a field in some kind of a shop. But there are many other shops that do not need these refinements and cannot afford to buy the machines in which they appear.

Perhaps most of the failures of machine tools in large production shops is due to neglect of lubrication. In the shops mentioned it is necessary to pay the added cost of securing positive lubrication, either mechanically or by men whose duty it is to do nothing else. But in shops where men know how to take care of machinery, machine tools last for years—too long for everybody in many cases. We recently saw a high-grade machine tool of well-known make which was torn down after ten years of steady service. The bearings were almost perfect, the alignment required very little readjustment. The gears, many of them cast iron, were in excellent condition. The machine could have been in no better condition with the latest type of oiling and with forged alloy steel gears. Their cost would have been an added investment entailing additional overhead.

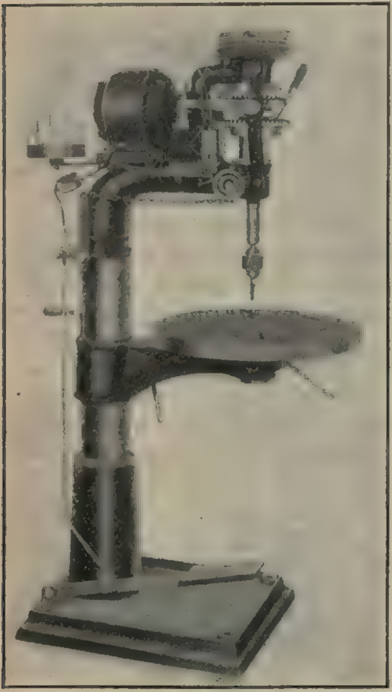
There is no question as to the need of the steel gears and forced lubrication in some machines and in some shops. But does this justify the cost on all machines or should we class a machine as behind the times if it lacks these features? Is it economic to add the cost of these to the overhead of shops which do not need them, especially when the machines last too long in most cases anyhow?

This is not an argument against highly developed and refined machines. We welcome all advances in the industry. But is there not a field where the simpler, plainer machine will answer every purpose and at a lower cost? Capital invested without an adequate return is a burden on the industry.

Shop Equipment News

Gaterman Drilling and Tapping Machine

The W. Gaterman Manufacturing Co., Manitowoc, Wis., has recently placed on the market the drilling and tapping machine shown in the accompanying illustration. The device is known as the "electro-magnetic" tapping machine, and by it hand tapping can be automatically imitated. The tap is held in a floating spindle, which is so driven through two coil springs that shocks and jars on the tap are avoided. On the top of the machine is a device which provides for adjustment to the proper torque required for driving the tap. This device weighs the torque transmitted to the tap, and is so connected with the reversing mechanism that the spindle automatically reverses when too great a torque is transmitted. Electromagnets are employed in the reversing mechanism. Should the tap strike the bottom of the hole, or some obstruction which places more strain on the tap than that for which the dial is set, the rotation of the spindle automatically stops, then reverses for one-sixth of a turn so as to free the tap, and immediately starts forward again. These reversals are accomplished almost instantaneously, and the spindle immediately takes up its original speed, which varies from 300 to 2,000 r.p.m., according to the size of the tap. The oscillating movement of the tap is carried on until the resistance has been overcome, but it does not occur unless the resistance offered by the work exceeds the torque for which the driving mechanism has been set. No friction or slippage device is employed to obtain the reversing action, it being accomplished by means of the spring balance in the drive and by the electromagnets.


GATERMAN DRILLING AND TAPPING MACHINE

The machine is said to be simply and durably constructed, having large journal bearings and ball thrust bearings throughout. Either hand or foot control can be employed. The machine can be furnished in different sizes, the No. 4 size having a range up to ½ in. Either belted or motor drives can be employed. The machine can be set so as to run the tap to a certain depth and automatically return it. It is claimed for the machine that it practically eliminates the breakage of taps; that it is not necessary to employ taper taps, since straight taps may be run through the hole immediately after drilling; and that great speed in tapping may be obtained, because of the rapidity of the reversal and the high speed of rotation.

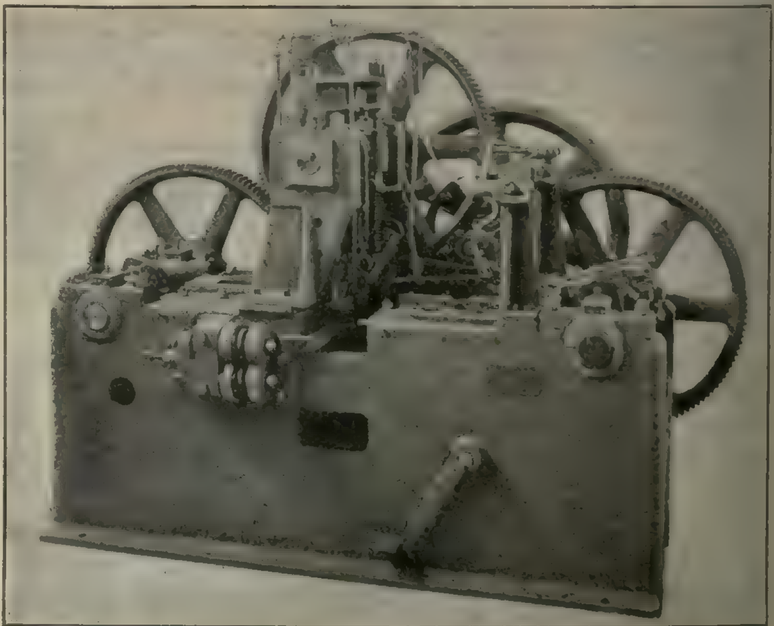
Acme Hot-Pressed Nut Machine

The illustration herewith shows a machine that has been developed by the Acme Machinery Co., Cleveland, Ohio, for making hot-pressed nuts.

A bar of special section is used and the first operation is to indent it on both sides, forming angles equal to those at the sides of two abutting nuts. As the indenters withdraw, the cut-off slide advances, shearing off the blank and carrying it into the die box. Then two punches, one of which is a piercing punch, and the other a short punch, advance from opposite sides and go part way through the blank, compressing it in the center so that the surrounding metal flows and fills all parts of the die, producing not only the sharp corners on the blank, but the crown as well. The punches dwell momentarily to allow the metal to flow and then as the short punch retreats, the piercing punch advances and punches out the core. The piercing punch is quickly withdrawn to prevent the nut from shrinking on to it, and the nut is then ejected from the die.

The partial forming of the nut by indenting the sides of the bar and compressing the core to expand the surrounding metal results in considerable saving in stock. The maker claims that 2,000 lb. of nuts can be produced from 2,200 lb. of stock, this being a saving of 1,100 over former methods.

The bed of the machine is an open-hearth steel casting and all gears are of steel with cut teeth. The machine


ACME MACHINE FOR MAKING HOT-PRESSED NUTS

is equipped with a simple automatic relief device that prevents undue strain during operation.

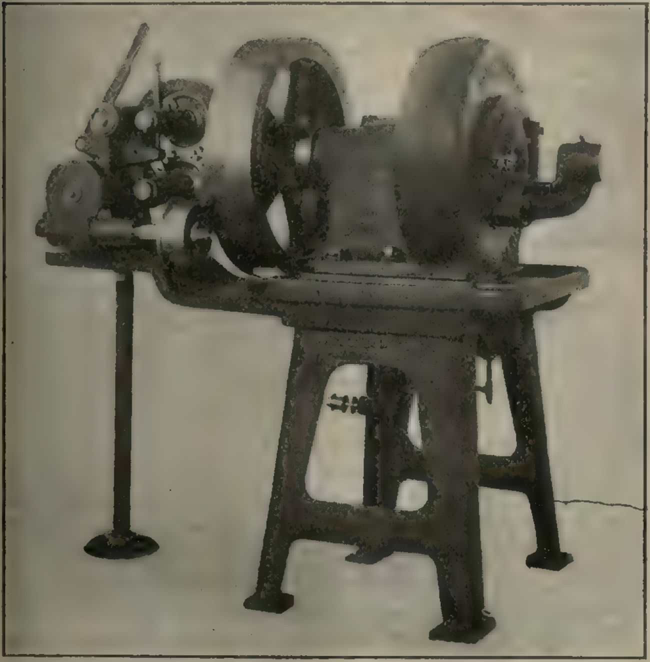
The indenting tools are operated from the upper shaft while the punches and cut-off slide are operated by the shafts at the opposite ends of the machine.

The indenting tools, cut-off tool and punches are of simple design and are made of air-hardening steel. Water is supplied to all parts that need cooling.

The machine is built in four sizes with capacities as follows: ⅜ to ¾ in.; ½ to 1 in.; ¾ to 1½ in.; 1 to 2 in. The number of strokes per minute varies from 70 to 75 for the smallest machine, to 35 to 40 for the largest.

Langelier Roller-Cage-Type Swaging Machine

The Langelier Manufacturing Co., Arlington, Cranston, R. I., has added to its line of swaging machines the type shown in the accompanying illustration, in which machine the rolls are carried in a floating ring or cage instead of being fixed in the head. The rolls in the cage are made of a high grade of tempered carbon steel. A similar roll is carried in the outer end of each hammer block, so that the metal-to-metal contact at the instant of delivering the blow is a rolling instead of a sliding one. The hammer blocks are slotted at the inner end to receive the swaging dies. Adjustment of the blow is provided by changeable shims between the hammer block and die.



LANGELIER ROLLER-CAGE-TYPE SWAGING MACHINE

A roll feeding attachmnt is mounted on the machine, its purpose being to withdraw the work with a slow, even motion, thus insuring straightness and uniformity of reduction. The capacity of the attachment is for stock from 0.375 to 1.313 in. in diameter, and it will hold any size between these limits. The attachment is movable to and from the head through a distance of 5 in. by means of a screw underneath the baseplate.

The main spindle bearing is provided with loose perforated bushings, the perforations acting as small reservoirs for oil, to insure proper lubrication to the spindle. The flywheel is held to the spindle by a two-bolt clamp hub, closing over a key. This construction is claimed to resist the tendency of the wheel to work loose because of the vibration induced by the rapid blows delivered by the machine.

New Britain Babbitting Fixtures for Ford Automobile Engines

Two fixtures especially designed for the convenience of the repairman in babbitting the main bearings and connecting rods of Ford engines, have been placed on the market by the New Britain Tool and Manufacturing Co., New Britain, Conn.

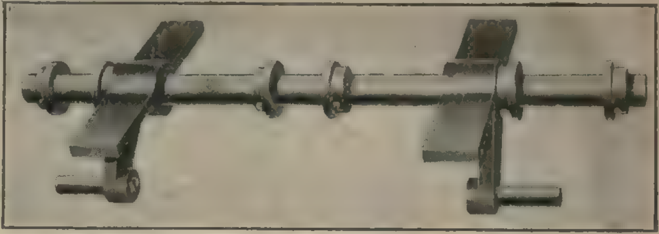


FIG. 1. FIXTURE FOR BABBITTING FORD MAIN BEARINGS

The main bearing fixture, shown in Fig. 1, is so made that it may be set in place on the inverted cylinder block and positioned by entering the studs in the camshaft bearings. The studs insure alignment and parallelism, while the crossbars resting upon the flanges of the upturned block hold the arbor central with relation to the bearings to be babbitted.

The movable collars are brought to bear against the ends of the bearings, where they are fastened by means of setscrews, and the device is ready for pouring the babbitt. The arbor is sufficiently undersize to allow stock for finish reaming the bearings.

The connecting-rod fixture, Fig. 2, consists of a flat base block of cast iron with two vertical studs set therein, and suitable collars to form the fillets at the ends of the bearings.

The wristpin end of the rod is placed over the smaller stud, thus bringing the crank end in proper relation to the larger stud; which is the babbitting arbor. The upper collar is now pushed over the projecting end of the stud until it bears against the rod. Recesses in upper and lower collars take care of the fillets.

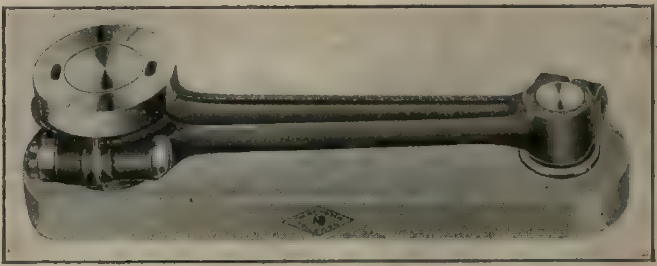


FIG. 2. FIXTURE FOR BABBITTING FORD CONNECTING RODS

Two pour holes are provided in the upper collar and when the metal has set, a sharp blow with a mallet will break the risers so that the collar may be removed without any trouble.

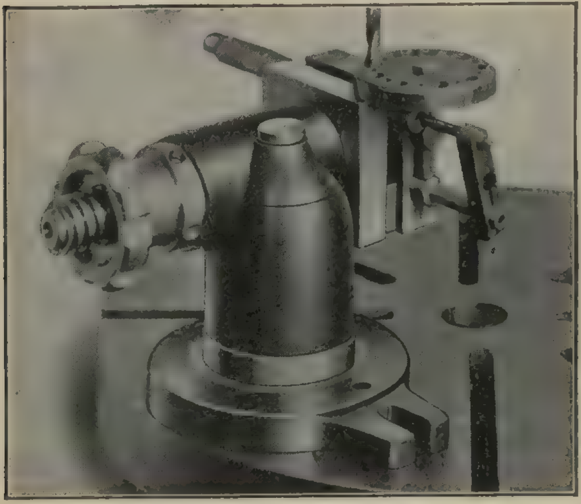
Separators may be set between the rod and cap when the device is assembled so that the bearing will be in two parts. The bearing is finished when taken from the fixture, no machining being required except to smooth the rough ends of the broken risers with file or scraper.

W.B.U. Combination Vise, Drill Jig and Milling Fixture

The accompanying illustration shows the Victor universal swiveling vise recently placed on the market by the W.B.U. Tool Co., 104 Harding St., Worcester, Mass. The device, which is intended especially for toolroom use, is adapted to holding work on a drilling machine, shaper, grinding machine or milling machine. Where two or more cuts are to be made on one piece at angles to each other, removal of the work is unnecessary, as the vise can be swung to change the position. Both the horizontal and vertical swivels are graduated to 360 deg., so that the work may be set at any angle desired. The work can be tested with a square direct from the table of the machine on which the vise is mounted.

The fixture can be used on the bench when filing small dies and punches, as it is not necessary to take the work out of the vise to ascertain its correctness. The vise jaws provide six square and true sides for the application of a square. The work can be quickly swung to the desired position.

When used as a drill jig, the tool is equipped with a bushing plate, as shown, having eighteen holes varying from $\frac{7}{64}$ to $\frac{3}{8}$ in. It can be set to drill round stock from $\frac{5}{16}$ to 1 in. in diameter, and square or flat stock from $\frac{1}{4}$ to 1 in. thick. A V-groove is provided for the gripping of cylindrical work. The vise can be clamped to the table of a milling machine for use as a milling fixture. The jaws have an opening of $2\frac{1}{2}$ in., and can be furnished either soft or hardened.


W.B.U. VICTOR UNIVERSAL VISE

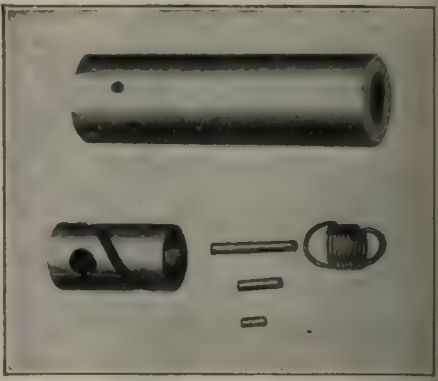
Sexton "Flush" Oiler for Cone Pulleys

An oiler especially adapted for use in the cone pulleys of machine tools but serviceable in many other places where pulleys are expected to run idly upon shafts or studs, has been brought out by the Sexton Machine Co., 308 Pearl St., Hartford, Conn.

The body of the oiler is a steel tube of a length just sufficient to reach from the surface of the pulley to the bore, and ground upon the outside diameter to a drive fit in a standard reamed hole. An inverted hollow plug fills the outer end of the tube; being held to a shouldered seat within the latter by the tension of a coil spring.

A helical groove in the shell of the plug engages a fixed pin in the wall of the tube in such manner that when the plug is turned back by means of a screwdriver, as in drawing a screw, the plug will rise against the pull of the spring until it reaches the limit of its movement, where a change in the direction of the groove holds it in position.

In this position, which is reached in less than one-half turn of the plug, a hole in the shell of the plug is exposed for the introduction of the spout of an oil-can. When filled with oil a slight twist with the fingers in a right-hand direction will allow the plug to snap back to place, flush with the surface of the pulley, effectively sealing the tube against the escape of oil. The tube and hollow body of the plug constitute a reservoir that will hold a sufficient quantity of oil to lubricate the pulley for a long time. The oiler is made in $\frac{1}{4}$, $\frac{1}{2}$, $\frac{5}{8}$ and $\frac{3}{4}$-in. sizes, and of any length of tube desired

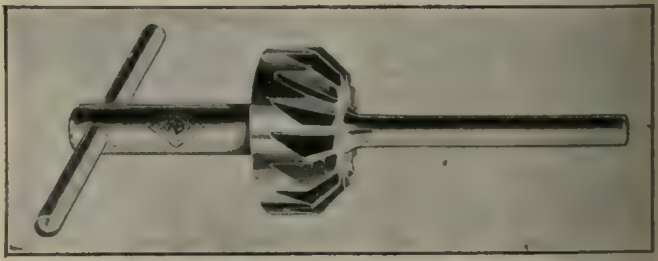

SEXTON "FLUSH" OILER FOR CONE PULLEYS

New Britain Valve Reseating Tool

The tool for resurfacing the valve seats of automobile engines, shown in the accompanying illustration, is now regularly manufactured by the New Britain Tool and Manufacturing Co., New Britain, Conn.

The cutter is made like a shell reamer and is a slip fit for the shank, upon which it is held against turning by a short spline or pin, fitting into a notch in the shell. It is of high carbon steel and may be furnished in any required angle to order, though it is stocked only in the most commonly used angles—30 and 45 degrees.

The pilot portion of the shank is furnished in any diameter to fit standard size valve stem guides or will be specially made to fit oversizes if desired. Cutters and shanks are interchangeable so that any combination may be quickly secured.


THE NEW BRITAIN VALVE RESEATING TOOL

Erratum

In the article "Notes on the Design of Shaving Tools," appearing on page 686 of *American Machinist*, there is on page 688, Table II, Note I, a misstatement due to the misplacement of a decimal point. The note should read: Minimum allowance for second shaving operation is 0.0015; not 0.015 as it was printed.

NEWS SECTION

Machine Industry Favored in Budget Requests

The President and the Director of the Budget have submitted to Congress their recommendations for expenditures by the executive departments during the next fiscal year. Here are some items of particular interest to the machinery industry.

Bureau of Standards: To provide for the standardization and testing of standard gages and screw-threads, and to calibrate and test gages, screw-threads and standards, $40,000; for the maintenance and equipping of automotive engine test plants, including vacuum and refrigerating machinery necessary to stimulate atmospheric conditions at altitudes up to 40,000 ft., and for testing engines and materials used in their construction, for testing carburetors, ignition devices, radiators, cooling systems, chassis, power transmission systems, and to conduct other researches incident to the standardization and development of automotive power plants, $45,000; for the establishment of standards, methods of testing, and inspection of mechanical and electrical devices, instruments, equipment and tools used in the industries, and by the Government, including practical specifications for quality and performance of such devices, $100,000; for technical investigations in co-operation with the industries upon fundamental problems involved in post-war industrial development, $150,000; to develop methods of testing and standardizing machines, motors, tools, measuring instruments, and other apparatus and devices used in mechanical, hydraulic and aeronautic engineering, $15,000.

ARMY AND NAVY

War Department: For the development, manufacture and purchase of airplane bombs and of ammunition for small arms for hand use, $511,500; for the manufacture and repair of arms at national armories, $453,000; for overhauling, cleaning, repairing and preserving ordnance and ordnance stores, $150,000; for the purchase, manufacture, and repair of automatic rifles, $459,000; for the purchase, manufacture, test and repair of tanks and other self-propelled vehicles, $350,000.

Navy Department: For procuring, producing, preserving and handling ordnance material, $13,130,000; for experimental work in the development of armor-piercing and other projectiles, fuses, powders and high explosives, $225,000.

Ordinary Expenditures Cut in Budget

In transmitting the first national budget to Congress on Dec. 5, President Harding drew particular attention to the fact that estimated ordinary expenditures for 1922 show a reduction of $1,513,537,682.20 under the 1921 amount. It was also brought out that the expenditures for 1923 were figured at $1,961,241,921.20 under the 1921 mark.

The total estimated expenditures for 1922 show a reduction under the 1921 estimate of $1,570,118,325.30.

◆

Civil Aeronautics in Department of Commerce

Representative Hicks, of New York, has introduced a bill in Congress (H. R. 9184) to create a Bureau of Civil Aeronautics in the Department of Commerce. This bureau will be charged with the duties of encouraging and regulating the operation of civil aircraft in interstate and foreign commerce.

It is planned to head the bureau with a deputy to be designated as the Commissioner of Civil Aeronautics and who will be appointed by the President. The bill provides for regulation of air routes, landing fields and stations, traffic rules, licensing of pilots and other operators.

The bill was introduced Nov. 17 and was immediately referred to the Committee on Interstate and Foreign Commerce and ordered printed.

◆

DuBrul Issues Bulletin on Tax Refund

Attention of machine tool builders is called to a resumé of changes in the revenue law in a bulletin issued by Ernest F. DuBrul, general manager of the National Machine Tool Builders' Association with offices in Cincinnati, Ohio. The bulletin is as follows: "The provisions for amortization deduction have been modified so as to require that no allowance shall be recognized for years ending between Dec. 31, 1921, and March 3, 1924, unless claim had been made at the time for filing return for the taxable years of, 1918, 1919, 1920 and 1921."

In the opinion of Mr. DuBrul a large number of machine tool builders have overpaid their taxes since 1918, because they have not taken amortization into consideration. Mr. DuBrul said that all claims must be filed with the Government not later than Mar. 15, 1922 in order to receive consideration.

Ninety Millions for Road Building a Boon to Machinery Trade

The signing of the highway bill by President Harding, on Nov. 9, has released $90,000,000 for road-building all over the United States. This release of capital should prove a boon to manufacturers of road-building machinery and inturn to the machine tool interests, as the extensive program of construction which is contemplated will require a larger amount of modern mechanical equipment. The effects of this need will no doubt stimulate all branches of the machinery business.

Fifteen million dollars of this appropriation is to be used exclusively for national roads in the publicly owned forests. Of the remainder $25,000,000 became available on the signing of the bill and $50,000,000 is to become available Jan. 1.

STATE RESPONSIBILITY

By far the most important feature of the new act is that it confines the Federal aid to one connected system which must not exceed 7 per cent of the road mileage of the state, and makes it mandatory that the road must be kept in good condition at the sole expense of the state. The act divides the highway system in two classes—interstate and intercounty roads. The interstate roads must not exceed three-sevenths of the system. At least 60 per cent of the state's allotment must be expended on these interstate highways. The remainder is to be expended on the intercounty highways.

Special permission must be obtained if any road is constructed with a surfaced width less than 18 ft. Once completed the road must be maintained in the best of condition as the act provides a drastic maintenance clause. If a road is not properly kept up the Federal Government has full authority to maintain it out of the state's allotment and must refuse to approve any new projects in the state until it has been reimbursed.

Prior to five years ago the United States was very backward in highway construction but this work was so stimulated by Federal aid that some $566,000,000 had been expended or made available prior to the enactment of the latest law. The Bureau of Public Roads estimates that not over one-half of the roads being built are receiving financial aid from the Government. The Federal aid roads alone give employment to 250,000 of which 6,000 are engineers.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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A few months ago most American business men believed that a capital operation of some sort upon the body financial was necessary to a recovery of prosperity, but their mood has changed and many of them are now making plans which presuppose great confidence in the future. It is not the facts, but the attitude toward them that has changed and it is our attitude that makes the difference between prosperity and prostration.

Three months ago the bankers having charge of the reorganization of the Missouri, Kansas & Texas and the Chicago & Eastern Illinois railroads would hardly have dared to announce their plans. The new capital necessary would not have been forthcoming. Now it is easily obtainable and these reorganizations are being consummated. The same feeling of confidence in the future is behind the extensive consolidations in the steel and coal industries that are being arranged against the time when the new securities that will be created can be sold. The *New York Herald* of Dec. 4 published "An exhaustive survey of the architectural offices of the United States," which showed that the cost of the new building construction now contemplated in the U. S. is $4,178,665,750.

Political Truce Helping

This revival of activity evidences a faith in the recuperative powers of the country that will spread, for faith, like doubt, is contagious. That conditions justify constructive optimism has long been apparent to the close observer, but it has also been plain that some striking concatenation of events was required to revive enterprise and quicken the business imagination. This has been provided in the developments at the disarmament conference and the nearly concurrent settlement of the Irish question which is a triumph of compromise over coercion that does great credit to the statesmanship of Lloyd George. The result is that men nearly everywhere have become convinced that a resort to the surgery of war will be unnecessary for a long time to come and capital is now hurrying to find employment in the work for which peace will afford opportunity. We have an accumulation of gold in this country which assures an extended period of easy money and abundant credit. Among the things that are definitely encouraging there must also be included President Harding's message to Congress, his recognition of the farmers' plight, the need of further tax revision and the desirability of a constitutional amendment that will give the Federal Government the right to tax incomes derived from new issues of State and Municipal securities. The President has also suggested that the right of labor to combine should be formally recognized by the passage of laws which limit the power of such combinations, just as the power of capital in combination is restricted. The proposal is not a novel one, but it is the first time it has received presidential approval and it contemplates an industrial disarmament that will greatly benefit both the wage earner and the employer.

Of course it will take time to make the President's program a reality, but it is heartening to comtemplate and it is to be counted as helpful in its psychological effect as is most of the routine news of the commercial and financial markets. There is here and there a bad spot, but in its entirety business seems to be on an even keel and moving toward the end of the year at an average though not an unusual speed.

A new era in governmental finance has been ushered in with the submission of a budget by the President to Congress. The taxpayer will find some relief in sight; the total estimated expenditures for the fiscal year 1922 are $1,570,118,323 less than in 1921 and the estimated expenditures for 1922 show a reduction of $2,032,285,000. Appropriations of $3,505,754,727 are asked for the next fiscal year.

Speculation Coming Back

In securities, and in some commodities, speculation is becoming a bit more venturesome—another symptom of returning confidence. Silk and rubber, which were among the first to collapse in price, have scored substantial recoveries. Cables from primary markets abroad report some excited buying of raw silk. Coffee is again higher and the inherent strength of the cotton market was demonstrated by an advance upon a ginners report that indicates a crop of over 8,000,000 bales. Trading in stocks and bonds has been active and new high quotations for the year were registered by a number of shares before a profit taking movement caused a temporary halt in an uninterrupted advance of several months' duration. The Victory bonds crossed par for the first time since their issuance.

So much gold has accumulated in the vaults of American banks that it holds menacing possibilities of a secondary period of inflation. That the mere possession of gold is not an economic panacea is conceded. The metal must be put to work—utilized as a basis of credit—but as this is done the danger of inflation will be great. In fact, the whole problem of international exchanges and credits is so complex that the policy of bankers is evidently one of inaction. From Germany, floundering in a sea of paper money, come reports of prosperity and activity while the United States, with its large gold supply, still hesitates to use it.

Improved sentiment alone has undoubtedly played a big part in the upturn in foreign exchange rates, several currencies, notably the English pound, reaching the highest level of the year this week. Swiss francs have climbed back to par for the first time in two years. Even marks are steadier on unofficial report from Paris that a three year moratorium on further reparation payments will be arranged for Germany. The number of paper marks outstanding has meantime been increased by 4,750,000,000 and the total now outstanding exceeds 100 billion marks, in view of which any permanent recovery in the gold value of the mark seems improbable.

Railroad net earnings for October will exceed $105,000,000, which is at the rate of nearly 6 per cent on the hypothetical value of the properties. The improvement is, however, largely due to a reduction in operating costs, for the gross is 16.6 per cent under last year. It is becoming increasingly evident that the high freight and passenger rates still restrict business and traveling.

Pig iron production during November was the highest since March, though there is still ample room for improvement. Copper is firm at slightly under the 14 cent level. Trade reports from the copper and brass industry are extremely optimistic.

The coal on hand Nov. 1 was 16,000,000 tons less than on the same date yast year. An early and severe winter may reveal a serious shortage. The National Industrial Conference estimates that only 2,000,000 persons are now unemployed as compared with 3,500,000 last spring.

Secretary Mellon urges a reduction of the maximum income surtax to 20 or 25 per cent and an adjustment of the levy on business profits. Both the President and Secretary Weeks are inveighing against the "bloc" system that threatens the older plan of government by party. It is, however, doubtful whether these counsels will be heeded and it may be that business will as usual have to resign itself to more or less irritation while Congress is in session.

This is, however, inevitable in a democracy and the philosophic student of affairs will not be much disturbed by it as long as he can discern the quickening of industry and the growth of confidence which has been inspired by the major events of the week.

The statement of the Federal Reserve System shows a further rise in the reserve ratio which now stands at 73.1 per cent as against 72.7 a week ago. The other changes are not important.

Peru Wants Machinery

The American Manufacturers Export Association informs us that a merchant from Lima, Peru, is in the United States. He is in the market for machinery for making hollow concrete blocks, cement tile and pipe. Also marble quarrying machinery, concrete mixers, cement guns, barrel staves and machinery for setting up barrels.

Manufacturers building any of these products can obtain further information by communicating with the association's office at 160 Broadway, New York City. Address all inquiries care of File A-1238.

Forty-Second Annual Meeting of A.S.M.E.

Elimination of Industrial Waste Given Chief Attention — General Education and Training Advocated—Technical Sessions on Variety of Subjects

FROM Dec. 5 to 9 the Engineering Societies Building, New York City, was the scene of the forty-second annual meeting of the American Society of Mechanical Engineers. The convention was very successful, both in attendance, material presented and conclusions reached. The general purpose of the meeting was to present definite technical information dealing with the elimination of waste in industry.

The first general session was held on the afternoon of Monday, Dec. 5, although the morning was devoted to a meeting of the council, a conference of delegates from the local sections and to a hearing on air tanks and pressure vessels with relation to the boiler code. President E. S. Carman sounded the keynote of the session—the elimination of waste in industry—and turned over the meeting to L. P. Alford as chairman of the management section. Mr. Alford said that probably no body of engineers had ever been accorded the interest, publicity and assistance that the committee on waste in industry had received.

Mr. Miller, whose speech is printed in full elsewhere in this issue, commented on the conclusion of the committee that management was responsible for the greater part of the waste in industry, since it alone can remedy the defects.

Prof. L. P. Breckenridge, chairman of the advisory committee of the superpower survey, announced that the report of the survey had been completed. He then pointed out some salient features of the report. Results of the successful application of the superpower scheme would be: (a) Reduction in price of power; (b) annual saving of 50,000,000 tons of coal; (c) annual saving of $240,000,000; (d) considerable transfer of coal from land freight to water freight; (e) greater flexibility of power distribution; (f) elimination of smoke.

E. F. DuBrul, who substituted at short notice for Sir H. L. Smith, took for his subject the waste due to economic depressions, of which there have been 14 in the last 100 years. He stated that all other savings were inconseqential beside the amounts that could be saved by the elimination of fluctuations in the business cycle. The remedy is definitely up to management.

INDUSTRIAL EDUCATION

The evening session was held under the auspices of the committee on education and training. A paper by Dean R. L. Sackett, Pennsylvania State College, gave an outline of education and training in industry. The paper contained a discussion of the development and the methods of training employed in both the United States and Europe. It outlined typical methods of training and apprenticeship courses, attention was called to the types of instruction that have been developed in our country and are not known abroad, special mention being made of correspondence and short-time courses. An important part of the paper was a table showing the extent to which instruction had been carried out in the various trades.

In the discussion of the paper, Dr. Hollis, past president of the society brought out the fact that training to increase the satisfaction of the workmen is ultimately more important than that intended only to bring increased returns to management. He voiced the need for comprehensive information on the various systems of industrial education in use in this country. Mr. Wallace brought out the point that the greatest hindrance to the educational movement was the fact that so little was known about the most important matters relative to the work. Most of the other speakers on the subject indorsed the suggestion of Dr. Hollis that an investigation of training systems be carried on, with the purpose of compiling reliable data on the subject.

D. C. Buell presented a paper on "Education and Training on Railroads." He began by stating that the only important criticism of American engineers was in the handling of the human problems. The development of the special training idea in the railroad field was followed up to the present time, when co-operative training on different roads is practiced. Employment and personnel are the big factors entering into the problem and requiring serious attention.

SESSIONS ON WASTE

On Tuesday morning simultaneous sessions were held under the auspices of the power division, the railroad division and the machine shop division. The last-named session, with F. O. Hoagland in the chair, was devoted to the subject of waste in the machine shop. The first paper "Salvaging Industrial Waste," was presented by J. A. Smith, of the General Electric Co. It will appear in full in a later issue. Discussion by A. L. DeLeeuw, Henry Eberhardt and W. O. Platt brought out additional evidences of waste, and suggested the possibility that the work of keeping track of small wastes might cost more than the savings obtained.

J. J. Callahan, an employment relations specialist, told in an interesting manner of the increases in production and reductions in waste attainable when the employees are enthusiastically behind the management in what it is trying to do.

The final paper, the first installment of which appears on another page, dealt with the art of milling and was presented by Prof. Airey of the University of Michigan and Carl J. Oxford of the National Twist Drill Co. The discussion, which lasted until 1:30, showed the keen interest in the paper. Among those who took part were Henry S. Beal, A. L. DeLeeuw, Carl Barth, Earl Buckingham, Frank G. Gilbreth, R. Poliakoff, Henry Eberhardt and Luther D. Burlingame. It was brought out in the discussion that a vast amount of research work in the cutting of metal is yet to be done, and that many believe that a very useful tool for this work would be the high-speed motion picture camera.

The afternoon of Tuesday was devoted to simultaneous sessions on management waste, gas power, and forest-products waste. One of the best sessions ever held by the society was the management waste session. The first paper on "Making Work Fascinating," by W. N. Polakov, gave a rather altruistic view of the industrial problem, and was promptly attacked by Walter Clark, A. L. DeLeeuw, Dr. Person and Dr. Pogue.

The paper by Frank B. and Lillian M. Gilbreth on the process chart used by them in their work was received with considerable interest, which was not lessened by the jovial wit of Mr. Gilbreth during his presentation. Discussion came from Messrs. Colvin, Kent, Clark, Cooke and Carlson. The reports of the committees on management terminology and measuring management ability were then presented and accepted after some comment. The last speaker was Sanford E. Thompson, who told of his work as arbitrator in the Rochester shoe-trades wage dispute. L. P. Alford, chairman of the management section, presided.

The address on Tuesday evening of the retiring president, Edwin S. Carman, dealt with the changes in industry and in the duties of the engineer. The need to carefully consider the question of service was emphasized, just as has been done in many of the papers.

The address was followed by the conferring of honorary membership on Henry R. Towne, whose work, both for the society and for the community, is perhaps too little known. Among his great achievements is the assisting in the securing of the present water supply for the city of New York, a work requiring long years of patient diplomatic work in order to overcome political obstacles and the inertia of public opinion. The new president, Dexter S. Kimball, Dean of the College of Engineering, Cornell University, was then introduced and the usual reception and dancing followed.

The following vice-presidents were elected for terms of two years: Col. Edward A. Deeds of Dayton, Robert Sibley of San Francisco, and Louis E. Strothman of Milwaukee. As managers, with three-year terms, there were elected Sherwood F. Jeter of Hartford, Conn., Horace P. Liversidge of Philadelphia, and Hollis P. Porter of Tulsa, Okla., while Walter S. Finlay is to fill the unexpired term of President Kimball. Wm. H. Willy of New York was elected treasurer, and Calvin W. Rice of New York will continue as secretary.

BUSINESS MEETING

Wednesday morning was devoted to a business session dealing with important developments and with the policies of the society. Much interest has been aroused regarding the desirability of allowing junior members to vote and to hold office. A letter ballot will now be taken on the matter, the results of which action will not be known until the next meeting. Other amendments were considered, but the greatest part of the time was devoted to the proposed new constitution. This constitution has been in preparation for some time, receiving its second reading at this meeting. In the light of the discussion occurring, further revision will be necessary, so that the document will again be taken up at the next meeting of the society.

The discussions on the amendments to the present constitution and on the adoption of the proposed constitution lasted through the afternoon session, but the morning session was adjourned with the awarding of prizes for distinguished work. The most important event in this ceremony was the presenting of the first medal given by the society for distinguished achievements in the field of mechanical engineering. A similar medal will be given each year, provided that a man worthy of it be available. Hjalmar G. Carlson, Worcester, Mass., was awarded the prize primarily on account of his invention making possible the production during the war of 30,000,000 drawn-steel booster casings, used principally as a component of 75-mm. high-explosive shells.

For his paper on the Moody ejector turbine, S. Logan Kerr, of Wm. Cramp & Sons Ship and Engine Building Co., Philadelphia, was awarded the junior prize. Prizes were awarded for the best papers submitted by student members during the past year, the presentations being to Karl H. White, University of Kansas, for his paper on Forces in Rotary Motors; and jointly to Richard H. Morris and Albert J. R. Houston, University of California, for their report on an Investigation of the Herschel Type of Improved Weir. A life membership was awarded to Forrest Nagler, Allis-Chalmers Manufacturing Co., Milwaukee, for his paper on "A New Type of Hydraulic Turbine," the paper having been adjudged the best in the 1919 transactions of the A.S.M.E. In a social way the afternoon was marked by a tea and reception; and later by an informal get-together dinner and smoker.

Simultaneous sessions were held on Thursday morning under the auspices of the fuel division, materials handling division, the research committee and the committee on relations with colleges.

STUDENT MEETING

The student session, presided over by Dean W. H. Kenerson, fairly bristled with interest, being very well attended. An innovation was introduced, professional papers being presented by students for the first time at an annual meeting. Papers were presented by W. K. Ramsey, of Massachusetts Institute of Technology; G. E. Lyon, of Rensselaer Polytechnic Institute, and J. M. Robertson, of University of Kansas. The Armour idea of the student A.S.M.E. was then presented by J. M. Splitzglass. A lively discussion participated in chiefly by students then followed. The idea uppermost in the minds of the delegates seemed to be the necessity for obtaining closer co-operation between the national society and the student branches.

Thursday afternoon was devoted to simultaneous sessions under the auspices of the fuel division and the materials handling division, to a session dealing with a mathematical analysis of the stresses in flat circular cylindrical heads, presented by G. D. Fish, and to the general session on the subject of professional engineering education for the industries, held jointly with the Society for the Promotion of Engineering Education.

In the last-named session the program was especially well prepared and admirably carried out. President C. F. Scott of the S.P.E.E. was the presiding officer and opened the session after Major Miller had read the report of the F.A.E.S. employment committee, by telling of the division of time in the electrical, mechanical and administrative engineering courses at Yale University between engineering, science, general and administrative subjects.

Professor A. G. Christie of Johns-Hopkins was the first speaker, reading a paper on the subject of a national policy on engineering education. He described briefly the European engineering schools and contrasted them with American engineering institutions.

ENGINEERING EDUCATION

F. C. Pratt, vice-president of the General Electric Co., then discussed the subject of professional engineering education for the industries from the point of view of an industrialist. He stated that the engineering students in the General Electric Co.'s courses during the last four or five years have been better trained in every way than any that had previosly come under his observation. Mr. Pratt argued strongly for assigning a large part of graduate work to the industries with the idea that the specialization, which has been a dangerous factor in certain college engineering courses, can better be handled by such companies as his.

Professor Jackson, of the Massachusetts Institute of Technology, read the paper prepared by J. E. Otterson, president of the Winchester Repeating Arms Co., entitled "College Education as Related to Industry." In this paper Mr. Otterson compared the engineering graduate to an electric motor, which could be stimulated to produce more and more work and eventually turned into a generator to produce new ideas; and he stated that this was the type he wanted, and not the storage-battery variety of engineer whose mind was simply an engineering encyclopedia of facts.

Dean Dexter Kimball, of Cornell, the newly-elected president of the A.S.M.E., presented the last paper. He commented on the widening application of the term engineering to various human activities such as employment engineering, human engineering and industrial engineering, and gave it as his opinion that this indicated the appreciation on the part of the public of the value of the engineering mind and its method of attacking problems.

The discussion which followed the regular papers indicated the keen interest in this subject. Among those taking part were: Mangus W. Alexander of the Industrial Conference Board, Prof. Arthur M. Greene, Jr., of Rensselaer Polytechnic Institute, E. H. Sniffen, of the Western Electric Manufacturing Co., Prof. Rowe, of the New York University, H. B. Shaw, of Doherty Training Schools, Dean A. A. Potter, of Purdue University, D. K. G. Matheson, president of Georgia Institute of Technology, Prof. Jackson, of Massachusetts Institute of Technology, his brother John Price Jackson, President Comfort A. Adams, of Harvard University, L. W. Wallace, executive secretary of the F.A.E.S., Willis H. Carrier, of the Engineering Corporation, Dean Sackett, of Pennsylvania State College and Frank B. Gilbreth.

Thursday night was marked by a dinner and dance held at the Hotel Astor. The last day of the convention, Friday, was devoted to special sessions held simultaneously under the auspices of the aeronautic division, the textile division and the ordnance division. All of these sessions were devoted to the subject of waste in the respective fields, with the idea of proposing means for eliminating it. The ordnance session was occupied with a paper by Col. J. W. Joyes on "The Record and Policies of the Army Ordnance Department in Regard to Elimination of Waste," and also by an address by Gen. G. E. Tripp. A session presided over by D. S. Jacobus dealt with steam power plant problems. In the afternoon no general sessions were held, a council meeting alone being scheduled.

Quite a large delegation made an inspection trip on Friday afternoon to the White Star liner "Olympic," the engineering features of which were a revelation to many of the landsmen. During the course of the convention several other inspection trips were held, the most important being probably those made to the Essex Street Station of the Public Service Corporation of New Jersey, and to the Seaboard By-Product Coke Co., of Jersey City. Friday evening was set aside for reunions of the alumni of various technical colleges, a custom in vogue for several years, in order to permit of closer relations between the graduates of each school.

American Institute of Weights and Measures

The annual meeting of the American Institute of Weights and Measures was held in the Engineering Societies Building on Dec. 9, with the president, W. R. Ingalls in the chair. The president outlined the years work of the institute, expressing regret at the necessity of curtailing its activities even to a slight degree and outlining the need for future work. The report of Secretary Stutz gave a good idea of the work accomplished by the staff in various lines, and told of the metric bills now before Congress. The necessity for eternal vigilance to prevent the compulsory adoption of the metric system by some means or other, was clearly pointed out. Only systematic effort to counteract these activities, such as can best be carried out by such an organization as this, can maintain the use of the present system of measurement.

Meeting of the A.E.S.C.

The annual meeting of the American Engineering Standards Committee was held at the engineers building on Dec. 8. Several changes in the constitution were proposed and, as with most of the other matters which came up, will be referred to letter ballot. Consideration was given to "Chemical Analysis of Manganese, Bronze and Gun Metal" in connection with the American Society for Testing Materials specifications, as well as to the specifications for "Cold-drawn Bessemer and Open-hearth Steel for Automatic Screw Stock."

The report on the "Translation of Inch and Millimeter Dimensions," which deals with the adoption of 2.54 centimeters as the equivalent of the inch, was not presented. Both the Industrial Lighting Code and the Abrasive Wheel Safety Code bid fair to be adopted as American Standards after the usual letter ballots have been taken.

Latvia Needs American Machinery—and Money

By Our Latvian Correspondent

Opinion seems to be divided as to whether the newly formed republics along the frontier of Russia will be able to exist and maintain their independence in the future. There are many who predict that as soon as Russia has acquired a stable government, the small border republics which are already burdened by internal taxes, will be glad to federate themselves with Russia. There is also another view taken by some of the larger European countries to the effect that these republics should maintain their independence, and keep Russia within her present boundaries. Countries which are seeking the friendship of Russia do not approve of these smaller republics, but prefer to see a strong and united Russia.

Whatever difference of opinion may exist, the first important fact to remember is that these smaller republics, especially Latvia, not being separated from communistic Russia by natural boundaries, were strong enough to resist the Bolshevik agitation and an armed invasion. These small nations have established strong governments and are endeavoring to adjust themselves in the family of nations as worthy members. Of course, much can be said about the mistakes in the management of the government's affairs, but these may be overlooked in view of the desolation and confusion caused by the war. The foreign trade of these republics is handicapped by the lamentable exchange situation. The Latvian rouble in 1919 was valued at 51 cents; in 1921 it had depreciated to 0.2 cents and is now valued at 0.4 cents. There is talk of the establishment of a bank of issue in Latvia, sponsored by foreign capitalists, and in which Latvia will participate with her gold reserve.

The trade balance of Latvia is very unfavorable. The country has not yet recovered from the destructive effects of the war. German and British merchants are busy establishing themselves in Latvian markets but so far Americans have not taken much interest in the opportunities offered.

The spending power of the two million inhabitants of Latvia could not be rated as high, because they have no way of obtaining a cash balance except through foreign trade, which is now in an unfortunate condition.

During the first six months of this year 79 per cent of the whole of Russia's export trade went through the ports of Latvia. These ports are the best on the eastern Baltic coast. They are better equipped and enjoy a longer period of open navigation than any others. Owing to the excellent storage facilities a greater part of the imports to Latvia will be resold to Russia. This should make Latvia a promising field for countries which hope to establish trade with Russia. Of the entire exports of Latvia, flax composes 62.6 per cent and timber 30 per cent; scrap iron forms a very minor part. The output of Latvian paper mills is steadily increasing. The principal items of machinery import during 1920 were agricultural machinery, $43,700; industrial machinery, $35,400; tools and implements, $5,600; metals, $9,000; miscellaneous machinery, $60,400.

In 1910 there were 782 industrial establishments employing 94,000 workmen in Latvia. During the war most of the machinery was taken away to Russia, or destroyed. Some of this machinery has been returned, but it is in such condition as to be unfit for use. Latvian industries cannot be returned to pre-war production work until new machinery is installed in the factories and raw materials and financial assistance is made available.

A Good Merchandising Move by the G. A. Gray Co.

The accompanying photograph taken at the plant of the G. A. Gray Co., Cincinnati, Ohio, shows some of the members of the Gray organization and the dealers who attended the convention of agents, held by the Gray Co. in its shop on Nov. 17 and 18, to demonstrate a planer recently placed on the market. Forty-one delegates represented twenty-one dealers.

Machinery Builders at Good Roads Show

Several prominent machinery builders have leased space at the Thirteenth National Good Roads Show, to be held at the Coliseum, Chicago, on Jan. 16 to 20, next year. The show is under the auspices of the American Road Builders' Association. About 60,000 sq.ft. of floor space will be taken up by eighty-six exhibitors. Among the machinery builders who have reserved space are: Baldwin Chain and Manufacturing Co., Worcester, Mass.; Brown Hoisting Machinery Co., Cleveland, Ohio; Chain Belt Co., Milwaukee, Wis.; Byers Machine Co., Ravenna, Ohio; Domestic Engine and Pump Co., Shippensburg, Pa.; East Iron and Machine Co., Lima, Ohio; Galion Iron Works and Manufacturing Co., Galion, Ohio; Hadfield-Penfield Steel Co., Bucyrus, Ohio; Holt Manufacturing Co., Peoria, Ill.; Locomotive Crane Co., Champaign, Ill.; Milwaukee Locomotive Manufacturing Co., Milwaukee, Wis.; Pawling & Harnischfeger Co., Milwaukee, Wis.; Wood Hydraulic Hoist and Body Co., Detroit, Michigan.

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U. S. Civil Service Examinations

The United States Civil Service Commission announces open competitive examinations for junior engineers to be held on Jan. 11, Mar. 8 and May 17. The examinations are to fill vacancies in the Bureau of Standards, Department of Commerce, for duty in Washington, or elsewhere, at salaries ranging from $1,200 to $1,500 per year, with yearly bonus if services are satisfactory. The following branches of engineering may be chosen by applicants: electrical, mechanical, civil, chemical, ceramic, radio and materials.

Applicants should apply at once for Form 1312, to the Civil Service Commission, Washington, D. C., or to any of the Civil Service boards throughout the country.

Another examination will be held for the position of instructor in ordnance at the Watertown Arsenal, Massachusetts. Applications for this test close on Dec. 27. The same form as indicated above will be used in making application.

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Government To Define Activities of Trade Associations

What functions and activities trade associations may legally engage in will soon be announced by the Government, according to E. W. McCullough, manager of the Fabricated Production Department, of the Chamber of Commerce of the United States. He said that such a statement would have been issued before this but for the fact that several governmental cases are now pending against certain trade associations, involving such questions as the proper use of statistics, open price plans and averages in cost accounting.

It is said that Secretary Hoover, of the Department of Commerce, desires closer contact with the industries through their associations, but he has intimated that such organizations should put themselves in position to speak for their industries by including in their membership the largest possible representation, and also by the perfection of their machinery for gathering, analyzing and compiling all desirable information not only of service to themselves, but to the Government and the public.

Business Items

The W. K. Millholland Machine Co., of Indianapolis, Ind., recently filed with the Secretary of State a final certificate of dissolution. The dissolution of this company was begun in 1918, at which time the business, patents and plant were taken over by the Millholland Machine Co., organized for that purpose, and which is now carrying on the business as manufacturer of turret lathes, screw machines and special machinery. The Millholland Machine Co. is controlled and supervised by the R. W. Dollings Co., of Columbus, Ohio, and Indianapolis, Ind.

The Wayne Oil Tank and Pump Co., of Fort Wayne, Ind., has purchased the plant and equipment of the Borromite Company of America, Chicago, Ill. The Wayne company will immediately enlarge the facilities of this plant and will erect an experimental laboratory to carry on the work of perfecting water softening and purifying apparatus.

The Bock Bearing Co. plant in West Toledo, Ohio, is reported to be nearing normal production, having orders exceeding a million dollars in value. R. E. Clingman, general manager, states that the company will add 10 per cent to its working force each month until the regular production basis has been reached.

The Morley Machinery Co., of Rochester, N. Y., has purchased the plant and equipment of the Defiance Check Writer Co., also of Rochester, and will take immediate possession of the premises. The Morley company will use the added facilities in manufacturing its line of iron planers and special machinery.

The Whiting Corporation, of Harvey, Ill., manufacturer of electric cranes and foundry equipment, has purchased a controlling interest of the Grindle Fuel Equipment Co., builder of powered coal plants. A reorganization of the combined companies was effected and the following officers were elected: B. H. Whiting, president; A. J. Grindle, vice-president and general manager; T. S. Hammond, secretary-treasurer.

The gray iron foundry of the Chain Belt Co., at Milwaukee, Wis., has resumed full time operation with an increase of 29 per cent in employees. H. M. Landgraf, an official of the company states that company has large orders on hand from machinery builders. He admitted that November was the biggest month his company had experienced this year.

The R. C. Lap Co., will be incorporated at Davenport, Iowa, to manufacture laps for use in finishing and polishing the surface of automobile motor cylinders, crankshafts and pins. Patents for the laps are held by L. S. Rasmusen and H. B. Carlson.

The car shops of the New York Central Railroad at Avis, Pa., have been reopened with a force of about 100 men, which will shortly be increased to 500.

The Westinghouse Electrical International Co., has been awarded a contract for electrical apparatus for use in hydro-electric plants in Japan. The material is for the power system of Tokio which is being built by the Diade Electric Power Co., of Japan.

Personals

William A. Durgin has been appointed director of the new division of the Department of Commerce which will make a study of waste in industry with a view to simplifying commercial practices. Mr. Durgin has been granted a leave of absence by the Commonwealth Edison Co., of Chicago, Ill., where he was assistant to the vice-president.

Dallas W. Clem, formerly of the Reeves Pulley Co., Columbus, Ind., has been appointed manager of the power transmission department of Manning, Maxwell & Moore, Inc., of New York City.

Homer G. Tate has joined the Wayne Oil Tank and Pump Co., of Fort Wayne, Ind., and is in charge of the old Borromite Company's plant, which was recently purchased by Wayne company.

Harry W. Jones, master mechanic in the Sunbury, Williamsport, Northumberland and Renova shops of the Pennsylvania Railroad, has been appointed to a like position in the Altoona shops.

E. W. Pittman, formerly of the Pittman-Smith Engineering Co., has been appointed general manager of the plant of the Penn Bridge Co., at Beaver Falls, Pa.

C. W. Laughlin, of the Laughlin & Barney Machinery Co., Pittsburgh, Pa., has retired from active business after nineteen years of service in the machine tool field. The business will continue under the management of Mr. Barney.

W. W. Davidson, Canton steel manufacturer, with several associates has purchased the Lorain plant of the Aetna Steel Casting Co. The Lorain plant, which formerly was owned by the Charles A. Otis interests, of Cleveland, has been operating here for two years.

R. W. Woodward has accepted a position as metallurgist with the Whitney Manufacturing Co., Hartford, Conn., resigning his position as physicist in the Division of Metallurgy, Bureau of Standards, to take up this new work. Mr. Woodward has for a number of years been devoting his attention to specifications for metals, both ferrous and nonferrous, and to conducting and directing a considerable number of research activities in the Bureau of Standards.

J. H. Wilhelm, Lloyd E. Larson and **John Cetrule**, consulting engineers of New York City, have been elected president, vice-president and secretary-treasurer, respectively, of the Triplex Machine Tool Corporation, which manufactures the Triplex line of combination machines.

John P. Ilsley, formerly of Niles-Bement-Pond Co., New York, and later with the Reed-Prentice interests of Worcester, is now the New England manager of the selling branch of the Solvay Process Co., Syracuse, N. Y., with headquarters at Boston, Mass.

J. P. Jordan, formerly vice-president and director of operations of C. E. Knoeppel & Co., Inc., has opened an office in New York to practice industrial consulting engineering.

Charles C. Phelps has been elected treasurer of the Uehling Instrument Co., New York City.

Obituary

Albert H. Chapman, a prominent member of the Southern Metal Trades Association since its organization a few years ago, and secretary and treasurer since 1902 of the Walsh & Weidner Boiler Co., of Chattanooga, Tenn., died last week at Chattanooga. He was 46 years old. Mr. Chapman joined the Walsh & Weidner company when he was 17 years of age and was elected secretary and treasurer nineteen years ago. He was well known in the metal trades industries throughout the South.

Horace W. Hadley, a pioneer in the sewing machine industry in New England, died at Belvidere, Ill., last week. He was eighty-six years old.

Book Reviews

The Metric versus the English System of Weights and Measures. Research report No. 42 of the National Industrial Conference Board. Two hundred fifty four 6 x 9-in. pages, paper cover. Published by the Century Co., New York City. Price $2.50.

In view of the agitation being carried on for compulsory adoption of the metric system in the United States (bills are now before the House and Senate) this book is particularly timely and valuable. It presents the findings of the National Industrial Conference Board as to the history and present status of the English, metric and other systems of weights and measures; analyzes the application of the English and metric systems to various specialized fields; and sets forth, without taking a position either way, the arguments advanced by advocates of the metric and English systems, for and against the compulsory adoption of the metric system in the United States. Sources of information are given in footnotes and in a bibliography.

In the three general divisions of the book, data are given on the origin of the English and metric systems; the importance of weights and measures in the fields of science and engineering, agriculture, mining, transportation and trade, manufacturing, foreign trade; the intrinsic merits of the two systems, the practicability of changing to the metric system in the United States, extent and character of the demand for a change.

The Industrial Conference Board was guided in the work by an advisory committee, which has fully approved the report. The members of the committee were: E. M. Herr, chairman, president Westinghouse Electric and Manufacturing Co.; Fred J. Miller, past president American Society of Mechanical Engineers; Henry D. Sharpe, treasurer, Brown & Sharpe Manufacturing Co., Henry R. Towne chairman of the board of directors, Yale & Towne Manufacturing Co.; and Frank O. Wells, formerly prisident of the Greenfield Tap and Die Company.

Forthcoming Meetings

Society of Automotive Engineers: Annual meeting Jan. 11 to 13, Engineering Societies Building, New York City. C. F. Clarkson, secretary.

American Society of Civil Engineers: Annual meeting Jan. 18 and 19, Engineering Societies Building, New York City. Charles W. Hunt, secretary.

United Engineering Societies: Annual meeting Jan. 26, Engineering Societies Building, New York City. A. D. Flinn, secretary.

American Institute of Electrical Engineers: Mid-winter meeting Feb. 15, 16 and 17. Engineering Societies Building, New York City, F. L. Hutchinson, secretary.

American Institute of Mining and Metallurgical Engineers: Annual meeting Feb. 20 to 24, Engineering Societies Building, New York City. B. Staughton, secretary.

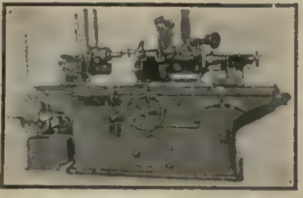
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Grinding Machine, Automotive-Parts, Special, No. 4-A

Landis Tool Co., Waynesboro, Pa.

"American Machinist," June 30, 1921.

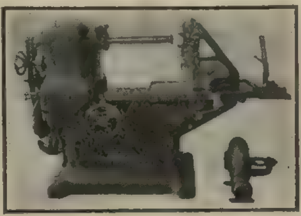


The machine is intended for regrinding all parts of automotive engines (except cylinders cast en bloc) and as shown is set up for grinding crankshafts. On the driving end of the crank-carrying fixture all loose attachments such as dogs and blocks have been eliminated. The work-carrying parts, which are a part of the headstock and the footstock, are equipped with three-jaw universal chucks, to grip each end of the crankshaft. An indexing dial for locating the chucks for the different strokes of crankshafts is furnished. The work-carrying heads are centered and brought in line by the use of the locating pins. The wheel carriage has power feed, and all traverse speed changes are controlled by one lever. The machine is intended to carry a 24-in., diameter wheel, having 5-in. belt for driving it. It is driven through a small countershaft and requires 5 hp. to operate.

Grinding Machine, Automotive Cylinder, No. 5

Landis Tool Co., Waynesboro, Pa.

"American Machinist," June 30, 1921.

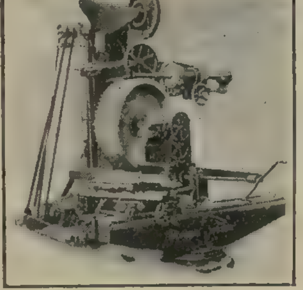


The machine is intended for regrinding automotive cylinders and its range of work capacity includes all makes and types of automobile cylinders cast en bloc, as well as a variety of irregular castings. The work-carrying fixture is an open angle plate with two adjustable work clamping bars. The work to be ground is clamped to the bars by two heavy machine clamps. A feature of this fixture is the arrangement for aligning the work in the proper position in relation to the axis of the spindle. Cross-slide movement of the work-carrying fixture is actuated by a screw and nut. The work-carrying fixture is mounted on a carriage traveling longitudinally, the traversing and reversing being automatic. Net weight, 2,900 pounds.

Gear-Cutting Attachment, Pattern-Milling Machine

Oliver Machinery Co., Grand Rapids, Mich.

"American Machinist," June 30, 1921.

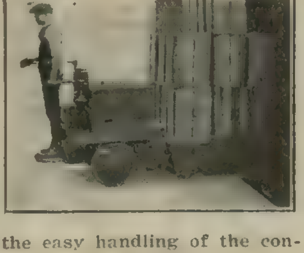


This gear-cutting attachment is for use on the No. 102 pattern-milling machine made by the concern. The attachment, known as the No. 733, consists of a complete set of appliances for cutting spur, helical, bevel and worm gears. The outfit includes a 14-in. universal dividing head with tailstock, index plate, index chart, two faceplates, set of raising blocks, recessing change gears, quadrants, and the connecting mechanism between the table and dividing head. The machine is so arranged that in turning helical gears the gear pattern rotates according to the helix angle as the cutting progresses from the back to the front edge. The chief features which the maker emphasizes are the adaptability of the machine, the speed of its operation and the accuracy of the work produced.

Truck, Lift, Electric, Series C

Baker R and L Company, Cleveland, O.

"American Machinist," June 30, 1921

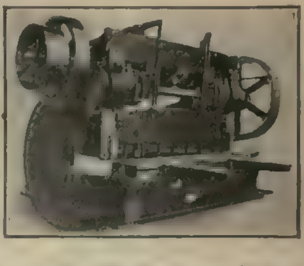


The chief feature of the truck lies in the method of suspension of the frame on the power axle. The duplex compensating suspension, as it is called, is intended to care for the thrust due to driving and braking, the axle unit being connected to the frame through two yokes which pivot on the frame and are attached to the axle through ball-and-socket joints. The weight of the frame is carried on helical springs. The construction is claimed to provide great flexibility to the axle assembly. The truck is said to be very easy of operation, because of the easy handling of the controls and of the steering.

Shear, Squaring, Power, No. 8-H

Niagara Machine & Tool Works, 639 Northland Ave., Buffalo, N. Y.

"American Machinist," June 30, 1921.

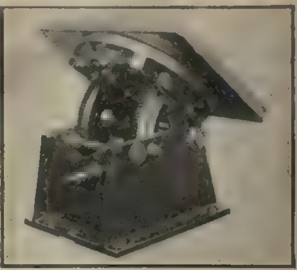


The machine is designed especially for use in tank manufacture for accurately cutting and squaring steel plates up to ⅝ or even ¾ in. in thickness. The crosshead is of heavy box sections, has large guides, and is counterbalanced. The mainshaft and eccentrics are forged in one piece. The clutch block is made of a hammered steel forging and is equipped with hardened and ground removable striking jaws, as well as with hardened blacklash jaws. Adjustable brakes lined with asbestos fibre are furnished. The crown is of box section and bolted and doweled in place. The knife chuck is provided on each end with a screw and setscrew to facilitate easy adjustment. The housings are of heavy construction and do not require stay rods for cutting at the maximum rated capacity.

Table, Tilting and Rotary, Universal

Pawling & Harnischfeger Co., Milwaukee, Wis.

"American Machinist," June 30, 1921.



This accessory table makes it possible to perform machining operations on five sides of a piece and at an angle, with but one set-up. The illustration shows the table tilted. It can be swung to the vertical position, and can be revolved 360 deg. whether horizontal or elevated. One revolution of the handle revolves the table 30 deg., or one revolution elevates the top 2½ deg. Adjustment along the bed-plate parallel to the spindle travel is accomplished by means of a rack and pinion. The table is 40 x 51 in. in size, and is 31¼ in. above the floor when in its horizontal position. The T-slots are ⅝ in. in width. The net weight is 3,906 pounds.

Tractor, Industrial, Electric, Series C

Baker R & L Co., Cleveland, Ohio.

"American Machinist," June 30, 1921.

The tractor can be furnished with either three or four wheels. A spring seat is provided for the driver, and the controls are all within easy reach. Heavy plate bumpers are provided at both the front and rear, so as to properly protect the battery and working mechanism. The tractor is said to be very easy of operation, because of the easy handling of the controls and of the steering.

Grinding Machine, Two-Spindle, Ring-Wheel, Type 1

Charles H. Besly & Co., Chicago, Ill.

"American Machinist," June 30, 1921

This is a heavy-pattern, direct-motor-driven, two-spindle, ring-wheel grinding machine, for grinding two parallel sides of a piece simultaneously. It is equipped with two 7½-hp., 900-r.p.m., a.c., fully enclosed motors. Push-button control is employed for starting and stopping, the starters being attached directly to the motor frame and mounted in sheet-metal cases. The motors are mounted on plates, which can be moved along the bed of the machine by means of racks and pinions to accommodate different widths of work. Both spindles slide endwise through the bearings in order to feed the wheels to the work while cutting. The machine carries two ring wheels 18 in. in diameter, with grinding faces varying from 1½ to 4½ in. in width. Disk wheels 20 in. in diameter can be used if desired. The maximum opening between the ring wheels is 10 in., the height to the center of the spindle is 39 in., and the floor space occupied is 50 x 96 in.

Clip, paste on 3 x 5-in. cards and file as desired

The Weekly Price Guide

This Week's Market

Blue annealed steel sheets, No. 10, are quoted at the Pittsburgh mills at $2.25 as against $2.25@$2.50; black steel sheets, No. 28, at $3 instead of $2.75@$3 and galvanized No. 28 at $4 as compared with $3.75@$4 one week ago. Steel plates and bars are quoted at $1.50 even on small tonnages; structural shapes at $1.50@$1.60 per 100 lb.

Tin is quoted at 32½c. as against 31⅝c. and zinc at 5½c. as compared with 5⅝c., last week. Solder has advanced 1c.; babbitt metal, best grade, ½c. and commercial ¼c. per lb. in New York warehouses.

Old metals have advanced ½c. to 1½c. per lb. in the New York market. Linseed-oil quotations continue at 72c. per gal. for 5-bbl. lots, but in quantities of from 10 to 15 bbl. this price is frequently shaded.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$22.50
Northern Basic	22.02
Southern Ohio No. 2	23.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	28.50
BIRMINGHAM	
No. 2 Foundry	18.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	23.26
Virginia No. 2	28.74
Basic	20.75
Grey Forge	22.50
CHICAGO	
No. 2 Foundry local	21.70
No. 2 Foundry, Southern, sil 2.25@2.75	24.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	22.46
Basic	20.96
Bessemer	21.96

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.25	3.28	3.10	3.38
No. 12	2.30	3.33	3.15	3.43
No. 14	2.35	3.38	3.20	3.48
No. 16	2.55	3.48	3.30	3.58
Black				
Nos. 17 and 21.	2.85	3.80	3.55	3.95
Nos. 22 and 24.	2.90	3.85	3.60	4.00
Nos. 25 and 26.	2.95	3.90	3.65	4.05
No. 28	3.00	4.00	3.75	4.15
Galvanized				
Nos. 10 and 11.	3.00	4.00	3.75	4.15
Nos. 12 and 14.	3.10	4.10	3.85	4.25
Nos. 17 and 21.	3.40	4.40	4.15	4.55
Nos. 22 and 24.	3.55	4.55	4.30	4.70
No. 26	3.70	4.70	4.55	4.85
No. 28	4.00	5.00	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel			Iron		
BUTT WELD					
Inches	Black	Galv.	Inches	Black	Galv.
¾ to 3	68½	56	¾ to 1½	44½	29½
LAP WELD					
2	61½	49	2	39½	25½
2½ to 6	65½	53	2½ to 4	42½	29½
7 to 8	62½	49	4½ to 6	42½	29½
9 to 12	61½	48	7 to 12	40½	27½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
¾ to 1½	66½	55	¾ to 1½	44½	30½
2 to 3	68½	56			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59½	48	2	40½	27½
2¼ to 4	63½	52	2¼ to 4	43½	31½
4¼ to 6	62½	51	4½ to 6	42½	30½
7 to 8	58½	45	7 to 8	35½	23½
9 to 12	52½	39	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv
1 to 3 in. steel butt welded	63%	49%	60½%	47½%	60%	46%
3½ to 6 in. steel lap welded	54%	40%	58½%	44½%	57%	43%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	5.00	6.00	4.28
Spring steel (light) (base)	6.00	6.00	3.68
Coppered Bessemer rods (base)	8.00	8.00	6.03
Hoop steel	3.53	3.14	3.28
Cold rolled strip steel	6.25	8.25	6.75
Floor plates	4.85	2.64@2.80	5.23
Cold finished shafting or screw	3.88	3.50	3.83
Cold finished flats, squares	4.38	4.00	4.35
Structural shapes (base)	2.78	2.64	2.88
Soft steel bars (base)	2.68	2.54	2.78
Soft steel bar shapes (base)	2.68	2.54	2.78
Soft steel bands (base)	3.28	....	3.48
Tank plates (base)	2.78	2.92½	2.88
Bar iron (2.00@2.10 at mill)	2.68	3.52	2.78
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
$\frac{3}{32}$	8.50		12@13
$\frac{1}{8}$	7.15		11@12
$\frac{5}{32}$ to $\frac{1}{4}$	6.75		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.3
Tin, 5-ton lots, New York			32.
Lead (up to carlots), St. Louis, 4.60; New York			5.
Zinc (up to carlots), St. Louis, 4.97½; New York			5.
	New York	Cleveland	Chica
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.20	20.00	18.
Antimony (Chinese), ton spot	5.50	6.50	6.
Copper sheets, base	21.25	22.00	23.
Copper wire (carlots)	16.50	17.00	16.
Copper bars (ton lots)	19.75	24.00	19.
Copper tubing (100-lb. lots)	21.25	24.00	23.
Brass sheets (100-lb. lots)	16.75	17.00	18.
Brass tubing (100-lb. lots)	18.50	19.50	20.
Brass rods (1,000-lb. lots)	14.75	16.00	15.
Zinc sheets (casks), (8% dis. carlots)	11.00	10.15	15.
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	...
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	...
Solder (½ and ½), (case lots)	20.50	21.00	19.
Babbitt metal (best grade)	22.50	39.75	36.
Babbitt metal (commercial)	9.75	13.50	9.

—Shop Materials and Supplies

MONEL METAL—Base price in cents per lb., f.o.b. Bayonne, N.J.:

Shot	35.00	Hot rolled machined rods (base)	53.00
Blocks	35.00	Hot rolled rods (base)	42.00
Ingots	38.00	Cold drawn rods (base)	56.00
Sheet bars	40.00	Hot rolled sheets (base)	55.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grades "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	11.25	10.75	11.00
Copper, heavy, and wire	11.00	10.75	10.00
Copper, light, and bottoms	9.50	8.25	8.75
Lead, heavy	4.00	3.75	3.50
Lead, tea	3.00	2.75	3.00
Brass, heavy	7.00	6.25	8.50
Brass, light	5.00	4.25	5.00
No. 1 yellow brass turnings	5.75	5.00	5.75
Zinc	3.00	2.00	2.75

TIN PLATES—American Charcoal Plates—Bright—Cents per lb

	New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:			
IC, 20x28, 112 sheets	20.50	19.00	18.50
IX, 20x28, 112 sheets	23.00	21.50	20.90
"A" Charcoal Allaways Grade:			
IC, 20x28, 112 sheets	17.50	16.75	17.00
IX, 20x28, 112 sheets	20.50	19.50	19.60
Coke Plates, Bright			
Prime, 20x28 in.:			
100-lb., 112 sheets	12.50	12.00	14.50
IC, 112 sheets	12.80	12.30	14.80
Terne Plate			
Small lots, 8-lb. Coating:			
100-lb., 14x20	7.00	5.60	7.25
IC, 14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb	\$0.07½@\$0.10	\$0.12	\$0.12
Cotton waste, mixed, per lb	.055@.09	.09	.10
Wiping cloths per M., 13¼x13¼	....	50.00	55.00
Wiping cloths per M., 13¼x20½	....	55.00	65.00
Sal soda, 100 lbs	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb	2.55	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.72	.77	.74
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 75 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville	per ton	\$3.00@3.15	
Coke, prompt foundry, Connellsville	per ton	4.00@4.50	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	—50%	—60%	60-10-10%
1⅛ and 1¼x3 in. up to 12 in.	—40%	-60-10-10%	-60-10%
With cold punched sq. nuts	—30%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	—40%	.....	..\$4.00 off
Button head bolts, with hex. nuts	—20%	\$3.90 net	.....
Hex. head and hex. nut bolts	—20%	....	-65-5%
Lag screws, coach screws	—50–10%	....	—60%
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	—50-10-10%	50–5%
Bolt ends, with hot pressed nuts	—50%	....	—55%
Tap bolts, hex. heads	—20%	....	.....
Semi-finished nuts all sizes	—70%	—75%	—80%
Case-hardened nuts	—60%	....	.....
Washers, cast iron, ½ in., per 100 lb. Off list	\$5.00	\$5.50	\$3.50 net
Washers, cast iron, ⅝ in. per 100 lb. Off list	4.25	3.75	3.50 net
Washers, round plate, per 100 lb. Off list	3.00	....	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	2.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	2.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.50	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.50	3.00	4.00
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	-50-10%	60-10-10%	-65-5%
Rivets, tinned	-50-10%	60-10-10%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	\$3.50	3.50	3.43
Cone heads, ditto (net)	3.60	3.60	3.53
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅞ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	\$4.03 base
Copper rivets	—50–10%	—40-10%	—50-10%
Copper burs	—25–10%	—15%	—10%

	New York	Cleveland	Chicago
Lard oil, pure, (50 gal. bbl.) per gal.	\$0.90	\$0.85	\$0.90
Lard cutting oil (50 gal. bbl.) per gal.	0.60	0.50	0.55
Machine oil, lubricating, per gal.	0.45	0.35	.....
Belting—Present discounts from list in fair quantities (½ doz. rolls)			
Leather:			
Light grade	50–5%	50–5%	50–5%
Medium grade	45%	40–10–2½%	.....
Heavy grade	40%	40%	....
Rubber and duck:			
First grade	50–10%	50–10%	.....
Second grade	60–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	List \$9.00 less 20-10-5%	50–10–5%	-20-10%
Emery paper	List 11.00 less 20%	\$11.00 net	-20%
Emery cloth	List 32.75 less 10%	32.75 net	-10%
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll	\$4.50 net	.....	list+10%
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	List \$1.65 less 20%	.....	-10%
Cloth	List \$3.55 less 10%	.....	-10%

NEW *and* ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

N. Y., Buffalo—The Victory Sheet Metal Wks., 195 Herman St., J. Gutz, Purch. Agt. —one 30 in. bar folder for folding sheet metal, etc.

N. Y., East Rochester—The Merchants Dispatch Transportation Co., manufacturer of railroad cars—car-shop machinery including plate heating furnace of progressive type also 2 modern type air compressors with 450 hp. motors.

Pa., Philadelphia—Gurrtz & Co., 1038 Chestnut St.—boring machine, small lathes and air compressor.

N. C., Greensboro—The Newman Machine Co., Jackson St. and Southern Ry., G. F. Newman, Pres.—one timber sizer, 18 or 20 in. wide x 10 or 12 in. thick.

Ill., Bloomington—Martens-Leary Co., 316 South Main St. and 207 East Front St., following second hand tools:

One or two anvils, 150 to 200 lbs. each.
One power drill.
Two vises, wrought iron preferred.
One emery wheel stand, 1¼ in. arbor.
Two sledge hammers, 8 to 12 lb. each.
One or two portable forges.

Ill., Chicago—The Chicago, Rock Island & Pacific R.R., La Salle St. Sta., F. D. Reed, Vice Pres. and Genl. Purch. Agt.—

Two double car axle lathes.
One 2 in. x 26 in. turret lathe.
One 3 in. x 18 in. turret lathe.
Two 3 in. x 36 in. turret lathes.
One 16 in. tool room lathe.
One 18 in. x 36 in. gap lathe.
Nine 18 in. x 72 in. centers double back geared engine lathes.
One 48 in. steel tired car wheel lathe.
One 20 x 96 in. double back geared engine lathe.
Five 16 in. portable engine lathes, 36 in. between centers.
Five 24 in. double back geared engine lathes, 72 in. between centers.
Two 36 in. double back geared engine lathes, 72 in. between centers.
One power hack saw to handle 4 x 4 stock.
One power hack saw to handle 8 x 8 stock .
One 26 in. heavy duty shaper.
Four 36 x 36 in. x 12 ft. heavy duty planer.
One 600 ton hydrostatic driving wheel press, 90 ft. between rails.
Six 60 ton hydrostatic driving box and rod presses.
Eight 36 in. upright drill presses.
One 48 in. heavy duty radial drill for drilling and boring cross heads.
One 1½ in. double head stay bolt cutting machine.
Two 1½ in. triple head bolt cutters.
Three 2 in. double head bolt cutters.
One Universal grinder, 36 in. between centers with 12 in. swing.
Eight 18 in. x 3 in. Duplex grinders.

Ill., Rockford — The Rockford Tool Co., Harrison Ave. and 11th St.—Brinnel testing machine (new or used).

Ill. Peoria—Stuber & Kuck Co., 2800 South Adams St.—One No. 12 Toledo Horning or Bumping Press, or its equal with or without swinging bolster, also one small size riveting machine.

Ind., Elkhart — The Metal Forming Corp., manufacturers of mail boxes, metal stamping, etc., E. Haiter, Purch. Agt. — Swaging machine having a die space of 8 in., 12 in. or 16 in and a 3 in. diameter capacity, to be used for swaging steel tubing.

O., Columbus — The expression Piano Player Co., 38 West Gay St., C. E. Bard, Pres.—wood-working tools and metal working machinery.

O., Columbus—The State Fourth Garage Co., State and 4ths Sts., A. B. Butler, Mgr. —general repair machinery including grinders, shapers and probably a lathe.

Wis., Milwaukee—The Badger Auto Repair Shop, 458 14th Ave., A. L. Wutke, Purch. Agt.—drill press, suitable for auto repair work.

Wis., Milwaukee — Franks Auto Repair Shop, 3030 Lisbon Ave., F. Miller, Purch. Agt.—one medium size lathe and a drill press, 16 to 18 in.

Wis., Milwaukee—A. W. Leverenz, 483 American Ave.—small size brake for sheet metal shop.

Wis., Milwaukee—E. F. Wiegand, 636 12th St.—one beater for heavy duty.

Wis., Sheboygan—Jenkins Machine Co., 318 North 8th St., A. K. Studerman, Mgr.—special machinery for proposed machine shop including lathes, presses, etc.

Wis., Waupaca—J. W. Osborn—equipment for garage.

Wis., Waupun—The Bd. Educ., B. Kastern, Clk.—additional machines and equipment for manual training department of high school.

Wis., Wausaukee—Parsons & Vertz—machinery and equipment for auto repair shop on Main St.

Mo., St. Joseph—Kings Fdry. Co., 8th and Doniphan Aves.—tools for welding shop.

Neb., Lincoln—The Bd. Educ.—equipment for shops.

Neb., Scottsburg—The Bd. Educ.—manual training equipment for proposed high school.

Okla., Pawnee—W. E. Foler—complete machine shop equipment (used).

Cal., Long Beach — The Perfect Caster Mfg. Co., Newport Ave. and 11th St.—one Model B, ⅝ x ¾ in. plain full Cleveland automatic machine No. 10 spindle drive, also one model A, ⅝ x ¾ in. Cleveland automatic machine.

N. Y., Buffalo—A. C. Penfold, 81 Thatcher Ave.—motor driven band saw and jointer.

N. Y., Buffalo—G. Stinson, 135 Jefferson Ave. (dealer in wood working machinery) —Band saw, rip saw, finish saw, jointer, planer, sticker, turning lathe, 16 in. swing or over, wood bed 10 ft. or over, drum sander, double surface planer, sash sticker, sash relisher, chain mortiser, two spindle shaper (ball bearing), veneer press, straight line chain-feed rip saw.

N. Y., New York—The United States Ferro Alloys Corp., 30 East 42nd St., N. Petinol, Purch. Agt.—one air compressor, gasoline driven, 6 to 75 C. F. per min. 100 lb. pressure.

N. Y., Rochester—C. L. Cadle, Supt. Pub. Wks., Albany, will receive bids until Jan. 4 for furnishing, installing and testing two 2-ton electric overhead wharf cranes, here, Terminal Contr. 120.

Pa., Phila.—D. Finkleman, 1729 North 42nd St.—manglers, washers, ironers, etc. for laundry.

Pa., Pittsburgh—M. Solomon, 14th Floor, Oliver Bldg.—two 25 ton locomotive cranes for use in scrap yard at Farrell.

Ky., Barbourville—J. H. Black Heading Co., P. O. Box 283—slack barrel heading machinery.

Ky., Louisville—R. C. Whayne Supply Co., 608 West Jefferson St.—portable air compressor, 200 to 300 cu.ft. per min., 100 lb. pressure, either gasoline engine driven or 250 volt., D. C., electric motor.

Miss., Aberdeen—J. W. Bone—machinery for the manufacture of handles, especially broom handles.

S. C., Greenwood—The Faris Seed Co.—grinding and milling machinery, also gasoline engine or electric motor for feed mill of from 10 to 20 ton capacity.

Tenn., Memphis—J. P. Gaines, 206 Falls Bldg.—one air compressor, 60 cu.ft. capacity; 50 and 100 kw. generators connected to oil engine; 5 and 15 hp. motors.

Va., Danville—J. S. Davis, R. F. D. No. 5, manufacturer of pine lumber, lathes, etc. —one saw edger and one 8 in. moulder (used if in good condition).

Va., Richmond — The Virginia Carolina Rubber Co., 17 North 19th St., R. J. Bell, Purch. Agt.—$90,000 worth of general and special machinery for the manufacture of rubber goods.

Ill., Chicago—The Stafford Mfg. Co., 218 South Wabash Ave., (furniture manufacturer), E. H. Stafford, Purch. Agt.—one 36 in. band saw.

Ill., Chicago—J. Zolton, 2317 South Wabash Ave.—one air compressor, 18-21 cu.ft. capacity.

O., Marion—The Hornell Ice & Cold Storage Co.—ice making machinery.

O., Cleveland—The Newcomb Galvanizing & Supply Co., 1714 Columbus Rd., bech polishers.

Wis., Antigo—The Howe Creamery Co.—dairy machinery including one 10-ton ice machine and a 40 qt. continuous freezer.

Wis., Beloit—Madsen & Jorgenson Co., 624 3rd St.—equipment for new blacksmith shop.

Wis., Blackcreek—The Outagamie Limestone Co., $100,000 worth of quarrying, crushing and finishing machinery.

Wis., Burlington—The Kellog Ice Cream Co.—ice cream making machinery, refrigerating machinery and one 20-ton compressor

Wis., Chippewa Falls—The Chippewa Wood Mfg. Co., H. J. Schafer, Purch. Agt. —mortiser and sander.

Wis., Cudahy—Cudahy Bros—nailing machine and two color printing press.

Wis., Fond-du-Lac—D. C. Sargent, 29 South Main St.—ice making machinery of several ton capacity.

Wis., Highland—Richter Mfg. Co., c/o J. Richter, Pres.—Woodworking machinery for the manufacture of patented gates.

Wis., Madison—Dane County Bd., c/o E. J. Smith, Court House—road machinery, also other machinery for gravel pit at Edgerton, including bucket conveyors, scoops, etc.

Wis., Milwaukee—Burnham Bros. Brick Co., 68 Wisconsin St.—conveying machinery for brick factory at South Milwaukee.

Wis., Milwaukee—Fischer & Zwicke, 1359 41st St., J. J. Fischer, Purch. Agt.—one 12 in. jointer, one 32 in. band saw, boring machine (post borer), and a saw rig, all with individual motors.

Wis., Milwaukee—S. Kosecki, 1479 Fratney St.—universal woodworker.

Wis., Milwaukee—W. E. Larsen, 504 11th Ave., (woodworker)—one belt block sanding machine.

Wis., Milwaukee—P. Lauer, 3934 Vliet St.—one 20 in. swing saw to swing to any angle.

Wis., Milwaukee—The Natl. Brass Fdry. Co., 758 Pierce St., J. Jacoby, Purch. Agt.—one motor driven sand blast outfit.

Wis., Milwaukee—F. C. Seeger, 660 3rd St.—one 8 ft. steel brake.

Wis., Milwaukee—The Wisconsin Ice & Coal Co., 216 West Water St.—One hundred-twenty ton refrigerating machinery.

Wis., Oconomowoc—The Nelson Weber Co.—two 5 ton chain hoists.

Wis., Rhinelander—The Taylor Beverage & Candy Co.—one capper and one filler, both motor driven.

Minn., Fairmont — The Fairmont Ice Cream Co., E. B. Nelson, Purch. Agt.—filling machine, capping machine and ice machine.

Mo., St. Louis—The Helvetia Milk Co., Arcade Bldg., E. F. Maher, Mgr.—machinery for condensed milk factory at Aurora.

Tex., Kingsville—The Kingsville Commission Co., M. Phillips, Mgr.—complete machinery for small tannery, several 10,000 gal. storage tanks for oils and gasoline, car load of 30-50 gal. storage tanks for gasoline and kerosene for domestic use.

Wash., Tacoma—The Port of Tacoma, G. W. Osgood, 612 Tacoma Bldg., Engr., will receive bids during month of February for the following equipment:

Four 3 to 5 ton steel cranes, Loft & Boom type.

One 2 ton electric monorail hoist, 220 volt, D. C.

Miscellaneous conveyor equipment and stacking machines.

About 4,000 ft. monorail trackage.

Ont., Georgetown—Leslie & Harding—machinery and equipment for making baskets.

Ont., Woodstock—The Woodstock Powdered Milk Co., Canterbury St.—special equipment for milk powder manufacture, including evaporators, separators, etc.

Metal Working Shops

NEW ENGLAND STATES

Mass., Rutland — Treasury Dept., J. A. Wetmore, Supervising Archt., Wash., D. C., has awarded the contract for the construction of several buildings, including 36 x 91 ft. laundry and garage. Estimated cost, $282,673. Noted Nov. 17.

R. I., Providence—The Textile Finishing Machine Co., 171 Westminster Ave., will soon award the contract for the construction of a 1 story, 200 x 250 ft. machine shop and a 2 story, 45 x 99 ft. office building. Lockwood, Green & Co., 60 Federal St., Boston, Mass., Archts.

MIDDLE ATLANTIC STATES

N. J., Fernwood (Trenton P. O.) — L. Grover, Clk. of the New Jersey Highway Dept., Trenton, will receive bids until Dec. 27 for the construction of a 106 x 404 ft. auto service station, here. Estimated cost, $125,000. C. A. Mead, 790 Broad St., Newark, Engr.

Pa., Philadelphia — Gurrtz & Co., 1033 Chestnut St., has had plans prepared for the construction of a 1 story, 60 x 177 ft. garage and service station on Broad and Carlisle Sts. Estimated cost, $50,000. J. S. Fuller, 1537 Chestnut St., Archt.

Pa., Philadelphia—The Velie Sales Co., 29 West Harvey St., Germantown, will receive bids until Dec. 20 for the construction of a 1 story, 50 x 106 ft. garage and service station on Price St. and Chellen Ave. Estimated cost, $60,000. Private plans.

Pa., Pittsburgh — The Bronx Equipment Co., Concord Ave., has awarded the contract for the construction of a 2 story, 52 x 60 x 81 x 120 ft. factory on 32nd St. and Sassafras Alley, for the manufacture of truck bodies. Estimated cost, $185,000.

Pa., Pittsburgh — The United Eng. & Fdry. Co., Farmers Bank Bldg., will build a 1 story, 65 x 220 ft. addition to its plant on 54th St.

Pa., Undercliff (Pittsburgh P. O.)—Seyler Mfg. Co. will build a 1 story, 40 x 60 x 140 x 180 ft. factory for the manufacture of bolts and nuts.

MIDDLE WEST STATES

Ill., Chicago—The Morand Cushion Wheel Co., 818-32 South May St., is having plans prepared for the construction of a 2 story factory on Western and 77th Sts. Estimated cost, $500,000. J. L. Marazek, c/o owner, Archt.

Ill., Chicago — Newhouse & Bernham, Archts., 4630 Prairie Ave., are receiving bids for the construction of a 1 story, 100 x 180 ft. auto sales room and service station on Cottage Grove Ave. and 50th St., for Salvat & Newmaster, 740 East 51st St. Estimated cost, $90,000.

Ill., Chicago—L. H. Wolf and E. Bain, c/o Newhouse & Bernham, Archts., 4630 Prairie Ave., will soon open bids for the construction of a 1 story, 100 x 160 ft. garage on Bway. and Fair Oaks St. Estimated cost, $80,000.

Ill., East St. Louis—The Natl. Malleable Castings Co. is having plans prepared for the construction of a 1 story, 128 x 200 ft. foundry and 111 x 197 ft. annealing room. Estimated cost, $50,000. Private plans.

Ill., Rock Falls—The Russell, Burdsall & Ward Co., 208 South LaSalle St., Chicago, has awarded the contract for the construction of a 1 story addition to its plant here, for the manufacture of bolts and rivets. Estimated cost, $35,000.

Ill., Sterling—The Charles Gas Engine Co. plans to construct a 1 story machine shop. Estimated cost, $25,000. Architect not selected.

Ind., Ft. Wayne — The Pennsylvania Lines West of Pittsburgh, Pennsylvania Sta., Pittsburgh, Pa., is having plans prepared for the construction of a 2 story, 82 x 180 ft. machine and boiler shop, here. Estimated cost, $400,000. R. Trimble, Pennsylvania Sta., Pittsburgh, Pa., Engr.

Ind., Indianapolis—F. R. Chandler, 3817 North Pennsylvania St., is receiving bids for the construction of a 5 story, 60 x 202 ft. garage at 30-32 West Vermont St. Estimated cost, $250,000. Vonnegut, Bohn & Mueller, 610 Ind. Trust Bldg., Archts.

Ind., Indianapolis—J. A. Huetter Machine Co., 545 Kentucky Ave., is having plans prepared for the construction of a 1 story, 54 x 85 ft. machine shop at 537 Kentucky Ave. Estimated cost, $25,000. Private plans.

Ind., Indianapolis—Many & Mayer, 443 Sciota St., are having plans prepared for the construction of a 1 story, 50 x 118 ft. machine shop on Ellsworth St. Estimated cost, $25,000. Private plans.

Ind., Michigan City — The Haskell & Barker Car Co. will soon award the contract for the construction of a 1 story power plant and foundry, on 4th and Wabash Sts. Estimated cost, $500,000. F. D. Chase, Inc., 545 North Michigan Ave., Chicago, Engr.

Mich., Ann Arbor — The University of Michigan is having preliminary plans prepared for the construction of a 2 and 3 story engineering shops and laboratory on University campus. Estimated cost, $250,000. S. W. Smith, Secy. Smith, Hinchman & Grylls, 710 Washington Arcade, Detroit, Archts.

Mich., Detroit—Simons Sales Co., 436 West Willis Ave., will soon award the contract for the construction of a 1 story, 50 x 170 ft. sales and service station on Canfield Ave. Estimated cost, $85,000. A. Kahn, 1000 Marquette Bldg., Archt. Noted Dec. 1.

O., Cleveland—The Ancaster Garage Co., c/o F. X. Cull, Cuyahoga Bldg., has awarded the contract for the construction of a 2 story, 90 x 142 ft. garage at 7500 Euclid Ave. Estimated cost, $75,000.

O., Cleveland—H. B. Townsend, c/o W. J. Mooney, Archt., 17430 Woodford Ave., Lakewood, is receiving bids for the construction of a 1 story, 60 x 100 ft. garage on Detroit Ave. near Forey Ave., here. Estimated cost, $40,000.

O., Lakewood (Cleveland P. O.)—T. L. White Garage, Clifton Blvd. and Webb Rd., has awarded the contract for the construction of a 1 story, 48 x 62 ft. garage at 1412 Riverside Rd. Estimated cost, $40,000.

O., Orrville—The Cyclone Drilling Co. has awarded the contract for the construction of a 1 story, 170 x 300 ft. machine and forge shop. Estimated cost, $150,000. T. Sanderson, Mgr.

O., Toledo—The Jeanning Electric Co. has awarded the contract for the construction of a 1 story, 60 x 300 ft. factory. Estimated cost, $40,000.

Wis., Burlington—J. A. Luke will build a 1 story, 68 x 132 ft. garage. Estimated cost, $40,000.

Wis., Delton — Cole Bros. are having plans prepared for the construction of a 2 story, 50 x 90 ft. garage on Sauk St. Estimated cost, $40,000. Private plans.

Wis., Fond-du-Lac—The Six Wheel Truck Co., Fox Lake, plans to construct a 2 or 3 story 150 x 150 ft. truck factory, here. Estimated cost, $150,000. D. G. Strobel, Mgr. Architect not selected.

Wis., Highland—Richter Mfg. Co., c/o J. Richter, Pres., plans to construct a 2 story, 50 x 60 ft. factory for the manufacture of patented gates. Estimated cost, $40,000. Architect not selected.

Wis., Madison—C. S. Hansen, 902 Jenifer St., will open bids about Dec. 20 for the construction of a 1 and 2 story, 66 x 132 ft. garage on Jenifer St. Estimated cost, $60,000. Private plans.

Wis., Milwaukee—J. Arrieh, 198 3rd St., will soon award the contract for the construction of a 1 story, 60 x 100 ft. garage on 16th and Cedar Sts. Estimated cost, $40,000. A. G. Wolff, 453 Mitchell St., Archt.

Wis., Milwaukee—The Dort Motor Co., 242 4th St., has awarded the contract for the construction of a 1 story, 118 x 120 ft. garage on Mason St. Estimated cost, $40,000. Noted Oct. 13.

Wis., Waupaca—J. W. Osborn plans to construct a 2 story, 58 x 65 ft. garage. Estimated cost, $45,000. Architect not selected.

Wis., Wausaukee—Parsons & Vertz have awarded the contract for the construction of a 1 and 2 story, 50 x 144 ft. garage and machine shop on Main St. Estimated cost, $45,000.

WEST OF THE MISSISSIPPI

Ia., Sioux City—B. Pill, 707 West 7th St., will build a 2 story, 50 x 150 ft. garage at 2002 Summit Ave. Estimated cost, $40,000.

Kan., Pratt—The Chicago, Rock Island & Pacific R.R., 139 West Van Buren St., Chicago, Ill., has awarded the contract for the construction of 1 story car repair shops, here, to replace those which were destroyed by fire. Estimated cost, $100,000.

Mo., St. Joseph—Kings Fdry. Co., 8th and Doniphan Aves., is having plans prepared for the construction of a 42 x 200 ft. welding shop. Estimated cost, $10,000. Private plans.

Mo., St. Louis — C. Remabecker, 4263 Juniata Ave., will soon award the contract for the construction of a 1 story, 120 x 160 ft. garage on Chippewa and Nebraska Aves. Estimated cost, $50,000. Private plans.

Neb., Lincoln—The Bd. Educ. is having plans prepared for the construction of a 1 story, 101 x 170 ft. shop, in connection with a 3 story school. Total cost, $750,000 Fiske & Meginnis, Bankers Life Bldg. Archts.

WESTERN STATES

Cal., Oakland—The Durant Motors Co. has awarded the contract for the construction of a 2 story auto factory with 4 wings, on East 14th St. (exterior dimensions about 800 x 800 ft.) Estimated cost, $750,000.

CANADA

Ont., Brockville—J. W. Baxter & Co., Ltd., 102 St. Antoine St., Montreal Que. plans to construct a factory for the manufacture of grinding whtels. Estimated cost, $40,000.

General Manufacturing

NEW ENGLAND STATES

Conn., Bridgeport—The Frisbie Pie Co., 363 Kossuth St., will soon award the contract for the construction of a 2 story, 90 x 100 ft. bakery etc. on Kossuth St. Estimated cost, $50,000. Private plans.

Me., Portland—W. Underwood, 52 Fulton St., Boston, Mass., manufacturer of canned goods, will soon award the contract for the construction of a 6 story, 60 x 120 ft. plant, here. Monkes & Johnson, Chauncy St., Boston, Mass., Engrs.

Mass., West Springfield—The Natl. Library Bindery Co., 29 Northington St., Springfield, is having plans prepared for the construction of a 2 story, 50 x 110 ft. binding factory. Estimated cost, $40,000. Private plans.

R. I., Providence—The E. Rosen Co., 269 Charles St., has awarded the contract for the construction of a 2½ story, 50 x 105 ft. candy factory on Charles St

R. I., Providence—C. S. Tanner Co. 250 South Water St., has awarded the contract for the construction of a 2 story, 50 x 76 ft. starch factory on South Water and Coin Sts. Estimated cost, $40,000. Noted Sept. 29.

MIDDLE ATLANTIC STATES

N. J., New Brunswick—The State Bd. of Directors of the New Brunswick experiment station is having plans prepared for the construction of a dairy and husbandry building. Estimated cost, $200,000. A. B. Mills, 142 West State St., Trenton, Engr.

Pa., Conshohocken—Rambo-Regar, Main St., Norristown, has had plans prepared for the construction of a 1 story hosiery mill on Main St., here. Estimated cost, $45,000. H. P. Friend, Inc., Boyr Arcade, Norristown, Engrs.

Pa., Greensburg—L. L. Smith & Co., 526 Horner St., Johnstown, plans to construct a 2 story, 80 x 160 ft. planing mill and storage plant on West Otterman St. Estimated cost, $50,000.

Pa., Lester—The Lester Piano Co., c/o G. H. Miller, 1306 Chestnut St., Philadelphia, is having plans prepared for the construction of a 2 story, 75 x 200 ft. addition to its piano factory here. Estimated cost. $35,000 Private plans.

Pa., Philadelphia—The Escourt Hotel Co., 910 Ridge Ave., plans to construct a 4 story, 45 x 60 ft. cold storage plant and store building at 913-15 Ridge Ave. Estimated cost, $100,000. Architect not selected

Pa., Philadelphia—Farmers Cold Storage Co., c/o G. T. Sales, Liberty Bldg., is having plans prepared for the construction of a 4 story, 90 x 100 ft. cold storage plant on Levick St. and Delaware Ave. Estimated cost, $200,000. Ophuls, Hill & McCreery, Inc., 112 West 42nd St., New York City, Engrs.

Pa., Philadelphia—Grubnau Bros., 2nd St. and Erie Ave., have awarded the contract for the construction of a 2 story, 80 x 150 ft. wool factory. Estimated cost, $19,500.

Pa., Pittsburgh—H. J. Heinz Co., manufacturers of pickles and preserves, will soon receive bids for the construction of a 6 story, 92 x 150 ft. manufacturing and storage plant, on Progress St. R. M. Trimble, Ferguson Bldg., Archt. Noted Nov. 24.

Pa., Turtle Creek—The Wilkensburg Ice Co., Centre St., will soon award the contract for the construction of a 1 story, 85 x 105 ft. ice plant on Monroeville Rd. Private plans.

SOUTHERN STATES

Ky., Louisville—The United Casket Co., 3022 West Chestnut St., has had plans prepared for the construction of a 1 story, 100 x 450 ft. dry kiln factory and a 40 x 40 ft. boiler plant, on 12th and Magazine Sts. Estimated cost, $300,000. M. Sartoro, Cleveland, O., Archt. and Engr.

W Va., Star City—The Star City Glass Co. has awarded the contract for the construction of a glass plant, including bldgs. A-1 and A-2, each 1 story, 140 x 500 ft.; Bldgs. B, 37 x 160 ft.; C, 35 x 100 ft.; D, 15 x 30 ft.; and E, 15 x 18 ft.

MIDDLE WEST STATES

Ill., Benton—The Benton Ice & Bottling Co. is having plans prepared for the construction of an ice and bottling plant on North Main St. Estimated cost, $100,000. Stegemier & Kennerly, Title Guarantee Bldg., St. Louis, Mo., Engrs.

Ill., Chicago—The Nemo Dye Wks., c/o P. Gerhardt, Archt., 64 West Randolph St., is receiving bids for the construction of a 1 story, 103 x 115 ft. factory at 4203 West Grand Ave. Estimated cost, $250,000.

Ill., Chicago—H. H. Windsor, c/o Marshall & Fox, Archts., 712 North Michigan Ave., is having plans prepared for the construction of a 7 story, 100 x 125 ft. publishing plant on Ontario and St. Clair Sts. Estimated cost, $400,000.

Ill., Peoria—The Leshnick Directory Co., 514 Main St., has awarded the contract for the construction of a 2 story, 50 x 150 ft. printing shop. Estimated cost, $100,000. Noted Nov. 10.

Ind., Franklin—D. M. Hoagland & Co., Scottsburg, is having plans prepared for the construction of a 3 story, 130 x 134 ft. canned goods factory, here. Estimated cost, $75,000. L. Griffin, Franklin, Archt.

Ind., Indianapolis—The Indiana Sawed Veneer Co., 324 West 14th St., is having plans prepared for the construction of a 2 story, 90 x 110 ft. factory at 340 West 14th St. Estimated cost, $24,000. Private plans.

Ind., Indianapolis—G. Ittenbach & Co., 916 Harrison St., plans to build a stone plant on Harrison St. Estimated cost, $25,000. Private plans.

Ind., Indianapolis — C. E. Pauley, 112 East Maryland St., plans to construct a 5 story, 95 x 135 ft. printing shop on North New Jersey St. Estimated cost, $225,000. Architect not selected.

Ind., Indianapolis—Piel Bros. Starch Co., 831 State Life Bldg., is having plans prepared for the construction of a 1 story, 85 x 150 ft. addition to its starch factory. Estimated cost, $20,000. R. F. Daggett 962 Lemacke Annex, Archt.

Ind., Winchester—Storms Novelty Wks is having plans prepared for the construction of a 2 story, 50 x 100 ft. factory, for the manufacture of wooden novelties. Estimated cost, $35,000. Private plans.

O., Canton—The Canton Ice & Fuel Co., 601 4th St., N. E., has had plans prepared for the construction of a 1 story, 30 x 100 ft. addition to its ice plant. Estimated cost $40,000. A. C. Bishop & Co., 427 Guardian Bldg., Cleveland, Archts. and Engrs

O., Cleveland—The Industrial Fibre Co., West 98th St. and Walford Rd., is having plans prepared for the construction of a 2 story addition to its silk factory. Estimated cost, $75,000. W. W. Boige, Pres. Private plans.

O., Cleveland—Whitmer, Jackson Sash & Door Co., 1996 West 3rd St., has awarded the contract for the construction of a 1 story, 70 x 128 ft. addition to its factory. Estimated cost, $40,000. Noted Dec. 8.

O., Marion—The Hornell Ice & Cold Storage Co. will soon award the contract for the construction of a 2 story, 60 x 90 ft. addition to its plant. Estimated cost, $45,000. S. Williams, care of owner, Engr.

Wis., Cudahy—Cudahy Bros. are having plans prepared for the construction of a 1 story, 82 x 190 ft. box factory. Private plans.

Wis., Milwaukee—A. W. Schmidt, 997 Greenfield Ave., has awarded the contract for the construction of a 2 story bakery on 23rd Ave. Estimated cost, $40,000.

Wis., Milwaukee—The Wadham Oil Co., 359 Clinton St., has awarded the contract for the construction of a 1 story refinery on Burnham St., including a 85 x 100 ft. tank house, a 100 x 150 ft. barrel house and a 30 x 30 ft. gasoline filling house, etc. Estimated cost, $75,000.

Wis., Milwaukee—The Wisconsin Ice & Coal Co., 216 West Water St., is having preliminary plans prepared for the construction of a 2 story ice manufacturing plant. Estimated cost, $145,000. R. Messmer & Bros., 221 Grand Ave., Archts.

Wis., Racine—The E. L. M. Tire Co., Deane Blvd., is having plans prepared for the construction of a 2 story, 148 x 160 ft. addition to its factory. Private plans.

Wis., South Milwaukee—Burnham Bros. Brick Co., 68 Wisconsin St., Milwaukee, plans to build a 1 story brick factory on Chicago Rd., here. Estimated cost, $150,000. Private plans.

WEST OF THE MISSISSIPPI

Ia., Bedford—J. J. Clark, J. H Baker, W. E. Crown, Jr., and J. Satters, all of Bedford, are members of a finance committee which is forming a company to build a 3 story, ice, cold storage and power plant. Estimated cost, $200,000

Mo., Aurora — The Helvetia Milk Co., Arcade Bldg., St. Louis, plans to construct a 2 story condensed milk factory on Main St., here. Estimated cost, $25,000. E. G. Maher, Mgr. Architect not selected.

Mo., Jackson—The International Shoe Co., 15th and Washington St., St. Louis, is having plans prepared for the construction of a 3 story factory here. Estimated cost, $100,000. A. Hume, care of owner, Mech. Engr.

Mo., St. Louis—J. O. Chenoweth Dyeing & Cleaning Co., 1400 Washington St., is having plans prepared for the construction of a 1 story dyeing and cleaning plant on Delmar and Bayard Aves. Estimated cost, $50,000. A. B. Groves, 314 4th St., Archt.

Okla., Dewey—The Dewey Portland Cement Co., Mutual Bldg., Kansas City, Mo., has awarded the contract for the construction of a cement plant, to contain 4 concrete storage tanks, 20,000 bbl. capacity, here. Estimated cost, $60,000.

Tex., Lubbock—The Texas Utilities Co., Plainview, plans to build an ice cream factory, here. Estimated cost, $30,000. B. Scott, Mgr.

Wyo., Casper — The Wyoming Refining Co., 217 Midwest Bldg., has purchased a 340 acre site, 3 mi. east of here and plans to construct a refinery, first unit with one battery of stills, having a capacity of 7,000 bbl. per day, to be gradually enlarged to 20,000 bbl. capacity. Project includes 40 *mi* pipe line from Salt Creek oil fields. Ultimate cost, $10,000,000. W. A. Blackmore, Casper, Pres.

SOUTHERN STATES

Cal., Los Angeles—C. C. Brown Candy Co., c/o T. B. Keim, Jr., Archt., 719 Haas Bldg., has awarded the contract for the construction of a 2 story, 60 x 165 ft. candy factory on Flower St. near 7th St. Estimated cost, $40,262.

Cal., San Leandro — The County of Alameda, Oakland, is having plans prepared for the construction of a 1 story laundry and a 1 story power house, to contain an ice making plant, refrigerating plant, incinerator shops, etc., on the County Infirmary grounds, here. H. H. Meyers, Kohl Bldg., San Francisco, Archt.

CANADA

Ont., Bridgeburg—The Buffalo Specialty Co., 601 Northland Ave., Buffalo, N. Y., plans to construct a factory here, for the manufacture of liquid veneer. Estimated cost, $40,000.

Ont., Wiarton—The Northern Texiles, Ltd., Chesley, plans to remodel woolen mill here.

Some Features of the New Tax Law

Revenue Act of 1921 Affords Real Relief to Business—Apparently Unimportant Changes in Wording Significant

BY ROBERT MURRAY HAIG, PH.D.
School of Business, Columbia University

AMONG the numerous changes made by the new tax bill signed by President Harding on Nov. 23, five stand out as of great importance from the point of view of the business man and the investor. These are:

(1) The abolition of the Excess Profits Tax as of the beginning of next year, coupled with an increase in the income tax on corporations at that time from 10 to 12½ per cent.

(2) The reduction in the surtax rates on individual incomes which comes into effect at the same time.

(3) The establishment, with the beginning of next year, of a new class of income to be known as capital gain, which will be subject to a maximum rate of 12½ per cent.

(4) The broadening of the definition of the "closed transaction," effective for the current year, which makes possible many exchanges of property for property without subjecting the gain to taxation.

(5) The recognition, beginning this year, of a net loss from one year's operation as an offset against any profits which may accrue in the two following years.

The first two changes, the repeal of the profits tax and the changes in the rates, have been the subject of wide comment but the other changes, being of a somewhat more technical character, have been less discussed and their significance less fully appreciated.

EXCESS PROFITS TAX REPEAL

In spite of great pressure, Congress finally declined to repeal the profits tax for 1921, but did agree to abolish it thereafter. With it disappears the "personal service corporation," a special class established to care for certain corporations which it was desired to exempt from profits taxation. When the profits tax goes, the income tax rate on all net income of corporations rises from 10 to 12½ per cent. The change in the rate will cause corporations which make only moderate profits to pay slightly heavier taxes but the total tax burden on corporate income will be much lighter, the official estimates of revenue under the new bill calling for $1,030,000,000 from this source (ignoring back taxes) this fiscal year and only $695,000,000 for the next fiscal year, when the changes will be in force.

REDUCTION OF SURTAX RATES

The surtax rates on individual incomes are scheduled for reduction beginning with the first of next year. A comparison of the new scale with the old is difficult to make. It should be made clear, however, that the change affects small taxpayers as well as large ones. The maximum rates remain very high—50 per cent as compared with 65 under the old law. The 50 per cent rate applies to all income in excess of $200,000. The old rate which applied to the increment of income above $200,000. income was 60 per cent. Surtaxes in the future will not begin until the $6,000 point is reached and will be 1 per cent for income between $6,000 and $10,000. Under the old law, the surtaxes begin at $5,000 and mount by more rapid steps. There are also slight changes in the personal exemptions, effective at once. According to the revenue estimates these changes will not provide much relief for the individual taxpayers, for the Government expects to get $785,000,000 next year with the changes in effect as compared with $850,000,000 this year.

NEW CLASS OF "CAPITAL GAINS"

The most revolutionary section in the new act is Section 206 which sets up a new division of income. After the first of next year, money made by individuals by selling or exchanging property "held for profit or investment" is subject to a maximum rate of 12½ per cent, instead of the regular rates which range as high as 58 per cent (normal plus surtaxes). This is hedged about by several restrictions. The individual may not take advantage of the permission to use the 12½ per cent rate unless he is willing to pay at least 12½ per cent on his other income as well. The property "held for profit or investment" must have been so held for more than two years and may not include property "held for the personal use or consumption of the taxpayer or his family," or property which properly is subject to inventory. It is not necessary, however, that the property be connected with his trade or business.

The reason for the adoption of some such section as this is plain, whatever one may think of the wisdom of choosing this particular method of meeting the situation. As everyone knows, many sales of property have been postponed or entirely blocked by the unwillingness of prospective sellers to take their profits when they would immediately become subject to heavy surtaxes. This, of course, handicapped business. The solution adopted was practically to wipe out the offensive surtaxes on profits from this class of transactions.

One anomalous result of the selection of this solution, however, is that under this new arrangement a dollar of profit made from property which has grown in value is taxed at the maximum only 12½ cents, whereas a dollar made otherwise may be taxed as much as 58 cents. For example, in the case of a bond bought at a discount and sold at a profit, every dollar of interest on the bond may pay a tax nearly five times as great as every dollar of appreciation in the value of the bond, a fact which is likely to effect profoundly future methods of corporate financing.

Much more could be said regarding the effects of this new section from the points of view of equity and of administration, but what is of particular interest here is to point out the very substantial relief granted by it to investors in property which appreciates in value.

The advantage to the investor in property which is gaining in value, conferred by the section just described, is accentuated by the liberal provisions governing the "closed transaction" (Section 202). This has long been a troublesome section of the field of income tax procedure. When one exchanges property for cash, no question arises. The transaction is "closed" and one accounts for his gain to the tax collector. But when one barters instead of sells, receiving other property instead of cash for his property, very serious questions arise. There are sometimes differences of opinion as to the value of the property received which lead to disputes and litigation. The old law went so far as to say that, in the case of such trades, the property received was to be treated as cash "to the amount of its fair market value, if any" (with certain exceptions in the case of a corporate reorganization, 1918 Law, Section 202). The new law goes much further. It now states positively that no gain or loss on trades shall be recognized unless the property received on the trade "has a readily realizable market value." The phrase, "readily realizable," adds a new and liberalizing element.

Even more important, however, are the exceptions made to the general rule. Even though the property received has such a "readily realizable market value," one need not account for the gain in certain cases. This is one:

"When any such property held for investment, or for productive use in trade or business (not including stock-in-trade or other property held primarily for sale), is exchanged for property of a like kind or use."

How the Treasury will interpret this section is, of course, as yet unknown, but it would be a very narrow interpretation which would exclude exchanges of bonds for bonds, or real estate for real estate. In other words, so long as one "barters" or "trades" his property for other similar property instead of selling it for cash, he need not account for his gains to the Treasury for tax purposes. Even if he does sell for cash, as has been noted above, he is subject to a tax of only 12½ per cent.

The provisions governing corporate reorganizations and sales of property to corporations are also greatly liberalized so as to make it unnecessary to report main gains for taxation.

NET LOSSES

With one minor exception included in the 1918 law, it has been the practice since the beginning of income taxation in this country, to treat each year as a unit and to refuse to permit the fact that one has lost money this year to affect the amount of profit he must report the following year. Each accounting period has been carefully "insulated" from other accounting periods. This practice has worked much hardship and the new law breaks away from the old precedents by inserting a provision, effective for 1921 (Section 204, with a restriction on mines), which permits a net loss suffered in one year to be offset against any net income realized in the two next succeeding years. In other words, losses may be used to blot off subsequent gains but losses are "outlawed" for this purpose after the expiration of two years.

The new law contains many other new provisions which it would be interesting to discuss, did not the limits of this article prevent it. Such changes include the new rule regarding gifts, which makes the recipient, if he sells a gift, account for the gain in the value of the gift before he received it [Section 202 (a) (2)], the section aimed to prevent "wash-sales" to establish losses [Section 214 (a) (5)]; the provision covering cases where property is involuntarily converted into cash [Section 234 (a) (14)] and the modifications in the various special taxes.

It has been possible to stress here only the most important departures in the new statute. Careful examinations by the business man and the investor will reveal the fact that it contains provisions, aside from the repeal of the profits tax and the changes in the rates, which will yield him very substantial relief from the burdens of war taxation under which he has been struggling for the past five years.

The Open Door Policy

By C. J. MORRISON

Many modern businesses have grown so large that the personal contact with employees which the executives of a small concern can maintain becomes impossible, and many substitutes have been tried with varying degrees of success. Some of the substitutes are very elaborate schemes involving shop conditions, employees' representatives, so-called "houses of representatives and senators," etc. Many of these arrangements have produced good results, but in the final analysis nothing can replace completely the personal contact and the establishment of a feeling in an organization that each individual employee will get a square deal. There is also the great advantage to both the management and the employees that each employee is always treated as an individual, is free to make his own arrangements with his employers and in the event of a grievance, can present his own case to the management.

THE PLACE FOR DIPLOMACY

At the beginning of the war a concern employing 3,000 persons composed of all classes from negro laborers to the most highly skilled artisans, and both men and women in the ratio of about five to one, placed all matters pertaining to the employees in the hands of one executive who reported directly to the president, and inaugurated what was known as "The Open Door Policy." By this was meant that the office door of every executive was always open to each employee as an individual, but that no employee would be received as a representative of others nor would any outsider be received as a representative of the employees. Matters were supposed to be taken up first with a foreman, then with the department superintendent, next with the supervisor of labor (the executive in charge of all employee relationships) and finally with the vice-president or president; but there was no rigid adherence to this routine and sometimes an employee went first to the president. Of course in such a case considerable diplomacy was required on the part of the president to handle the situation without creating friction in the organization, but a man qualified to be president of such a concern must have such diplomacy.

The supervisor of labor had complete charge of all matters pertaining to every one on the pay roll except the executives of the company. He did the hiring (after the preliminary questioning of applicants had been performed by assistants), set the rates of pay, established the hours of work, made the working rules, arranged for promotions and transfers, gave discharges when necessary, adjusted all grievances, etc. The fact that no one could be hired or discharged except through the supervisor of labor was one of the important factors in the success of the work. At first considerable objection was raised to the discharging feature as it was argued that to take the power of discharging away from the foremen would weaken their control over their men, particularly so in the case of the negroes, but such did not prove to be the result as the employees soon learned that a just cause for discharge would receive immediate action. On the other hand the foremen learned that tyranny and fits of temper were not tolerated. Of course in the early days of the scheme there were cases where sufficient friction was engendered so that transfers had to be made, but after a little while these troubles died out and the net result was almost no discharges and few transfers, except in the way of promotions.

A classification of occupations was made and graded rates of pay established for each which were known as A, B, C, D, etc. Employment was always made at the lowest grade and promotions given according to merit as shown by the records kept for each employee. These records were watched very closely so that promotions were usually made before they were asked for. In fact, in most cases where they were asked for, they were not deserved and the employee was shown what he must do to receive more pay. The A-B-C classification had a queer psychological effect in that no one wanted to be rated anything except class A. This condition was not altogether due to the difference in the rates of pay, but was caused largely by pride, and there were a number of cases where employees asked to be rated class A even though they would still receive the pay of a lower class.

THE PERSONAL CONTACT

However, the methods described above were simply a means to an end and the real work of the supervisor of labor was to supply the personal contact between the management and the employees. This was accomplished by a continuous round of visits to all departments, by eating in the company's restaurants, of which there were four, by attending or by taking part in all activities of the employees, by riding to and from work with them, in fact by generally mixing with them. He soon knew practically all by sight and a large proportion of them by name. Nearly all soon reached the point where they would talk quite freely and many riffles were straightened out before they became troubles. The talks did not stop at company business, but before long a number were bringing up all their outside difficulties and seeking advice on subjects ranging from what to give the baby for colic to how many Liberty Bonds should be purchased.

When the influenza epidemic swept the country the supervisor of labor, as the representative of the management, provided food, fruit, medicines, nurses, doctors, and undertakers for the employees and their families where assistance was needed. The expense of this aid, was of course borne by the company. All of this was simply an application of the Golden Rule to business.

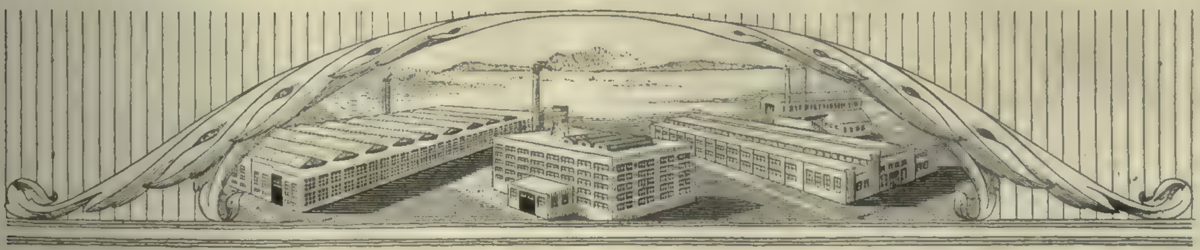
In order to establish a more personal relationship with the women than could be maintained by a man, a very capable woman was employed as an assistant to devote her entire time to the women. By acting under instructions from the supervisor of labor and by holding daily conferences with him, this assistant soon had as cordial relations established among the women as with the men.

Advantage was taken of this close personal contact with the employees to explain to them the policies of the company, its troubles, its prospects of profits, its standing in the industry, its reputation, its service to the Government, and particularly to explain the "reason why for everything."

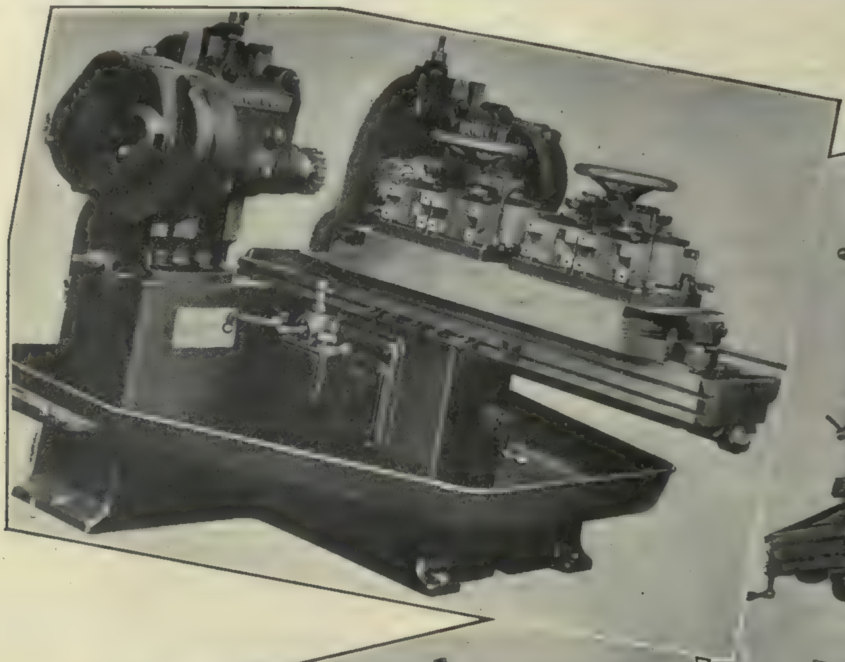
THE DIRECT RESULTS

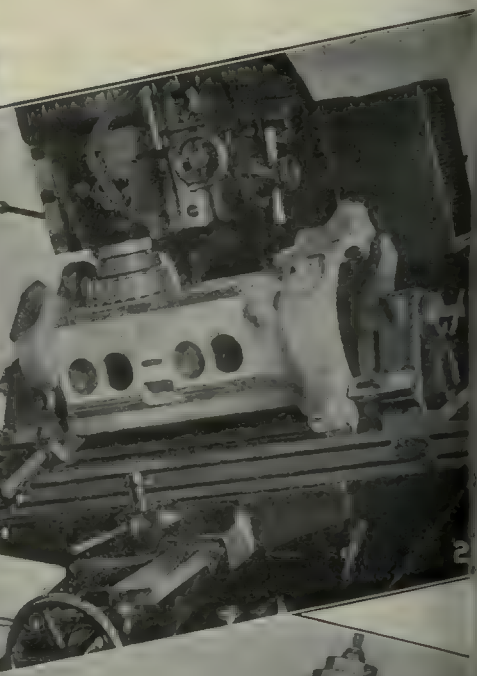
That these methods were successful is shown by the results obtained. Although this industry was located in a labor market which was torn by strikes and discord, it had no labor troubles of any description, had all the employees it needed and had a labor turnover remarkably low for the location and time. The results are particularly noticeable when the further fact is known that although much of the product of this company was a vital necessity to the Government in the war, the remuneration carried very little profit and the company therefore could not compete in wages with many of its neighbors who were working on a cost-plus basis. Employees stayed with this company, not for a mere money consideration, but because they liked to work where they were treated like human beings and where they felt that each one received a square deal.

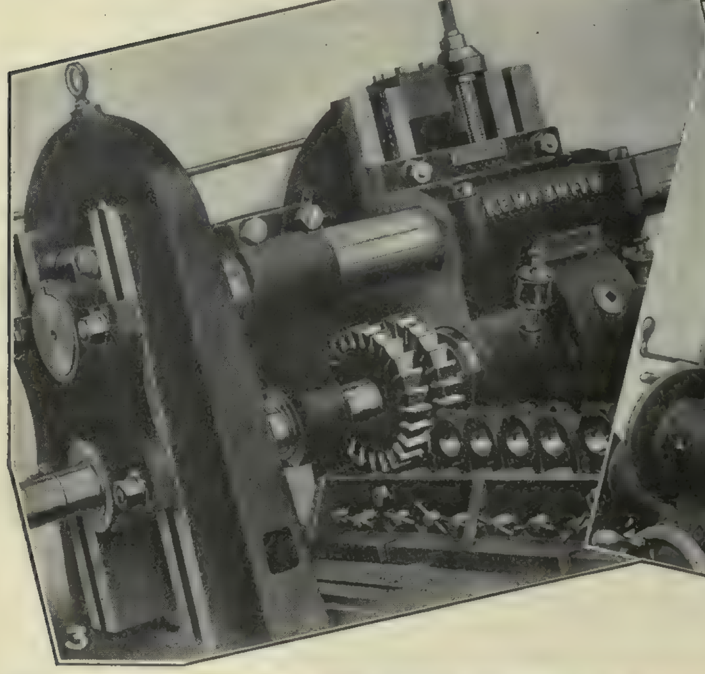
As many know the success of the open door and personal contact methods in small establishments and bemoan the fact that they are not applicable to a large business, it may be well to point out the fact that the methods have been successful in a number of instances besides the one cited here. In a large industry it is hardly possible for the regular executives to do this work and it is therefore necessary to employ someone to devote his entire time to keeping open the door and to applying the personal contact. However, a word of caution is necessary. This is not a job for an amateur, for a poor relation or for any other man who can be hired for a low salary. A broad gage man of wide experience must be secured and his salary may approximate that of the general manager, but the services of the right man will pay large dividends.



PRODUCTION







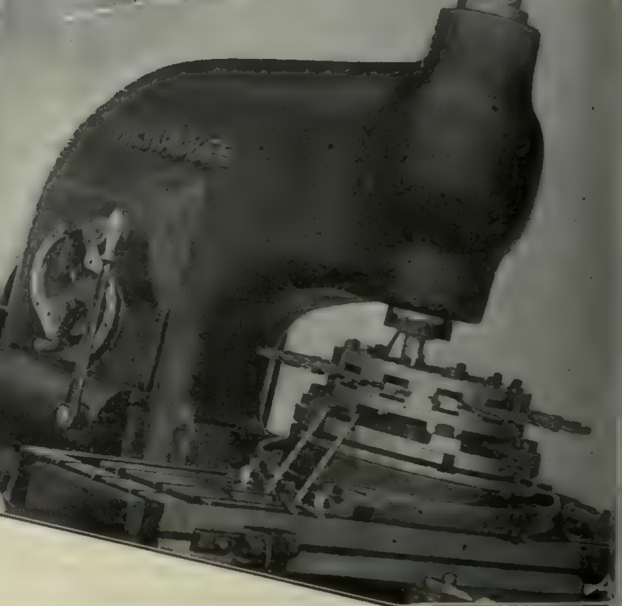


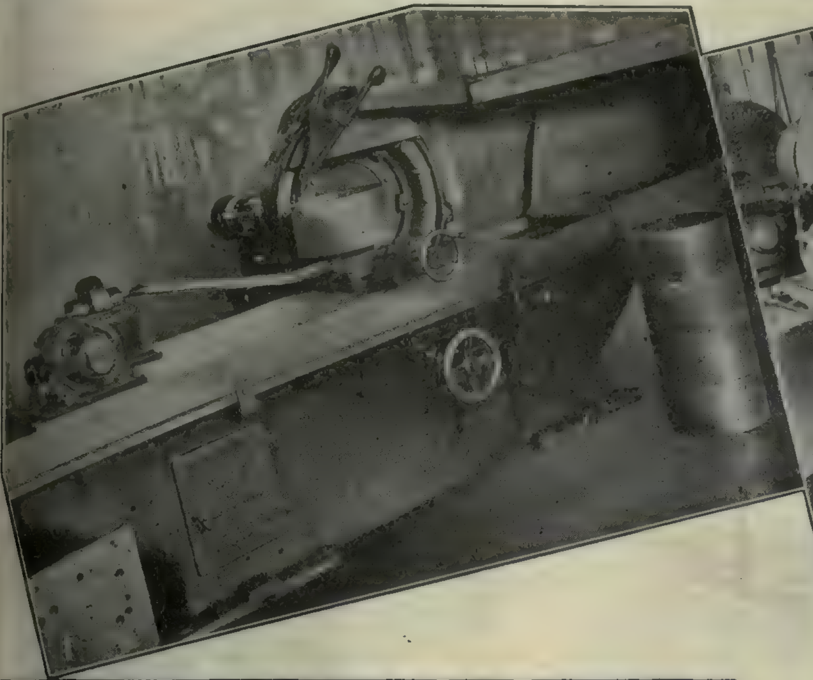
Fig. 1. The Cincinnati duplex automatic milling machine shown here is milling the feet of small electric motors. There are two fixtures each holding eight motor frames. The table has an automatic fast traverse between cuts, so that there is no "cutting wind." One fixture can be unloaded and loaded while work in the other fixture is under operation. The production is 120 frames per hour.

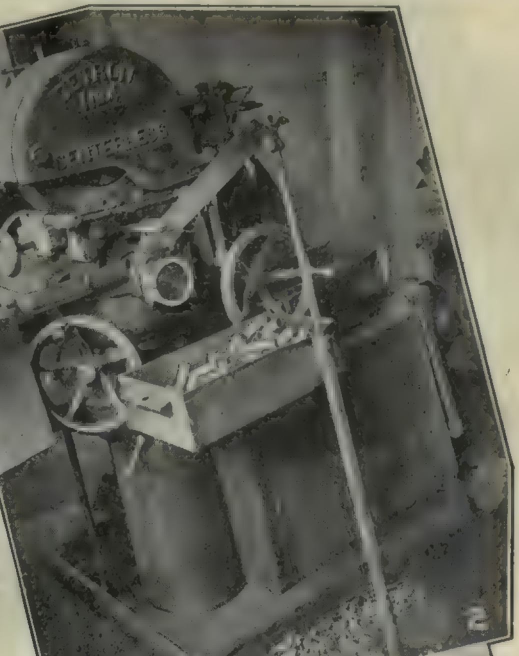
Fig. 2. The Cincinnati high power milling machine to be seen in this picture is milling the joint faces on an aluminum crankcase. A single piece is held in an indexing fixture mounted on trunnions. Two joint faces at 90 deg. to each other are milled in 9.85 minutes.

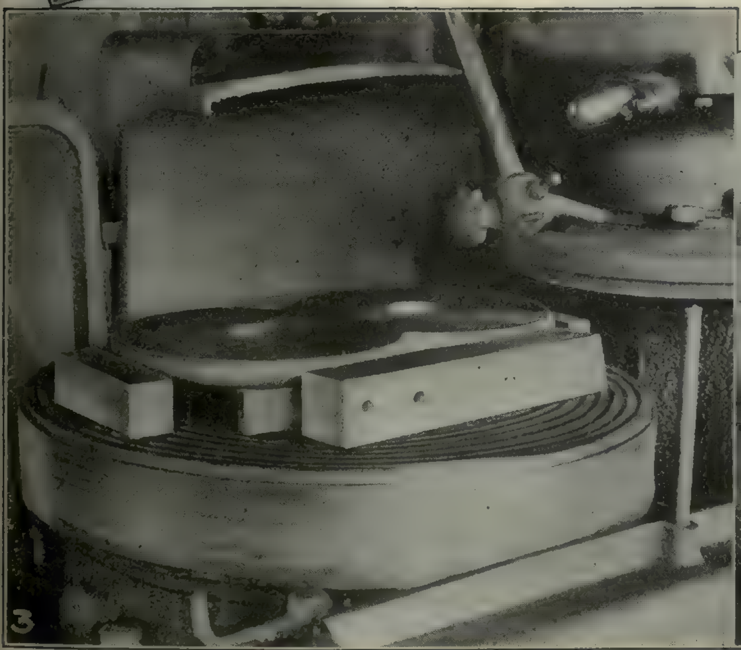
Fig. 3. This Kempsmith No. 33 production milling machine is straddle milling cast-iron gear-box levers. Production, including loading and unloading the fixture, is 120 pieces per hour. The bosses of these levers were formerly faced in a lathe and the time was 4 min. each. The saving by milling is 87½ per cent.

Fig. 4. Here is a Milwaukee vertical milling machine fitted with a rotary table and multiple holding fixtures. The operation is milling the tangs on taper-shank twist drills. The production on drills with No. 3 taper shanks is 750 per hour. As drills can be removed from the fixtures as fast as finished and others put in place, the operation is continuous.

IN PICTURES







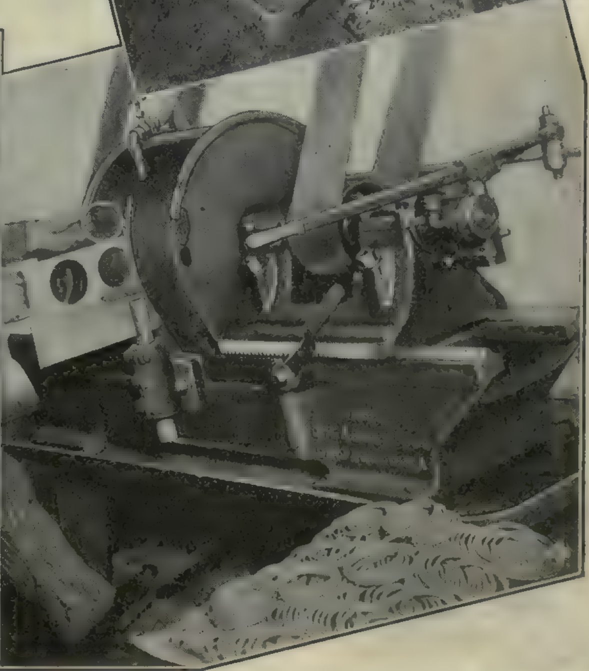


Fig. 1. Pulley rims are thin and apt to be chilled, so that turning in a lathe is a slow operation. Machining pulley faces by grinding on a Diamond face-grinding machine is shown in the accompanying illustration. By varying the location of the work in relation to the wheel plane, pulleys may be ground with either straight or crowned faces.

Fig. 2. Precision-grinding cylindrical work not held in centers, is somewhat anomalous—but it works—and the length that can be ground is almost unlimited. The illustration shows a Detroit centerless grinding machine at work on piston pins, which, according to the builder's claims, it turns out at the rate of 140 or more per hour.

Fig. 3. In this illustration is shown a Blanchard rotary grinding machine surfacing one side of a cast-iron cylinder head. The work is held by a magnetic chuck and $\frac{1}{8}$-in. of stock is ground off. The production is six pieces per hour.

Fig. 4. The sides of automobile piston-rings must be parallel and of the required thickness within close limits. On the Besly wet ring-wheel grinding machine shown herewith, piston rings can be ground on both sides at a rapid rate, the variations not being greater than 0.0015 in. in thickness nor 0.001 in. from parallel. The wheels run in opposite directions and at slightly different speeds, giving the rings a slow rotating movement.

PRODUCTION

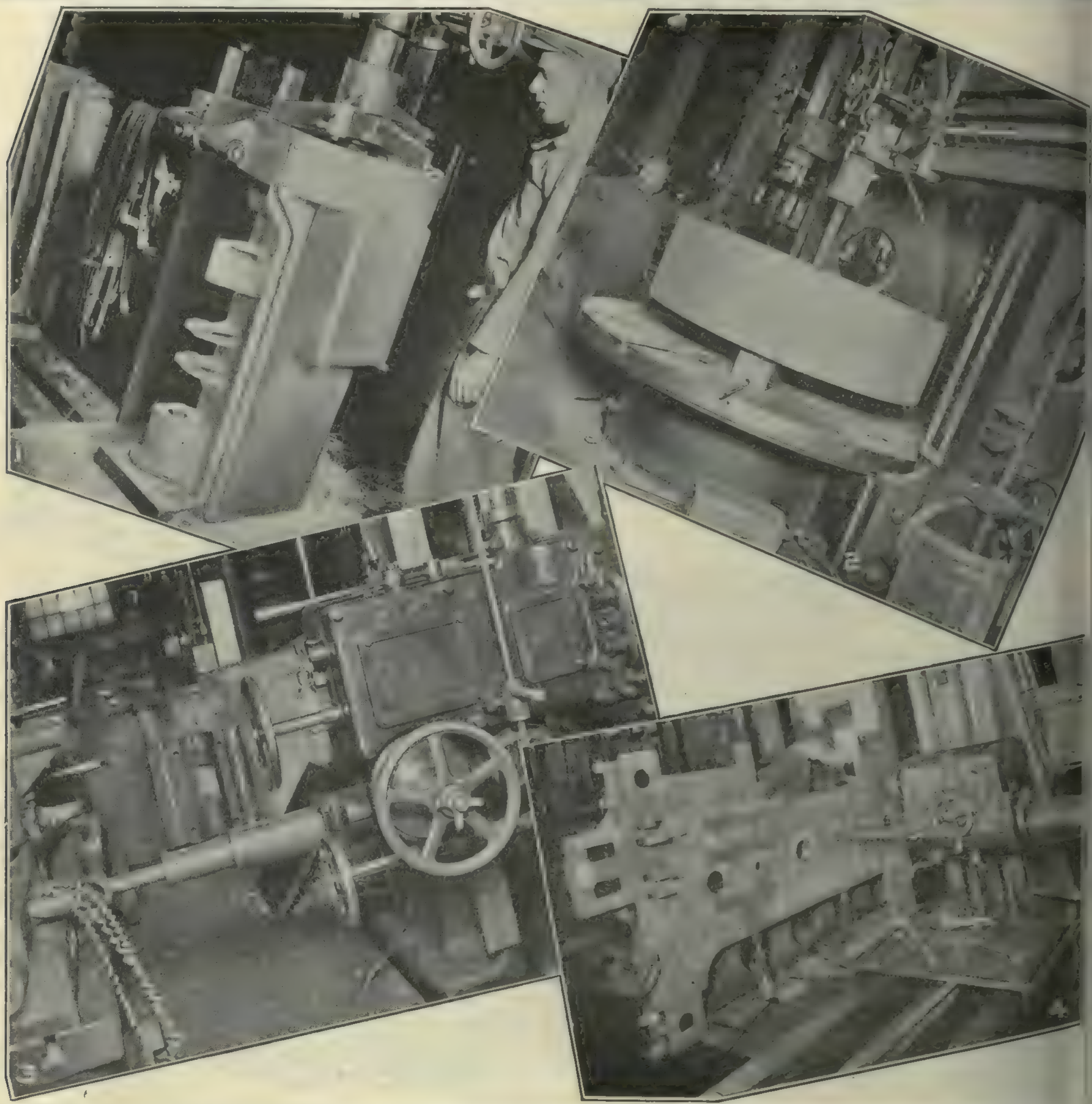


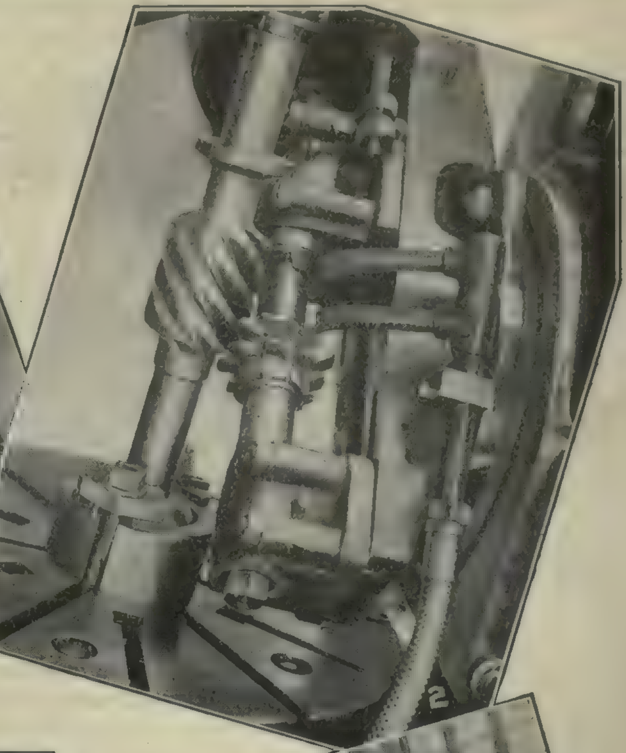
Fig. 1. This Baker boring and drilling machine is boring and facing the flywheel housing on the crankcase of an automobile engine. The work table has been removed from the machine and a special clamping fixture attached to the base and column. It is only of late years that drilling machines have been built heavy enough for such work.

Fig. 2. A Niles vertical boring and turning mill is here shown machining a 70 x 20-in. pulley. Not only can the work be more conveniently handled in machines of this type than in a lathe, but it can be done in less time. While the hole in the pulley is being bored by the bar in one head, the face is being turned by a tool in the other head.

Fig. 3. Here is a Pawling & Harnischfeger horizontal boring machine drilling 3-in. holes from the solid in cold-rolled steel. To get production on work of this kind, the machine must be massive and rigid. The chips coming from the drill are evidence that the machine is standing up to the work.

Fig. 4. Boring a series of holes in large work and keeping them all in alignment means that the work must not be moved after it has once been set. In the Rochester horizontal boring machine illustrated herewith, the work is stationary while the spindle head is moved from the location of one hole to that of another.

IN PICTURES



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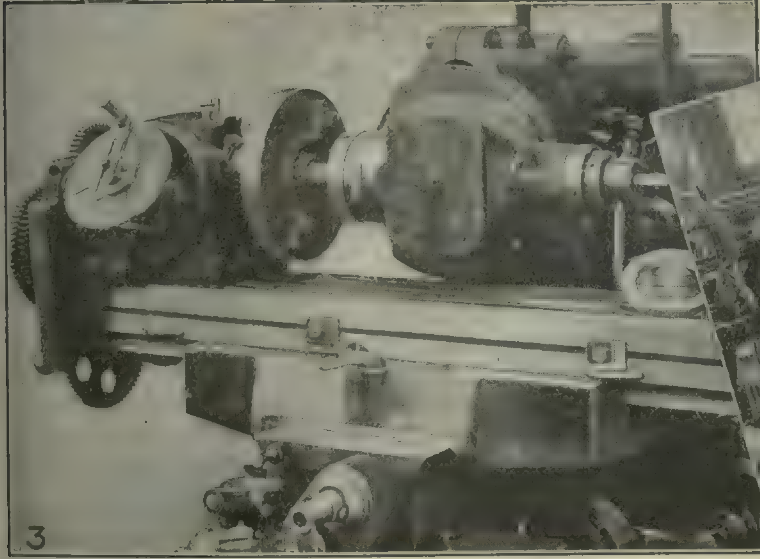

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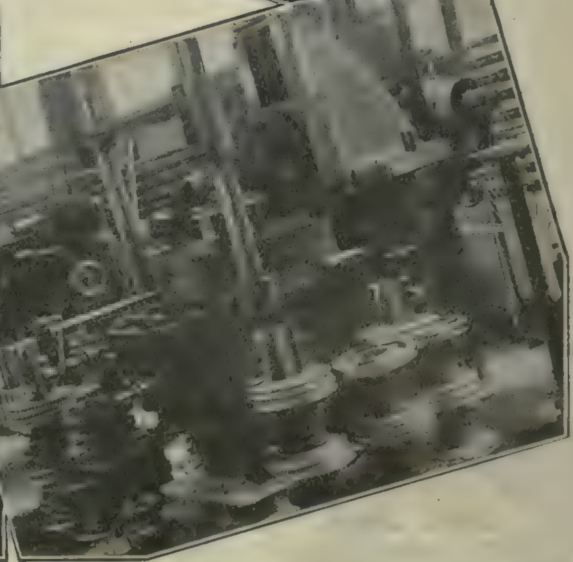


Fig. 1. When wormwheels are wanted in large quantities, a generating machine such as the Gould & Eberhardt machine shown here is capable of high production without loss of accuracy. The tapered hob starts in with a light cut, gradually getting heavier as the wheel revolves until the teeth are finished, without preparatory gashing. The wheels shown are 1½-in. circular pitch, have 28 teeth and the cutting time is 48 min. each.

Fig. 2. The hobbing machine, properly equipped, will do a great variety of work from gear cutting to cutting multiple key seats. The Gould & Eberhardt machine shown herewith is hobbing a seven-thread worm with a hob of unique design. The worm is 4.12 in. in diameter, 1⅜-in. pitch and 5-in. face and was cut in 70 minutes.

Fig. 3. In hobbing internal threads, the thread on the hob has no lead, the hob is longer than the threaded part of the work and the operation is completed in practically one revolution of the work. The Kempsmith milling machine shown here is fitted with a special attachment and is hobbing threads in steel collars. The production is eighteen an hour.

Fig. 4. The gear hobbing machine shows up at its best in comparative accuracy in the manufacture of wormwheels. The Farwell hobbing machine illustrated herewith is hobbing wormwheels, including the gashing, in 30 min. each. Formerly 2½ hr. were required when the work was done in a milling machine.

Are Automobile Manufacturing Methods Applicable to the Textile Industry?

How the Two Industries Developed—Contrasting Production Methods and the Machinery Involved—A Chance for the Machinery Manufacturer

By DOUGLAS T. HAMILTON
Fellows Gear Shaper Co.

THE depression through which we are passing has focused our minds on many subjects to which we have not given very close attention in the past. Economy of production, for instance, has taken on a new meaning—and justly so. It is only by lowering production and sales costs that the final cost of a product can be reduced. In looking at the prominent industries, we see that the automobile business has had a wonderful and phenomenal growth, and it is only natural that we should endeavor to discover the reasons for this.

One of the reasons is that the automobile filled a want and filled it well, but this is not the most important one. If automobiles could not have been produced at a price at which a large number of people could purchase them, the demand that necessitated the production of 9,000,000 automobiles in a comparatively few years could never have been created. We necessarily come to the final conclusion that methods of production have been largely responsible for this growth. The question is, can these methods which have proved so successful in the automobile business be adapted to one of our largest basic industries—the textile industry?

Development of the Textile Industry

Long before the power-driven vehicle was ever thought of or contemplated, the textile industry had reached a position of no mean proportions. In fact, it is our oldest industry, dating back thousands of years. The fabrication of cloth of great beauty was an art that was well developed long before biblical times; but the advent of machinery for the weaving of cloth and the spinning of yarn is of more recent development. The first development in the textile industry of importance was the invention of the fly shuttle by John Kay in 1733. This was followed by other improvements by such inventors as James Hargreaves, Richard Arkwright, Samuel Crompton, Edmond Cartwright, Samuel Slater, Francis C. Lowell, Alvin Jenks and many other well-known names in the textile industry. The ring spindle frame invented by Alvin Jenks was a great step in advance in the production of modern cotton thread. This process, with improvements in machine construction and design, is in use today. If we study the history of the textile industry, we can learn considerable, not only in regard to machine design and the adaptation of ingenious mechanical movements, but we will also find that this industry has been responsible for some of our present-day economical production methods.

Great credit is due to the designers of textile machinery and equipment for the skill and ingenuity that they displayed; but it must be admitted that the developments in this industry have not kept pace with some of our modern industries. The methods of spinning cotton thread, as an example, have not improved in the last fifty years. Larger machines have, it is true, been built, but the production per spindle has not been greatly increased, some of the reasons for which will be given later.

The production of textile machinery, in a sense, preceded the development of tools for producing machinery, and certainly was in advance of the machine-tool industry. In fact, there are now certain machine tools which were later developed solely for use in this industry. The textile-machine manufacturer, however, largely produced his own machine tools and equipment used in the production of textile machines, and naturally, also developed his own shop methods of manufacture.

Examples of the ingenious methods that were adopted have spread out into other industries including the manufacture of agricultural machinery, shoe machinery, etc., that were developed at an early date. In the production of textile machinery, manual skill and dexterity were developed to a high extent, and special machines, though crude in design, were used entirely in place of standard machine tools, as such tools did not exist at that time. In fact, progenitors of some of our present-day machine tools are to be found in certain textile plants, but these machines bear little resemblance to their offsprings; still, the parts produced on these machines were of a high order due to the dexterity and skill of the workmen. Piece work and what we know as the single-operation method really had its inception in the textile industry.

Development of the Automobile Industry

The automobile industry started only about 25 years ago and has had a much more rapid growth. Instead of taking fifty or one hundred years to develop to its present state, the automobile industry has advanced in ten or fifteen years to a stage which is generally conceded to eclipse all other industries in cheapness of production of high-grade products. There are several reasons why this is so. The automobile was invented at a time when the machine-tool industry had reached a stage of considerable importance, and the ability of machine-tool builders as designers of machinery was well recognized; hence, the automobile manufacturer instead of going it alone and producing his own machinery, called in the assistance of the machine-tool builder. Together they worked out production problems, the results of which we see today as one of the highest developments in manufacturing methods. In fact, one of our most conspicuous examples of interchangeable manufacture, and the one which represents the highest grade of goods for the least money, is our best example of what co-operation between machine-tool builder and manufacturer can accomplish.

It has been the boast of one of the largest manufacturers in the automobile industry that he could pay the highest wages in the industry and yet produce the cheapest goods, the reason for which was the productive capacity of the equipment and the application of the well-known principle of multiple operation work. Such results, of course, could not be secured without the use of special and highly-developed machine equipment. There is little question at all that the automobile industry would not have reached its present stage had it not been for the development in manufacturing methods; and it certainly is a fact that it would not have been possible to produce 9,000,000 automobiles in a period of less than ten years, unless present-day improved manufacturing methods had been adopted.

ARE THESE METHODS APPLICABLE TO THE TEXTILE INDUSTRY?

The question is, can the methods used by the automobile manufacturer be applied to the use of the textile-machine manufacturer? If we compare these two industries, we see quite a difference. In the first place, the textile-machine manufacturers, except in a few cases where their equipment has become modernized, are using special home-made machinery of crude design and construction. These machines are adapted to produce one piece at a time, but doing it with such rapidity that the cost per piece is small. The automobile manufacturer, on the other hand, also is using a specially designed machine tool capable of making a large number of pieces at one time. His equipment costs him considerably more than does that used by the textile-machine manufacturer, but his unit costs are lower for the reason that his labor cost is lower. In other words, we have two extremes. We see, in one case, the use of crude equipment and highly-skilled workmen, and in the other case, the use of expensive and well-developed equipment and the employment of comparatively non-skilled workmen.

It is generally conceded by those who have made a study of manufacturing methods that the future lies along those lines that the automobile manufacturer is following, for the reason that labor costs will never be reduced to the same rate that they were 25 or more years ago, and that any improvements which are made in reducing manufacturing costs must be on the side of greater efficiency of the workmen, and the use of better machines and machining methods.

TEXTILE VERSUS AUTOMOBILE INDUSTRY

Regarding the question of design and more particularly the application of gearing, we find a remarkable difference between the advance in the textile and automobile industries. The automobile manufacturer should be given the credit largely for the present high state of development in the production of gearing; also the materials used in the production of gears. High-grade alloy steels were developed solely for use in automobile manufacture; cast iron, except in a very few cases where it best serves the purpose, has been practically eliminated in favor of forgings, so that an automobile of great strength and of light weight can be produced today at a very small cost indeed. It is certainly clear that it would have been impossible to reach this stage with the materials that were in existence at the time that the automobile was developed, and it is also equally a fact that the automobile industry has made the best use of present high-grade steels in the production of automobile parts.

If we look at the textile industry, we see that cast-iron parts predominate, and particularly for gears, necessitating the use of heavy bulky castings, the gears being of coarse pitch and generally extremely noisy. When we get down to the lighter equipment such as cotton-spinning and roving machines, we see the parts lightened up somewhat, but still made from cast iron. In some cases the teeth are not even cut, but are cast. It might be argued that no great strength is required in such gears, especially on light machinery such as spinning and roving machines. This, however, is all the more reason why the lighter design could be adopted and higher speeds used. At the present time, spinning-machine spindles seldom exceed 10,000 r.p.m. and are belt-driven, whereas with properly cut and designed gears and properly designed spindles, speeds as high as 20,000 r.p.m. could be used. Here we see that production would be practically doubled just by one step in advance. The question of floor space also seems to have been overlooked; with gear-driven spinning frames, a possible saving of over 50 per cent could be effected. The machines could be more compactly and rigidly made and capable of producing a great deal more work in half the space.

There are many other cases in the textile industry where the methods developed by the automobile manufacturers could be applied with equal success. The use of better materials and improvements in machines and construction are some of the most important.

The Need for Better Blueprints

By MARTIN H. BALL

The making of blueprints is one of the many operations in which careless or poor work may lead to very serious and costly mistakes, and it is the writer's belief that in many manufacturing establishments sufficient care is not always exercised to insure against such losses. The care and extra expense necessary to secure faultless work in this respect would be far more than offset by the gain in time and accuracy to be obtained by the use of clear blueprints.

Many firms go to considerable expense to protect their prints from injury in the shops by mounting them in various ways; but they continue to make hazy and faint prints which compel those who use them to take extra time in reading them. What is still worse, it may lend them encouragement to take chances by providing them with an alibi if they wrongly read figures or dimension lines.

Lightly penciled tracings on paper and wrinkled and worn cloth tracings are sometimes used, both of which are difficult to make readable blueprints from; but the lack of thorough washing is responsible for the greatest number of poor prints and this particular trouble seems to be more common on prints made on blueprinting machines than on those that are made by hand.

It would seem that in some of these machines the washing capacity is hardly equal to the printing capacity and, as the printing capacity determines the amount of production, the washing process is cut somewhat short and the prints suffer accordingly. This difficulty can usually be remedied without lowering the production by increasing the volume of water used.

Another common cause of poor prints is incorrect time of exposure, which can only be corrected by close attention to the work coupled with sufficient knowledge and experience to understand the adjustments necessary to meet the variations in the light and in the printing paper.

[The samples submitted by our correspondent are too awful for reproduction.—ED.]

Manufacturing Operations on Milling Machines

Special Toolholders for Facing Four-Step Cones—Fixtures and Tools for Machining Milling Machine Heads—A Unique Angle-Facing Fixture

By ROBERT MAWSON

THE tools and operations described in this article are some of those used by the Becker Milling Machine Co., in the production of the various parts that are necessary to the manufacture of their products. In Fig. 1 is shown a set-up of four tools arranged for machining the steps on an upper feed cone for a milling machine. This cone has been previously chucked and the central hole drilled and reamed to 1.125 in. The tools used are solid and of the round-nose type, as shown in Fig. 2. The toolposts are special, each being fitted with two screws so that the set-up will be maintained under a heavy cut if necessary.

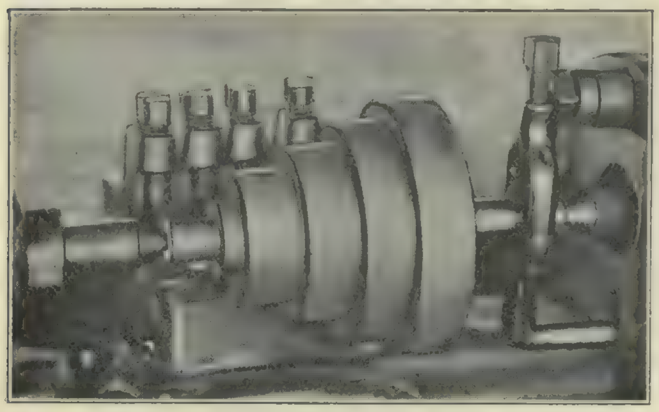


FIG. 1. TOOL ARRANGEMENT FOR FACING FOUR-STEP CONE

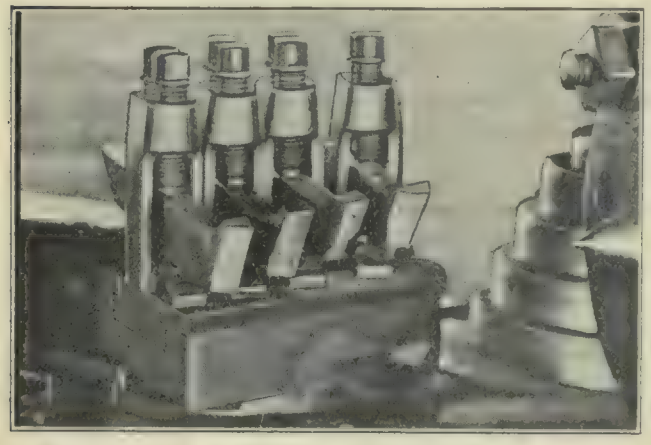


FIG. 2. SPECIAL TOOLHOLDER

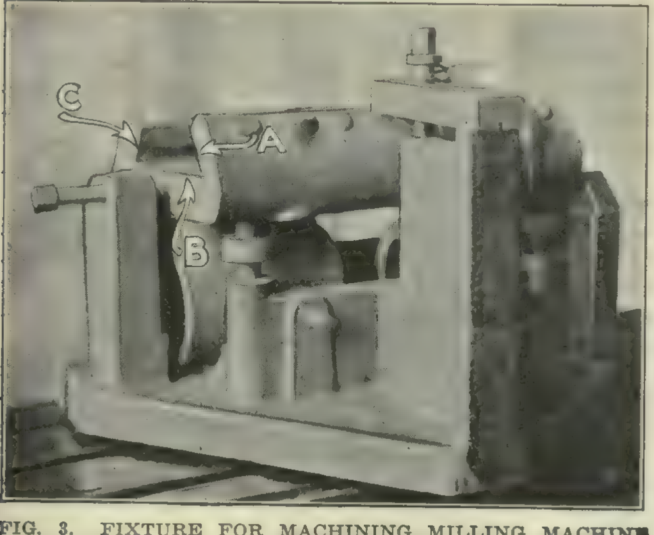


FIG. 3. FIXTURE FOR MACHINING MILLING MACHINE HEADS

A head such as is used on one size of a vertical milling machine, together with the fixture in which it is held for the first milling operation, is shown in Fig. 3. This operation is milling the surfaces *A*, *B* and *C* for which two different sets of cutters are used, the cutters in one set being angular, for milling the 50-deg. dovetails. An expert job of grinding is required on these cutters, as the surfaces and angles are held to very close limits, as shown in Fig. 4. Fig. 5 shows the fixture with the casting removed. At *A* can be seen two of the four hardened steel pins on which the casting rests. Screw *B* is tightened, forcing the casting back against the right-hand vertical wall of the fixture which acts as a stop, and the four knurled-headed screws *C* are tightened up under the body of the casting to support it. The straps *D* are then fastened down, holding the piece securely for machining.

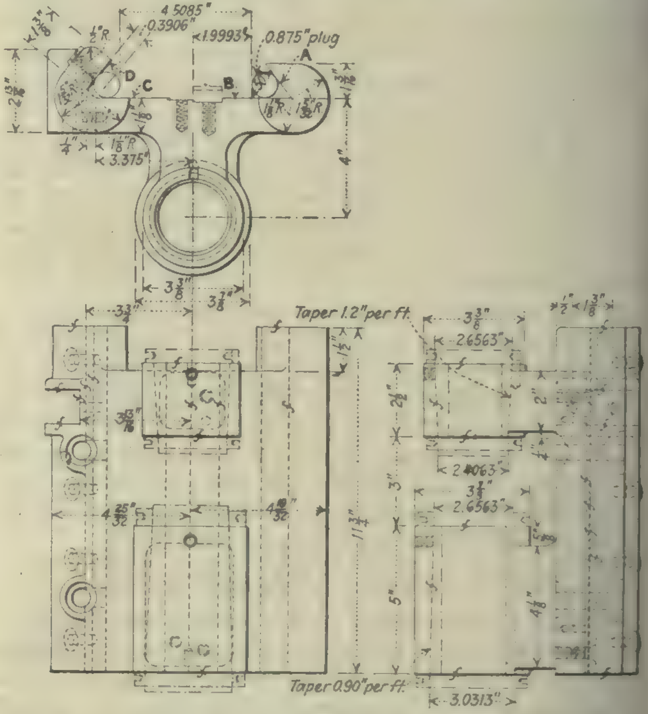


FIG. 4. HEAD FOR VERTICAL MILLING MACHINE

By referring to Fig. 4 again, it will be seen that the two spindle bearings are bored tapering, the small ends of both being toward the center. This operation is performed on a Gisholt lathe, using the fixture shown in Fig. 6. This fixture is centered by means of a raised register at the rear of the fixture-flange, which fits into a recess in the faceplate of the machine. The fixture

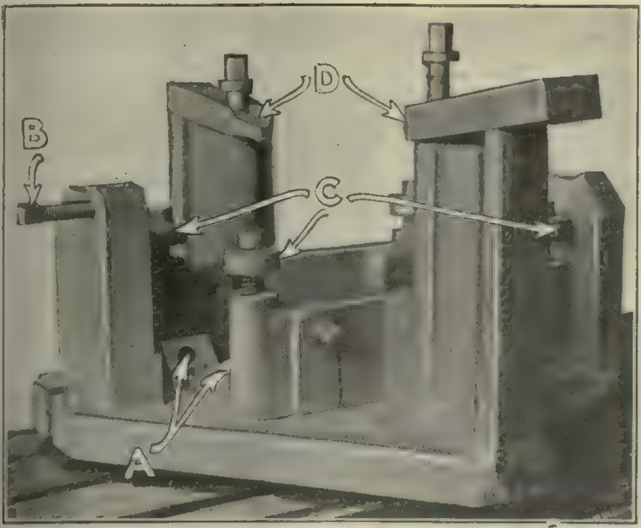


FIG. 5. FIXTURE WITHOUT CASTING, SHOWING MANNER OF OPERATION

with the casting removed is shown in Fig. 7. Two hardened steel dovetail blocks are fastened in the base of the fixture as shown at *A*. The casting to be machined is slid on over the ends of these blocks, which are arranged to fit the dovetail in the casting. The casting is pushed back against the stop *B* and held by the two clamps *C*. The two screws shown at D are used to force the dovetail on one side of the casting firmly against one of the hardened plates to insure correct alignment. In order to finish the spindle holes to the desired accuracy, they are hand-reamed after machining, the tools for this operation being shown in Fig. 8. The tapered guide bushing *A* is first slid into the lower bored hole as shown, and the upper hole hand-reamed, the hole being tested with a tapered plug-gage until the correct size is obtained. The casting is then reversed and the operation repeated, using the reamer shown at *B*, a similar plug-gage being employed for testing the hole.

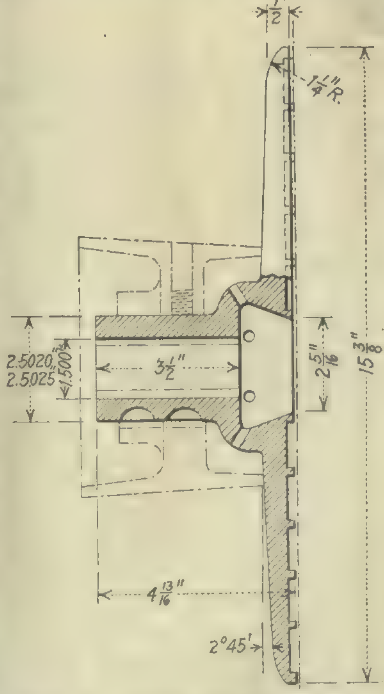
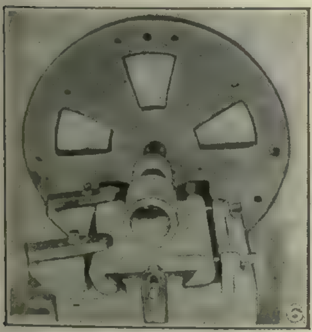


FIG. 9. FRICTION DISK FOR BECKER MILLING MACHINE



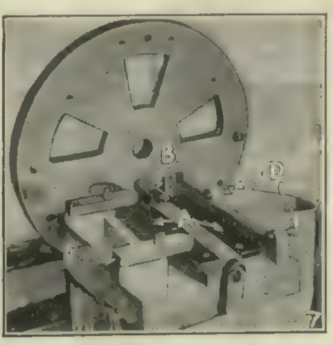


FIG. 6. HEAD READY FOR BORING. FIG. 7. FIXTURE SHOWING DOVETAIL SLIDES

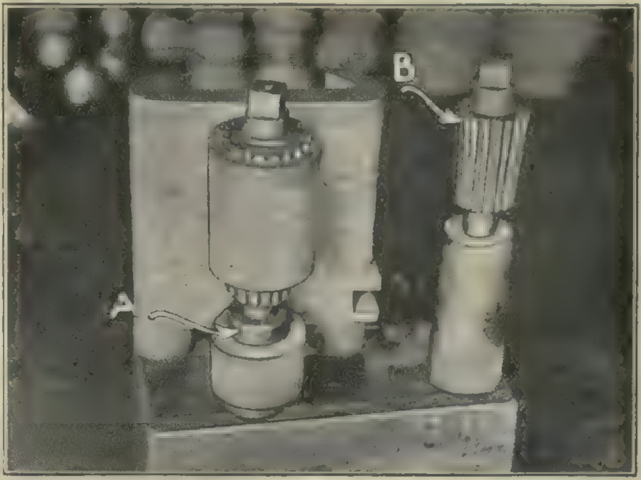


FIG. 8. REAMERS AND GUIDE-BUSHINGS

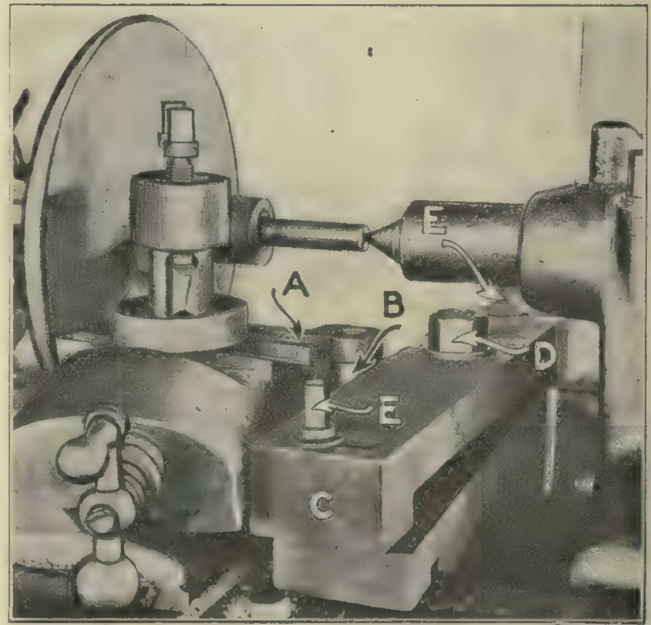
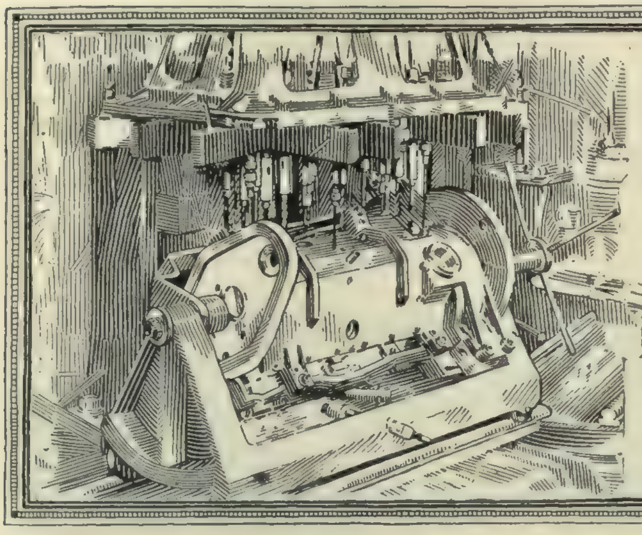


FIG. 10. LATHE FIXTURE FOR ANGLE-FACING

The friction disk shown in Fig. 9 is faced in an engine lathe, as shown in Fig. 10. The hole has been bored and the flat surface faced in a previous operation, the next operation being to face the back side at an angle of 2 deg. 45 min., as shown on the drawing in Fig. 9. Referring to Fig. 10, the arm *A* is fastened rigidly to the rear of the toolslide, the arm being made with a slotted end in which the hardened steel roller *B* is held. The adjustable taper bar *C* is clamped to the shears of the lathe by the large bolt *D*, being made in two parts so that the upper section can be swiveled to the angle desired and held in position by the two screws *E*. When the crossfeed is thrown in with the tool feeding outward, the roller runs along the edge of the taper bar, moving the carriage slowly in a longitudinal direction thus forcing the tool to follow the inclination and facing the work at the angle to which the bar is set. This arrangement can be adapted to a number of similar operations.



Tool Engineering

By

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Turning Tools for Turret Lathes—Factors To Be Considered in Designing Tools—Use of Back Rests—Construction of Toolholders—Arrangement of Cutting Tools

IN all kinds of production work, the machine furnishes the power and applies it in various ways. The tools, however, do the actual work, removing the metal and finishing the surfaces as determined by the "set-up." Any machine without tools is of little use in the production of metal parts. If the tool equipment is not well designed and proportioned for the work it has to do, the machines cannot be operated at maximum efficiency, and as a consequence the production will suffer. To obtain high production, the tool equipment must be intelligently designed, carefully built and properly used.

Many factors affect the design of tools for turret lathes—the material to be cut, the method of holding, the amount of stock to be removed, the length and width of the various cuts and the accuracy required. Many of the points cannot be covered fully in general notes, but will be treated in detail in connection with the specific examples illustrated.

(1) Material to be machined: In designing tools for any sort of cutting, the material which is to be cut naturally has an effect on the design. The shape of the work and its fragility are also important factors. The cutting requires tools which are properly ground for the kind of material, and shaped to remove the metal in the easiest possible way. Very thin work influences the design because the cutting action may so tend to distort the work that a support of some sort is necessary, either for the tools or for the work itself. Material may be of such a nature that it is cut dry, or again it may require cutting lubricant in order to produce good results. These points must all be taken into consideration in the design.

(2) Method of holding: The method by which work is held affects the design of tools in two ways. First, by the possibility of interferences which might be caused by a lug or clamp on some portion of the fixture; and second, by the direction of the cut. In machining irregular castings care must be taken in the design of tools, so that they cannot strike or interfere with portions of the fixture.

(3) Amount of stock to be removed: This is an important factor, not only with respect to the shape of the toolholder itself, but also on account of the necessity for sufficient rigidity to withstand the pressure of the cut. This factor affects the cutting tool itself, as there must be sufficient "section" to carry away the heat rapidly.

(4) Length and width of cut: When short work is to be machined, the cutting tools do not require a great deal of care in their design, other than to make sure that they are properly shaped and held. When the work is long, however, tools must be designed so that they have considerable overhang from the turret. This matter is likely to cause trouble either in the indexing of the turret or in vibration during the cut, unless some method of support is provided.

(5) Accuracy required: In turret-lathe work it is possible with careful tooling to produce work within very close limits of accuracy. Suitable provision must be made to compensate for slight inaccuracies in the indexing of the turret. Unless this is done, work may vary somewhat over or under the size desired.

Turret-lathe work usually consists of a number of different operations on the same piece of work. The operations are performed in sequence; and, for example, work may be turned, faced, drilled, bored, reamed, tapped, recessed or threaded. All of these operations require different tools, some of which are standard, some special, some applied to the turret and others to the cross-slide. We shall treat them separately as to design, but later shall consider them as they are affected by others which may be used with them. The operations of turning, drilling and boring are often performed together, and occasionally a grooving or facing operation takes place at the same time as one or more of the former operations. This depends upon the nature of the work and the method of handling.

DESIGN OF TURNING TOOLS

In the removal of stock from the outside of a piece of work by the process of turning, the presentation of the tool to the work is of great importance. It is not our purpose to go into the theory of cutting tools to a great extent, but a few fundamental points which are important in connection with the design will be discussed briefly. The purpose of a cutting tool of any kind is to remove stock as easily and rapidly as possible, at the same time leaving the work in good condition.

For the authors' forthcoming book. All rights reserved.

Modern machine tools are usually proportioned so that they have power enough to pull practically any kind of a tool combination through the work. Some of the heavier machines have excess power sufficient to break the largest tool that can be put in the holder without "stalling" the machine, or even causing it to hesitate. Maximum tool efficiency can only be attained by having a great number of tools working simultaneously, thus removing as much stock as possible in a minimum amount of time. Consideration must be given to the work itself, the method of holding, the accuracy required, and the cutting lubricant. Feeds and speeds must also be properly proportioned in accordance with the nature of the work.

Cutting tools for turret and engine lathe work really consist of two parts, the holder and the tool. The combination of holder and cutting tool are often referred to as a "tool," although this is not strictly accurate.

Two fundamental points in design are as follows: 1. The holder must be so proportioned that it will be rigid in relation to the work. It must be firmly secured to the turret or cross-slide, and must support and hold the tool firmly.

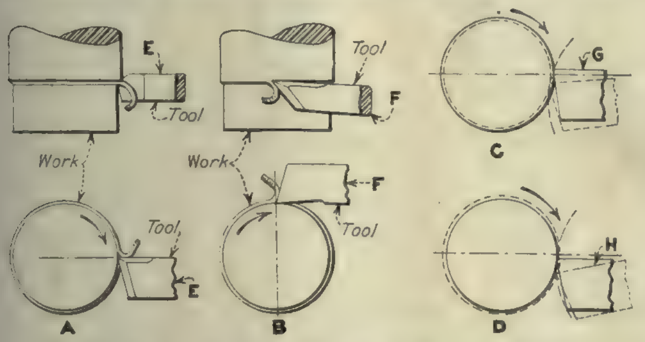


FIG. 288. APPLICATION OF TOOL TO WORK

2. The tool must be large enough to carry away the heat generated by the cutting action, and so proportioned as to withstand the stresses to which it is subjected. Small tool sections are not economical in any way, except for light finishing cuts.

Tools for turning bar stock are arranged in two different ways, viz., radial or tangent to the work. The radial position is commonly used for box tools and multiple set-ups of various kinds. Tangent tools are used most frequently in universal turning tools or other similar devices. In the application of a cutting tool to the work, the aim is to remove the stock by a tool of such shape that the metal will be "sheared" rather than "torn" off.

Several examples which illustrate the application of a cutting tool to a piece of bar work are shown in Fig. 288. The illustration at *A* shows the position of the radial tool *E* with respect to the work. The form which the chip takes is clearly shown. At *B* the tool *F* is a tangent tool. Its shape is somewhat different from that shown at *E* and it removes the metal in a little different way, there being more of a wedging or splitting action in the tangent tool.

The position, with respect to the center of the work, of radial tools for turning is important. If placed above the center, as shown at *C*, the tool *G* under the stress of a heavy cut may be deflected and take the position shown by the dotted lines. This tends to produce chatter, as the tool "digs into" the work when deflected. If the tool is set as shown in the example *D*, slightly below the center, a heavy cut may cause it to deflect as shown by the dotted lines at *H*. However, its position is such with respect to the center and the outside of the work that this deflection tends to throw it away from the work and not into it, as in the preceding case. Both of these examples apply entirely to outside turning, and they are somewhat exaggerated in order to illustrate the points clearly. It is an advantage at times to position the tool slightly below center on a heavy cut, in order to avoid the chatter that might otherwise be caused.

BACK RESTS FOR BAR WORK

If the work being turned tends to spring away from the tool, the result will be inaccurate work and a certain amount of chatter. In order to provide against such a condition, box tools are so designed that the work is supported by means of back rests so arranged that the work lies in a sort of a V. Several examples which illustrate the use of back rests are shown in Fig. 289. In the example *A*, the work is being cut by means of the tool *B*, and opposite to it are two rollers *C* and *D*, adjustably mounted so that they give support to the work during the cutting action. This example shows the use of back rests in connection with a radial cutting tool. Another example shows a tangent tool at *E* and two roller back rests at *F* and *G*. The latter are in a somewhat different position with respect to the tool than those shown in the previous example.

In cutting bar stock with box tools having roller back rests, the rests may be adjusted differently according to the work. If the cutting is being done on a rough bar of stock like that shown at *X*, tool *H* would be set slightly in advance of the rollers *K*, so that the latter would bear against the finished surface. It is possible when machining cold-rolled steel, like that shown at *Y*, to adjust the rollers slightly ahead of the tool *L*, as indicated at *M*. The fact that the stock which is being cut is smooth allows this arrangement to be made.

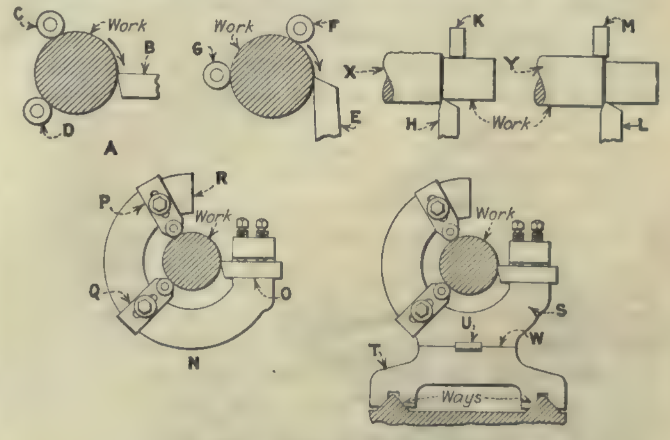


FIG. 289. USE OF BACK RESTS

In order to give a little better idea of the general features of importance in a box tool, another example, which illustrates several points in connection with the design, is shown at *N*. This type of tool uses two adjustable slides at *P* and *Q*, each of which is so arranged that it can be reversed to bring the rollers ahead of the tool, or *vice versa*. The tool itself is clamped in place at *O*, and a large body of metal is under it, so that it has sufficient support. It is necessary to provide a wide opening at *R* in order to allow the chips to pass out freely, so that they will not clog up or pack in around the tool itself and interfere with its proper working.

On work requiring very heavy cutting, it is sometimes necessary to support the box tool. Provision for a condition of this kind can be made by the use of a casting, such as that shown at *T*, which is applied to the ways of the machine and clamped in position. The box tool *S* is furnished with a tongue at *U*, to act as a guide in the member *T* and assist in taking the pressure of the cut. The surfaces at *W* are carefully finished, so that the tool *S* slides freely over the lower member. Very often when a support of this kind is to be made, hardened blocks are provided on the bottom of the tool and on the top of the member *T*. This is simply a detail of the construction regarding which the tool designer will decide according to the nature of the work.

There is nothing much simpler in design than a turning tool used in a turret lathe for a small diameter. At the same time there are some points of interest which should not be neglected by the tool engineer when attempting to design tools of this nature. There is great difference between a tool which will work, and another which will work at maximum efficiency. Almost any kind of a holder with setscrews which can be used to hold a tool will turn a piece of work approximately to a given diameter, if it is set properly. Approximate sizes, however, are not good enough for the majority of work, and the results obtained from properly designed tooling are much more satisfactory than those produced by tools which are poorly designed.

There are a number of well-designed, standard, single-point turning tools on the market that can be purchased cheaply and used for work within their capacity. Certain pieces of work require special tools, either on account of their length or diameter, and the tools must then be designed to suit the conditions. It may be mentioned here that it is always advisable to design a special tool in such a way that it is more or less adjustable, so that it can be used if certain small changes should be made in the work. In other words, the tool should have a certain amount of latitude, so that it can be adapted to other work in case of need.

In Fig. 290 are shown several types of simple turning tools for comparatively small work and short lengths. The work shown at *A* is a plain cylindrical piece that is to be turned by the tool *B*. The machine on which the work is to be done is of the round-turret type, which permits holding the tool by the shank *C* only. A binder of some sort is generally used on the turret to make it secure. The body of the tool is of cast iron enlarged slightly at *D* and made rectangular in shape there in order to hold the tool. The tool *E* is of rectangular section, so that it fits an angular slot in the end of the holder. It is held in place by two setscrews, as indicated at *F*. The section which holds the tool should be made heavy enough to give plenty of stock for the setscrews, so that the tool can be clamped rigidly. If the operation to be done is a finishing cut, or if the amount of stock to be removed is not great, a tool of this type will give satisfactory results. The body of the tool should be made substantially so that it will not spring and cause chatter on the work.

A similar type of tool is shown at *G*, the work being the same as in the preceding case. A different type of turret is used here, and the hole *H* simply assists in locating the tool on the face of the turret. Bolts are used to secure it through the flange *K*. This design would be improved by reinforcing with one or more ribs, as shown by the dotted line at *L*. In general the type shown here will permit of slightly heavier cuts than the style at *B*, because of the added support that the turret gives and the somewhat stronger construction throughout.

It is very convenient to make a turning tool so that it can be adjusted both for length and diameter. This can be done as shown at *M*, in which the tool *N* is held in a bar which is adjustable lengthwise in the holder *O*. The holder is clamped in place in the turret by means of the shank *P*. The bar *Q* is flattened on its upper side to prevent it from turning, and can be clamped in any desired position by means of the setscrew at *R*. A similar type of holder applied to another kind of a machine is shown at *S*. The general features of this holder are like those previously described, the bar *T* being adjustable, so that it can be moved longitudinally as may be required.

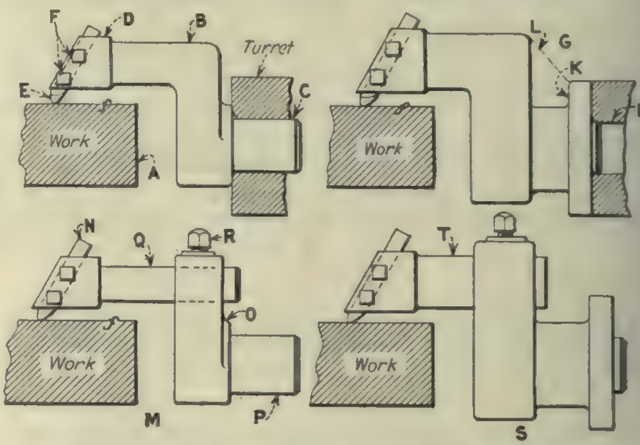


FIG. 290. SIMPLE TURNING TOOLS FOR TURRET LATHES

None of the tools shown in this illustration are suited for heavy cutting, as they are not intended for this class of work. They will give excellent results on work which does not require the removal of a great amount of stock, but care must be taken in the design to make all parts heavy enough to stand the pressure of the cut.

A few points have been mentioned in connection with the design of holders for turning tools, but very little has been said about the cutting tools themselves, as far as methods of holding and adjusting are concerned. Very frequently several tools are required to produce different diameters at the same setting. They can be located in the same holder; but it is necessary to make the holder proportionately stronger, as the pressure of the cut is greater. Thus, a holder for a single tool can be much lighter in construction that one used for three or four tools cutting together.

The work *A* shown in Fig. 291 is to be finished on two diameters, as indicated by the finish marks. The tool holder *B* is of similar type to those previously described, but it has two tools in it, shown at *C* and *D*. These tools are spaced the correct distance apart, as determined by the shoulders on the work. They are held by means of setscrews in a slot in the end of the holder. In general, this tool conforms to standard practice, but the end *E* should not project beyond the end of the tool, as this limits the adaptability of the tools so that it can not be used to turn work close to a large shoulder because of the interference at the point

E. This trouble can be easily avoided, however, by cutting off the end of the block, as shown by the dotted line.

In setting two tools which are to be used to turn shoulder distances and diameters, it is not advisable to set both of them at an angle unless they are so arranged in the slot that they can be moved about. It is quite difficult to grind and set tools of this kind to produce accurate diameters and shoulder distances at the same time.

Another method of making up a tool block for the same piece of work is shown at *F*. The toolholder *G* is a casting similar to the one just described, but the block which holds the tool is adjustable vertically, so that several diameters can be handled. Other blocks with different tool spacings can be used in the same holder. An objection to this design is that the end *H* extends beyond the first one of the cutting tools. For special work this might not cause any trouble, but it would limit the field of action of the tool if it were wanted for another piece of similar work. In making up a holder with an adjustable block, the latter must be made very heavy, as the pull of the cut comes against the block. The two screws shown at *K* and *L* will not be sufficient to hold it. It would be an improvement to use four screws instead of two. A still more rigid construction could be obtained by placing the block on the other side of the holder *G*, thus letting the pull of the cut come directly against the body of the casting.

The diagram at *M* shows another method of arranging two tools for cutting diameters and shoulders on the same piece of work, one of these tools *N* being set straight, while the other *O* is at an angle. It would be better to arrange the tools in the opposite way, and use the angular tool at *N* and a straight tool at *O*. This method would allow the tool to work close to a shoulder, if necessary.

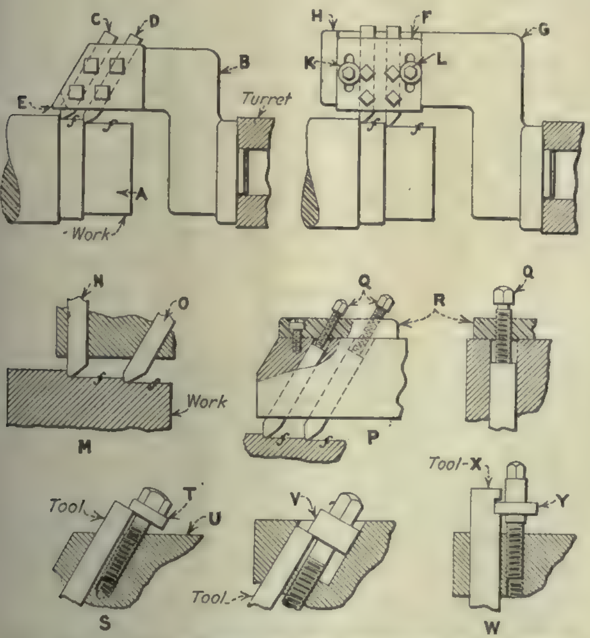


FIG. 291. ARRANGEMENT OF TURNING TOOLS AND BACKING-UP SCREWS

Wherever possible, it is good practice to use a backing-up screw behind the tool, as shown in the example at *P*. The two screws at *Q* are supported by a plate *R* fastened to the top of the holder. The tools can be adjusted for diameter by means of the backing-up screws, which greatly assist also in preserving diameters on the work, as they form fixed stops against which the ends of the tools rest.

Another method of adjusting a tool is shown at *S*. This method is limited in its action, as the collar on the screw at *T* will interfere with the casting at *U* after the tool has been ground several times. It is better to arrange the screw as shown at *V*, by counterboring the casting so as to permit a greater amount of movement. Another method for the same purpose is shown at *W*. The tool *X* must be made specially when this kind of an adjustment is used, as the collar *Y* fits a groove in the tool itself. For certain kinds of work this arrangement may be found advantageous, because it permits adjustment both in and out.

The Payment of Unemployment Relief

BY JOHN S. WATTS

In this article, I propose to consider the necessity and advisability, or otherwise, of the payment of unearned wages to the unemployed during periods of unavoidable idleness.

The first point to consider is the effects of the present system, or lack of one, of leaving the burden of supporting the unemployed to be borne by the unemployed themselves, with only what assistance from the community as is absolutely necessary to support life. In the better-paid trades, it is expected that the workers will save sufficient from their wages in good times to tide them over the dull periods. This is, in essence, nothing else but the payment of unemployment relief to that class of workers which is strongly enough organized to compel it, in the form of increased wages, part of which wages are intended to form a relief fund administered by each worker individually. The weakness of this system is that the unemployment fund is paid, in the final analysis, by the public to the workers, and may or may not be used by them for its intended purpose, depending entirely upon the thrift and foresight of each worker.

If, through the extravagance or misfortune of the worker, the surplus is not saved, but is spent while work is plentiful, the worker and his family must be supported by the community at additional expense or left to starve, when the worker is idle. The payment of sufficient wages to enable the worker to set aside funds for his support during periods of temporary idleness, is defective in that the worker practically always looks upon the wage received as the income he should have continuously, and even if he does save a sufficient part of it, he feels it unfair that he should have to lose his savings through inability to get work.

In the majority of cases, those who are thrifty do not get out of work, but those who do not save are the very ones to be thrown out of employment first. Thus, the extra wages paid for unemployment relief are either misused to furnish a higher standard of living to the thrifty, or are wasted in extravagant living by the unthrifty, and in either case are, in large part, diverted from their intended use.

The lower-paid classes of labor can hardly be expected to be able to finance themselves in bad times, and when unemployment comes to them a week of idleness usually sees them destitute and a charge upon the resources of the community.

Then again, this system is weak in that it pays the same amount to the single man as to the married man with a family to support, which is either too much for the one or too little for the other. As already suggested, there is no control over the money to see that it is reserved for its intended purpose, and in effect it creates a false standard of living among the unthrifty in times of plentiful work, and fails in fulfilling its purpose in bad times. Moreover, it is actually paid only to those who are already sufficiently well paid to be able to afford the expense necessary to organize themselves into a body strong enough to enforce their demands for sufficient wages to carry them through the lean periods.

Payment of Relief Now

From a consideration of the above facts, we may conclude that we actually do pay unemployment relief, although in a most inefficient and uneconomical manner, and presumably because it has been necessary to do so. Indeed, unless we are willing to allow a part of the people to die from starvation or other privation during the ever-recurring slumps in trade, there is no room for argument on the necessity for such relief being paid in some form or other. Even if we were able to contemplate allowing such a state of affairs, the payment of unemployment relief would still be at least advisable, if not necessary, because history proves that the mildest and meekest of people will become rebelious if deprived of the necessities of life, and the ultimate cost of subduing the tumult would be greater than would be necessary to alleviate its causes.

The fact that, when a famine strikes the whole community, all will submit to deprivation with more or less equanimity is beside the question, as in the circumstances we are considering, only that part of the population which is out of work is in want, and there is not necessarily any particular scarcity of goods. In fact, there is frequently a surplus, and under such circumstances, whenever the deprivation reaches a certain point, the sufferers, no matter how docile they be ordinarily, will attempt to take by force what they need, and generally destroy much more than what would have satisfied their demands.

It follows, therefore, that even from a purely commercial standpoint, it is both necessary and advisable that unemployment relief be paid, and that we do actually pay it now, except in those extremely rare cases where the one out of work actually dies from privation.

Under the present system, whenever unemployment is more widespread or lasts longer than usual, a considerable portion of the idle workers become subjects for charity, and suffer both moral and physical trials, which undermine their physique and their morality to a point where their efficiency as workers becomes seriously impaired. They are then easily led by agitators to follow Bolshevistic theories, which turn them from producers into dangerous nuisances. Some others, finding it possible to live on charity, will adopt this easy life and cease entirely to produce.

It may be contended, with some truth, that this applies only to a small percentage of the workers, and that most of them are well able to tide over a temporary period of idleness. But, the point I wish to make in this connection is that the man who by thrift has saved up enough to carry him through, has not consciously set aside a percentage of his pay as having been paid him for that purpose. He will, when he returns to work, use every effort at his disposal to reimburse himself for the savings he has spent, and which he regards as money earned during his working period and lost through no fault of his own. Whether he is successful in this depends not upon the ethics of the question, but upon his ability and the strength of the organization to which he belongs; and successful or not, there remains with him a feeling of discontent at his loss, which he will lay to the blame of his employers.

Separate Relief Needed

The remedy for this state of affairs would seem to be the payment of unemployment relief, separate entirely from the payment for work done, basing the amount of such relief on the man's responsibility in such matters as the family to be supported. In this way, the thrifty would be freed from the discouragement of seeing their savings dissipated by causes over which they have no control, and the extravagant would be prevented from spending that part of their wages which should be set aside for bad times. By paying this relief as a right due to every one, the stigma of receiving charity would be removed, and the possibility of adding to the professional mendicant class be eliminated.

The relief would be more fairly distributed than now, as those poorly organized workers would get precisely the same as those who were strongly organized. The cost would be much less than is actually being paid out now, especially when we remember that the stronger trades are steadily paid a total wage including the amount necessary to cover unemployment, whether unemployment ensues or not. Further, when we as a people commence paying unemployment wages, it is to be expected that we will be more keen on preventing unemployment than we are at present, because then the cost will come directly home to us, instead of being absorbed into the general cost, and paid by us all indirectly.

The indirect losses of the present lack of system in unemployment relief, such as the losses incurred by the storekeepers giving credit during periods of unemployment, the losses at the banks through the failures of retailers giving this credit, and other losses which the reader can easily add for himself, are in themselves enough to warrant the systematic payment of this relief.

Making Oil Well Tools

Reamer Cutters Forged from Nickel Steel Billets — A Universal Fixture for the Planer — Drilling, Slotting, Milling and Turning Operations

BY FRANK A. STANLEY

THE illustrations show features of the practice of the Wilson & Willard Manufacturing Co., Los Angeles, Cal., in the production of under reamers for oil well work. These under reamers are made in various sizes from 3 to 20 in. in diameter and range in weight from say 200 lb. in the small size to something like a ton in the case of the 20-in. tool. The reamer parts are of steel forgings and some interesting methods are applied in machining the body and cutters.

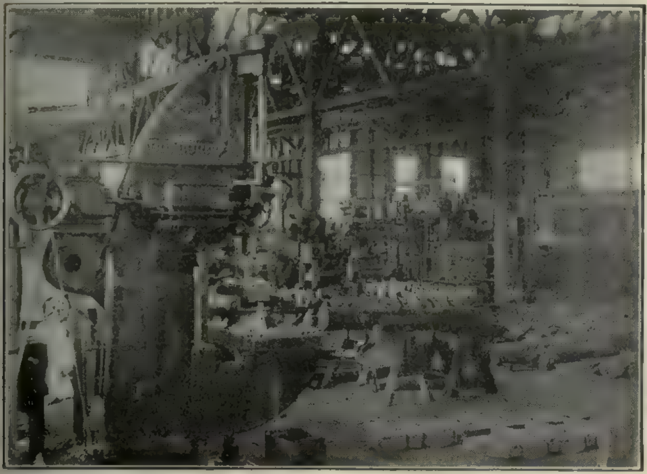


FIG 1. VERTICAL MILLING OPERATION

An idea of the character of the forgings used in the reamers will be gathered from Fig. 1 which also illustrates a vertical milling operation that will be referred to later. The construction of the reamer will be seen in Fig. 2 which shows an assembly drawing of the 10-in. size. Here the body is represented in longitudinal section at *A*, the cutters at *B*, the T-bar to which they are attached at *C*. The shank of the T-bar passes up through a heavy coiled spring *D* enclosed in the hollow body *A*.

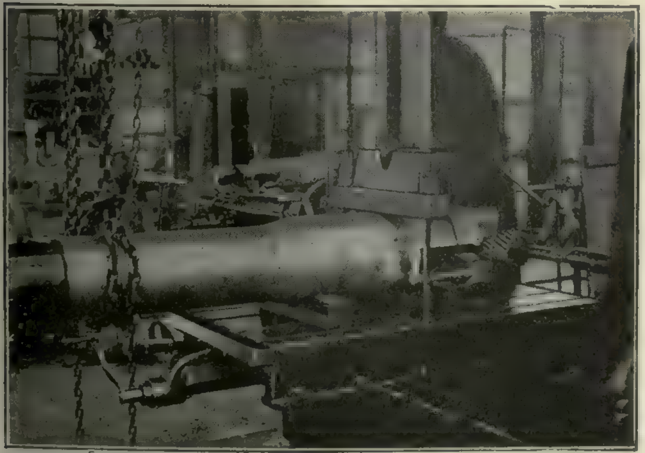


FIG. 3. MILLING END OF REAMER BODY FOR THE CUTTERS

The nickel-steel forging for this one-piece body is turned on the outside and then mounted in a lathe for drilling out the interior. The drilling is accomplished with long flat drills operated under a liberal supply of cooling liquid which is forced to the point of the drill under pressure and washes out all chips. The feed for the drills is applied through a special ratchet and lever which force the feed spindle forward and advance the tool into the cut.

The drilled body then is placed in a slotting machine where the metal is cut out through opposite walls to form openings for the cutter shanks and where the metal at the extreme end of the body is cut away at the sides to leave the projecting ears *E*, Fig. 2. The enlarged chamber *F*, at the end of the body, is bored out in the lathe to the required taper for the cutters and the inner and outer corners formed to the desired radius as represented in the drawing.

For finishing the side slots to width to receive the cutters, the reamer body is mounted on the machine shown in Fig. 3 and milled out in the manner indicated. The body rests on a pair of V-blocks in which it is secured by a heavy strap with long bolts at each end. The outer end of the forging is carried by a chain sling suspended from the hook of a hoist.

Forging the cutters under a 3,500-lb. steam hammer is illustrated by Fig. 4. The billet is suspended in an endless chain on a crane and manipulated by the long tongs in which it is handled between heating furnace and anvil. The cross lever on the tongs enables the workmen to roll the work over from face to face for operation under the hammer.

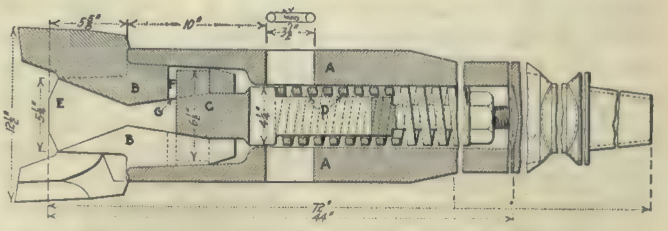


FIG. 2. AN UNDER REAMER FOR OIL WELLS

The forgings are heated for several hours in a gas furnace and allowed to cool over night. This relieves the surface hardness and allows the parts to be machined without difficulty.

Some of the operations through which the cutters pass in the process of finishing are illustrated herewith.

For all sizes of reamer cutters there are special planing fixtures, two of which are represented by Figs. 5 and 6. These fixtures are so designed as to be universal for any sizes of cutters within their capacity; that is, once the forged cutter is gripped in the fixture, it is carried through different planing operations without being removed from its holder and in taking successive cuts on the exposed face of the work the fixture is adjusted to the necessary positions without being released from the planer table.

Referring to Fig. 5, the fixture is shown as set up for the crosswise planing of the cutter shank. The work is gripped in a holding block mounted upon a trunnion, *T*, Fig. 7, upon which the holder may be adjusted to different positions for the various angles of surfaces to be machined. These angular surfaces are taken care of by positive locations through an index pin and suitably located holes; and in any position of holder, the parts are gripped fast by clamp bolts at the side of the base casting. The work itself is gripped by setscrews in the holding casting.

The main casting in which the trunnion fixture is mounted is itself mounted upon a swivel plate upon which it can be indexed around in a horizontal plane to bring the work into longitudinal position as represented in Fig. 6. In this view the forging to be planed is at a right-angle to the position occupied in Fig. 5. This photograph also shows the jack which is placed under the holder to support the work against the pressure of the cut.

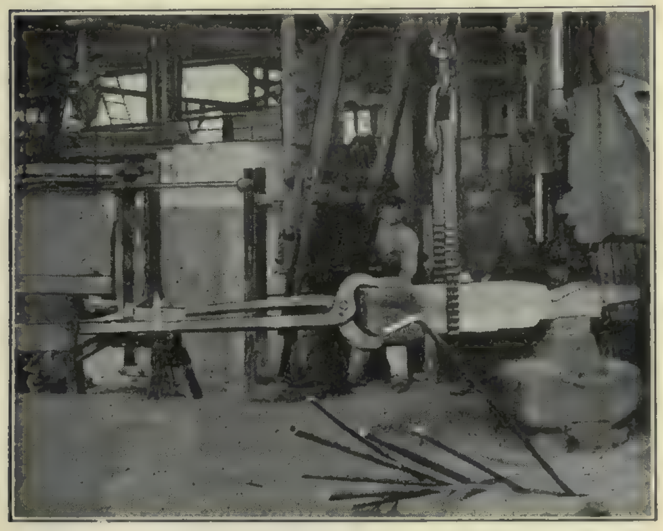
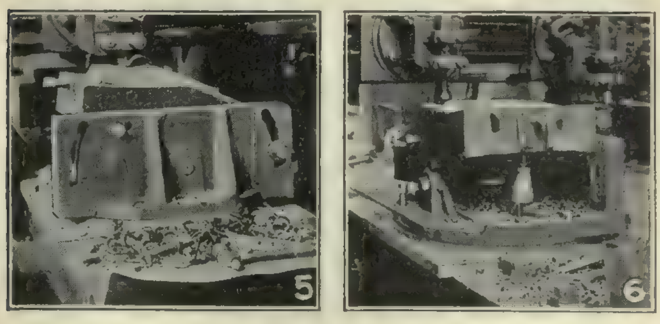


FIG. 4. FORGING THE CUTTERS

The forgings are heavy and owing to their shape they are very awkward pieces to hold for any of the planing cuts unless mounted in some such device as shown. Then owing to the several angles to which the surfaces are finished, a great amount of time would be consumed in the mere setting of individual forgings for successive cuts, to say nothing of the difficulty which would be experienced in getting these angles established properly for a large number of cutters.



FIGS. 5 AND 6. PLANING THE CUTTERS

Machining the sides of the cutters for fitting into the seats milled in the body, is accomplished in other fixtures of suitable design.

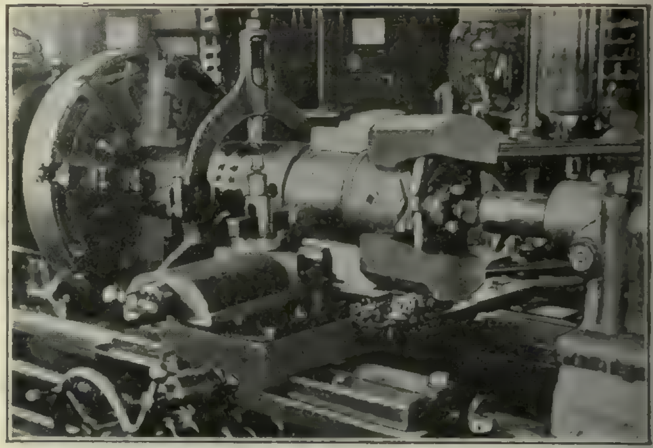


FIG. 8. A TURNING OPERATION

Turning the outside diameters of the cutters is attended to with the two cutters set into position in a holding body as shown in Fig. 8, where the operation of finishing the rear ends of the cutters is represented. The turning of the various diameters involves also the finishing of the tapered portions, that is the large diameter at the front end, the bevelling of the outer ends and shoulders and the turning of the tapered rear ends of the cutters where they fit into the corresponding tapered mouth or chamber in the body of the reamer.

This means that there are at least four different tapers to be turned on each pair of cutters, and suitable attachments and devices are applied to set the cutters properly for each cut. In the operation illustrated in Fig. 8 a pair of toggle-shaped jaws are set out

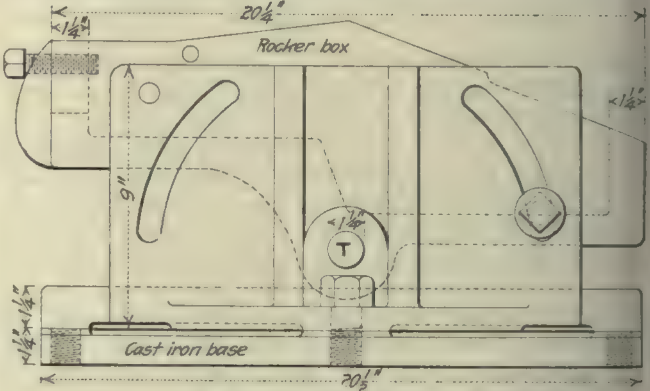


FIG. 7. SIDE VIEW OF PLANING FIXTURE

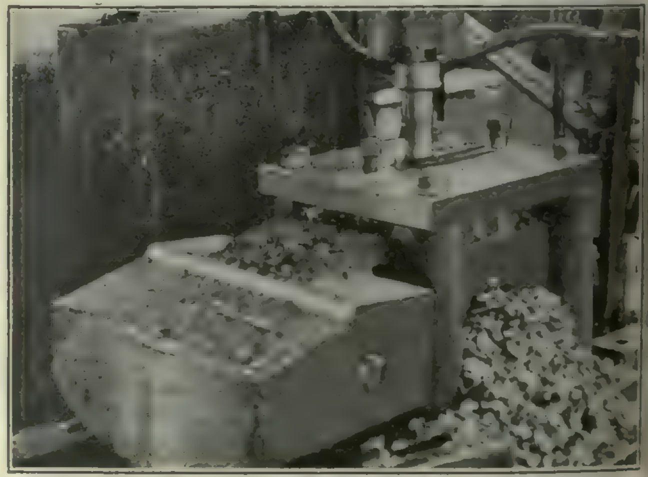


FIG. 9. CUTTER DRILLING JIG

between the inner faces of the cutters to force them outwardly to correct position so that when a straight cut is taken across the outside the sizes will be correct. Other fixtures hold the cutters for the proper finishing of the other outside surfaces.

There is in each cutter a slot (shown at *G*, Fig. 2) to admit the ears on the T-bar, and these slots are formed by first drilling out the stock as far as possible by means of a jig and then finishing the job by end milling.

The drill jig used is of the type shown in Fig. 9 and is in the form of an open device into which the machined cutter blank is placed, after which two setscrews are tightened to secure the work against possibility of shifting during drilling. The jig plate is provided with series of bushings in a row spaced as closely as feasible. After drilling, the thin web left is removed and the slot sized by means of the operation already referred to in connection with Fig. 1.

For end milling, the machined cutter is secured in the vise on the table of the machine and supported under the overhanging end by means of a short jack which serves to keep the work in level position. The end milling is then accomplished, completing the slot.

In the case of the cutters shown in Fig. 2, the slots thus cut are $\frac{5}{8}$ in. wide by $3\frac{1}{2}$ in. long.

Squeezing Out the Surplus

By John R. Godfrey

The more I get to know old man Johnson the more I wish he were twenty years younger: He's got such a bunch of the good horse sense that we need so badly just about now. And it takes so long to get under the skin of the hard-shelled oldtimers who pride themselves on the good old days and want to go back to pre-war days in everything. But not Johnson—he knows better.

They had a meeting of motor builders the other day and he rang me in again as his alleged secretary. He says it adds to the dignity of the occasion and nobody knows whether I'm a real "sec" or not. It wasn't to set or hold prices, of course—such meetings never are —but they got down to hardpan after the first half hour and there was sure some fireworks before we adjourned *sine die*, or something which means that some of them will be among the late departed before they meet again.

The old-timers don't exactly love Johnson, but the younger men sort of egg him on. He says about what they believe and it carries weight because he's been in the game a long time. He kept pretty quiet till old man Stanhow proposed a big combination of motor builders, each man putting in his plant, at a good price of course. and letting the public in as a special favor, to hold the bag. Then Johnson got into action.

"Can't be done, Stanhow, even if we wanted to. The public has its eyes open and I wish they were open wider. You want to unload a plant that was built at high prices and equipped with any old junk you could buy at a profit at war-time prices. You'll be lucky if you get 10 per cent and you won't get that if you hug the delusion of a profit. You are one of those who patriotically broke into the motor field as a war measure —made a big profit—and now want to stay in a game that's overcrowded. You better drop motors and go back to sawmills. The going won't be any better for war babies than it is right now.

"Let's look the facts in the face and not kid ourselves. There's over twice the motor capacity in this country there was in 1914. We all have enough stock to supply a normal demand for months. Besides that there are thousands of used motors on the market or ready to sell as soon as anyone hears any sound like an order. This can only mean one thing—some of us have got to get out or be forced out.

"Probably all of us think the other fellow ought to get out and leave him the field. Perhaps we might draw lots—but that would only be a temporary settlement. Chance would leave in the wrong ones. There's got to be a weeding out of at least 50 per cent of our building capacity—and that means a lot more than 50 per cent of the shops.

"As long as you've asked me to talk I'll suggest a way. All of us must lay the cards on the table, face up. Show our plant cost, capacity and condition. We must show our costs for material, labor, factory overhead, office overhead and selling costs, not forgetting our available surplus, cash and credit. And lastly our profit, both total and in percentage.

"This ought to show pretty clearly who has a right to stay in the game. It's just possible that those who stay can utilize some part of the equipment or patents of those who are eliminated. But it must be at a bargain price. The business won't stand anything more."

Of course Johnson isn't popular with the daddies of the war-baby shops. Stanhow threw a fit about co-operation and restriction of output so that all could live.

"Fine suggestion, Stanhow, especially as you are the fellow who told us how un-American it was for labor to restrict output so as to make jobs for more men. You proved that the more work they did the more there'd be to do. But you don't think it'll work with motors evidently. And your kind of co-operation is lop-sided. The only co-operation that can live is the kind that helps everybody, clear down to the consumer.

"Whether we get together in a new corporation, or some voluntarily withdraw on the basis of the statements I suggested, I feel the time has come to reconsider prices very carefully. Little cuts of 5 and 10 per cent only delay the game. The buyer waits for what he calls a *real* cut in price. When we cut, let's make it a real one—show why we made it, why it can't go lower— and see if we can't get the buyer to have some confidence, just for a change.

"Our shop has gone into costs pretty carefully. We've figured these costs on present-day values, not on fifty-dollar pig iron. We got stuck with some of that and must take our loss. Our castings will be cheaper, likewise some other materials. Labor will not go down much. If it does we lose a big market for all sorts of manufactured goods from vacuum cleaners to dishwashers and the like. Selling costs ought to go down if we put prices down to rock-bottom at one fell swoop. That's what we are going to do in any case. We're going to put prices where we believe they belong. And incidentally, I happened to know that this is below the shop cost of some of the other motors.

"With these shops eliminated the selling costs will go down, more motors will be sold and we'll be started back toward a normal business. I hate to seem ruthless, but I don't play with any cards up my sleeve. If I had high production costs and small volume—I'd try and get out while I still had a shirt and an overcoat left."

I'm wondering whether the old man isn't more of a prophet himself than some of them like to think.

Why Work Curls Towards the Wheel While Being Surface Ground

Plausible Theory Deduced from Long Experience — Work Heated Beyond Critical Point in Numberless Places Takes Permanent Set When Quenched by Coolant

By E. A. DIXIE

ONE of the commonest phenomena of surface grinding is the curling of the work towards the wheel. Having had much to do with surface grinding during the past few years this objectionable feature, especially with thin work, has given a great deal of trouble. It has been said that if the cause of an effect is found it is a simple matter to effect a cure. With this in mind I have attempted to run down the cause of curling in the hope that a remedy would be evolved which would assure the production of perfectly flat thin work. I believe I have found the cause, but so far no cure.

The cause of curling towards the wheel is the shrinkage of the side of the work which is next to the wheel. I don't ask anyone to believe this till sufficient evidence is offered in proof. But I do ask—is it not reasonable to suppose that the work would curl towards the wheel if it were possible to shrink and shorten the side being ground, while the length of the other side remained unchanged? If one takes a piece of steel 1/32 in. thick and 1 in. wide by, say, 6 in. long, heats it, then holds it horizontally and spills a few drops of water on the top surface, the two ends will curl upwards. If the piece of steel is again heated and wet on the convex side the ends will curl and it will become concave, but the effect is not so pronounced because of the previous shortening of the other side. A blast of cold air will produce results similar to those produced by the water.

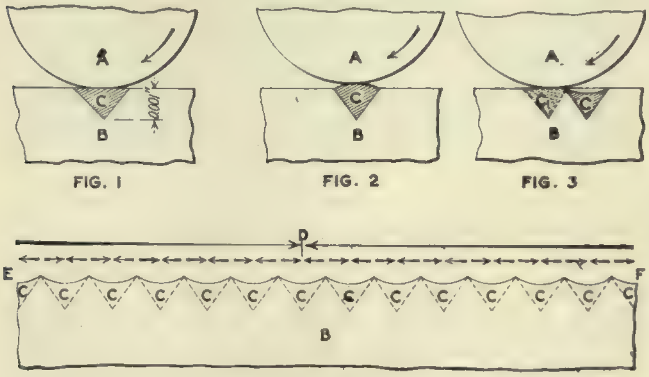


FIG. 1 FIG. 2 FIG. 3

FIG. 4

FIGS. 1 TO 4. DIAGRAMS SHOWING THE CAUSE OF CURLING TOWARDS THE WHEEL

The reason I have suggested the employment of such thin stock for this experiment is because the effect is more noticeable, but the same effect is present when thick stock or even square or cylindrical bars are used. Have you ever seen an expert straightening hardened steel reamers? He heats them till solder will melt on them, places supports under the two ends, applies pressure to the convex side and then wets the same side with water. If the reamer is long, one can see the ends curl towards the side to which the water is applied. The water chills and contracts that side while the other side is still warm.

The force which causes the contraction is enormous, as is well known to all engineers, and is sufficient to put a permanent set in the opposite side of the piece, in other words it is greater than the yield point of the steel.

With conditions as outlined above, the piece curls toward the side which while heated is suddenly cooled Similar conditions exist during the surface-grinding operation. The work *after* passing the wheel is *appar ently quite cool,* but is *very hot exactly at the poin where the wheel is taking its cut.*

The critical points of all hardening steels are some where over 1,300 deg. F. This means that in order t harden a piece of such steel one must heat it to or *little over* the critical point to cause it to harden whe quenched. If it be quickly quenched at this temperatur it will *harden,* but if it be heated *to below* the critica point and then quenched it will *not harden,* or if it b heated to the critical point and allowed to cool *slowl* to below the recalescent point it will *not harden.* I thin all metallurgists agree in this.

If a piece of *annealed tool steel* is ground on the sur face grinder and a *hard* wheel and *heavy* feed is use there are likely to be "burnt" spots on the surface Such burnt spots are very noticeable when one uses vertical surface-grinder either with or without coolin water. The burnt spots show discolorations similar t the so-called "temper colors," which vary from pal straw to deep purple or blue. These burnt spots ar usually *depressed* below the surrounding surface an very often *they are file hard.* Not only are they de pressed below the surrounding surface, but their center are lower than their edges. That is to say, a burnt spo is concave, with its lowest point in the center. Th fact that they are hard indicates they have been heate to or above the critical point, then rapidly cooled.

There is a great deal of friction between the dull o hard wheel and the work and the heat at the point c contact is so intense that the surface of the work i heated to or above the critical point. However th traverse of the grinding machine table is constant an the heated area passes quickly from under the wheel, exposed to the flood of cooling water and is instantl chilled, becoming hard as evidenced by the hard spo previously referred to.

THINNESS OF HEATED AREAS

I do not mean to say that these heated areas are any appreciable thickness; they cannot be, as the su rounding metal being cool absorbs the heat very rapidl At most there is but a very thin film of metal whic is heated to or above the critical point, and is therefo capable of being hardened when it is quenched by th cooling water. That this is really a thin film of met of no appreciable thickness is proved by careful grin ing. For if the surface be removed by successive cu of slight depth and the surface of the burnt spot tested with a file after each cut, it will often be fou that the hard surface is *not over a thousandth of an inch thick.*

As the surfaces of these burnt or hard areas are *below* the surface of the surrounding metal and as this feature is *almost invariably* present, there must be some reason; it cannot be just chance.

The reason why the surface of the burnt areas are below the surrounding surfaces is not far to seek. At the point where burning takes place the thin film of metal is heated by the friction of the wheel till it is above the critical point. It is in a quasi-plastic state. On top of it is the wheel and surrounding it elsewhere is the cold or comparatively cold metal of the body of the work. This small "lake" (if I may so term it) of plastic metal occupies more space than it did when cold. It cannot expand downwards because of the unyielding body of cold steel below; it cannot expand sidewise because of the cold steel which surrounds it, so the only direction in which it can expand is upwards against the wheel, and the minute quantity of metal which thus protrudes is cut off and removed by the rapidly revolving wheel. The next instant the wheel passes on beyond this portion of the surface and the cooling water chills the burnt "lake." The instant it is chilled it shrinks back to normal density and as there is now less steel in the lake than there was before its top was cut off by the wheel, its surface shrinks below the surrounding surface. Naturally the greatest shrinkage takes place at the center where the heated area was deepest.

Results Under Certain Conditions of Grinding

These examples of burnt surfaces are the *extremes* which are given as evidence that under certain conditions of grinding the surface of the steel is heated to at least the critical point of the steel. In ordinary flat grinding the surface does not become so highly heated. But there is no doubt that the surface is superheated (not necessarily to the critical point) in a series of very minute points or lines where the wheel has contact with the work. The heating by the wheel and cooling by the coolant, or by the air, of these minute points or lines is practically coincident, so rapidly does the cooling follow the heating.

In the illustrations I have shown the idea diagrammatically, similar reference letters being used throughout the sketches to designate similar elements.

In Fig. 1, *A* is the wheel, *B* the work and *C* the highly heated area immediately below and in contact with the wheel. I have arbitrarily stated its depth as 0.001 in. but this may, in either direction, be very far from its actual depth.

In Fig. 2 the wheel *A* is *raised* above the surface to show how the top of the heated area *C* would tend to rise toward the wheel. In practice the wheel would, of course, not be thus raised but would remain on a level with the surface being ground, and the curved top of the heated area *C* would be cut off level with the rest of the surface.

In Fig 3 is shown the shrinkage which takes place on the top surface of the heated area *C* after the wheel has passed and it has been cooled. In Fig. 3 the wheel has passed *C* and is now heating the area C^1 shown in dotted lines.

In Fig. 4 is shown a series of areas *C*, each with two arrows indicating the direction of shrinkage in each of them, and above are two long arrows showing the direction of the aggregate shrinkages of all the areas on each side of the center *D*, of the work. It must be borne in mind when considering the sketches that the areas *C* in properly surface-ground work are very short, possibly not more than two or three thousandths of an inch, and perhaps not even that. The sum of the shrinkages on each side of the center is toward the center, thus we have a greater or less force tending to pull the point *E* toward *F* and vice sersa. The result of this force is to curve the two ends *E* and *F* upwards, leaving the work hollow on the top, which is the wheel side.

I can hear some of the readers say: "If the wheel heats the top of the work that should make the bottom and not the top concave." This perhaps might be true if the applied force were as great; but it cannot be. Heating the top would momentarliy make the bottom concave, but hot metal is more easily compressible than cold, so that it is reasonable to assume that the bulk of the force created by heating the top would be rendered ineffective by the compression of the metal in the heated top. It is very doubtful whether the force of expansion of the top could be made so great as to exceed the elastic limit of the cold bottom and cause it to take a permanent set.

Reminiscences of an Old-School Machinist

By R. Thomas Huntington

Sixty years have brought about many changes. Not only has there been a wonderful increase in the capacity of machine tools that were then standard, but new ones have been introduced in infinite variety so that now many jobs that, in my boyhood days could be performed only by hand at the expense of many hours, or perhaps days, of patient and painstaking endeavor, are now regularly finished in a matter of minutes by precision machinery.

So, too, have the shops themselves changed. Though the Norris Locomotive Works wherein I served my apprenticeship was a large shop, it was not large in comparison with the large shops of today; nor were shops of even that size common. Machine shops were much more likely to be conducted by one man, or by two men in partnership; men who had "served their time" and had worked up from the ranks to a position where they were able to start a shop of their own.

Practical Men Shop Proprietors

Machine-shop proprietors were thus practical men; working at least part of the time at the bench with the "boys" and keeping in close touch at all times with their employees so that many of the evils that follow in the train of the later day large organizations were then unknown.

Such were the conditions when I first went to Boston in 1870. During my experience there, a part of which I have already set down here, I saw the beginnings of some of the organizations that are today numbered among the country's largest producers, and made the acquaintance of men whose names have become known all over the world as leaders in the machinery and machine-tool industry.

I remained in Boston nearly ten years; going from there to a near-by town in the employ of a man named Remington who had devised a method for making jewelry by a process which he called by the high-sounding title of "Kalvano-Plastic-Manipulations," but which in plain English was nothing more than electrotyping. He would take an impression in prepared wax of the object he sought to reproduce, put the wax mold in the plating bath and leave it there all night, or perhaps for several days, according to the thickness of deposit that was desired.

Mr. Remington experienced considerable financial difficulty in the Boston markets and finally removed his small plant to Providence, R. I. I did practically all the work of taking down the machinery and re-erecting it in the shop which he had secured in the latter city. Shortly after getting started in Providence he again became involved in money troubles, and I was obliged to seek employment elsewhere.

The micrometer caliper was then a comparatively little known tool and it was in Providence that I saw one for the first time. I happened into the Loomis hardware store on Weybosset St. at a time when a salesman was trying to sell such a tool to a customer—a rather oldish man and evidently a mechanic—who was decidedly skeptical of the capability of the device for making the minute measurements claimed for it.

"You can never make me believe," he said, "that a man can work to such a close measurement as the one-thousandth part of an inch." Though never having seen the tool before, I was familiar with the principle upon which it was constructed, and, seeing the salesman at the end of his rope, I butted into the conversation. "My friend," I said, "did you never fit two parts together and have them slide freely but without shake?" "Many a time," he replied, "I have been doing it all my life." "Then," I told him, "you have been working well within the one-thousandth part of an inch with nothing better than your old callers." I thereupon explained to him the principle of the instrument; that there was quite a distance between the marks upon the thimble that represented thousandths; and that by using this graduation in conjunction with the fine-pitched screw it was quite possible to measure within the limits claimed.

I succeeded so well in convincing the man of the practicability of the micrometer that he bought the tool then and there.

I applied for and secured employment at the well-known shops of Brown & Sharpe, and was assigned to the "punch and die job" on the third floor of the sewing machine department, which was under the general foremanship of H. M. Leland.

I found that a good deal of the manufacturing in this shop was done upon what was practically a contract system. Different jobs, such as the "frame job," the "milling machine job," the "screw-machine job," etc., would be let out to capable mechanics who would employ others to help them when the job became too big for their individual capacity; and thus there were a number of sub-foremen under the general supervision of Mr. Leland, each of whom would have from one or two to a dozen men working for him.

Not long after I went there Mr. Leland decided to establish a new job, the drilling job, and of this work he placed me in charge. Before that, the different contractors had been accustomed to do their drilling whenever and wherever they could find an idle drill-press, and there had been much trouble and loss of parts from careless or indifferent workmanship in this respect.

My new department had four Pratt & Whitney four-spindle drill presses, two single-spindle sensitive drill presses, and a tapping machine. My work was to set up these machines for each new job that came along, see that the first pieces were drilled and tapped to conform to all the gages, and then to turn the work over to a machine hand; keeping tabs upon him from time to time to see that the work did not fall off in quality. As most of the jobs were paid by the piece, this was not always an easy task.

All drills, taps, etc., necessary to the job, were furnished to the man free of charge at the start, but if he broke any he was obliged to replace them at his own expense. The company made all these small tools themselves and supplied the men at cost.

Some time after I entered their employ Brown & Sharpe instituted the practice of sending their foremen out upon the road as salesmen; with the double object in view of getting acquainted with the users of Brown & Sharpe products, and seeing for themselves what others were doing along similar lines of manufacture. On one such trip through the Middle-West Mr. Leland, the foreman for whom I worked, was offered the superintendency of a shop just starting in business in Columbus, Ohio, to manufacture the Jordan furniture caster; an offer which he accepted, and he soon after severed his connection with Brown & Sharpe.

Not being entirely satisfied with conditions as I found them after Mr. Leland's departure, I wrote that gentleman in Columbus, offering my services which offer he accepted, and I soon joined him in the Ohio city, where I tried to the best of my ability to assist him in lowering the cost of production to a point where the firm could stay in business.

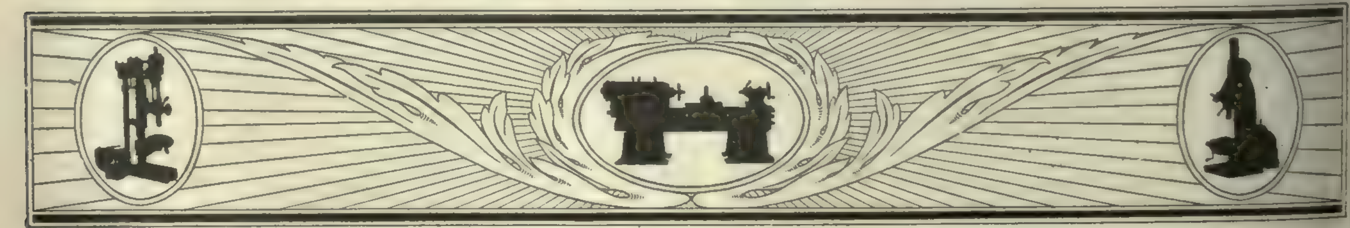
The Jordan caster was of excellent design but it was too complicated to compete in the open market with the ordinary form. It had two wheels, or rollers, instead of one, and the axes of the wheels were inclined away from each other so that the wheels were quite close together at the bottom and half an inch or so apart at the top. The number of parts and the difficulty of assembling them made it a losing proposition to manufacture.

A Use for Old Bearing Balls

By Dave Hughes

Recently we had a number of clamping screw pins to make with a ball on each end. The pins were ¼ in. in diameter.

While turning down the ends of the pins, I put the required number of bearing balls in the furnace for annealing. The annealed balls were held in a universal chuck against a stop in the back, spot-faced to the diameter of the pin and drilled for a drive fit. They were then driven on and polished. The balls were reclaimed from the scrap box.



Grinding Differential Spider Arms

A Method Which Eliminates the Use of Centers and an Inspection Gage for Insuring Accuracy in Alignment

BY CHARLES KOTERSALL
Chief Tool Designer, Peerless Motor Car Co.

THE accompanying illustrations show an indexing fixture for grinding the four arms of the differential spider for an automobile rear axle.

Previously, this operation was done by grinding on centers, but this method did not prove to be very satisfactory on account of the arms not coming at right angles with each other and not parallel in the same plane. This deviation is caused by the heat-treating, and it is extremely difficult to get a part of this kind through the heat-treating department without distortion. The fixture herewith described eliminates the centering operation and the straightening operation after the heat-treating is done.

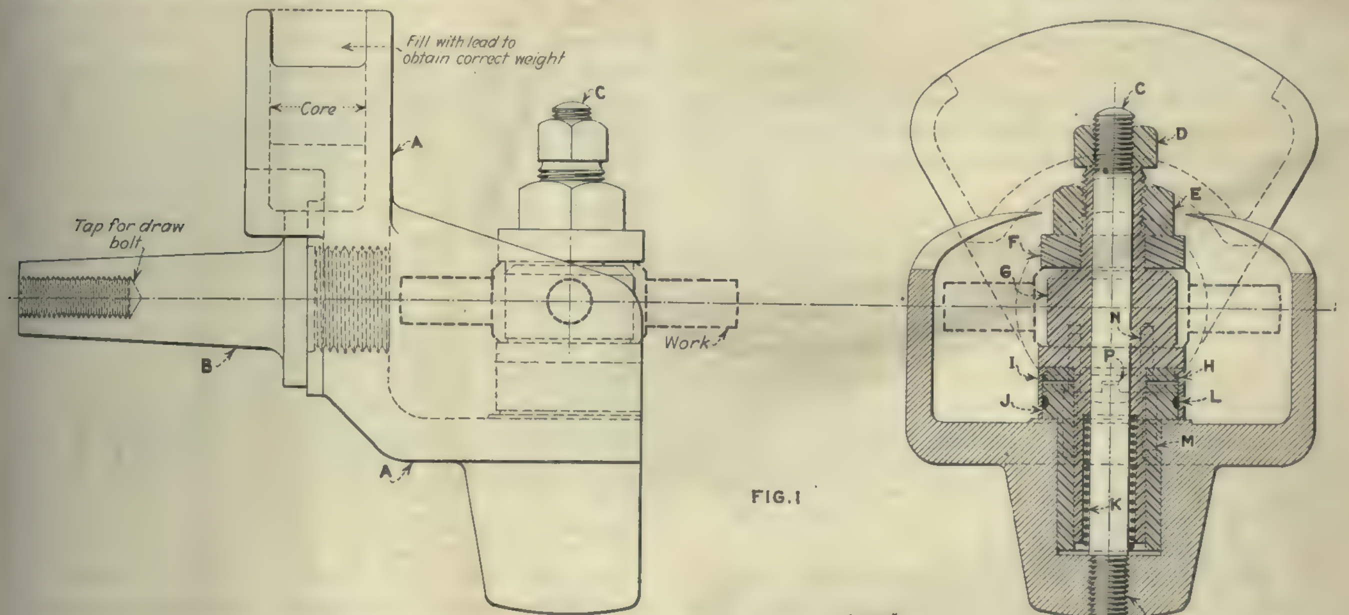


FIG. 1

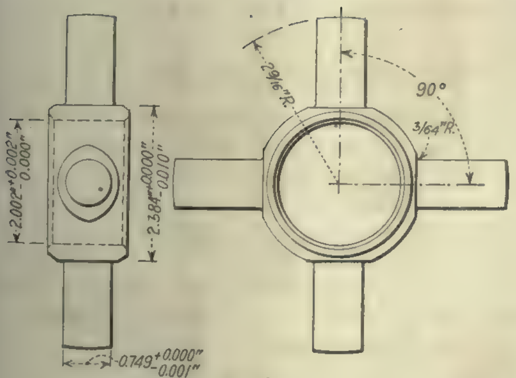


FIG. 2

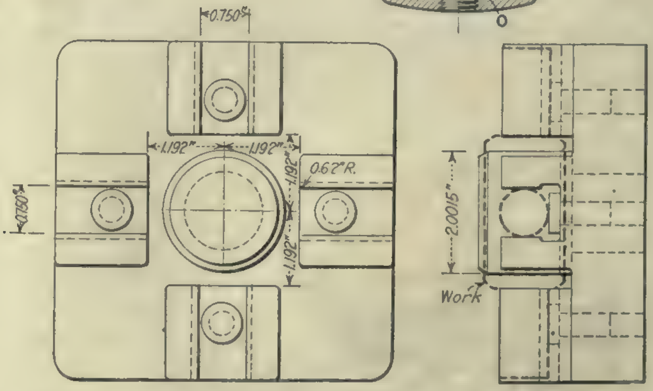


FIG. 3

FIG. 1. TWO VIEWS OF THE GRINDING FIXTURE. FIG. 2. THE SPIDER TO BE GROUND. FIG. 3. THE GAGE FOR TESTING ALIGNMENT

In the first place, it is very essential that the arms be ground at right-angles and parallel in the same plane. Fig. 1 shows the grinding fixture, Fig. 2 shows the work to be ground, and Fig. 3 shows the gage used for checking the squareness and parallelism of the differential spider. It is also to be noted that in this case the grinding of the arms is to be the last operation after machining and heat-treating is done.

In Fig. 1, the body *A* is mounted on the taper shank *B* which is fitted to a 10 x 24-in. Norton grinding machine having a live head. The body casting *A* is made with a cored pocket to receive lead to secure the proper balance. The stud *C* is screwed into the body *A* at *O*. The lower index plate *J* is pressed into the body at *A* and doweled with pins *M*. The upper index plate *H* is pressed and doweled with pins *N* to the index plug *G*. *F* is a U-washer. *E* is a clamp work nut. *D* is the index clamp nut. *K* is a compression spring to lift the index plug *G* off the index plate *J*. *L* is a soft packing to prevent the grit and water from working up into the index plates *H* and *J*. The shell *I* is to cover the indexing mechanism.

To grind the spiders, the clamp nut *D* is to be tightened against the index plug *G* to lock it. The U-washer *F* is removed and the spider passed over the clamp nuts

D and *E* and slipped on the index plug *G*. It must be a close sliding fit. The U-washer is slipped into place again and the clamp nut *E* is then tightened slightly at this point. The operator must next true up this first arm before tightening the nut *E*.

When this is done the operator is ready to grind the first spider arm. The wheel used for grinding the arms is a 2 x 18-in. wheel. Care must be taken that the grinding wheel is dressed straight and true.

After the first arm is ground to the proper size the clamp nut *E* is not to be loosened or tampered with in any way. To index the second arm the clamp nut *D* is loosened enough so that the spring *K* will lift the index plug *G* to allow the index keys on *J* and the slots in *H* (shown at *P*) to pass each other. The spider is then indexed 90 deg. The clamp nut *D* is next tightened and the operator is ready to grind the second arm.

The remaining arms are ground in the same manner as the second arm. Care must be taken in making this fixture to have the index keys 90 deg. apart and both the adjacent surfaces of *H* and *J* parallel with the horizontal centerlines *ZZ* and at right-angles with the vertical centerlines *YY*.

Effect of Heat-Treatment on Steel Castings and Drop Forgings—Discussion

By F. B. Bayless

Metallurgist, Oil Well Supply Co.

On page 413 of the *American Machinist* appears an article by A. A. Blue entitled, "Effect of Heat-Treatment on Steel Castings and Drop-Forgings." I do not agree with all of Mr. Blue's conclusions. Some of them remind us of the forging salesman who is too much a gentleman to openly "knock" steel castings, yet he "damns them with faint praise."

Mr. Blue writes that S. A. E. specifications cover only phosphorus and sulphur; but he does not state that under the heading "carbon," these specifications say, "As required for physical properties." While such specifications are not as definite as those imposed on forgings, they do place certain limits within which the casting manufacturer must keep his product. However, the steel casting specifications as set forth by the American Society for Testing Materials, are much more explicit. Here we find not only carbon, phosphorus and sulphur specified, but physical properties as well. Soft, medium and hard castings are covered, with tensile strengths from 60,000 to 80,000 lb. per square inch, yield points 45 per cent of the tensile strength, elongation in 2 in. from 15 to 22 per cent, and reduction of area from 20 to 30 per cent. The method of manufacture, analysis, heat-treatment, cold-bend tests, tests to destruction, etc., are also given. Surely a purchaser using such specifications would hardly agree that "a steel casting is a steel casting."

Heat-treated castings, especially for hardness, are coming more and more into favor. This is especially so since the advent of electric furnace steel, which has made possible the production of castings of very complicated design and thin section, and from the purest metal of almost any analysis. Electric steel castings are regularly produced with carbon contents from 0.30 to 1.10 per cent and within 10-point limits, manganese, phosphorus and sulphur being controlled as closely as in rolled stock.

I do not believe that the figures given in Mr. Blue's casting analysis table are representative, especially for electric and open-hearth steels. These steels when made in basic-lined furnaces would easily be of much lower sulphur and phosphorus content. The refining slags would take care of that; and if made on acid bottoms, purer metal would compose the charge, so that such high percentages of these two elements would be out of the question for a casting that required a degree of strength and toughness.

If castings are desired with properties approaching those of forgings, it would not be good policy to use metal of the same composition and give them the same heat-treatment. With the desired properties in mind, the steel and the subsequent treatment must be of a special nature. The treatment given a forging would hardly bring out the desired properties in a casting of the same analysis.

The simple fact that a certain part is made from a forging does not mean that this part might not fail, as eternal vigilance from the steel furnace all the way down the line to the piece ready to use must be observed, in order to develop to the fullest degree the quality of the part. It is not necessary for the buyer of steel castings to simply send his patterns to the foundry and receive just any kind of castings in return. Steel foundries today can and are supplying castings within very close limits as to analysis and physical properties.

The plant with which the writer is connected produces for its own use castings of grey iron, so-called semi-steel, malleable iron, electric-furnace steel, brass and bronze, as well as forgings. The decision to use one or the other is made after the properties and strength desired are decided upon. After it is all said, the one thing above all others that determines just what a given part shall be made of is this: "What material will produce this part, to meet the specifications, at the lowest cost?" There are many who jump from grey iron, semi-steel, or malleable to forgings, when the steel casting would fill the bill, and be a great saving.

Germany's Export Trade

The 1920 trade figures for Germany's exports to the various countries of the world naturally show a great difference from the pre-war figures. In the pre-war statistics Great Britain is shown as the largest consumer, taking nearly 15 per cent of the total German exports; the old Austro-Hungarian Empire comes second, with 11 per cent; and Russia, including Poland, third, with almost 9 per cent. France and the United States were next, with around 7½ per cent, closely followed by the Netherlands, which took close to seven.

After the armistice and resumption of trade great changes took place The neutral countries' markets were, of course, easier for Germany to regain, and the 1920 statistics show that the Netherlands imports from Germany increased from 7 per cent to almost 21½ per cent of the German total. Switzerland has gained the second place, with 9½ per cent, followed by the new States of the former Austro-Hungarian Empire, with 8 per cent. Denmark, which in pre-war days only took 2 per cent of the German exports, reached 6 per cent in 1920. Of Germany's former enemies the United States is the only country which so far has reached pre-war figures, having taken more than 7 per cent of Germany's exports in 1920. The reason for this lies in the purchasing power of the dollar as compared with the depreciated currency of other allied countries.

Front Axles and Steering Knuckles

Spring Actuated Drilling Fixtures Which Are Quickly Handled—Holding Long Work for Milling—Automatic Lathe Work on Steering Knuckles

By FRED H. COLVIN
Editor, *American Machinist*

THE Peerless axle is of the I-beam type with the yoke at each end for holding the steering knuckles. It has the usual characteristics for a car of the size and weight on which it is used and some interesting fixtures have been devised for the various machining operations. The nine machining operations are as follows: Operation (1) straighten; (2) mill spring pads; (3) straddle-mill the ends; (4) bore and ream yoke ends; (5) drill eight bolt holes in spring pads; (6) spot face the eight holes; (7) counterbore for steering knuckles; (8) drill two holes for ⅛-in. pipe tap; (9) tap two ⅛-in. holes; (10) inspection.

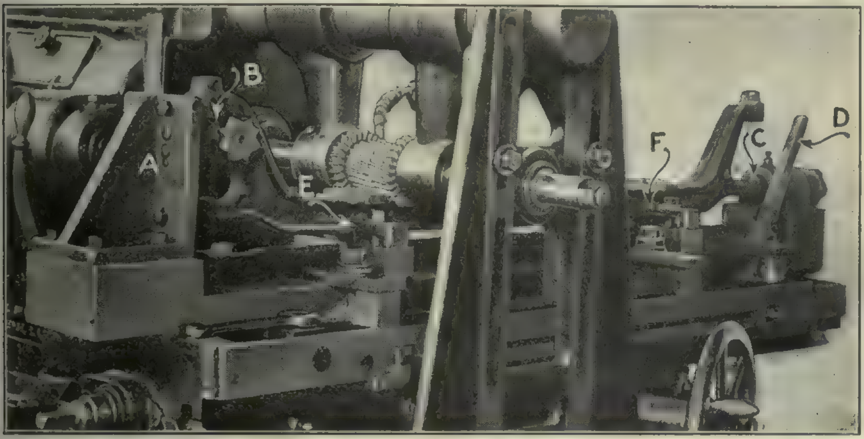


FIG. 1. MILLING SPRING PADS

The front axle is held for milling in a special fixture which is used on the Brown & Sharpe knee-type milling machine, shown in Fig. 1. One end of the axle is centered by the angle plate *A*, a V-block holding the lower end of the yoke, while the upper end is clamped by a hook bolt at *B*. The lower end of the opposite yoke is held at *C* while the gage *D* indicates how well the axle has been straightened after forging. The lower web is held by the bent clamps *E* and *F*, the whole fixture holding the axle firmly in position while the pads are being milled.

Located by the spring pad at *A*, Fig. 2, the yoke is straddle-milled by the four cutters shown. It will be noted that three of the milling cutters have the teeth cut with alternate angles.

In boring and reaming the ends the spring type of fixture shown in Fig. 3 is used. The upper plate is controlled by means of the lever *A* and the drill is guided into the lower hole by use of the bushings *B*. The jackscrews *C* take the thrust of the drilling cut. The two toolboxes each having six compartments for tools, wrenches, etc., are placed well out of the way and yet in a convenient position.

The holes in the spring pads are drilled in sets of four as shown in Fig. 4. The axle is located from the yoke hole in one end by the pin *A*, the other end being lined up with the support shown. The milled surfaces of the spring pads are forced up against the bushing plates *B* and *C*, by means of wedges operated by screws *D* and *E*. Four holes are drilled at one setting, the fixture then being moved for the next set of holes. The holes are counterbored or spotfaced at *F*, the axle being held in a vise and the work done by the single spindle shown.

After inspection the axles go to the assembling department, a section of which may be seen in Fig. 5. Here the knuckles are assembled to the axles on the bench shown. The trial assembly is made at *A*, the bar *B* being fitted with suitable connections for testing the proper location of the steering knuckles in the axle. This view shows both king pins being put into place at *C* and *D*. The steering arms are tested as to position by the arms *E* and *F* on the bar *B*. The knuckles are finally fastened in position on the bench at *G*. This bench has special clamps for holding the axle, as can be seen. The completed axle units are then ready for inspection before assembling.

The steering knuckles are made of drop forged steel and require sixteen operations including the final inspection. The sequence of operations is as follows: Operation (1) drill and ream spindle hole; (2) spot-face to length and groove both ends of kingpin hole; (3) center both ends of stem; (4) rough and finish turn stem; (5) face to length and chamfer thread end; (6) drill and ream stop pin hole; (7) drill and ream taper hole; (8) spot-face back side of taper hole; (9) broach keyway in taper hole; (10) thread end of stem; (11) drill four cotter pin holes; (12) mill keyway in end; (13) hand ream kingpin hole; (14) heat-treat; (15) grind both diameters; (16) inspection.

A good example of spring-operated drilling fixtures is shown in Fig. 6 where three of these fixtures are mounted under a Foote-Burt three-spindle drilling machine with a single table. The upper and lower ends of the forgings are centered by suitable cones in the fixtures. The knuckle is drilled through while the forging is held by the double springs shown. The upper plate *A* can be raised by the levers *B*, acting through rods *C* at each end of the plate. This compresses the springs, allows the drilled piece to be removed and a new knuckle inserted. By lowering the leaves the new knuckle is held in position ready for drilling.

Facing and Turning

The ends are then spot faced to lengths and grooved in a Bardons & Oliver turret lathe as shown in Fig. 7. This view shows a stem which has already been turned, although that operation is in reality performed later, the piece being put in the machine to show how the work was held in the special chuck *A*. It also indicates that both the spot facing tools, as well as the outside milling and the grooving tools, are guided by pilots so as to insure concentricity with the kingpin hole

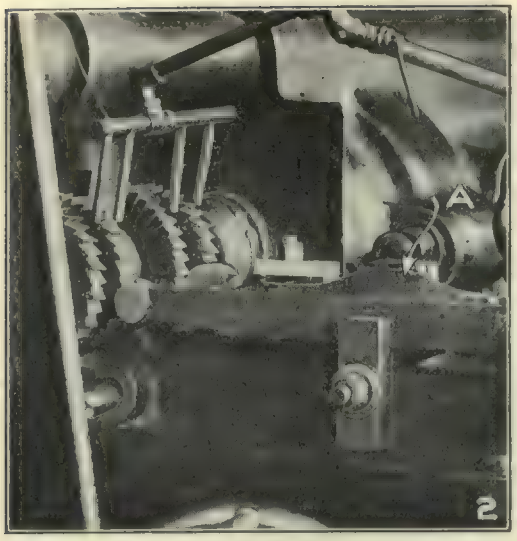


FIG. 2. MILLING THE YOKE.

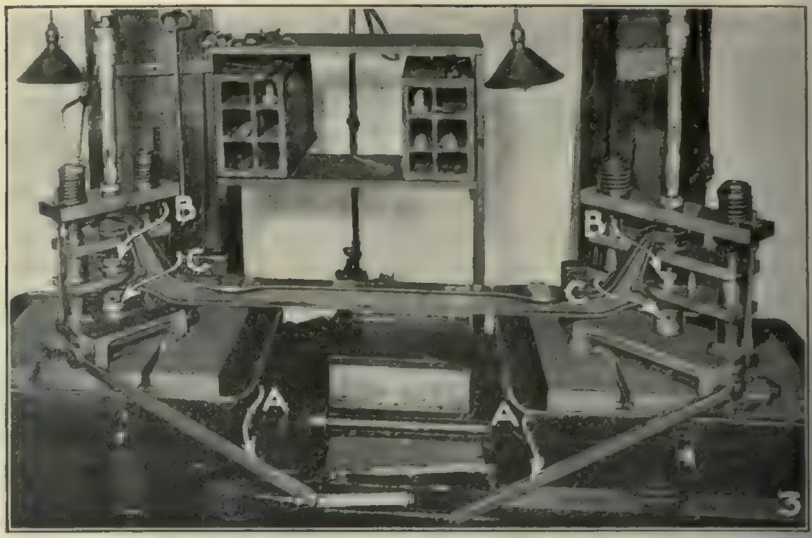


FIG. 3. DRILLING THE ENDS

already drilled. The type of cutters is clearly indicated.

The end of the stem is then centered, together with a corresponding point on the back of the knuckle so as to afford an easy and substantial method of turning the stem for the wheel bearing. This turning is accomplished in a Fay automatic lathe as shown in Fig. 8. The forging is held between centers and driven by means of the ear through which the steering arm fits. The stem is both rough and finish turned in this operation.

The stem is then faced to length and chamfered for the threaded end. Next comes the drilling and reaming of the ½-in. hole which is used for the steering stop in Fig. 9. This hole is drilled clear through so as to be usable from either side. It will be noted that the

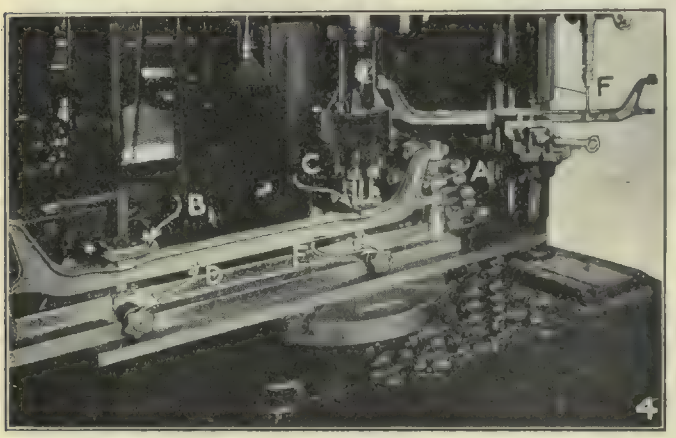


FIG. 4. DRILLING AND COUNTERBORING SPRING PADS

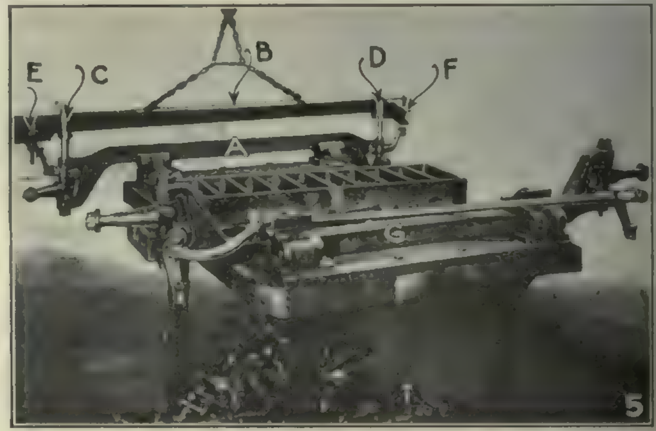


FIG. 5. ASSEMBLING AXLE AND KNUCKLES

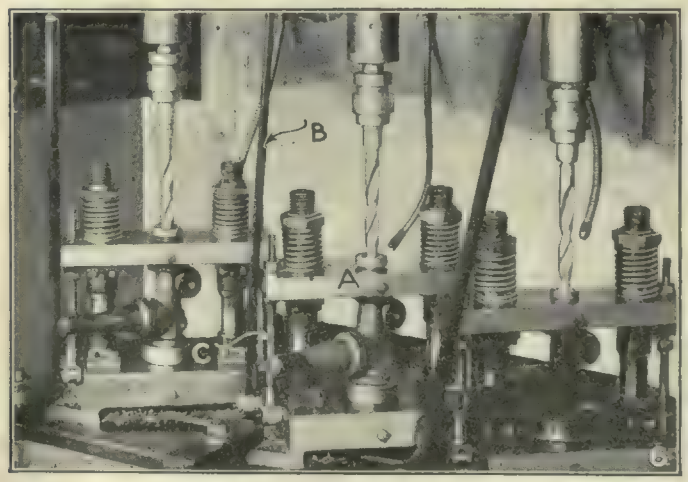


FIG. 6. DRILLING KINGPIN HOLE

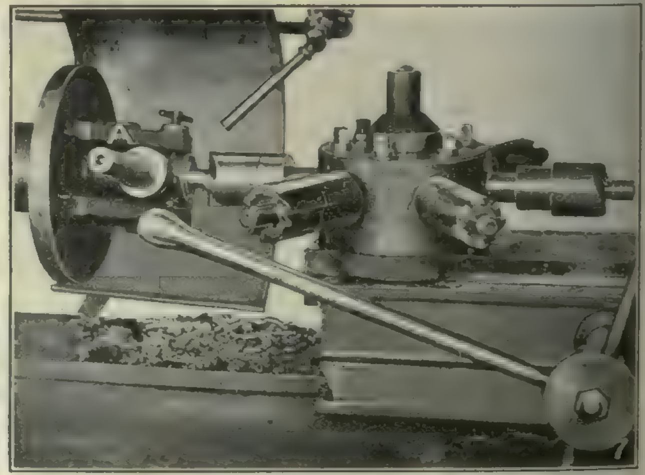


FIG. 7. FACING ENDS AND GROOVING

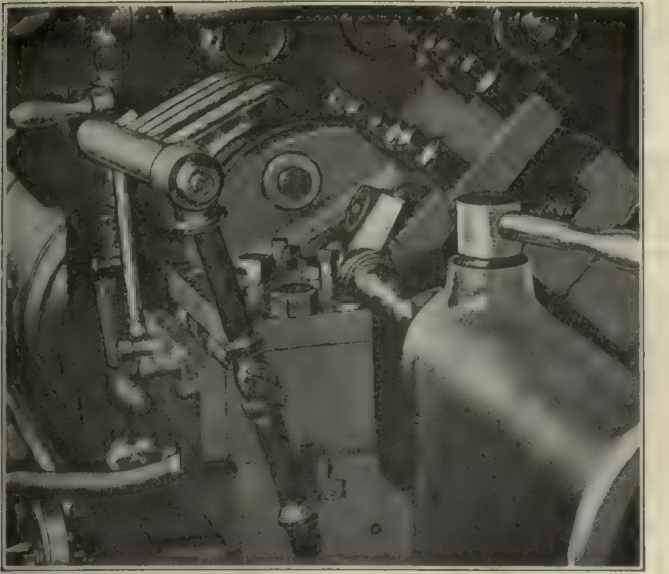


FIG. 8. TURNING THE STEM

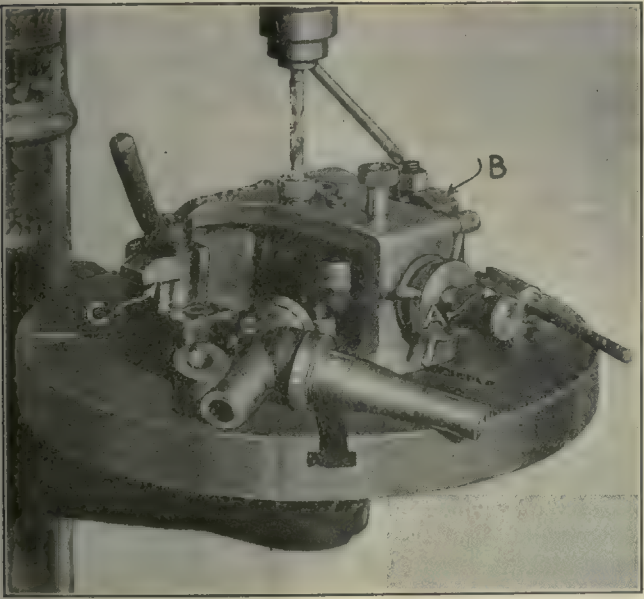


FIG. 9. DRILLING FOR STEERING STOP PIN

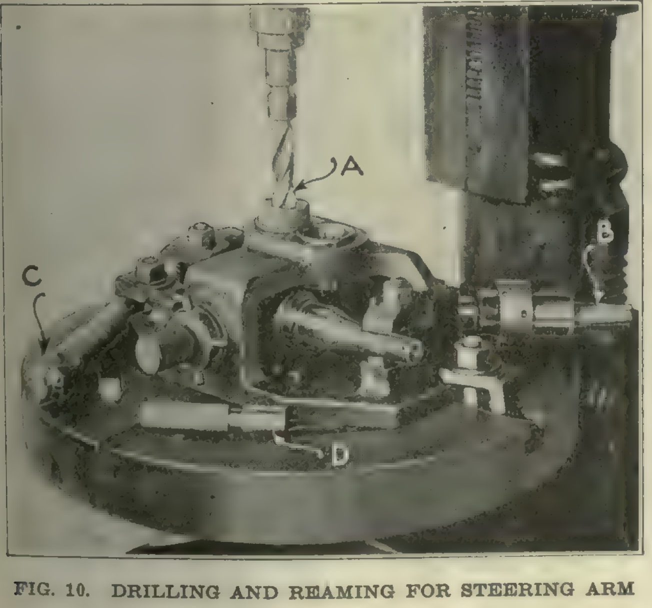


FIG. 10. DRILLING AND REAMING FOR STEERING ARM

knuckle is supported by the pin *A* which centers it, the end being clamped by the hook *B*. When knuckles are being drilled left-handed the other side of the fixture is used. In this case the clamp *C* holds the end in position.

The drilling of the taper hole is accomplished in a similar fixture, as shown in Fig. 10. This view shows the knuckle in place and the hole being drilled at *A*. It also shows the taper reamer at *B* and the spot-facing cutter at *C*. The gage is shown at *D*. The remaining operations are outlined in the operation list given at the beginning.

Painting Machine Tools White

By Ellsworth Sheldon

The advantage of painting the interior of shops white for the purpose of reflecting and diffusing light, thus lighting up otherwise dark corners and obscure places, has long been recognized. Not only does it increase production and assure more accurate and careful work from physical reasons alone, but its effect upon the temperament of the operatives is even more far-reaching.

Unquestionably dark walls and ceilings absorb light and upon dull, cloudy days render the shop atmosphere dismal and depressing; under these circumstances no worker, however willing, can give his best service.

Though many shop managers, probably most of them, acknowledge the advantages to be obtained and ungrudgingly sanction the expenditure of the time and money necessary to keep their shops up-to-date in this respect, the prevailing colors of machinery and machine tools still remain black or dark grey.

The first machine tool, if it was painted at all, was probably black, and except in sporadic cases where some intrepid proprietor has essayed a departure from time honored custom by painting his machinery a dark green or red, the dull colors still persist.

The shop of H. Bickford & Co., situated upon the shore of Lake Winnipesaukee, where, if anywhere, light and sunshine should abound, was by no means dark. The walls and ceilings were white and the floors and machinery were kept clean and neat, so that full advantage was derived from outdoor light.

There was one corner, however, where an engine lathe and an automatic gear cutter were so situated that the lathe operator could keep his eye on the gear cutter and see that it attended strictly to business, that did not have as much light as the rest of the shop. The proprietor decided to paint both of these machines white.

An enamel paint, that because of its hard exterior surface would not be discolored by oil and grease, was used, and the result in lightening up the corner was far beyond expectations. As the pleased operator enthusiastically expressed it, "the sun shines all the time now."

The experiment was tried over a year ago, and so satisfactory was the result, that the practice is being extended to all the machines in the shop. The effect is such as to impress upon the casual visitor the belief that artificial light is being used.

It is no more trouble to keep the white surfaces clean than would be required by the dark ones, and dirt is so much more conspicuous that the operators are inspired to keep their machines really clean, instead of allowing dust and grease to accumulate, as is quite likely to be the case upon the dark colored surfaces where "the dirt don't show."

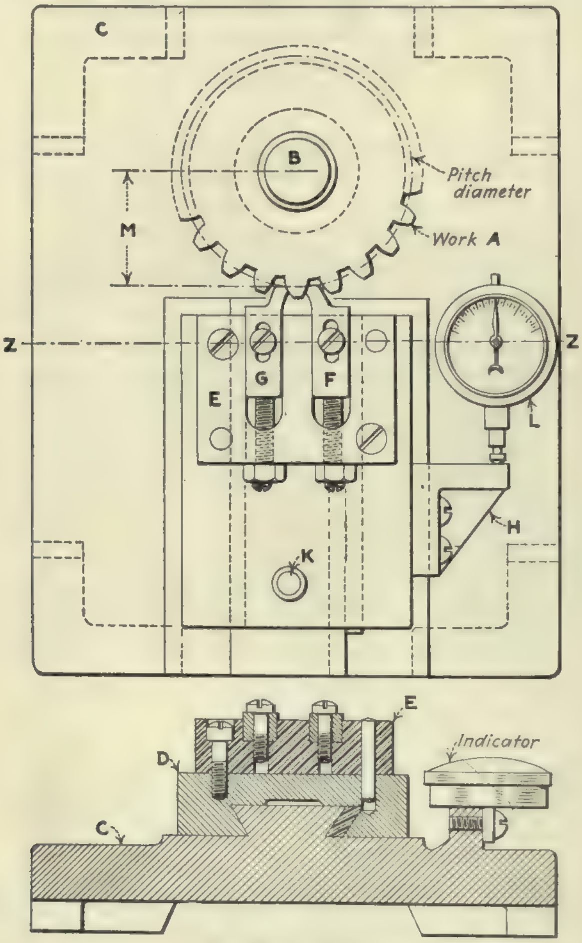
Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Gage for Testing Spur Gears

By Gene Phelps

The most important inspection requirement of spur gears is that they must run quietly. This covers most any defect possible. In the manufacture of gears it is necessary to approach the most efficient tooth form in order to avoid friction. The most important factors which govern the inspection of spur gears are the outside diameter, pitch diameter, thickness of tooth at pitch diameter and concentricity of teeth with center of rotation.



Section Z-Z

GAGE FOR CHECKING THICKNESS OF GEAR TEETH AT PITCH LINE, MEASURING PITCH RADIUS AND CHECKING CONCENTRICITY

The outside diameter is important because the thickness of the tooth at the pitch line is generally measured from it by means of gear tooth verniers. The pitch diameter must be held accurately in order that the gears mesh properly together. Gears which are not concentric and with teeth cut slightly off center, are noisy and inefficient.

There are many ways of inspecting the form of a gear tooth, the simplest of which is a templet gage. The outside diameter of a gear blank is generally checked by a snap gage or micrometer.

Inspecting the concentricity of a gear requires a special form of gage. The illustration shows a very good gage for this operation. The work *A* fits on a stud *B* suitably fastened on the body of the gage *C*. The slide *D* has a block *E* fastened to it and onto which are located two gaging blocks *F* and *G*. These gaging blocks are set to conform with the thickness of the tooth at the pitch line. On one side of the slide is fastened a bracket *H* as shown. The slide is moved forward by means of the pin *K* until the gaging blocks strike the tooth of the gear. At the same time the bracket *H* strikes the indicator *L* which should read zero if the gear is correct. This gives the distance from the center of the hole to the pitch line as shown at *M*. Section *ZZ* shows the construction of the gage.

After one tooth has been inspected the work can be turned around so that the gaging blocks will engage in some other tooth, thus showing whether the gear is concentric or not. Undersized and oversized pitch diameters are easily detected and at the same time both the distance *M* and the concentricity are shown.

The indicator is set to zero by putting a master gear on the stud *B* and gaging it as mentioned. It will be noted that the gage blocks *F* and *G* are fitted in slots and held in position by screws. This is done so that they may be removed and replaced by other gage blocks for gears of various pitch.

A gage of similar construction for checking inaccuracies in the spacing of gear teeth can be made but would require two slides similar to the one shown and would gage two teeth at the same time.

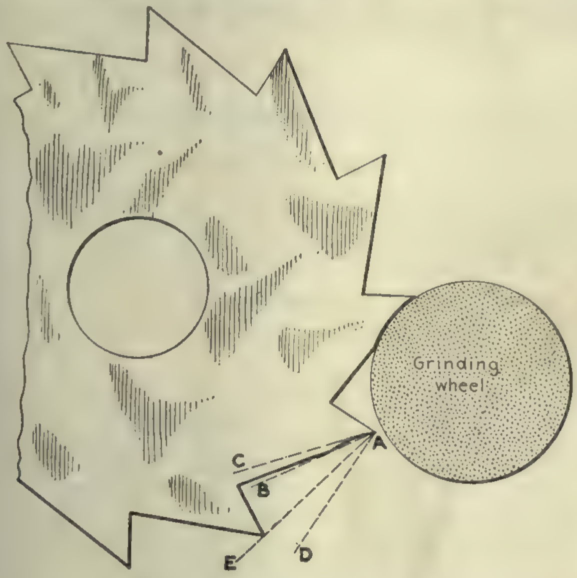
Chatter in Milling Machines

By A. W. Forbes

In an article under the above title on page 386 of the *American Machinist*, P. V. Vernon makes the statement that having tools too sharp causes chatter on milling machines. This may be a factor, but I should like to suggest that the clearance angle will more often give the results he mentions than the sharpness of the tools. It is well known that a large clearance angle increases the tendency to chatter on many tools. This angle is often greater on milling cutters than the machinist realizes, due to common methods of grinding.

The accompanying illustration is purposely exaggerated and the grinding wheel is drawn smaller than usually used in order to make the effect much more noticeable.

The actual clearance angle is *CAD* on the figure and is the angle between the tangent to the curve made by the grinding wheel at the point *A*, and the tangent to the circumference of the cutter at the same point. The machinist in looking at the edges will see the curve made by the grinding wheels as a straight line *AB* and the clearance angle will appear to be *BAE*. Now if an



CLEARANCE ANGLES ON A MILLING CUTTER

oilstone is held against the cutter as described by Mr. Vernon, one of the first effects of dulling the edge is to remove this excessive clearance right at the edge.

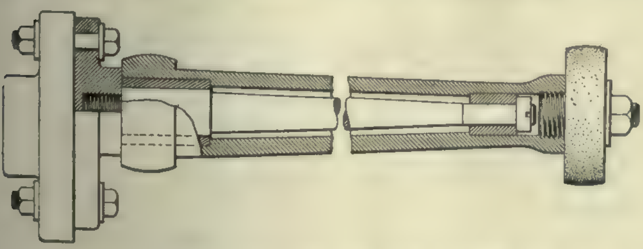
Grinding Automobile Cylinders in a Lathe

By J. McHenry

While on a trip to the Pacific coast the writer saw a lathe cleverly adapted to the grinding of automobile cylinders. The essential parts of the grinding rig are shown in the accompanying sketch.

The grinding wheel spindle was a cast-iron sleeve of sufficient length to enter the ordinary cylinder, and appeared to be somewhat tapering and about 2 in. in diameter at the center. The larger end was crowned to form a pulley of about 1½-in. face.

This casting was presumably cored throughout its entire length and the ends of the cored hole bored to receive bronze bushings. The hole at the outer end was threaded for a short distance and the bushing at this end forced in past the threads. The sleeve rotated upon a long stud, screwed into a block of cast iron which was in turn bolted to the small faceplate, or driver, of the lathe. Provision was made to move this block in or out from the center to adjust the wheel for different diameters of cylinder, and also to feed the wheel outward for the successive cuts in grinding.



SPINDLE CONSTRUCTION OF THE GRINDING RIG

After the sleeve was placed over the stud a left-hand ring nut was screwed on the end of the latter, and, bearing against the bushing, served as an end thrust bearing as well as to hold the sleeve on. A short stud, screwed into the threaded hole in the end of the sleeve, was provided with collar and nut to hold the grinding wheel.

Power was delivered to the grinding spindle from an extra overhead countershaft located somewhat back of the lathe. A bracket, carrying a swinging idler, was attached to the headstock, and this idler served to maintain an even tension upon the 1-in. driving belt and to compensate for the slight eccentric motion of the spindle. The cross-slide had been removed from the carriage of the lathe and a suitable angle-plate substituted, to which the cylinder blocks were bolted.

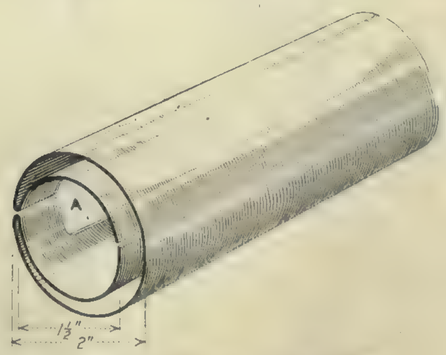
A Heater Connection That Saved Money for a Customer

By I. B. Rich

One of my customers was fortunate enough to get a new car this year—a closed car at that—and he asked me to put his old heater in the new car. The old car had a 2-in. exhaust pipe while the new one was only 1½ in., so the connection with the heat deflecting valve didn't fit.

I called up the heater people to get a new connection and they were out of stock, wouldn't have any more for three weeks—in dull times too. Furthermore they said the price was $7.50 for a little cast-iron dufangle that I'd like to make for 75 cents, even in small lots.

So I got busy with a strip of sheet steel and a pair of tinsmith's snips, bent up the eccentric reducer shown beneath and cut out the opening *A* for the damper to come through. I trimmed the sides of the damper to suit a 1½-in. pipe and had the whole thing ready to put on in less than an hour. Scrap material and one hour's time—saved my customer $5 and three weeks' delay.



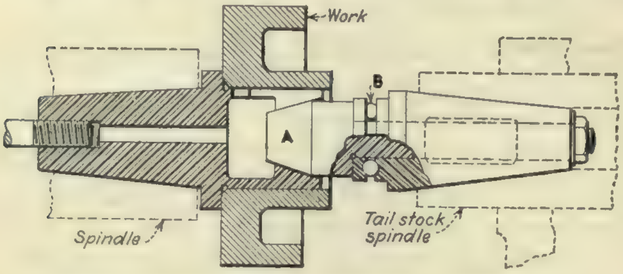
A SHEET-METAL REDUCER

This charging of outrageous prices for fittings and small parts will react some of these days and we'll have a huge concern that will do things on the Henry Ford plan of charging a fair cost price plus a fair profit.

Expansion Arbor Operated by Tailstock

By C. W. Frank

The illustration shows a somewhat unusual way of operating an expansion arbor that has been used very successfully. In place of a draw bar or taper screw, a cone center held in the tailstock of the lathe is used. The arbor has three slots and the tailstock is brought up until the tapered portion of the cone center has expanded it enough to grip the work. The taper should be less than generally used, so that it will not have a tendency either to back out or impose too much pressure on the ball bearing *B* which is used to take the thrust. The tailstock used on this arbor was of the quick-acting lever type, but the ordinary style with handwheel can also be used to advantage.



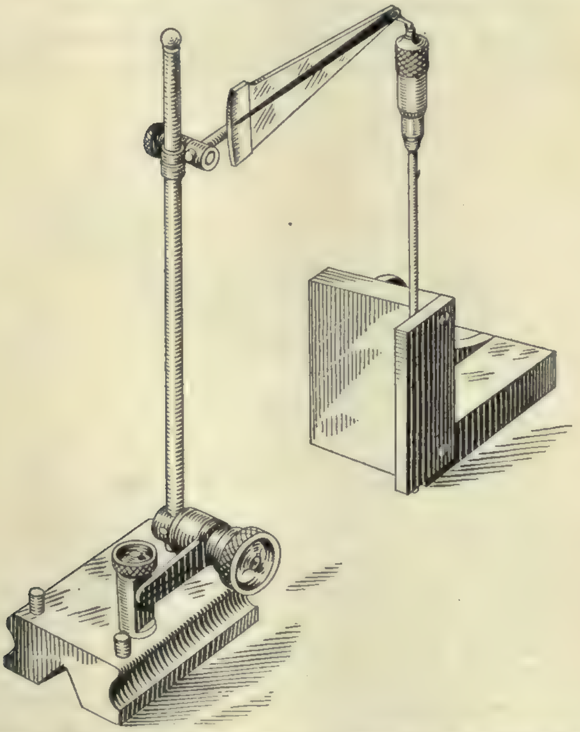
EXPANSION ARBOR OPERATED BY TAILSTOCK

An Improvised Height Gage

By L. G. Dickinson

Having occasion to gage a piece of work accurately for height, and no standard gage being available, I adopted the method outlined in the sketch.

With a small angle iron that was quite accurate and that had an extra piece attached to one side so that a rod could be held exactly perpendicular to a bench plate, I set my inside micrometer in the angle thus formed and held it in place while I passed the ball of a sensitive indicator over the measuring point, adjusting the surface gage to which the indicator was applied, until the dial of the latter registered zero.



USING AN INDICATOR AND AN INSIDE MICROMETER IN PLACE OF A HEIGHT GAGE

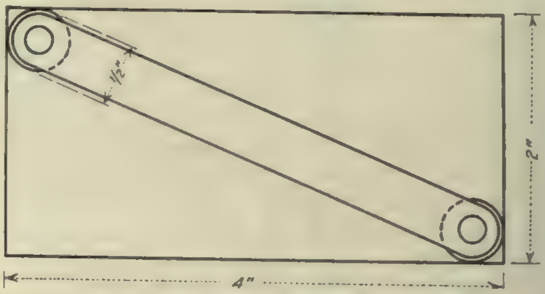
With the micrometer set to the required length, corresponding to the height of the piece to be gaged, it was a simple matter to determine the error in the work by passing the indicator in turn over the piece.

This method is even better than the use of the height gage, as the indicator unmistakably shows an error of one-half thousandth.

A Substitute Gage

By R. K. Rowell

The problem presented by A. D. Hallet on page 31 of the *American Machinist* and its solution by Prof. Pearse, on page 400, were both interesting from a mathematical standpoint; but as a gage for rectangular holes the device has little merit.



THE SUGGESTED TYPE OF GAGE

If two hardened and ground cylindrical plugs were used at the end of the bar as shown in the sketch, while presenting only a line contact for wear, they would stand up longer than the theoretical sharp corners of a square-end bar and when wear takes place the plugs could be revolved slightly, thus offering a new wearing surface.

The problem presented to find the center distance between the two plugs in this type of gage is an easy one to solve.

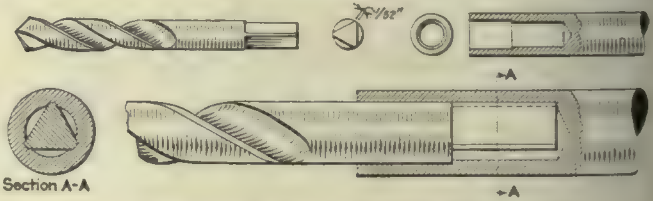
Solderless Extension for Small Drills

By George P. Nelson

The small drill extension shown in the accompanying sketch has been used by the writer for a number of years, and I think it is superior to anything I have seen, for there is no soldering or fitting to it.

The shank of the drill is ground three cornered, leaving about 1/32 in. land on the corners, and then ground square across the end to make these corners sharp; it is now really a broach.

The extension is drilled about 3/8 in. deep, a snug fit for the drill to be used, and then drilled 3/8 in. deeper with a drill about 1/32 in. smaller. The drill is now driven into the extension, in which it broaches three grooves, holding the drill securely.



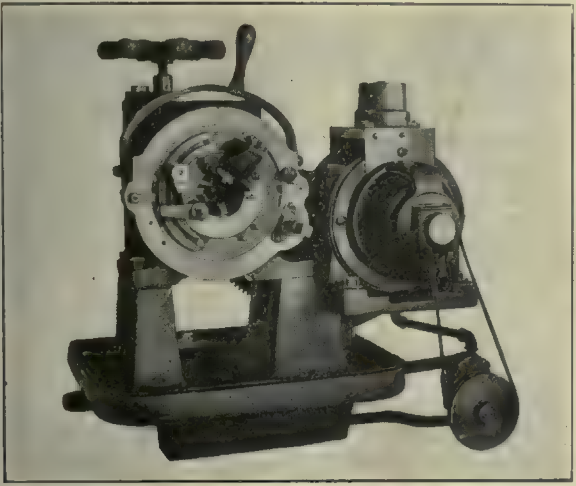
EXTENSION FOR SMALL DRILLS

This method is very satisfactory for putting taper shanks on small drills, for when the drill breaks or is worn out, it is easily replaced with a new one.

Shop Equipment News

Curtis & Curtis Pipe-Threading Machine

In the accompanying illustration is shown a machine recently placed on the market by the Curtis & Curtis Co., Railroad Ave. and Garden St., Bridgeport, Conn. The machine is known as the No. 430 Forbes direct-connected, motor-driven pipe threading and cutting machine. The head is mounted in a supporting shell and rotated by direct-connected electric motor through a train of gearing. Longitudinal travel is provided for the head, so that the dies may be fed on the pipe. The pipe itself is held stationary in a self-centering vise located on the rear of the shell. The advantages which the maker claims for the machine are small floor space, portability, and the fact that the machine can thread pipe bends.



CURTIS & CURTIS PIPE THREADING MACHINE

The die head itself is encircled by two cast-steel rings forming a bearing against the cast-iron shell, and thus preventing chips from entering the gear teeth. The position of the dies is adjustable to fit the work, while the dies can be replaced if broken or worn. There is an automatic release and cam lock on the front of the head, which locks the cam during the threading operation and automatically unlocks and throws the dies open at the completion of it. The dies are then reset by the turn of a lever, so as to be ready for cutting the next thread. An automatic feed is provided for the cutting-off device.

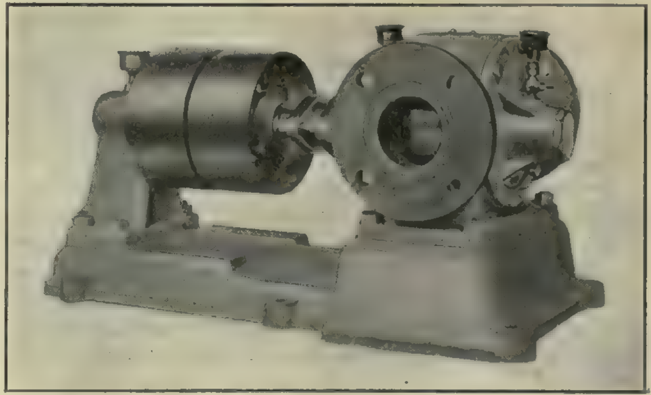
The gears used in the driving train are all of the spur type, and are protected by guards. A rotary oil pump delivers oil to the dies and to the cutting-off tool. The base is formed into a large drip pan and provided with a reservoir, into which the oil is strained. The machine as shown is intended for mounting on the end of a bench, but can be equipped with a floor stand and a high adjustable pipe rest, if desired. Three sets of three dies each are furnished with the machine, as well as three cutting-off tools. The machine has a range of ½- to 2-in. right-hand threads, and requires a 1-hp. motor running at a speed of 1,800 r.p.m. The height is 20 in., the bench space required 24 x 16 in., and the net weight 350 pounds.

Exeter Rotary Pump

The Exeter Machine Works, Inc., West Pittson, Pa., has recently placed on the market a rotary pump made for the handling of liquid of practically any specific gravity. The pump is adaptable to use in a machine shop for circulating lubricating oil and coolant. In general, the principle of operation of the pump may be compared to that of the square-hole drilling device in which a triangular bit functions inside a square former It is in reality a three-tooth gear meshing with an internal four-tooth gear set eccentrically to it. The contacting surfaces consist entirely of circular arcs, and are said to give smooth rolling contact.

The inner rotor is keyed to the driving shaft, and both of the rotors are inclosed in a cylindrical casing. The outer rotor has four ports which open into the chambers of both the suction and the discharge side of the pump during rotation. The ports are closed momentarily by a lip at both the top and bottom of the pump body, in order to effect the cut-off between the suction and the discharge parts of the cycle. The liquid is drawn into the pump through the ports while the size of the pocket between the two rotors is increasing, and it is forced out at the opposite side of the pump during the last half of the revolution, when the size of the pocket is decreasing. The outer rotating member has a running fit in the casing on its periphery, being otherwise free and receiving its rotating motion from the inner rotor.

The pump has no reciprocating parts; it operates at comparatively slow speed and delivers a continuous flow of liquid. It is stated to be practically noiseless, and to be but little affected by wear. Due to the fact that the pump is positive in its action, it is stated to be able under normal barometric conditions to give 28 in. of vacuum, being run with a small liquid seal. Small pumps so far tested are said to have shown a volumetric efficiency of 98.67 per cent, and a pumping efficiency between 70 and 82 per cent. A pump of the same style can be furnished with the body so strengthened as to operate against a pressure of 600 lb. per square inch.



EXETER ROTARY PUMP

The suction life is dependent upon the size and speed of the pump, and the nature of the liquid to be pumped.

Spindle-type Grinding and Sanding Machine

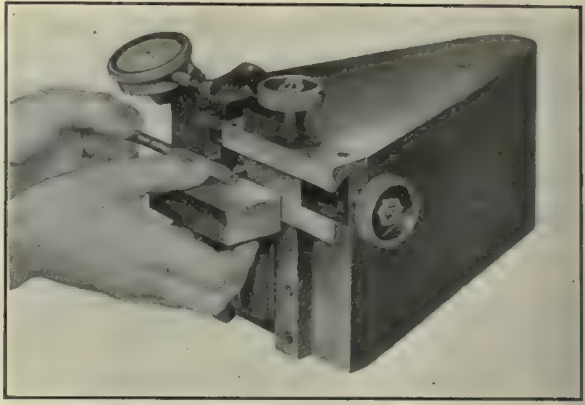
The Wonder Grinder Co., 612 West 12th Street, Erie, Pa., has recently placed on the market the "Little Wonder" spindle-type grinding and sanding machine, intended particularly for internal circular grinding on both wood and metal. The work-holding table of the machine is circular, as shown in the illustration herewith, and is provided with two bearings that enable it to be tilted 45 deg. to either side. It automatically locks in position at right-angles to the spindle, and may be set and locked in any desired position within its swing by means of a knob in front of the protractor scale.

The spindle or roll for carrying the abrasive is mounted on a vertical shaft, and driven directly from a ¼-hp. electric motor mounted vertically in the base of the machine. Provision is made for easily removing the motor when desired. The spindle runs at a speed of 1,725 r.p.m. The top bearing of the spindle is adjustable to compensate for wear, and is provided with a grease cup. The spindles are 9 in. in length and provided in diameters of 1¼, 2¾ and 4½ inches. The oscillation of the spindle is ⅞ in. The motor can be furnished for the type of current that is available, whether direct current or alternating current of 25, 40 or 60 cycles. The controlling switch is placed on the front of the column. The table of the machine is 20½ inches in diameter and the height 37 inches above the floor.

"LITTLE WONDER" SPINDLE GRINDING MACHINE

Toledo Thread-Lead Gage

The Toledo Tap and Die Co., Clinton St., Toledo, Ohio, has recently placed on the market the device shown in the accompanying illustration for gaging the lead of threads. The machine was originally developed for the purpose of checking the lead on the taps and precision studs made by the concern, and it is stated to be possible for an operator to accurately check the leads of four to seven thousand threads in an 8-hr. day.



TOLEDO THREAD-LEAD GAGE

The gage consists essentially of an arm 8 in. long pivoted on an adjustable bearing and carrying at its outer end a suitably hardened and ground point to engage the thread to be tested. This point is connected with the dial gage, and registers the accuracy of the work. One of the measuring points is movable, and can be set within a range of from ½ to 2 in. Since it is necessary to test the lead at the center of the work, an elevating table that can hold work up to 2 in. in diameter is provided. The arm and the pivot point are inclosed within the casing, so as to be entirely protected.

In operating the device, the adjustable point is set to the zero position from a master thread gage, which has been brought to the center position by means of the elevating table. The elevating table is then adjusted to center the work to be tested, and the threads of the work are pressed against the measuring points. Any difference in lead from the master setting is registered on the dial gage.

"Champion" Garage Stand

The accompanying illustration shows the Champion garage stand, which has recently been placed on the market by the Western Tool and Manufacturing Co. Springfield, Ohio.

The stand is made of steel throughout, the trays being of pressed steel, and the whole being supported by a frame of heavy pipe. The vise used is the company's plain-jaw "Champion" vise No. 13. A drawer is provided for tools. An important feature of the stand is the brake which can be operated very easily by the lever underneath the vise. When locked, the brake prevents movement of two of the casters, thus providing a substantial work-bench.

"CHAMPION" GARAGE STAND

Specifications: Height, 39 in. Length: top shelf, 42 in.; middle and bottom shelf, 43 in. Width: top shelf, 14 in.; middle and bottom shelf, 26 in. Drawer, 14 x 14 x 4½ in.

EDITORIALS

Relief Afforded by the New Tax Law

THE Revenue Act of 1921 has received scathing criticism from all over the country. If the critic can see good in one section, there are certain to be others which he can shoot full of holes. Taken as a whole it represents a distinct failure to fulfill the pre-election pledges of both parties, and will fall far short of stimulating business revival to the extent hoped for by the people.

The failure to reduce surtaxes and eliminate excess profits taxes for 1921 is worthy of the severest condemnation and is perhaps the greatest fault in the bill as passed. Some Congressmen are going to find it difficult to explain their votes on these provisions when they come up for re-election.

However, a close reading of the bill will disclose certain sections, and parts of sections, which afford considerable relief from some of the onerous requirements of the older tax laws. Some of these are so important that we have thought it worth while to secure the opinion of a tax expert on them for the benefit of readers of the AMERICAN MACHINIST. His analysis of the tax law is, of course, not complete, but it brings out the possibilities of relief underlying some of the sections mentioned above. We have given his article leading position.

The Importance of the Railroad Shop Executive

A RECENT editorial in *Chemical and Metallurgical Engineering* pointed out very forcibly the blight of financial methods on technical enterprises. In no case is this more noticeable than with the railroads of the country. The technical engineer and the practical shop executive have been too long ignored or given too little consideration, not only for their own good, but what is even more important, for the good of the railroads and of the transportation of the country.

The executives in the mechanical departments of the railroads have been handicapped in many ways. They have been asked to do the impossibe in maintaining locomotives and rolling stock efficiently with inadequate tool equipment. Locomotives have increased greatly in size and in hauling capacity, and cars in tonnage; but in too many cases the machine equipment of the shops has not grown to keep pace with the increased demand. In many shops it has not even been kept in the best possible condition.

Economical transportation is necessary for the carrying on of all business. This cannot be secured unless the mechanical department of our railways is given the machine equipment needed for keeping locomotives and cars in repair at minimum costs. Shop executives must be better recognized, both as to their importance and their remuneration; the latter has never been commensurate with their value to the railroads.

Unjust and wasteful labor conditions in the railroad shop must and will be eliminated. So must the wasteful financial burdens imposed by unfair leases and dividend guarantees. Both of these obstacles should be overcome by negotiations which will avoid antagonisms and secure harmonious co-operation in the future. But the elimination of these wastes will not secure the greatest benefit, unless the mechanical forces of the railroads are given the opportunity to reduce costs in their departments with proper machine equipment. The mechanical executive is the key to successful railroading.

Adding to Selling Costs

BEFORE placing orders for a batch of machine tools, the purchasing agent of a large railroad recently interviewed a large number of sales representatives. It is said that about seventy-five men each spent from three to ten days endeavoring to convince the aforesaid purchasing agent of the desirability of buying his special machine.

It seemed to be one of the cases where the purchaser tried to see how much he could increase the selling cost to the manufacturer. Aside from the ethical phase of the question, this is bad economics. No matter which machines are finally bought, the total cost of having the seventy-five men attend the hearing, must ultimately be paid by purchasers of machine tools. The individual manufacturers who lost out on the order must be reimbursed for their expenses from other sales.

Buyers of machinery would do well to remember that manufacturers must pass all expenses, necessary or otherwise, along to the purchaser. Making it hard to sell machinery reacts on the buyer in the way of added costs all along the line. Some purchasing agents seem prone to forget this in their endeavor to make an impressive showing to their superiors as to their ability.

There is no more effective manner of cutting down industrial waste than to make it less expensive to get goods from the maker to the user.

High Priced Castings Delay Business

ONE of the stumbling blocks to machine building in some quarters is the continued high price of castings. Foundrymen who stocked up with high priced iron are loath to take a loss, and so continue to demand from six to seven cents a pound for castings. Orders would be placed on a basis of four to five cents a pound but the foundrymen are still refusing to pocket their loss in order to do business.

On the other hand, one foundry at least is offering to take work at less than three cents a pound. This is either because they were not overstocked with high priced iron or they have taken their loss in heroic doses in order to get things moving again.

As one manufacturer put it—"they are willing to reduce wages, which are a less important part of costs than they realize, but refuse to take a loss on their speculation in buying pig iron at the wrong time." Incidentally, the foundrymen are by no means the only ones in this class.

NEWS SECTION

New Offices of Allied Machinery Company of America

The Allied Machinery Company of America announces the removal of its offices in London to more suitable quarters at 70 Victoria St., S. W. 1. This street is one of the most prominent in London, and is the headquarters for most of the large engineering firms of England and the continent.

The offices of the company in Barcelona, Spain, were moved earlier in the year to larger and more commodious quarters that were erected especially for them at Consejo de Ciento, 318.

In Belgium, inability to renew the lease at 34 Rue Melsens forced the company to move to 52 Rue de la Montagne, where new quarters were especially fitted for them.

The company also announces the completion of its own warehouse in Paris, a building of steel and brick construction with traveling cranes, at 12 Rue Lieutades, Saint Ouen (Seine). The office quarters are still located at 19 Rue de Rocroy.

The company's offices in Turin, Italy, are not changed, although the receiving branch at Genoa, needed during the war to clear goods rapidly through the port, has been closed.

The company during the year has reopened its Switzerland branch at Zurich, and has re-stocked it from warehouses in Paris, Brussels and Turin.

The Allied reports that while business in Europe has been dull all year, a brisk revival has been noted since September which, with improvement in exchange, promises to continue. The company, while not expecting a large business in Europe for some time to come, predicts a gradual improvement and ultimately a more genuinely steady and profitable return than before the war.

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Machine Tool Builders Hold Regional Meetings

Following out the policy of holding occasional regional meetings, the National Machine Tool Builders' Association held a meeting for the New York district members at the Hotel Astor on Dec. 13, and one for the New England members at the Hotel Bancroft, in Worcester, on Dec. 14. General manager E. F. DuBrul presided at the meetings and led the discussion on federal taxation problems and the possibility of association aid to the members in solving them. There was also some consideration of the budget and the method of assessing dues.

Du Pont Settles Oakland Rumors

The recent statement of P. S. du Pont, president of the General Motors Corporation, regarding the Oakland Division of General Motors, definitely settles rumors concerning the attitude of General Motors toward this division. The statement indicates that the Oakland Motor Car Co., will be developed and expanded to its full possibilities, along with the other units of General Motors.

Mr. du Pont's statement, in part, is as follows: "The Oakland Division is in a healthy condition, with its business stabilized and sales increasing. The present line of passenger cars, with gradual improvements, will be continued for the 1922 selling seasons. Thereafter, new models as may be required by the trade may be introduced."

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W. C. K. Organize Alumni Association

One hundred and forty former employees of Westinghouse, Church, Kerr & Co., met on Wednesday, Nov. 30 and organized the "W. C. K. Alumni Association."

The object of the association is the maintenance of the friendships formed by the members during many years of service with the company. The periods of this service run anywhere from three years to twenty-five years, three years being the minimum requirement for membership.

The secretary, A. H. Tummel, 131 Warwick St., Brooklyn, N. Y., will be glad to hear from any former employees who are desirous of joining.

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U. S. Steel Corporation Faces Charges

The complaint of the Federal Trade Commission against the United States Steel Corporation and its subsidiaries has been amended to make its charges more specific. The issue in the amended complaint is the same as that contained in the original complaint, which charges the corporation and its subsidiaries with discriminating in price between the purchasers of its rolled steel products. The amended complaint makes precisely the same charges with respect to each particular rolled steel product and charges that discriminations are in violation of the Clayton and Federal Trade Acts for the reason that they are not made because of any difference in the grade, quality or quantity of the product sold, nor because of different costs of selling or transportation, nor because the different prices were made in good faith to meet competition.

Dr. Klein's Report on Foreign Trade

Lower prices rather than diminished quantities, are responsible for the three billion dollars decline in the value of American foreign trade in the last fiscal year, as compared with the immediately preceding year, in the opinion of Dr. Julius Klein in his first annual report as director of the Bureau of Foreign and Domestic Commerce of the Department of Commerce.

A compilation of exported commodities, reduced, so far as possible, to a quantity basis, shows weight increases of 34 per cent for the groups of raw materials, and of 37 per cent for foodstuffs in 1921 over 1920, with a decrease of 4 per cent for such partly or wholly manufactured articles as can be shown in weight.

The final totals in this compilation, which included articles forming 69 per cent of the value of domestic exports in 1921, indicated that the exports of these goods increased 23 per cent in quantity over the amounts sold last year, though their value decreased 19 per cent.

The world-wide exchange situation, revived competition in foreign markets and decreased demand for American raw materials on the part of Europe, combined with a drastic cut in American imports of raw materials are the principal factors contributing to the lower foreign-trade totals.

The report refers to the fiscal year 1920-21 as "the most dramatic in the entire history of the foreign trade of the United States." The extraordinary episodes of that year in our business overseas resulted in a most severe strain upon the facilities of the Bureau of Foreign and Domestic Commerce; first, as a consequence of the "amazing strides" made by American export interests during the early months of the year, and secondly as a result of the disorganization and confusion which spread throughout the markets of the world with the accompanying panic of cancellations during the period of depression which marked the closing months of the year.

An unusual feature of Dr. Klein's report is a sixty-page review of world trade and of economic conditions in each of the important markets of the world.

◆

Meeting at Birmingham

The Southern Supply and Machinery Dealers' Association has announced through its secretary, A. M. Smith, that it will hold its 1922 convention at Birmingham, Ala. The dates set are given as April 24, 25 and 26.

Sectional Meeting of S. A. E.

The meeting of the Metropolitan Section of the Society of Automotive Engineers on Dec. 15 was of unusual interest. After a get-together dinner, C. M. Manly gave a resumé of a paper prepared by J. G. Vincent on the trend of aircraft. He considers the lack of landing fields, the element of danger, lack of comfort and unsuitability of the power plant, as the greatest handicaps to its development at present. To these he ascribes the difficulty in securing the necessary capital and gives stalling near the ground as being the greatest real danger. He discussed thick and thin wings, the use of metals, both aluminum and steel alloys. He advocated the pioneer use of planes where there was no direct competition as a means of transportation, believing this will develop the demand as it did in the case of bicycles and automobiles.

Ralph Upson, one of the best known balloonists in the world, told of the development of air routes in Europe. The main difference is that our best example is the U. S. Air Mail Service, while their's is commercial and practically all subsidized.

European experience has shown that military airplanes are not adapted to economical commercial work and that the two services are different in many ways. He feels that we do not want subsidies, but we do need the passage of the bill now pending for a Bureau of Aeronautics in the Department of Commerce and the control of aerial navigation, which should accord as far as possible with the international codes adopted in Europe. The three objects to strive for are safety, economy and night flying. To this end Mr. Upson advocates the Government offering substantial prizes in lieu of a subsidy. He said in effect, "don't copy, stand on our own feet. The United States offers the best opportunities on account of our distances and the fact that we value time more than is done elsewhere." He pointed out that back of all the European subsidies and development was the military idea—the use in war—and urged that we avoid this because it would not develop the best commercial machines and because war should not be the prime motive.

C. F. Redder, general manager of the Aeromarine Company, that has done so much for commercial aviation, told of the work of that company and showed very interesting films of a trip from New York to Havana. These showed miles of beautiful shore which is inaccessible by rail or road but within an hour or less of large cities, by airplane. After people get accustomed to flying they will demand the airplane as a means of transportation. He advocated the establishment of landing fields in all towns as the surest means of securing commercial air travel.

Commander H. C. Richardson, now of the Naval Aircraft Factory, represented Admiral Moffat and told of the development of airplanes in navy work. He pointed out the difference between commercial and fighting planes, and felt that the main use of commercial aviation in war would be to form a base of supplies from which planes of military design could be quickly secured.

The use of planes makes it necessary to have them with the fleet, either on carrier ships or with fighting ships. The use of catapulting devices has proved very successful as well as a means for checking a plane's speed in landing. These he felt might make it possible to utilize large office buildings and railway terminals as landing platforms.

Among the needs of aircraft he mentioned metal construction, weather information while in flight, and a healthy public interest rather than a subsidy.

Other films followed, one by the Seaboard Consolidated Airline showing a trip around New York City and some intensely interesting views of the bombing of the German ships at the bombing test held last summer. The accuracy of the bomber was little less than marvelous, and when it is considered that the army planes had to fly from 60 to 100 miles out to sea, drop their bombs and get home, some idea of the reliability of modern aircraft may be secured.

Test of Safety Device for Stopping Trains

Before a representative body of engineers, railroad officials and safety experts a series of safety tests was conducted on Dec. 15 on the Raritan Railroad, running between New Brunswick and South Amboy, in New Jersey.

The subject of the investigations was an automatic induction device which has been patented by the M. V. All-Weather Train Control Co., Inc., of Newark, N. J. The device is said to be a distinct improvement over all such safety devices. Its operation is controlled by magnetism and it is claimed by the engineers that it will bring a train to a stop within a hundred yards after the mechanism has been set in operation by an obstruction on the track ahead. The equipment operates in sufficient time to avoid accidents by stopping the train some distance away from the point of danger.

Dr. Charles W. Burrows, magnetic induction expert formerly with the U. S. Bureau of Standards, assisted in the tests.

Employment Statistics

Increased employment is shown by the U. S. Employment Services report covering November in the following industries: Paper and printing; lumber and its manufacture; vehicles for land transportation; iron and steel and their products; tobacco manufactures, chemical and allied products; stone clay and glass products; textiles and their products; metals and metal products. Decreased employment was shown in the liquor and beverage industry, in railroad repair shops and in the food and leather industries.

While there were employment increases in 40 of the 65 cities, the total unemployment throughout the country increased largely due to seasonal and climatic conditions.

Foundrymen Dine

To celebrate a quarter century of existence, the New England Foundrymen's Association held a dinner on Dec. 14 in the Exchange Club, Boston, Mass. The event was held in honor of the past presidents of the association, who were all present as the guests of the organization. C. L. Newcomb, of the Deane Steam Pump Co., Holyoke, Mass., was the spokesman for the past presidents. C. S. Lovell, present incumbent, presided.

Foch Honored by Engineers

At an elaborate ceremony significant of the advancing movement to promote international peace through the furtherance of ideals on both sides of the Atlantic, Marshal Foch, soldier of France, was elected to honorary membership in the four leading engineering societies of the United States. The honors were conferred at the Engineering Societies Building, New York City, on Dec. 14, before a large assemblage of prominent engineers and scientists. The four societies which took part were the American Society of Mechanical Engineers, American Institute of Electrical Engineers, American Society of Mining and Metallurgical Engineers, and the American Society of Civil Engineers.

The presentation address was made by Col. William Barclay Parsons, chairman of the board of Columbia University, the commander of the famous 11th Engineers in the World War. Speaking for the engineers, Col. Parsons said in part: "The four national engineering societies of the United States now desire to make record of their appreciation of this fact and to convey to you an expression of their most profound admiration for the great leader of men by conferring on you honorary membership in all the societies, the highest honor in their gift and one hitherto never conferred on a single individual.

"Four thousand members of these societies were enrolled in the armed service of the United States, the greater part of whom had the glorious distinction to serve the common cause in France under your orders. Now we desire that you will still continue to lead us, but in peace, by permitting us to inscribe your name at the head of our roll of honor, where it will be, as your deeds have been, an example to us to do better work, and where it will remain forever a noble inspiration for all future generations."

Mr. Webster then presented to Marshal Foch the certificate of honorary membership.

In response to the presentation address, Marshal Foch said:

"It was due largely to the engineers and the engineering industries that the war was brought to a successful conclusion. The armies could not have accomplished much without the effort of the engineer. Success was made possible to a great extent by the industry of the people at home, but when decisive moments arrived the engineer stood out as an essential factor in attaining success.

"What would have become of the armies without the engineering industries and without the professional knowledge which you exercised and which enabled us to lead our armies in the field, to feed them, to protect them and to facilitate their forward movement.

"It is for these reasons that I am pleased to be here today, to receive so splendid a welcome, to express my gratitude and that of France and of all my countrymen for the splendid sacrifices made by the men of your calling. I am grateful to you for including me in your ranks as one of the members of your four national engineering societies. This honor I deeply appreciate, and I shall always cherish this event among the happiest memories of my visit."

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
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In interpreting the week's news the philosophical business man will give first place to the advance in foreign exchange which carried sterling up to $4.24½ and lifted other foreign currencies, including particularly francs, almost sensationally. Even marks sympathized somewhat in the improvement despite the fact that the German printing presses are still at work, and while there has been some reaction from the highest figures touched, the changed aspect of the foreign exchange markets connote the recovery in European credit that is requisite to and presages reconstruction.

This is directly due to the disarmament program and the four power treaty tentatively adopted at Washington, as well as to the settlement of the Irish question that now awaits ratification in London and Dublin. While all three of these great proposals have still to be approved of by one or more legislative bodies, their popularity with the people is so evident that there is hardly any doubt of their final confirmation, and in this assurance men are preparing to rebuild the world's economic structure with the hope and vigor that a consciousness of security inspires. Of course, it will take time to get all the wrecked machinery repaired and running again, but confidence, the first essential in the process, has been provided and with it there is no limit to what human enterprise can achieve.

Goods Instead of Gold

The preoccupation of the public mind with these larger aspects of the world's affairs has diverted attention from the routine details of the week's business news which are, to tell the truth, without any special significance except as they indicate a continued swing of the pendulum toward the median line of normalcy.

The figures of our foreign trade for November have been called unfavorable because they show exports valued at only $295,000,000 and imports worth $211,000,000, the resulting balance in our favor being but $84,000,000, as against $355,000,000 in November, 1920. As it is, however, impossible that we should continue indefinitely to buy more than we sell, this showing should not be surprising, nor is it to be regretted that we are now commencing to be paid in goods rather than gold for what we ship abroad.

Our continued importation of gold was becoming a menace, and while some large shipments are still on the way the rise in exchange seems to foreshadow a slackening of the movement and will operate to the advantage of our export trade, while it will tend to restrict imports as it increases their cost as measured in dollars.

The admission by the Department of Agriculture that it had previously underestimated this year's cotton crop by 1,500,000 bales and that the indicated yield is 8,340,000 bales has also been bearishly construed in some quarters, but as a matter of fact it has only served to bring out the inherent strength of the market, for most of the decline caused by the revised estimate was recovered when it became known that the consumption in November was the largest of any month since June, 1920. This increase in consumption affords striking proof of the real revival that is developing in the cotton as well as the woolen textile industry of the United States, and were it not for the surplus remaining over from last year a crop of less than 8½ million bales would be regarded as utterly inadequate. Eighteen years ago in the famous Sully boom cotton went to over 17 cents upon the theory that a yield of 10 million bales meant famine, and when Europe regains its purchasing power the bullish implication of this year's deliberate curtailment of the yield will be more generally appreciated.

Lower Rail Rates Needed

There have been no striking developments or price changes in the other commodity markets. In the grain and live stock territory of the West and Southwest the low figures at which corn and cattle are selling continue to be the subject of bitter complaint, but the plight of the farmer is attracting so much attention and sympathy that remedial action of some sort is almost certain to be taken soon. The remedy most advocated is a reduction in railway freights and despite the protestations of poverty with which the railroads oppose lower rates, the probability is that public opinion will soon compel their adoption. One has only to read the "Congressional Record" to see that the agricultural prosperity that the Pacific Coast and especially the fruit growers of Oregon and Washington are enjoying is because they have cheap transportation to the markets of the East via the Panama Canal and is an object lesson that is having its effect upon the Congressmen from the land locked regions of the Middle West.

The bond market, which was somewhat reactionary early in the week, is again booming upon the sale of $55,000,000 New York City bonds due in 50 years to a syndicate that bought them on a basis that yields only 4.35 per cent. As this presupposes their retail distribution to investors, at a price the return upon which will probably be as low as 4¼ per cent or less, it is inferred that the bankers anticipate a further decline in the money market in the near future. This expectation is confirmed by the statement of the Federal Reserve Banks, which shows an increase of $18,000,000 in gold reserves and a reserve ratio of 72.6 as against 73.1 per cent a week ago.

The slight decline in the reserve ratio is probably due to year end tax payments and the delivery of the $250,000,000 Treasury certificates bearing interest at 4¼ and 4½ per cent which, it is officially announced, were four times over-subscribed.

Stock Market Firm

In the stock market speculative interest is gradually spreading. Th advances have not thus far been great but they have been sufficient to inspir predictions of "a temporary recession from the ever present reactionaries wh take a short-sighted view of grea market movements and cannot see tha underlying the present demand for securities is a plethora of investmen capital and gold that exceeds anythin this country has ever known in th past. The low priced railway stock compose almost the only group tha has not thus far shared in the improvement. Their sluggishness i largely due to the persistence of th railway managers in advertising th poverty of their properties, while the are trying to reduce wages and maintain rates. Shrewd observers believe nevertheless, that it is in this department of the market that the greates bargains are to be found.

In London, as in the United State the year is ending with what may b described as a condition of suppresse buoyancy in the markets and there i a growing feeling of confidence in th future. Germany, Russia and India ar about the only really dark spots lef on the world's map and to their illumination the world's statesmanship wil shortly be able to address itself.

Germany has formally announced he inability to meet the reparation payments due in January and Februar unless she can negotiate a foreign loa It is possible that such a loan will b arranged. Through America's peaceful penetration of Russia with food fo the starving, it may be that the politica sanity of the people can be re-established. It seems to be the only wa and offers us a great opportunity.

As to India and the growing unres there, all that can be said is that th problem is one in the solution of whic the British Empire needs more tha ever the marvellous genius of Lloy George in compromise.

Machine Tool Trade in France

Foreign trade in machine tools ha considerably advanced in France, bot in import and export. Taking the 191 figures of 237,350 quintals (quintal 100 lb.) imports and 45,830 quinta exports, imports advanced 36 per ce in 1919, 239 per cent in 1920, and 1 per cent during the first eight mont of 1921; exports decreased 11 per ce in 1919, increased 190 per cent in 192 and 171 per cent during the first eig months of 1921. Germany's export machine tools in 1920 amounted to 949 226 quintals, as compared with 872,7 in 1913, showing an increase of le than 9 per cent.

Technical Developments in Ordnance Department

At no time in its history has the Ordnance Department of the Army been engaged in such important technical development and research work as at present. Relieved as it is of the necessity to secure quantity production, the department is busy in an effort to improve the lessons of the war and to keep abreast with the revolutionary developments in automotive armament, in artillery and in airplane bombs. Major General C. C. Williams, the Chief of Ordnance, is just at this time concentrating much of his personal attention on the matter of bomb development. To his mind the bombing tests off Hampton Roads against the ex-German war vessels demonstrated that the powerful bombs that can now be dropped from airplanes constitute a menace fully as great as the submarine.

General Williams is also very much interested in the development looking to the compounding of the combustion engine. If crude oil can be used as the engine fuel for tanks, it will greatly increase the efficiency of that weapon, he points out. The weak point in the tank is the danger which follows any escape of gasoline. A very extensive research program has been carried on. The principal investigations were in connection with the auto-frettage method of gun construction, the proper heat treatment for nickel-chrome steels used in the manufacture of cannon having steel of high elastic limit, the inauguration of a program for the measurement of internal pressures in the bore of cannon, and a large amount of work pertaining to range finders and optical instruments of all types.

An innovation worthy of note has been introduced in the manufacture of guns and howitzers. In order to maintain a minimum weight of material, the elastic limit of gun steel has been raised to 80,000 lb. per square inch in some of the experimental types.

SEVERAL ACCOMPLISHMENTS

General Williams cites the following as the chief accomplishments of his technical staff during the year:

Development of a time pressure gage based on the Piezo electric effect in quartz crystals.

Experimental study of the initial stability of projectiles and the causes and circumstances affecting their flight has been continued with the result of an accumulation of very valuable data. In connection with these firings there was also experimental study of the effects of air resistance upon projectiles fired with velocities higher than those obtainable in the experiments at the works of the General Electric Co.

Orders were placed with two private factories and with the Watertown Arsenal involving the manufacture of thin armor plates with various compositions and heat-treatments, with a view to the development and selection of the best combination.

A contract was entered into with the University of Michigan for conducting research work on small-arms cartridge cases; several reports were received and considered, which are expected to be of material assistance in the improvement of cartridge cases.

Study of the erosion of machine-gun barrels was continued during the year, and one set of 20 barrels of different compositions was completed, tested, and reported upon; work upon the second set of barrels is in progress.

During the year four meetings were held with the Society of Automotive Engineers, at which questions of automotive engineering were discussed with much benefit to the department's program of development of automotive material.

An ordnance division of the American Society of Mechanical Engineers was formed during the year, and held its first meeting at the Rock Island Arsenal, which was generally considered a most auspicious commencement of what, it is hoped, will be a mutually beneficial liaison. The liaison between the techincal staff and the Bureau of Standards has continued with satisfaction. The bureau had rendered valuable assistance in connection with several investigations.

Increase in Commerce Appropriations

In view of the propitious start made by the commodity divisions of the Department of Commerce, the President and the Director of the Budget have approved a request for an appropriation of $540,000 for the continuance of the work in the interest of the export industries during the next fiscal year. This is an increase of $290,000 over the amount appropriated for this work during the current fiscal year. It is proposed to set up seventeen additional commodity divisions. The iron and steel division is receiving an allotment of $17,000. The existing divisions are each alloted $15,000 for their annual expenses. It is planned that each of the new divisions is to be alloted $15,000.

It is proposed to establish new trade commissioner offices in Russia, in Greece, and in Canada. It is also the plan to undertake special technical investigations in connection with iron and steel in England, Belgium, Germany and France.

In addition, $213,650 is asked to promote the commerce between the United States and Latin America. This is an increase of $113,650 over the current year's appropriations. A portion of the increase is to be applied to the establishment of new trade commissioner offices in Cuba, Colombia, Uruguay and Venezuela.

For promoting commerce in the Far East, $235,630 is asked. This is an increase of $85,650. It is proposed to establish under that appropriation new trade commissioner offices in Delhi, Bombay or Calcutta and in Canton.

For Latin-American Trade

In the opinion of Southern manufacturers further expansion of the South's export trade with Latin America is assured if the United States Shipping Board will permit shipping board vessels operated by various North Atlantic companies, to stop at southern ports for cargo while enroute to South America. If this request is granted the board will co-operate with the South Atlantic Maritime Corporation which now operates in Wilmington, Charleston, Brunswick, Savannah and Jacksonville, and the plan is expected to open a vast potential market for various Southern products in South America. Lumber, naval stores, railroad equipment, machinery and supplies, and various other iron and steel products will probably be among the exports.

Taxes and Exchange Hamper German Competition

Rumors about the ability of German automobile manufacturers to outdistance their American competitors in the world's markets vanish as soon as distinction is made between domestic and export prices of motor vehicles, according to a statement by L. J. Ollier, member of the Foreign Trade Committee of the National Automobile Chamber of Commerce. Reports from abroad indicate that German factories are well occupied with domestic orders.

In Germany the pre-war custom was to quote lower prices for export trade than for domestic consumption. Because of changed economic conditions, the practice is of necessity reversed now, and motor vehicles for export must be sold at a considerably higher price than would be received in domestic trade.

Readers, seeing a list of domestic prices for German motor vehicles and failing to realize the difference between these and export prices, come to a hasty conclusion that German manufacturers are sure to be most formidable competitors of the American motor vehicle industry. A closer analysis will show just the opposite. A typical German automobile, supposedly of medium price, was recently quoted for sale in that country at 150,000 m. The prevailing exchange rate of the mark was then 1.38c., so that the domestic price of the vehicle figured $2,070 in American money. This, it should be remembered, is the equivalent of the price charged in the domestic trade in Germany but not that stipulated for export.

RED TAPE COSTS MONEY

To ship this car abroad, application would first have to be made for an export permit. Upon payment of a nominal fee, this would undoubtedly be granted, but under the stipulation that the sale be effected in gold currency and the exchange thus received made available to the Reichsbank. This monopoly in exchange by the Reichsbank has a direct relation to the reparation payments that must regularly be made to the Allies. By having sole authority to control transactions in gold currencies, the Reichsbank is afforded direct access to the money from which 26 per cent must be obtained for payment of the indemnities. A foreign purchaser would consequently pay for a German automobile a price fixed in gold currency and increased sufficiently to cover the export tax of 26 per cent. Instead of $2,070 as quoted to domestic users, the foreign purchaser would actually pay $3,608.20. Judged on the basis of prices for export rather than for domestic trade, the advantage of German manufacturers is not as great as is generally supposed and even shows further diminution where purchases of foreign raw materials are required in the manufacture of the exported article.

Reports from trade authorities abroad show that German automobile factories are congested with domestic orders.

An Opportunity

The American Welding Society is in receipt of a notice of two openings, with a large corporation, for salesmen on electric arc welders and welding repair jobs for the New York district.

The society will be glad to give any information to applicants who are able to show experience in this line.

Stutz Flays Metric Advocates Before Senate Committee

Hearings have been taken up again on the Ladd metric system bill by the sub-committee of the Senate Committee on Manufactures, of which Senator McNary, of Oregon, in chairman. As this is written those who oppose the bill are presenting their arguments. A voluminous brief was submitted by C. C. Stutz, of the American Institute of Weights and Measures. In addition to this brief, Mr. Stutz presented an oral argument in opposition to the bill. Among other things the brief discusses the metric system in its relation to the artisan, the householder, the farmer, the retail drygoods trade, the railroads, the grocer, foreign trade, education, educators, manufacturing chemists, fire insurance and machine tool builders; also the cost of the change to manufacturers, the metric equivalent scheme, conversion figures, fraud, the two systems in calculation, Japan and the metric system, currency and the metric system, existing demand for the metric system, and previous metric bills. The brief discusses the attitude of various industries toward the metric system; the failure of the system in Peru; exceptions to the metric law in Germany and a discussion of the use of the metric sytem in scientific work in England. Lists of anti-metric resolutions were presented as was a long list of objections to the bill and of answers to arguments which had been presented earlier in the hearing by those in favor of the legislation. Some of the arguments presented by Mr. Stutz follow:

"We are opposed to legislation aimed at making the metric system the single standard of weights and measures in the United States and involving thereby also the prohibition by law of the use of our present English system now employed by our people and in daily use with us since the days of the earliest settlements.

"We are opposed to installing the metric system by compulsion. Any existing system of weights and measures affects the daily habits of every inhabitant of the country. Experience has shown that it is impracticable to change such deep-rooted habits by law.

"The law of 1866 makes the use of the metric system permissible—those who want to use it can do so. In spite of this permission it has made little if any progress in the industrial and daily life of this country.

"The bill as a whole is loosely drawn, the relation of its various sections is obscure and indefinite and its real meaning is concealed.

"The metric system is devoid of the English system's handiness and convenience; its units are either too large or too small for everyday requirements of industry.

"From the English system many subdivisions have been dropped, having outlived their usefulness, thus proving the English system's adaptability to the requirements of progress. The metric system on the other hand presents a rigid structure incapable of modifications and requiring conditions to adapt themselves to its use.

"There are no specific advantages to the average citizen.

"The metric system can never get over the immense disadvantages due to the fact that 10 has only the factors 2 and 5, whereas 12 has 6, 4, 3 and 2.

"The binary division of a unit into halves, quarters, eighths, etc., is the universal natural system. The division and subdivision of the units by 10 is artificial. Metric units are either too small or too large and, therefore, lack the convenience required for everyday use.

"The metric system possesses not even approximate equivalent units for important English designations constantly used, such as the foot and the inch."

Agricultural Information in Department of Commerce

The value of the Agricultural Implements Division of the Bureau of Foreign and Domestic Commerce is being recognized more each day by the manufacturers and exporters throughout the country. The work of this department is collecting trade information from all available sources, digesting and selecting it, and passing it on to the trade. It has become one of the biggest assets to machinery builders during the period of industrial reconstruction.

The department is co-operating with the National Association of Farm Equipment Manufacturers, which represents 75 per cent of the implement and tractor builders in the country. Through this agency the bureau is kept in close touch with the trade and has been of inestimable value to the association.

A good deal of information covering agricultural products is already available in the bureau and is now being selected and consolidated so that it will be at all times accessible. Another important source of information is reports received from abroad. These come from consuls, commercial attaches, and trade commissioners, and give information which is both first hand and up-to-date. Official publications of foreign countries furnish valuable information relative to domestic and foreign trade. The bureau receives about fifty publications and periodicals each month, from which all subject matter relating to the implement industry is digested and published in *Commerce Reports*, or sent out through the manufacturers' association.

A recent report of the implements division announces that agricultural implements manufactured in the United States during 1920 were valued at $343,382,000. Of this amount $46,270,000, or 13 per cent, was exported. During the same year tractors to the value of $165,809,000 were produced; exports reached $31,093,000, or 19 per cent of the total.

J. W. Duntley Killed by Auto-Truck in Chicago

John Wheeler Duntley, founder and one-time president of the Chicago Pneumatic Tool Co., was struck and killed by an automobile truck in Michigan Ave., Chicago, on Dec. 15. He was fifty-five years old.

Mr. Duntley was a pioneer in the manufacture and use of pneumatic tools, working with Charles M. Schwab to place them on the market. In 1884 he organized the Chicago Pneumatic Tool Co., and was its president until a few years ago, when he resigned to become head of the Duntley Automobile Accessories Co. He was also a director of the Taite-Howard Pneumatic Tool Co., of England.

Robert H. McKean Dies Suddenly

Robert H. McKean, manager of the credit department of the McGraw-Hill Company, Inc., died at his home on Dec. 17.

Mr. McKean's services began with the *Engineering and Mining Journal* in April, 1902, as assistant in the accounting department. Within two years he had been promoted to the position of head bookkeeper and at the time the paper was purchased by Mr. Hill he was in charge of the accounting department. About a year after the purchase of the *Engineering and Mining Journal* by the Hill Publishing Company, Mr. McKean was appointed manager of the *Journal*, which position he held until he was elected a director and secretary of the Hill Publishing Company. At this time he assumed the management of the credit department of the company He was a director and secretary of the Hill Publishing Company until its consolidation with the McGraw Publishing Company. After the consolidation he became manager of the combined credit departments and held this position until his death.

Mr. McKean's loss to the McGraw-Hill Company, Inc., will be a serious one because of his unusual ability in his chosen work. His ready wit and keen sense of humor will be missed by his associates.

Georgia Rail Rates

The Georgia State Railroad Commission has again resumed hearings in Atlanta on a petition of the carriers for increased intra-state transportation rates in the state, products of iron and steel plants and machine shops of the state being scheduled for consideration That the carriers will take virtually the same petition before other commissions in the Southeastern states immediately on completion of the Georgia case, is regarded as certain by southern industrial interests, which are combining their forces to defeat the efforts of the carriers for increased rates. A hearing is scheduled before the Alabama Public Service Commission to begin Jan. 9, 1922, and also to concern intra-state transportation.

An Oakite Sales Conference

Quite in line with the determination to build a bigger business in spite o hard times, the Oakley Chemical Co held a sales conference in New Yor on Dec. 13, 14 and 15. Sales representatives from all over the country t the number of about fifty were assembled for a conference, both as to th sales and to the technical side of sel ing Oakite. The technical sessions wer especially interesting and showed th great changes which have taken plac in sales organization during the pas ten years.

Live, interesting papers were presented by the most experienced men i the organization, among them bein papers on cleaning with Oakite, especially the prevention of discoloration i metals which are to be plated or othe wise covered. The use of Oakite solutions with spraying machines ar heated cleaning tanks were discusse at length and many interesting poin were brought out.

A theater party and a banquet wer provided as a relaxation from the thre days' strenuous sessions.

Patent Office Must Have Aid

When Commissioner Newton was in charge of the Patent Office in July, 1919, he testified before a committee of Congress to the effect that the situation in his bureau was deplorable and that it was in a worse condition at that time than at any other time since he had been in the service. His service began in 1891. The present commissioner of patents in his report to Congress, points out that the degeneration has continued steadily since the testimony of Commissioner Newton. Between July, 1919, and June 30, 1921, the Patent Office lost 163 of its examiners. "These men," says the commissioner in his report, "were scientifically trained and also members of the bar. They have been replaced by inexperienced men, fresh from college, without any knowledge of patent law and without legal training." Continuing the reports says:

During the time the Patent Office has been losing the 163 men aforesaid, the number of applications received in this office has increased by leaps and bounds. The number of applications for patent has increased 34 per cent during the period under discussion, while the trade-mark applications increased 85½ per cent. There are now about 50,000 applications awaiting examination. It is further shown that a number of divisions are over eleven months behind in their work, and to illustrate the large turnover in the personnel, there is cited one of the chemical divisions where five out of the nine examiners have been appointed in the last few months. One out of every four examiners has resigned in sixteen months and more than one-half have resigned in 32 months.

INDUSTRY HELD UP

It is shown that there are many industries which cannot enter into development work on account of the doubtful status of their applications for patents. A bill is now pending in the House, H. R. 7077, which is designed as an emergency measure to help relieve the situation.

The receipts of money for the fiscal year just closed increased from $2,615,697.33 in the previous fiscal year to $2,712,119.69. A net surplus of $284,342.93 was earned, and if the bonus be subtracted therefrom, the surplus amounted to $71,745.73, making the total net surplus to date, that is, the excess of receipts over expenditures during the history of the Patent Office, $8,376,769.29.

Emphasis is laid upon the figures given and the conditions cited to show that the volume of business presented to the Patent Office is altogether too large for the present personnel.

◆

A Real Disarmament Conference

Rear Admiral David Potter, Paymaster General of the Navy, announces a series of conferences at which plans for the disposition of obsolete battleships will be discussed. Admiral Potter expects to discuss the matter with steel operators, shipbuilders, scrap-dealers, financiers and editors of technical and trade papers with the view of determining the best method of developing the ship-breaking-up industry in the United States and the disposition of the resultant scrap.

Coal Mining Machinery in British Mines

An increased use of mechanical appliance in British coal mining is disclosed by the official report of the chief inspector of mines which has just been issued. Less than 6 per cent of the coal mined in British pits in 1910 was obtained by coal cutting machines, while in 1920 the quantity thus obtained amounted to 13.2 per cent of the total production.

Comparative figures from the official reports, received by the Bankers Trust Company, of New York, from its English information service, indicate that in 1910 the tonnage cut by machinery was 15,747,558 tons; in 1920 that tonnage was almost doubled.

The use of electricity at British coal mines, for all purposes, continues to expand. In 1918 the horsepower of motors installed was 965,367; in 1920 the horsepower was 1,080,822, a gain in two years of approximately 12 per cent. Of the total number of mechanical coal cutters in use three-sevenths are electrically driven.

◆

Navy Yard Workers and Wage Cut

With regard to navy yard wages, the Secretary of the Navy has the following to say in his annual report to Congress:

The act of July 16, 1862, requires that wages in navy yards shall conform, as nearly as consistent with the public interest, to those paid in private establishments in the vicinity of the navy yards. Therefore the department, on May 10, 1921, directed the convening of wage boards at navy yards and stations throughout the United States and at Pearl Harbor, for the purpose of collecting data and submitting recommendations to the department as to a fair and just rate of pay in accordance with the provisions of the law.

The department had the wage question considered with great care, local boards utilizing some two and a half months. These local boards received committees representing employees of the various trades and occupations and collected data, submitting recommendations to the department as to what they considered a fair and just rate of pay for employees at the yard in consideration of the data collected. In addition, the department appointed a commissioned officer of the Navy, a civilian official of the department, and a representative of labor to act as a reviewing board. This board received all of the reports from the yard boards, went into the matter from all angles, and submitted a unanimous report advocating various wage reductions, which has been adopted. It is worthy of note that the navy-yard employees are discharging their duties with their customary fidelity.

◆

Bulletin of Engineering Advertisers

The Engineering Advertisers' Association, of Chicago, has adopted a new method of keeping its members advised on subjects related to their field, by the publishing of a monthly bulletin. This bulletin gives a digest of the proceedings of the association meetings and also furnishes facts and useful information on industrial problems.

The bulletin will be sent upon application to advertising managers of concerns selling technical engineering products.

Railroad Salaries

Architectural, chemical and engineering employees of the Class I railroads received an average compensation of $236 during July. This refers to employees of this type in Class A. In Class B the average earning was $185. Sub-professional engineering and laboratory assistants received $144, per employee. The total amount paid Class A architectural, chemical and engineering assistants was $603,268. Class B employees in the same work received a total of $585,203. Sub-professional engineering and laboratory assistants received a total of $371,245. The number of full time positions in the respective grades were as follows: Architectural, chemical and engineering assistants Class A, $2,504; architectural, chemical and engineering assistants, Class B, $3,082; sub-professional engineering and laboratory assistants, $2,464. The figures have just been made public by the Interstate Commerce Commission.

Total earnings per employee in July in certain other lines of work are as follows: General foremen, electrical transmission, $238; assistant general foremen, electrical transmission, $215; linemen, $159; electrical inspectors, $202; shop inspectors, $202; boilermakers, $162; electrical workers, Class A, $170; electrical workers, Class B, $167; electrical workers, Class C, $130; machinists, $159; molders, $128; skilled trades helpers, $115; laborers (shops, engine-house, power-plants), $94; common laborers (shops, engine-houses, power-plants), $82; stationery engineers (steam), $157; stationery firemen and oilers (steam and electrical plants), $130; laborers, coal and ore docks, $102; road passenger engineers and motormen, $250; road freight engineers and motormen (through freight), $190; road freight engineers and motorman (local freight), $251.

◆

Ordnance Tests on Auto Tracks Prove Satisfactory

The ordnance department of the Army is very much pleased with the progress of experiments with light, flexible, fabric tracks for automobiles. The most encouraging results have been obtained from such a track which can be applied readily over the ordinary tires of a Ford car. The mechanical additions to the machine to enable it to use this track are simple and easy to install. It has been found entirely feasible to drive the car on this caterpillar tread at a rate of thirty miles per hour over very soft ground. An incident of the experiment is that there is no wear on the regular tires when the track is in operation. The same type of track has been applied successfully to Dodge and other makes of cars. Gratifying results also are being obtained in the application of the track to the mounts of heavy guns. It is very generally held that the greatest post-war advance in ordnance activities has been in connection with the motorizing of Army artillery and vehicles.

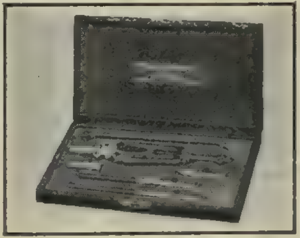
The ordnance department is about to complete a very extensive study of ballistics and other ordnance theories. A staff of computers has been busy for some time on new ballistic tables which will mark a great advance in the facility of computation. New range tables also are being prepared.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Instrument, Drafting, Precision, "Normal"

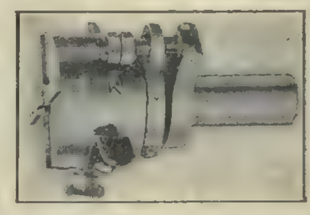
E. Lawrenz, 2533 McClellan Ave., Detroit, Mich.
"American Machinist," July 7, 1921.



The instrument is intended for the drawing of circles from 1/16 to 12 in. in diameter; and by the use of an extension bar, circles 24 in. in diameter. The instrument is shown in its case with two non-hinged ruling pens, as well as with the extension arm and the pen attachment. It is stated that the set is capable of performing all ordinary drafting work, since no small compasses are needed. The principal feature of the instrument is the fact that the two legs are always parallel, or normal to the plane of working. The instrument can be quickly set to the radius desired, and then clamped into position. The grip is made of aluminum, while the working parts are made of steel. The arms are rust-proofed by either of two methods.

Die Head, Self-Opening, Adjustable, Style DS

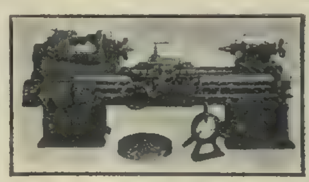
Geometric Tool Co., New Haven, Conn.
"American Machinist," July 7, 1921.



This die head was designed primarily for use with the Brown & Sharpe automatic screw machine, but is said to be quite as well adapted to other automatics. The spindle does not have to be reversed to back the die head off the threaded work. The head floats to suit the thread being cut. Buffer springs allow the head to yield slightly when the chasers come in contact with the work. Two check nuts at the side of the head provide adjustment of the point of tripping. A spring closing attachment is provided to automatically close the head when the turret revolves. The head is furnished in three sizes, 5/16, 9/16 and ¾ in. The work that can be cut varies in diameter from 1/16 to ¾ in., in length from 1¼ to 1¾ in. and in pitch from 10 to the finest desired.

Lathe, Cone-Head, Double Back-geared, 22- and 24-in.

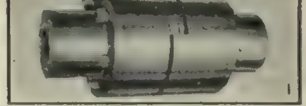
Lehmann Machine Co., St. Louis, Mo.
"American Machinist," July 14, 1921.

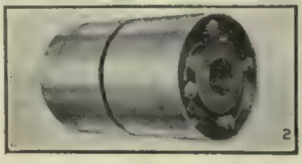


This three-step-cone, double-back-geared engine lathe is built in 22- and 24-in. sizes. The bed has chilled ways and is braced by large cross-ribs. The V's are large, and have a total angle of 90 deg. The inside front way is flat. A rack is cast in the center of the bed for engaging the pawl on the tailstock. A geometrical progression of nine spindle speeds is provided in the head. The hardened spindle runs in hard bronze bearings. The apron has a central oiling system and a removable front plate, so that the mechanism is accessible without removing the whole apron from the carriage. The whole quick-change mechanism is a unit contained within a housing that can be entirely removed in a few minutes. The feed rod is not running when thread cutting, and the lead screw is inoperative when the feed rod is employed. All gears are covered.

Coupling, Flexible, "Cushion," Karge

Karge-Baker Corporation, Phoenix, N. Y.
"American Machinist," July 14, 1921.





This cushion coupling is adapted to the connection of rotating shafts transmitting power, and it not only corrects for parallel and angular misalignment and permits armature float, but it also cushions the drive and absorbs the shocks occurring between the two shafts. The drive is transmitted through a helical steel spring of square section. The coupling is made in a variety of forms to adapt it to various uses. In Fig. 1 it is shown fitted with flanged ends carrying hubs to fit the shafts being connected. The standard coupling is made in sizes to transmit from ½ to 160 hp. Fig. 2 shows the compression coupling. For cushioning shocks occurring in power transmission, the coupling mechanism is incorporated in the hubs of pulley and gears. It is also built integral with a friction clutch.

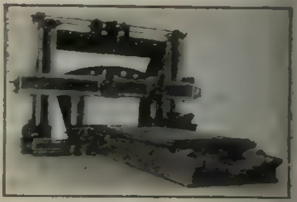
Pump, Oil, Hand

Rothweiler & Co., 2962 First Ave. South, Seattle, Wash.
"American Machinist," July 7, 1921.

The pump is intended for the removal from the container of oil of any grade, gasoline, turpentine, paint or other liquids. The suction pipe at the bottom of the pump is placed down in the container; and a bushing on it fits either the ¾-in. opening in a steel drum or a 1-in. hole bored in a wooden barrel. The spout can be swiveled, being turned up after using, so that oil does not drop from it. The cylinder is made of steamless steel tubing, the valves ground, and oil-proof leather packings are used. The pump throws about a pint of oil at each stroke, so that 4 gal. per minute can be delivered, it is said. The weight of the complete pump is 7 pounds.

Planer, Movable Side-Rail, 13-ft.

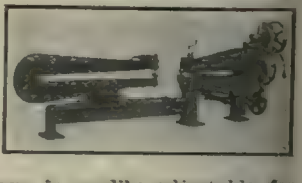
Betts Machine Co., Rochester, N. Y.
"American Machinist," July 14, 1921.



The planer has one side head mounted on a vertical rail that can be moved relative to the table. The advantage of the arrangement is that work of different widths can be accommodated in the machine, and yet both side heads put in use without any undue overhang of either one. The machine has a capacity of 13 ft. 2 in. between the housings, 8 ft. 2 in. under the crossrail, and a planing length of 20 ft., although it can be furnished in any desired length. All four heads are equipped with patented feed and power rapid traverse arrangements. The feeds are entirely independent of each other in all directions. The drive is furnished by a 75-hp. reversing motor, giving cutting speeds of 20 to 40 ft. per minute. Forced feed lubrication is provided, and the oil is filtered by a Bowser oil-filter system.

Shear, Ring and Circle, No. 13-B

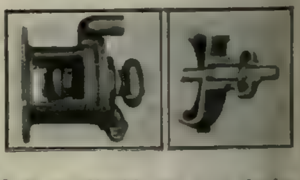
Niagara Machine and Tool Works, Buffalo, N. Y.
"American Machinist," July 14, 1921.



This deep-throat ring and circle shear is intended for work on light material. The machine not only cuts outside circles, but also internal circles or holes. It is also suitable for cutting reverse curves within certain limits. The upper cutter can be raised and lowered to penetrate the stock, so that the cut can be started in any part of the sheet, and not only on the edge. The slitting gage is readily adjustable for strips of various widths. The circle arm has a throat of sufficient depth to permit of cutting from square blanks the largest circles for which the machine is rated. An eccentric device is used for clamping, enabling the easy and rapid fastening of the work. A clutch, actuated by a hand lever, permits of stopping the motion quickly at any point. The machine is regularly furnished for bench use. Weight, 430 lb.

Pump, Rotary, Packing Gland for

Arrow Pump Co., Buhl Bldg., Detroit, Mich.
"American Machinist," July 14, 1921.



The concern is prepared to manufacture different types of rotary pumps in which are incorporated its own design of self-lubricating packing gland. It is claimed that the construction eliminates leaky glands and scored shafts due to improper lubrication at the glands. The cut-away view on the right side of the accompanying illustration shown the construction. The gland is applicable to any device requiring the packing of a rotating shaft. A ring oiling device is used. A constant and positive flow of oil is thus supplied to the gland and to the bearing which is part of the construction. The shaft is supported close up to the load. Soft, resilient packing is not used, as metallic packing affords all the resiliency necessary to completely seal without scoring the shaft. At the left side of the illustration is shown a centrifugal pump intended for circulating water on an automotive engine, and fitted on each end of the shaft with a gland such as just described.

Clip, paste on 3 x 5-in. cards and file as desired

Business Items

A report coming from J. J. Tynan, manager of the shipbuilding plants of the Bethlehem Steel Co., states that the steel works at Alameda, Cal., will be devoted to the building of Diesel engines. Plans are being formulated to start the program within the next few months.

The Exeter Machine Works, Inc., of West Pittston, Pa., announces the appointment of the following companies to handle the Exeter rotary pump line: Hodgard & Co., Chicago, Ill.; H. M. Stark Machinery Co., Detroit, Mich.; Vickes & Co., Seattle, Wash.; Reeves & Skinner Machinery Co., St. Louis, Mo.; Buckmaster-Luck-Walochee, Inc., New Orleans, La.

The American Bosch Magneto Corporation is reorganizing its system of distribution with a view to an intensified drive for the sale of its new line of automobile accessories and appliances. A council of branch managers and salesmen from different parts of the country was held at the plant in Springfield, Mass., Dec. 1 to 3. Numerous agency houses will be established to handle products under a contract arrangement. Among the score or more of specialties to be put on the market are a new battery ignition system, a new magneto for tractors and trucks, starting motors, magneto fittings, impulse couplings, switches, ammeters, spark plugs, and various tools and accessories.

The Connery Machine and Tool Co., Springfield, Mass., has bought a site for a new shop on Fisk Ave., and will erect a new building 150 x 50 ft. The company is manufacturing tools for several automotive industries in this vicinity.

The Robert M. Keating Co., Springfield, Mass., will soon place on the market an improved model of its silent flush valve. Tools for the work are now in making, and it is expected production will be reached in January.

The Liberty Pressed Metal Co., at Kokomo, Ind., a manufacturing concern that has been in the hands of a receiver since last February, was purchased Nov. 29 by J. W. Johnson, of Kokomo, and C. T. Byrne, of Chicago. The price paid was $65,000. The purchasers are interested in Kokomo industries.

The Loshbaugh & Jordan Tool and Machine Co., at Elkhart, Ind., has increased its capital stock from $50,000 to $110,000.

Announcement has been made at Indianapolis, Ind., that J. M. Neher has purchased the Model Machine Works, at Frankfort, from Perry Goble. Mr. Neher has assumed possession.

The Buffalo Machinery Sales Corporation has been organized at Buffalo, N. Y. Directors are A. M. Andresen, W. J. Hogg, E. G. Russ and G. W. Brunton.

The Terminal Iron Works has been organized at Stockton, Cal. Harry W. Fawke, formerly superintendent of the Moore Shipbuilding Co., and Edward McKarley are the owners. They have purchased the plant of the Stockton Iron Works and have leased several acres of land from the Southern Pacific R.R. for the construction of an additional plant.

Fenwick Freres & Co., of 8 Rue de Rocroy, Paris, France, will close its New York Office on Jan. 1. Lunham & Moore, of New York, will act as agents for the company in this country.

The Atlas Vise Co., has been incorporated to manufacture buy, sell and deal generally in vises and tools of all kinds. Principal offices are at Lowville, N. Y. Directors are F. M. Stricklan, E. W. Fulton, G. L. Fulton, Henry Pettie and H. W. Green. The company owns and controls patents for the Nutyp and Velox vises.

The Cincinnati Shaper Co., of Cincinnati, Ohio, has established a branch office at 940 Lemcke Annex, Indianapolis, Ind. T. C. McDonald has been appointed manager.

The Kendell Engineering Co., has been organized at Fort Wayne, Ind., by C. A. and R. L. Kendell. The company will manufacture a piston ring which is claimed to have several improvements and which is the invention of the Kendell brothers.

The Kemp Machine Works, Muncie, Ind., formerly manufacturers of aeroplane and marine motors, has changed to manufacturing pistons, piston rings, valves, wristpins and machine tools.

Legislation has been introduced into Congress providing for the extending of the term of the National Screw Thread Commission, for a period of five years from Mar. 21, 1922.

The Phoenix Sprinkler Co., of Springfield, Mass., recently filed papers of incorporation in Massachusetts, to make and install sprinkler systems, etc. The capital stock is $250,000. Chas. H. Atkins, Springfield is president and Fred G. Burnham of the F. G. Burnham Coal Co., Willimansett, Mass., is treasurer.

The Betson Co., Inc., New Haven, Conn., has been incorporated under the laws of the State of Connecticut to engage in selling tools, machinery, etc. The capital stock of the concern is $50,000. The incorporators are: W. C. Bettilyon, 280 Whalley Ave., New Haven; F. W. Pierson, and H. F. Parmalee.

The Gilbert & Barker Manufacturing Co., West Springfield, Mass., recently awarded five years' service pins to M. F. Bennett, of the Albany, N. Y., sales branch and C. W. Kincaid, of the Dallas, Tex., sales division.

The Hemming Manufacturing Co., 706 Howard Ave., Bridgeport, Conn., filed papers of incorporation Nov. 26, with the Secretary of State of Connecticut, to engage in the manufacture of metal goods, etc. The capital stock is listed at $25,000. Alex Berg is the president, G. A. Berg, secretary, and R. F. Clark, treasurer.

Unofficial figures indicate a production of more than 115,000 tons of pig iron in Alabama during November, according to William E. Dunn, Jr., of Atlanta, secretary of the Southern Metal Trades Association. Counting November, pig iron production in the state exceeded the 100,000 ton mark only four times this year. There was steady improvement in pig iron production during September, October and November of this year. A large part of the melt is being used by cast-iron pipe, sanitary pipe and fittings plants, many of which are operating at full capacity in the Alabama district.

Personals

A. A. Albaugh has been appointed vice-president and general manager of the Barnhart-Davis Co., Warren, Pa.

Nelson B. Gaskill, of New Jersey, has succeeded to the chairmanship of the Federal Trade Commission for a term of one year. Mr. Gaskill was appointed to the commission in December, 1919, to fill an unexpired term caused by the death of John Franklin Fort.

George K. Vail, general manager of the Arthur G. McKee Co., Cleveland, Ohio, blast furnace and steel mill engineers, has resigned to become vice-president of the Ohio Steel Foundry Co., Lima, Ohio.

J. J. Herlihy, successor to Charles N. Newman as division master mechanic of the Baltimore & Ohio, with headquarters at the Washington, Ind., shops, has taken up his new duties. Mr. Newman was promoted to the superintendency of the company's shops at Pittsburgh and left for that city last week. Mr. Herlihy comes to Washington from Parkersburg, West Va., where he was master mechanic.

Herbert A. Pike, president and treasurer of the Boston Pressed Steel Co., Worcester, Mass., has disposed of his interest in that business and has retired. His stock was purchased by William Sanger, of Toledo, Ohio, formerly general manager of the Clauss Shear Co., Fremont, Ohio, who has become treasurer. Douglas P. Cook, who was vice-president is now president and general manager.

Thomas A. McGinley has been elected director of the Westinghouse Air Brake Co., succeeding his father John R. McGinley, who recently retired.

J. M. McNeal, sales engineer of the Landis Machine Co., Waynesboro, Pa., has returned after spending a year and three months in England and the continent.

P. T. Irvin has been placed in charge of the recently formed small tool division of the Greenfield Tap and Die Corporation, of Greenfield, Mass. Mr. Irvin was formerly sales manager of the Lincoln Twist Drill Co.

T. C. McDonald has been appointed local sales manager of the Cincinnati Shaper Co., in its office in Indianapolis, Ind. Mr. McDonald also represents the Reed-Prentiss Co. in that city.

B. H. Anibal has been appointed chief engineer of the Peerless Motor Car Co., of Detroit, Mich. Mr. Anibal recently resigned as chief engineer of the Cadillac Motor Car Co.

Martin G. Sperzel has succeeded John D. Sells as sales manager of the Royersford Foundry and Machine Co., of Royersford, Pa. Mr. Sells has retired to private life, leaving his work to Mr. Sperzel who has been the company's sales engineer for a number of years.

V. A. Root, formerly with the Bausch Machine Tool Co., of Springfield, Mass., has been appointed assistant sales manager of the National Automatic Tool Co., of Richmond, Ind.

C. F. Meyer, assistant secretary of the Landis Machine Co., Waynesboro, Pa., has returned from a years trip in

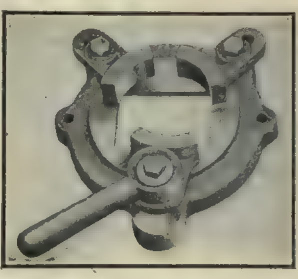
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Vise, Piston, Universal

Manley Manufacturing Co., York, Pa.

"American Machinist," July 14, 1921

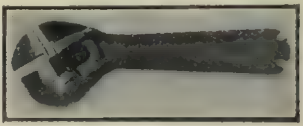


The vise is for holding automotive pistons while working on them, as when replacing the rings or wrist-pins or tightening the connecting-rod bolts. The device is said to be adaptable to all sizes of automobile pistons, hence is called "universal." It is intended for attachment to a work bench. The vise grips the piston by means of three jaws, the inside bearing surfaces of which are circular arcs. The front jaw is fitted with an eccentric operated by means of a small lever, so that the piston can be quickly released and clamped when once the jaws have been adjusted to fit it. The square hole in the center of the vise is for use when the connecting rod is attached to the piston that is placed in the vise, as the rod can be allowed to hang through the hole. The vise holds pistons from $2\frac{11}{16}$ to $5\frac{5}{16}$ in. in diameter. It is made of cast iron and weighs 15 pounds.

Wrench, Adjustable

Messers Huber & Dubs, Zurich, Switzerland

"American Machinist," July 14, 1921

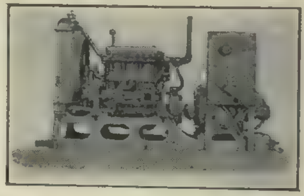


The body and jaws are made in one piece of drop-forged steel. Between the jaws, as shown by the accompanying illustration, are placed a number of thin oblong plates 0.032 in. in thickness. These plates move on hinges, and can be turned back singly from their position between the jaws. In each position, they are rigidly held in place by a spring plate screwed to the body. The wrench is at present made in one size only, the jaw opening being adjustable from $\frac{1}{2}$ to 1 in. It can, however, be produced in any desired thickness. The thin metal plates are made of hardened steel, and the spring and the plates are easily renewable. The chief claim is that the wrench maintains a constant distance between the jaws better than screw-adjustable wrenches.

Generator Set, Arc-Welding, Electric, Medium-Duty, WD-10

General Electric Co., Schenectady, N. Y.

"American Machinist," July 21, 1921



The equipment is intended particularly for intermittent work. The generating unit consists of a type WD-10 generator, directly connected by a flexible coupling to a Matthews, Model F, 4-cylinder, 4-cycle, 20-hp. gasoline engine. The engine, radiator, generator and welding panel are assembled on wooden skids. The set is 86 in. long, 28 in. wide, and has a net weight of about 2,000 pounds. The generator is self-exciting and regulating, and gives a no-load, or striking voltage of 60, which automatically decreases to the proper welding voltage, usually 18 or 20 volts, when the arc is struck. It is driven at a speed of 1,200 r.p.m., has a normal output of 4 kw. and delivers a maximum working current of 200 amp.

Screw Machine, Mechanical Control for, "Iron Man"

Pearson-Scott Co., 1523 East Washington St., Indianapolis, Ind.

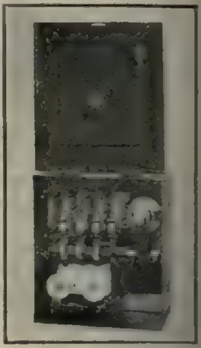
"American Machinist," July 21, 1921

The machine is intended for attachment to a hand screw machine, so as to make the operation automatic. It is designed so that it is suitable for placing either at the turret end of the screw machine or at the head end, the latter arrangement being shown. The essential element of the machine is the large worm-driven disk, upon the sides of which cams can be mounted. The cams operate to press against hard steel rollers carried on the horizontal crosshead, causing this crosshead to slide back and forth on the finished guide at the center of the machine as the disk revolves. The motion is conveyed to the screw machine controls through a combination of levers. The motions start, reverse or stop the screw machine; and the turret is indexed, and cutting-off and forming tools operated, as desired. The machine, called the "Iron Man," can be set between two screw machines working on the same part, so as to control both of them at the same time.

Switch, Starting, Magnetic, A.C. Motor, G.E.

General Electric Co., Schenectady, N. Y.

"American Machinist," July 14, 1921

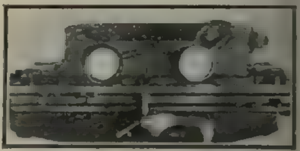


This inclosed magnetic starting switch is for small alternating-current motors, and known as the C. R.-7005-A-2 switch. It is for use with motors of from 3 hp. and 110 volts up to 5 hp. and 220, 440, and 550 volts. The switch is suitable for use with momentary contact start and stop push-button stations, or snap switches, float switches, pressure governors and thermostats. The apparatus consists of an operating magnet, contactor, and protective plugs, all mounted on a sheet-steel base and inclosed in a case with a cover hinged at the top. All parts are easy of inspection, and renewal of vital parts is a simple matter, owing to their accessibility and design, it is said.

Dynamometer, Milling Machine, Poliakoff

Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio

"American Machinist," July 21, 1921



The dynamometer is used to determine the pressure exerted by a milling cutter at work. It is intended for mounting on a machine table, to hold the piece being cut. The pressure of the cutter on the work is shown by means of dials, one of which gives the vertical and the other the longitudinal thrust. Heavy springs are used to put initial loads on each hydraulic chamber, so that the dials will show loads in either direction. The dynamometer has the capacity to withstand longitudinal loads of 25,000 lb. in one direction and 4,000 lb. in the opposite direction, vertical downward pressures of 10,000 lb. and upward pressures of 7,000 pounds. The working surface of the table is 16 in. long by 10 in. wide, and is provided with three T-slots. The height of the working table is 8 in. The total size of the base is 35 x 14 inches.

Generator Set, Arc-Welding, Electric, Heavy-Duty, WD-9

General Electric Company, Schenectady, N. Y.

"American Machinist," July 21, 1921

The equipment can be arranged to supply either one or two welding circuits. It consists of a 20-hp., 2-cylinder, opposed, Reliable Heer, Model 00 gas engine, a type WD-9 generator and welding panel, the whole mounted on a welded structural steel base. The net weight is 2,400 lb. for the single-operator equipment, and 3,200 lb. for the two-operator equipment. The engine is designed for continuous operation, and will run on kerosene, distillate, gasoline, or natural or artificial gas. The generator is driven by a silent chain running in oil, at a speed of 1,750 r.p.m.

Attachment, Drilling, Boring and Milling, Universal

Supreme Machine and Tool Co., 1738 St. Clair Ave., Cleveland, Ohio.

"American Machinist," July 21, 1921

The device is intended especially for jig boring; and it is said to eliminate the necessity of figuring and checking the angles on the work in the toolroom, of buttoning the jig and of removing the work. The attachment is arranged to fasten on the column and overarm of a milling machine. The boring spindle is driven from a main gear which is adapted to the spindle of the milling machine. The movements of the traveling spindle are two, being radially in a slide which, in turn, has a circular movement imparted by a series of worms and gears, so that any angle can be obtained. The attachment is self-contained and easily attached, and when in place it forms an integral part of the machine. It does not extend beyond the spindle of the milling machine any more than the ordinary drill chuck or boring toolholder.

Clip, paste on 3 x 5-in. cards and file as desired

foreign lands. He visited India, Java, China, Japan and the Hawaiian Islands.

William R. Norcross, president of the American Molding Machine Co., of Terre Haute, Ind., has been appointed a member of the Board of Public Works of that city.

J. D. Mooney, general manager of the Remy Electric Division of the General Motors Corporation has been promoted to vice-president in charge of operation. He will be located in the East. Mr. Mooney was formerly manager of the industrial bearing division of the Hyatt Roller Bearing Co.

I. J. Reuter has been appointed general manager of the Remy factory of the General Motors Corporation at Anderson, Ind.

W. H. Heard, president of the Spramotor Company, London, Canada, has purchased the business and plant of the Aylmer Pump and Scale Co. at Aylmer, Ontario, and plans to carry on both factories .

Prof. Wentworth Stewart, president of the American Association of University Professors, addressed the Springfield (Mass.) Employment Managers' Association at its annual meeting on Dec. 6. Dr. E. C. Gilbert, of the Chapman Valve Co., was elected president; and L. A. Blanchard, of the National Equipment Co., was elected treasurer.

F. L. Rowland, assistant treasurer of the Gilbert & Barker Manufacturing Co., West Springfield, Mass., was recently elected executive secretary of the National Association of Office Managers at the recent meeting of that association in Buffalo, N. Y.

R. K. Winans, of the advertising department of the Gilbert & Barker Manufacturing Co., West Springfield, Mass., has severed his connections with that company to become sales and service manager of the J. H. Bordeaux Co., advertising printers, etc., of Springfield, Mass.

E. J. Charron, of the general sales department of the Gilbert & Barker Manufacturing Co., West Springfield, Mass., has recently been transferred from the Montreal, Canada, to the South Bend, Ind., sales division.

H. L. Gardner, of the general sales division of the Gilbert & Barker Manufacturing Co., West Springfield, Mass., has just returned from a three months' leave of absence spent traveling in England, France, Belgium and other countries of Europe. He will shortly take up his sales duties for the company in the California district.

Obituary

Gustav Akerlund, inventor and consulting mechanical engineer, died in New York City on Dec. 13. Mr. Akerlund was president of the engineering firm of Akerlund & Semmes and was a prominent member of the American Society of Mechanical Engineers.

Edgar W. Summers, president of the Summers Steel Car Co., of Pittsburgh, Pa., died last week at Glenshaw, N. Y. He was sixty-three years old.

Charles C. Hale, president and general manager of Peck Brothers Company, New Haven, Conn., died at his home in that city on Dec. 7 after a short illness.

Book Reviews

The J. E. Aldred Lectures on Engineering Practice, 1920-21. Issued by the School of Engineering of the Johns Hopkins University, Baltimore, Md. Two hundred eighty-five 6 x 9-in pages, paper cover. Published by the Johns Hopkins Press, Baltimore, Md.

The nine lectures contained in the book comprise one part of a general plan carried on at Johns Hopkins to further and improve undergraduate instruction in the methods and problems of the practice of engineering. They deal with the practical phases of engineering problems, presupposing an elementary knowledge of theory.

The nine lectures are as follows: Electricity Supply Systems in Large Cities, by Philip Torchio, chief electrical engineer, New York Edison Co., New York City; Railway Signaling, by Azel Ames, engineer, Kerite Insulated Wire and Cable Co., New York City; Radiotelephony: Its Principles and Use, by John V. L. Hogan, manager, International Radio Telegraph Co., New York City; Subway Construction in New York City, by Robert Ridgway, engineer, Subway Construction, New York City; Municipal River Front Improvements, by George S. Webster, chief engineer, Western Electric Co., New York City; Modern Methods of Gas Manufacture, by Col. Frederick H. Wagner, Bartlett-Hayward Co., Baltimore; The Methods of Manufacturing a New Product, by Edwin Pugsley, Winchester Repeating Arms Co., New Haven; The Use of Automatic and Semi-Automatic Machines, by Ralph E. Flanders, manager, Jones & Lamson Co., Springfield, Vt.

Technologic Paper, No. 198. Bureau of Standards, Department of Commerce, sold by the Superintendent of Documents, Government Printing Office, Washington, D. C., price 5 cents.

A summary of some results of tensile tests of 368 specimens of manila rope, conducted by A. H. Stang, associate physicist, and L. R. Strickenberg, assistant mechanical engineer of the Bureau of Standards. The results of the tests are given in table and graphic form and a formula is arrived at for determining the average breaking load as a function of the diameter of the rope.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

An importing firm in Norway desires to purchase and secure an agency for the sale of hand tools, steel pulleys, all kinds of transmission appliances, and machine tools for iron and steel. Quotations should be given f.o.b. New York. Payment to the made through bank in Norway. Reference. No. 383.

A merchant in Italy desires to purchase or secure an agency for the sale of woodworking machinery and machinery repair parts. Correspondence should be in Italian. Reference No. 373.

The sole agency is desired of American motor car manufacturers, by a firm in New Zealand which uses a large number of cars in its own business. Reference No. 392.

Catalogs Wanted

The Engineering School of Drawing, 457 Main St., Springfield, Mass., would like to receive catalogs and diagrams of production machinery.

A gentleman in Barcelona, Spain, desires to be put in touch with American exporters of machinery supplies, such as cotton waste, leather belting, etc. He is in a position to sell such products in Spain and would like to take on a few representations of lines that are of high quality and reasonable price. Address J. G. Alonso, Fontanella 10, Barcelona, Spain.

Trade Catalogs

Recorder. Yarnall-Waring Co., Philadelphia, Pa. Circular describing recent development of a self-contained WRCO recorder.

Coffin Balancer Needle Valve. Coffin Valve Co., Neponset, Boston, Mass. Catalog describing the latest types of balanced needle valves.

Tips for Tool Hardener. Vanadium-Alloys Steel Co., Latrobe, Pa. Card for hardening room, contains thirty-seven tips or suggestions for the practical workman. Cards are sent gratis to the trade.

Hart Roller Bearings. Hart Roller Bearing Co., Orange, N. J. A well-made-up booklet entitled "Value versus Competition," which gives an intelligent presentation of the value of Hart staggered roller bearings of the radial and thrust type.

Whiting Cranes. Whiting Corporation, Harvey, Ill. Beautifully illustrated catalog, eighty 6 x 9-in. pages, No. 158, describing a full line of electric cranes, bucket cranes, jib cranes, lifting attachments and railway specialties.

Hobbing Cutters. Simmonds-Method Hob Co., Philadelphia, Pa. Catalog describing construction and use of hobbing cutters with generated teeth. Tables of size and specifications are included.

"Wonder Chuck." The Callis Company, Clinton, Ohio. Bulletin "A," illustrating and describing the latest model "Wonder" chuck now on the market.

Quality Tools. The Callis Company, Clinton, Ohio. General catalog No. 10 describing, with illustrations a line of drill chuck arbors lathe bushings and centers, sockets, chucks and tapers.

Chuck Arbors. The Callis Company, Clinton, Ohio. Bulletin "E" describing a line of Collis drill chuck arbors. Tables of sizes, specifications and prices are included.

Sebastian Lathes. The Sebastian Lathe Co., Cincinnati, Ohio. Catalog No. 26 describing a line of quick change lathes and attachments. Each model is fully specified and individual parts, as well as the whole machine, are illustrated.

Parker Grinding, Drilling and Turning Machine. Ex-Cell-O Tool and Manufacturing Co., Detroit, Mich. A four-page circular describing a new machine for use in a garage machine shop. The machine is illustrated in each of the operations which it performs and all details are clearly given.

Connecticut Universal Grinding Machine. Middlesex Machine Co., and New Haven Sherardizing Co., Hartford, Conn. Catalog describing the No. 3 machine equipped for cylinder grinding. Parts and attachments are also described and illustrated.

Lead Base Babbitt Metal. Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa. Folder No. 4474, announcing the placing on the market of lead base babbitt metal. Many valuable hints are given in the text which covers design and machinery of bearings and shells, overheating, tinning pipe and malleable iron, and cleaning solutions and materials.

Forthcoming Meetings

American Engineering Council: Annual meeting Jan. 5 and 6, Washington, D. C. L. W. Wallace is secretary.

Society of Automotive Engineers: Annual meeting Jan. 11 to 13, Engineering Societies Building, New York City. C. F. Clarkson, secretary.

American Society of Civil Engineers: Annual meeting Jan. 18 and 19, Engineering Societies Building, New York City. Charles W. Hunt, secretary.

United Engineering Societies: Annual meeting Jan. 26, Engineering Societies Building, New York City. A. D. Flinn, secretary.

American Institute of Electrical Engineers: Mid-winter meeting Feb. 15, 16 and 17. Engineering Societies Building, New York City, F. L. Hutchinson, secretary.

American Institute of Mining and Metallurgical Engineers: Annual meeting Feb. 20 to 24, Engineering Societies Building, New York City. B. Staughton, secretary.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Trolley System, Overhead, "Short-Turn"

The Whiting Corporation, Harvey, Ill.

"American Machinist," July 21, 1921

This overhead trolley system is intended for the carrying of chain blocks or hoists. The track itself consists of two parallel channels spaced 2⅛ in. between the flanges and held in place by clamps. The track is designed to carry loads with supports at only the splices, corners and switch points. The apparatus consists of standard channels, turns, 90-deg. right or left switches, and universal switches. The illustration shows a view looking up at the track equipped with a series of universal switches. Each corner and switch connection is interchangeable. All the corners and switches have a track curvature of 18 in. The hoist is carried on either 2-, 4-, or 8-wheel trolleys, having ball-bearing wheels and guide rollers. The wheels of the trolley run on the level tops of the channels, and its design permits it to swing in the 18-in. radius curves.

Straightening and Cutting Machine, Wire, Automatic, "Bevico"

Bevington Metal Stamping Co., 1545 E. 18th St., Cleveland, Ohio

"American Machinist," July 21, 1921

The machine handles round wire directly from the coil. It is driven by a single belt. Norma ball bearings are used for the arbor, and interchangeable bronze bearings for the other parts. An operator can attend to several machines at once. The feed rolls and cutting dies are made of heat-treated tool steel. The straightening dies are either gray iron, wood, babbitt or brass, depending upon the kind of wire to be handled. The Model B machine handles wire from No. 20 W & M gage to 5/32 in. in diameter, cutting it automatically into lengths from 6 in. to 4 ft. The machine can be furnished to cut any length of wire, however, and can be built to handle wire ¾ in. in diameter. It requires ¾ hp. to operate it, and it weighs 250 lb.

Hoist, "Turbinair"

Sullivan Machinery Co., 122 S. Michigan Ave., Chicago, Ill.

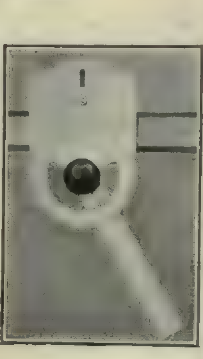
"American Machinist," July 21, 1921

The device, known as the "Turbinair" hoist, is intended for general hoisting or hauling work, being so compact that it may be mounted in a very small space. It is stated to be very powerful, considering its size, having a capacity of 1,500 lb. dead load lifted at 100 ft. per minute, using an air pressure of 80 lb. per square inch. The hoist consists primarily of a cylindrical drum, mounted on a steel frame and completely enclosing the operating mechanism, consisting of a motor and reduction gearing. There are two cylindrical rotors, each provided with right- and left-hand helical flutes converging to a spur tooth in the center. The rotors mesh together, and are caused to revolve by the pressure of the incoming air. The hoist is provided with a friction clutch and brake.

"Protractagraph," Drafting Instrument

Turner Devices, Inc., 5 S. Newstead Ave., St. Louis, Mo.

"American Machinist," July 21, 1921

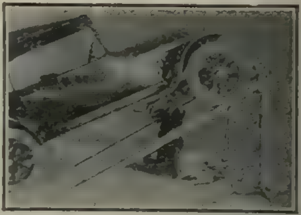


The instrument is intended to take the place of the usual drafting tools, such as triangles, scales and protractors; and it is said to be a combination of all of these tools, so that the draftsman has but one instrument to handle when making a drawing. The device is intended for use with any parallel-ruler attachment on a drawing board, being shown clamped to the straight edge. It consists primarily of a plate formed at its lower end into a semi-circular protractor graduated to ½ deg., the working arc being 180 deg. Various scales and a transparent amber inking blade, all of which are easily detachable, are furnished with the machine. A knob on the axis of the device is used to revolve the scale, and a screw is provided for locking it in position.

Under-worker, Floor-Level, Automobile

Manley Manufacturing Co., York, Pa.

"American Machinist," July 21, 1921

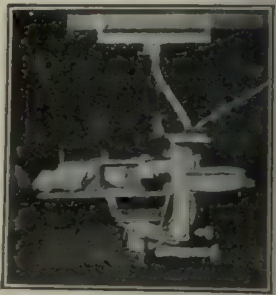


The device is intended for elevating either the back or the front end of an automobile, so as to give access to the under parts of the chassis, and to eliminate the necessity for a pit in the floor. The mechanic can work in a sitting position and with the job in front of him, varying the height of the machine to suit his convenience. The position permits light to reach the parts. A double crank on one of the uprights is used to rotate the top horizontal member of the frame, winding around the member a heavy chain attached to the axle of the automobile and pulling the machine up the incline. The tracks can easily be removed from the under-worker so that the device can be put out of the way, requiring but little space. The under-worker can quickly be moved wherever desired, so as to work on a car in any part of the shop, only one man being required to handle it.

Molding Machine, Suspended, Howe-Teetor, No. 9

R. J. Teetor Co., Muskegon, Mich.

"American Machinist," July 21, 1921



The illustration shows the machine suspended, the trolley wheels running on roller bearings, so that the machine can be moved along as the row of molds is made. The device can be swung about a vertical axis. The machine can be supported from the floor by means of two legs operated by compressed air. When it is desired to move the machine, the air is released and the feet drawn up by means of springs. The legs may be turned into a horizontal position, as shown, giving a clearance of 19 in. The squeezer platen is a malleable-iron casting mounted on a 2-in. shaft pivoted between centers, and has a vertical adjustment of 6 in. The cylinder and column are cast in one piece. The side bench at the left of the machine is rigidly attached to the main casting. At the right is a swinging riddle shelf that may be swung over the mold into position for riddling sand onto the pattern.

Rule, Caliper, Machinists'

Union Tool Company, Orange, Mass.

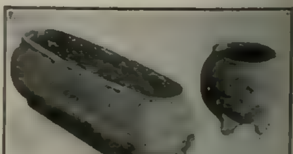
"American Machinist," July 21, 1921

The slide is held in position on the rule by the tension of an elliptic spring and may easily be moved in either direction by the pressure of the thumb. The slide is ground to exactly 1 in. in length, and beveled edges are provided at each end to facilitate reading the scale. When reading from the outer end, allowance is made in the number of full inches for the length of the slide, the fraction indicated being the same at each end.

Boxes, Carbonizing and Case-Hardening

Pioneer Alloy Products Co., Cleveland, Ohio.

"American Machinist," July 21, 1921.



The boxes are cast in any size or shape desired. However, square and rectangular boxes are not used, because of the fact that they are more apt to crack. The small round box shown on the right of the illustration is 13⅜ in. inside diameter, 20 in. overall in height, has a 10-in. opening at the top, and weighs with the cover 108 lb. The long box of cylindrical shape, shown on the left, is intended for the heat-treating of camshafts. It is 34⅛ in. long and 12½ in. wide on the inside, the height overall being 12⅜ in. The weight with the cover is 280 lb. The material from which the boxes are made is an alloy steel containing sufficient chromium to make it practically non-oxidizing. The merits of the box and its long life are said to be due not only to the alloy used but to the shape employed.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

N. J., Newark—The Kreuter & Co., Inc., 571 18th St., manufacturer of mechanics tools—two power presses and milling machinery.

N. J., Trenton—E. R. Huddy, 755 Cass St.—sheet metal machinery for proposed plant on Lexington St.

N. Y., New York—The Moritaini Co., 24 Stone St.—three vertical boring mills of 6, 7 and 8 ft. diameter each.

N. Y., New York—The Patent Scaffolding Co., 647 West 50th St.,—combination punch and shears to cut 2½ x ⅝ bars and 2½ x 2½ x ⅝ angles.

Pa., Philadephia—L. F. Seyferts Sons, Inc., 437-41 North 3rd St., one No. 00, one No. 0 and one No. 2, Brown & Sharpe automatic; one P-3 Ferracute press; one style 31 or 32 Lucas boring mill; two No. 74½ straight side Bliss geared presses and one No. 2-A Warner & Swasey screw machine.

Ky., Poor Fork—Fields Bros. Motor Co., Inc.—complete equipment for automobile repair shop, including lathe, etc.

N. C., Greensboro—The Newman Machine Co., Jackson St. along tracks of Southern Ry., G. F. Newman, Pres.—Doig or Morgan nailing machines.

Va., Richmond—Hackley Morrison Co., 16½ North 9th St.—Berlin or Yates planer, 6 x 15, high speed, thin knives; circular resaw; 20 brick dryer cars, double or single.

Ill., Chicago—The Chicago, Milwaukee & St. Paul Ry., 80 East Jackson Blvd., G. H. Walder, Purch. Agt.—one No. 2 Champion tool grinder.

Ill., Chicago — LaSalle Co., 30 North LaSalle St., Room 706—drawing press, double action toggle with 14 in. to 16 in. stroke and 20 in. blank space.

Ill., Chicago—A. D. White Mchy. Co., 108 North Jefferson St. — one straight sided geared press, 10 in. stroke, light pattern, five to ten thousand pounds.

Ill., Peoria—The Stuber & Kuck Co., 2800 South Adams St. (tin ware)—1 bench lathe, screw cutting about 9 in. swing by 3 ft. bed.

Mich., Detroit—The Hudson Motor Car Co., 12601 East Jefferson St., I. R. Halladay, Purch. Agt.—

One No. 30 Natco multi driller having 22 x 38 in. rectangular head, arranged with patented independent change of speed to each individual drill, arranged for 34, but equipped with 3 1¼ in. spindles No. 2 Morse Taper, 21 1 in. spindles No. 2 Morse Taper, 2 ⅝ in. spindles No. 1 Morse Taper with lubricating pump. Complete with all standard equipment.

One No. 30 Nacto multi driller having 22 x 38 in. rectangular head arranged with patented independent change of speed to each individual drill arranged for 34, but equipped with 2 1¼ in. spindles No. 2 Morse Taper, 20 1 in. spindles No. 2 Morse Taper, with lubricating pump. Complete with all standard equipment.

One No. 3 single spindle LaPointe Broach, complete with all standard equipment.

One Fisher oil groover "Standard," complete with countershaft and all standard equipment.

One No. 18 Globe tumbling barrel.

Five 1¼ in. Cone automatic complete with countershaft and all standard equipment. 3-3 Sets 1 1/16 in. Round Collets, 2-2 Sets 13/16 in. Round Collets.

One 1 in. Cone automatic complete with countershaft and all standard equipment. 1-1 Set 9/16 in. Hex Collects. 1-1 Set ¾ in. round Collets.

One 3½ in. Cone automatic complete with countershaft and all standard equipment. 1-1 Set 1½ in. Hex Collets, 1-1 Set 2 in. round Collets, 1-1 Set 2⅜ in. round Collets.

One ⅝ in. "B" Cleveland plain automatic complete with countershaft and all standard equipment.

One 021 Williams & White or substitute bulldozer.

Two 22 in. Aurora or substitute drills sliding head power feed to spindle.

Two No. 2 Warner & Swasey turret screw machine with geared friction head, automatic chuckless bar feed, power feed to turret, hand feed to cut off, complete with countershaft and all standard equipment.

One No. 4 Warner & Swasey turret screw machine with geared friction head, automatic chuckless bar feed, power feed to turret, hand feed to cut off, complete with countershaft and all standard equipment.

Two No. 6 Warner & Swasey turret screw machines with geared friction head, automatic chuckless bar feed, power feed to turret, hand feed to cut off, complete with countershaft and all standard equipment.

One No. 103 rivet internal automatic grinder, complete with countershaft and all standard equipment.

One No. 6 Blanchard vertical high power surface grinder with direct motor drive, including one 20 hp. G. & E. motor for spindle and one 2 hp. G. & E. motor for base. Motor current 220 volt, 60 cycle, 3 phase. Chuck current 220 volt.

One 3 ft. Pratt & Whitney vertical surface grinder or 4 ft. Springfield brandes vertical surface grinder, motor or belt driven, 220 volt, A.C., 60 cycle, 3 phase.

Two No. 2-B "Milwaukee" horizontal plain milling machine, complete with all standard equipment.

One No. 3-B "Milwaukee" horizontal plain miling machine, complete with all standard equipment.

Three No. 6 Toledo or Whitney hand miller, complete with countershaft and all standard equipment.

One No. 2 Bilton gear automatic miller.

Three BW-1 single spindle edlund or sipp sensitive drill press, 8 in. overhang with water pump, pan and piping.

Four BW-2 two spindle high speed ball bearing sensitive drill with 8 in. overhang with water pump, pan and piping.

Mich., Kalamazoo — The Reed Fdry. & Machine Co., Fulford St.—machine shop equipment for finishing steel castings for tractor parts.

O., Cincinnati—The Economy Mchy. Co., 428 East Pearl St., J. Flynn, Purch. Age.—one 6 ft. boring mill and one 14 in. lathe, 10 ft. between centers.

O., Cincinnati—The Eastern Mchy. Co., 408 East Pearl St., R. Smith, Purch Agt.—one 60 in. boring mill, 2 heads on rail; one 48 x 48 in. open side planer, 10 ft. table, 1 head on cross rail and 1 head on side; one 60 in. locomotive driving wheel lathe; one 3¼ in. Gridley automatic lathe, single spindle.

O., Cincinnati—The Jones Machine Tool Co., 435 East Pearl St., H. C. Jones, Purch. Agt.—one 10 ft. bending rolls for 1 in. plate; one angle and slitting shear for 6 in. x 6 in. x 1 in. angles; one 10 ft. power square shear for 3/16 in. plate; all to be motor or belt driven.

O., Cincinnati—The E. A. Kinsey Co., 331-5 4th St., W., J. O. McManus, Purch. Agt.—one planer type milling machine, similar to Ingersoll or Newton, about 4 ft. wide, 4 ft. high, with 16 ft. table and one vertical head on rail, belt or motor driven (used).

O., Cincinnati — Rittenhouse & Deremo Auto Service Co., 1212 Race St., C. Rittenhouse, Purch. Agt.—equipment for garage, including one ½ ton chain block, one Red Devil jack and one emery wheel.

O., Cleveland—The Simmons Mfg. Co., 3405 Perkins Ave., J. W. Simmons, Purch. Agt.—one 8 in. or 10 in. vertical grinder with rotary magnetic chuck (used); one floor computing scale.

O., Cleveland—Strong, Carlisle & Hammond, 1394 West 3rd St.—No. 6 Bliss geared double crank press, 8 in. stroke, No. 79½ Bliss straight sided geared press, 8-12 in. stroke, three No. 76½ Bliss geared straight sided presses, 8 in. stroke, two No. 77½ Bliss geared straight sided presses, 8 in. stroke, No. 21 Bliss geared inclinable pres 3-4 in. stroke No. 14½ Toledo geared press., 3-4 in. stroke.

O., Cleveland—The White Co., St. Clair and East 79th Sts.—one motor driven grinding stand, 18 in. x 8 ft. lathe, arbor press and miscellaneous tools for service station.

O., Cleveland—The Y. M. C. A. Manual Training School, Prospect and East 22nd Sts., A. Sperry—one 9 in. bench lathe.

Wis., Green Lake—Green Lake County, D. C. Williams, Highway Comr.—lathe, drill press, grinder, electric motors, to be used in repairing road machinery.

Wis., Milwaukee—C. I. Banker Iron Wks., 213 Reed St., P. Pinter, Purch. Agt.—medium size lathe.

Wis., Milwaukee—F. Toepfer & Son, 460 Natl. Ave. (auto repairs), F. Toepfer, Purch. Agt.—lathe, suitable for repair work.

Wis., Wauwatosa—Whipp & Goebel, 67 Vine St., manufacturers of sheet metal, J. Goebel, Purch. Agt.—8 in. brake, square shear and beader.

Kan., Kansas City—The Kaw Boiler Wks. Co., 1st and Walker Sts., C. T. Moyle, Purch. Agt.—one 32 in. lathe, 8 ft. between centers, one 12 in. lathe 6 ft. between centers, direct connected for 3 phase, 60 cycle 440 volt, a.c. current.

N. Y., Buffalo—The Buffalo Hardwood Lumber Co., 940 Seneca St., T. H. Wall, Purch. Agt.—Ideal Stencil cutting machine to stencil lumber. Letter size to be ⅝ or 1 in.

Pa., Philadelphia — L. A. Esler, 1016 Callowhill St.—manglers, washing machines, ironers, etc., for laundry.

Pa., Philadelphia—G. F. Morgenthaler & Bro., Phillips and Jackson Sts., G. F. Morgenthaler, Pres.—general ice manufacturing machinery.

Ky., Somerset — The Continental Rock Asphalt Co., Inc., W. A. White, Pres.—one 24 x 12 to 20 ft. lathe, hollow equipment; one 36 x 16 to 18 ft. lathe with hollow spindle; one 50 to 60 in. radial drill; Cincinnati No. 3 milling machine or other machine of equal size; shaper, medium size; power hacksaw; other miscellaneous machine tools, etc. (used if in good condition); also 1½ miles 90 lb. rail, frogs, spikes and switch equipment for two sidings.

The Weekly Price Guide

This Week's Market

The new Pittsburgh basing card of Dec. 15 quotes increased discounts on wrought steel pipe, all sizes, averaging 3 per cent on black and 2½ per cent on galvanized. This makes a reduction of about $5 per ton and constitutes the first change in price since Sept. 16. The change at the mill has been immediately reflected in the New York warehouse quotations.

Cold finished shafting is quoted at $3.55, and flats, squares, hexagons, etc. at $4.05 in both New York and Chicago warehouses—making a reduction of 33c. in New York and 28@30c. per lb. in Chicago. Tin has advanced 1½., zinc ⅛c., solder ½c. and babbitt metal 2⅛c.; while tin plates have declined ½c. per lb. in New York warehouses. Cleveland reports advances ranging from ¼c. to ¾c. in old metals and ½c.@2½c. per lb. in babbitt metal, best grade.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$22.50
Northern Basic	22.02
Southern Ohio No. 2	23.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	28.50
BIRMINGHAM	
No. 2 Foundry	18.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	23.26
Virginia No. 2	28.74
Basic	20.75
Grey Forge	22.50
CHICAGO	
No. 2 Foundry local	21.70
No. 2 Foundry, Southern, sil 2.25@2.75	24.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	22.46
Basic	20.96
Bessemer	21.96

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.25	3.28	3.10	3.38
No. 12	2.30	3.33	3.15	3.43
No. 14	2.35	3.38	3.20	3.48
No. 16	2.55	3.48	3.30	3.58
Black				
Nos. 17 and 21.	2.85	3.80	3.55	3.95
Nos. 22 and 24.	2.90	3.85	3.60	4.00
Nos. 25 and 26.	2.95	3.90	3.65	4.05
No. 28	3.00	4.00	3.75	4.15
Galvanized				
Nos. 10 and 11.	3.00	4.00	3.75	4.15
Nos. 12 and 14.	3.10	4.10	3.85	4.25
Nos. 17 and 21.	3.40	4.40	4.15	4.55
Nos. 22 and 24.	3.55	4.55	4.30	4.70
No. 26	3.70	4.70	4.55	4.85
No. 28	4.00	5.00	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel			Iron		
Inches	Black	Galv.	Inches	Black	Galv.
BUTT WELD					
1 to 3	71	58½	¾ to 1½	44½	29½
LAP WELD					
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	29½
9 to 12	64	50½	7 to 12	40½	27½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	69	57½	1 to 1½	44½	30½
2 to 3	70	58½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded.	66%	53%	60½%	47½%	60%	46%
2½ to 6 in. steel lap welded.	61%	47%	58½%	44½%	57%	43%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	5.00	6.00	4.28
Spring steel (light) (base)	6.00	6.00	3.68
Coppered Bessemer rods (base)	8.00	8.00	6.03
Hoop steel	3.53	3.14	3.28
Cold rolled strip steel	6.25	8.25	6.75
Floor plates	4.85	2.64@2.80	5.23
Cold finished shafting or screw	3.55	3.50	3.55
Cold finished flats, squares	4.05	4.00	4.05
Structural shapes (base)	2.78	2.64	2.88
Soft steel bars (base)	2.68	2.54	2.78
Soft steel bar shapes (base)	2.68	2.54	2.78
Soft steel bands (base)	3.28	....	3.48
Tank plates (base)	2.78	2.92½	2.88
Bar iron (2.00@2.10 at mill)	2.68	3.52	2.78
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
$\frac{3}{32}$	8.50		12@13
⅛	7.15		11@12
$\frac{5}{32}$ to ¼	6.75		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.37½
Tin, 5-ton lots, New York	34.00
Lead (up to carlots), St. Louis, 4.60; New York	5.00
Zinc (up to carlots), St. Louis, 4.97½; New York	5.62½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.20	20.00	18.00
Antimony (Chinese), ton spot	5.50	6.50	6.75
Copper sheets, base	21.25	22.00	23.00
Copper wire (carlots)	16.50	17.00	16.25
Copper bars (ton lots)	19.75	24.00	19.50
Copper tubing (100-lb. lots)	21.25	24.00	23.00
Brass sheets (100-lb. lots)	16.75	17.00	18.75
Brass tubing (100-lb. lots)	18.50	19.50	20.50
Brass rods (1,000-lb. lots)	14.75	16.00	15.75
Zinc sheets (casks), (8% dis. carlots)	10.50	10.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ½), (case lots)	21.00	21.50@23.50	19.25
Babbitt metal (best grade)	24.62½	43.75	36.00
Babbitt metal (commercial)	9.87½	13.50	9.00

—*Shop Materials and Supplies*

MONEL METAL—Base price in cents per lb., f.o.b. Bayonne, N.J.:

Shot........	35.00	Hot rolled machined rods (base)...	53.00
Blocks.......	35.00	Hot rolled rods (base)............	42.00
Ingots.......	38.00	Cold drawn rods (base)...........	56.00
Sheet bars...	40.00	Hot rolled sheets (base)...........	55.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots..............................	45
Malleable nickel sheet bars..........................	47
Hot rolled rods, Grades "A" and "C" (base)...............	60
Cold drawn rods, Grades "A" and "C" (base)..............	72
Copper nickel ingots.................................	37
Hot rolled copper nickel rods (base).....................	45
Manganese nickel hot rolled (base) rods "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

OLD METALS--Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible......	11.25	11.50	11.00
Copper, heavy, and wire..........	11.00	11.00	10.00
Copper, light, and bottoms.......	9.50	9.00	8.75
Lead, heavy....................	4.00	3.75	3.50
Lead, tea......................	3.00	2.75	3.00
Brass, heavy...................	7.00	6.50	8.50
Brass, light....................	5.00	4.50	5.00
No. 1 yellow brass turnings.......	5.75	5.50	5.75
Zinc..........................	3.00	2.50	2.75

TIN PLATES—American Charcoal Plates—Bright—Cents per lb

	New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:			
IC, 20x28, 112 sheets.......	20.00	19.00	18.50
IX, 20x28, 112 sheets.......	22.50	21.50	20.90
"A" Charcoal Allaways Grade:			
IC, 20x28, 112 sheets.......	17.00	16.75	17.00
IX, 20x28, 112 sheets.......	20.00	19.50	19.60
Coke Plates, Bright			
Prime, 20x28 in.:			
100-lb., 112 sheets.............	12.50	12.00	14.50
IC, 112 sheets.............	12.80	12.30	14.80
Terne Plate			
mall lots, 8-lb. Coating:			
100-lb., 14x20....................	7.00	5.60	7.25
IC, 14x20....................	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb....	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb....	.055@.09	.09	.10
Wiping cloths per M., 13¼x13¼..	....	50.00	55.00
Wiping cloths per M., 13¼x20½.	....	55.00	65.00
Sal soda, 100 lbs..............	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb........................	2.55	3.25	3.50
Linseed oil, per gal., 5 bbl. lots...	.72	.77	.74
White lead, dry or in oil.......	100 lb. kegs.	New York, 12.25	
Red lead, dry................	100 lb. kegs.	New York, 12.25	
Red lead, in oil..............	100 lb. kegs.	New York, 13.75	
Fire clay, per 75 lb. bag.......		.80	1.00
Coke, prompt furnace, Connellsville.......	per ton	$3.00	
Coke, prompt foundry, Connellsville.......	per ton	3.75@4.75	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in............	—50%	—60%	60-10-10%
1⅛ and 1¼x3 in. up to 12 in..........	—40%	-60-10-10%	-60-10%
With cold punched sq. nuts.........	—30%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)........	—40%	......	..$4.00 off
Button head bolts, with hex. nuts......	—20%	$3.90 net	.....
Hex. head and hex. nut bolts.........	—20%	....	-65-5%
Lag screws, coach screws............	—50-10%	....	—60%
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	—50-10-10%	50-5%
Bolt ends, with hot pressed nuts.......	—50%	....	—55%
Tap bolts, hex. heads................	—20%	....	.....
Semi-finished nuts all sizes...........	—70%	—75%	—80%
Case-hardened nuts................	—60%	....	.....
Washers, cast iron, ½ in., per 100 lb. Off list	$5.00	$5.50	$3.50 net
Washers, cast iron, ⅝ in. per 100 lb. Off list	4.25	3.75	3.50 net
Washers, round plate, per 100 lb. Off list	3.00	....	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	2.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	2.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.50	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.50	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller.....	-50-10%	60-10-10%	-65-5%
Rivets, tinned.................	-50-10%	60-10-10%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb..............(net)	$3.50	3.50	3 43
Cone heads, ditto............(net)	3.60	3.60	3.53
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb..............	0.25	....	0.15
⅞ in. diameter........... *EXTRA*	0.15	....	0.15
½ in. diameter........... *EXTRA*	0.50	....	0.50
1 in. long, and shorter..... *EXTRA*	0.50	....	0.50
Longer than 5 in......... *EXTRA*	0.25	....	0.25
Less than 200 lb......... *EXTRA*	0.50	....	0.50
Countersunk heads....... *EXTRA*	0.35	......	$4.03 base
Copper rivets...........	—60-5%	—40-10%	—50-10%
Copper burs..................	—40%	—15%	—10%

	New York	Cleveland	Chicago
Lard oil, pure, (50 gal. bbl.) per gal..	$0.90	$0.85	$0.90
Lard cutting oil (50 gal. bbl.) per gal.	0.60	0.50	0.55
Machine oil, lubricating, per gal.	0.45	0.35	.....
Belting—Present discounts from list in fair quantities (½ doz. rolls)			
Leather:			
Light grade....................	50–5%	50–5%	50–5%
Medium grade..................	45%	40–10–2½%	.....
Heavy grade..................	40%	40%	.....
Rubber and duck:			
First grade....................	50–10%	50–10%	.....
Second grade..................	60–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper ....List $9.00 less	20-10-5%	50–10–5%	'-20-10%
Emery paper ......,..List	11.00 less 20%	$11.00 net	-20%
Emery cloth ....List	32.75 less 10%	32.75 net	-10%
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	$4.50 net	.....	list+10%
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper..................List	$1.65 less 20%	.....	-10%
Cloth..................List	$3.55 less 10%	.....	-10%

S. C., Newberry—The Chamber of Commerce, C. P. McDaniel, Secy.—complete machinery for pickling plant, also supplies, including bottles, etc.

Tenn., Nashville—The Nashville Box Co., 5th and Crutcher Sts., C. V. Hicks, Secy.—lock corner machine for boxes to 18 x 18 in.; assembling machine; continuous feeder joiner machine (wooden boxes); screw driving machine.

W. Va., Salem—The Salem Flint Glass Co., H. L. Bee, Secy. and Treas.—single and double crimpers, pipes, snaps, fitters, fan blowers, etc., for glass plant.

W. Va., Wheeling—C. L. Hills, 403 Natl. Bank Bldg., manufacturer of ice—refrigerating machine, 30 to 50 ton capacity, prefer horizontal designed for belt drive (used), also ice tank up to 50 ton capacity.

Ill., Chicago—The Amer. Hide & Leather Co., 1320 Elston St.—tanning machinery for proposed plant at 658 Commerce St., Milwaukee, Wis.

Mich. Ironwood—J. F. Gluck—air compressor and gasoline pumps for garage.

Mich., Marquette—The Marquette Model Wks., L. J. Genette, Purch. Agt.—woodworking machinery for the manufacture of wood patterns.

O., Cincinnati — Clifton-Pratt Co., 1224 West 8th St., A. E. Clifton, Purch. Agt.—one triplex, belt driven, ¾ plunger hydraulic pump, 5,000 lb. pressure, also four 24 x 48 in. tumblers for foundry, belt driven.

O., Cincinnati — The Jung Brewing Co., 2014 Freeman Ave., A. Tiebermann, Purch. Agt.—converting brewery into ice plant—additional ice making machinery.

O., Cincinnati—I. Oscherwitz & Sons Co., 569 West 6th St., M. B. Oscherwitz, Purch. Agt.—refrigerating plant, 25 ton capacity; 25 hp. horizontal boiler, 100 lb. pressure; sausage machinery including kettles, etc.

O., Cleveland—The Newcomb Galvanizing & Supply Co., 1714 Columbus Rd.—bench polishers.

O., Columbus—The Dept. Pub. Wks., Oak and 9th Sts., H. M. Seabright, Engr.—one coal and ash conveyor for institution for epeliptics at Gallipolis. $8,000.

Wis., Beaver Dam — Bartelt Bros.—ice making machinery mechanical freezers and electric motors.

Wis., Elcho—C. W. Fish Lumber Co.—woodworking machinery for proposed planing mill at Antigo.

Wis., Fond du Lac — The Combination Door Co., 180 Ruggles St., manufacturer of woodwork and doors, L. C. Schmidt, Purch. Agt.—hollow mortiser, medium size planer, one sander, electric motor.

Wis., Green Bay—The Fort Howard Paper Co., A. Cofrin, Mgr.—special paper machinery.

Wis., Green Bay—The Investment Corp. of Green Bay, 113 West Walnut St., L. M. Hansen, Pres.—two ice machines for proposed cold storage plant on North Bway.

Wis., Madison—The University of Wisconsin, M. E. McCaffery, Secy.—printing machines and presses, for printing university publications.

Wis., Manitowoc—The city, c/o A .H. Zander, Clk., will take bids about Feb. 1 for machinery and equipment for gravel pit, including loader, gravel conveyors, (buckets) and 3½-ton truck for gravel.

Wis., Manitowoc—F. Sterzik, Pres. of the Natl. Toy & Tinsel Co., 16th and Hamilton Sts.—woodworking machinery for proposed furniture factory at Chippewa Falls.

Wis., Markesan—Folsom-Miller Co.—special machinery for the manufacture of washing machines.

Wis., Milwaukee—E. Buschach, 1682 11th St.—belt sander to carry 6 in. belt.

Wis. Milwaukee—H R. Erdmann, 109 Nock St—one belt sander.

Wis., Milwaukee — J. Leenhouts, 1614 Lloyd St.—combination planer, rip saw and boring machine.

Wis., Milwaukee—The Milwaukee Oldsmobile Co., 528 Bway., C. Goersch, Purch. Agt.—chain hoist or monorail suitable for machine shop use.

Wis., Milwaukee—The Oswald Jaeger Co., 914 Central Ave., manufacturer of food products—ice machine.

Wis., Milwaukee—J. A. Starck, 1167 39th St. (woodworker)—30 or 32 in. band saw, planer up to 18 in., hollow chisel mortiser.

Wis., Racine—The Webster Electric Co., De Koven Ave. and Clark St., K. H. Studt, Purch. Agt.—crucible furnace for lead on cyanide hardening, crucible size 12 in. x 12 in.

Wis., Rhinelander—The S. Miller Fruit Co.—artificial ice making machinery.

Wis., Sheyboygan—The Wisconsin Mirror Plate Co., 10th and Maryland Sts.—special machinery for proposed plant.

Wis., Sparta—E. Genseline—belt driven grain grinding machinery.

Wis., Wisconsin Rapids—The Consolidated Water Power Co., J. Schnable, Purch. Agt.—elevator conveyor and buckets for handling shredded pulp, also other equipment for pulp storage plant.

Wis., Wisconsin Rapids—Mott & Wood Co., Wisconsin Rapids, dairy products, R. J. Mott, Purch. Agt.—belt driven ripeners, pasteurizers and churns

Mo., Carterville—The Carterville Fruit & Tomato Cannery, c/o F. L. Gass, Secy.—canning machinery and cookers.

Mo., St. Louis—L. A. Paule, Jr., 1125 Pierce Bldg., manufacturer of preserves, jellies, etc.—equipment for preserving plant including apple pulper, two pickle vats, about 700 to 800 gal. or 1,000 gal.

Cal., Sacramento—A. B. Atkinson, 3256 5th Ave.—equipment for proposed ice plant on South East 13th and S Sts.

Cal., Sacramento—The Sacramento Brick Co., Front and N Sts.—machinery and equipment for the manufacture of brick and roofing materials.

Cal., San Anselmo—B. B. Jones—laundry equipment.

Ont., Glencoe—J. G. Best—equipment for drilling oil wells.

Ont., Norwich—W. W. Avey—engine, boiler and complete equipment for new planing mill.

Ont., Penetang—Gropp Bros.—saw mill machinery, boiler, engine, belting, etc.

Que., Sherbrooke—The Canadian Brakeshoe Co., Ltd., N. J. Holden-Holden Co., Ltd., 354 St. James St., Montreal, Purch. Agt.—foundry equipment.

Metal Working Shops

NEW ENGLAND STATES

Conn., Bridgeport—Estate of S. H. Wheeler, 1188 Main St., is having revised plans prepared for the construction of a 3-story, 90 x 120 ft. garage on Middle and Gold Sts.—C. F. Baron, 79 Sage St., Archt. Noted Aug. 4.

Conn., Danbury—H. Dick, 140 Main St., plans to construct a 1-story, 100 x 100 ft. garage on Main St. Estimated cost, $40,000. Architect not selected.

Conn., East Hartford (Hartford P. O.)—H. E. Bidwell, 209 State St., Hartford, is having plans prepared for the construction of a 1-story, 50 x 122 ft. and 20 x 122 ft. garage on Connecticut Blvd. here. Estimated cost, $40,000. Associated Architectural & Eng. Co., 145 State St., Springfield. Mass., Archts. and Engrs.

Conn., East Hartford (Hartford P. O.)—The Charter Oak Machine Co., 438 Asylum St., Hartford, has awarded the contract for the construction of a 1-story, 60 x 100 ft. factory on Connecticut Blvd. here.

Conn., Southington—Peck, Stow & Wilcox Co., Railroad Sq., is receiving bids for the construction of additions to its hardware plant, including a 1-story, 67 x 180 ft. hardening shop, a 2-story, 56 x 156 ft. grinding shop and a 1-story, 59 x 100 ft. forge shop. Estimated cost, $200,000. Private plans. Noted April 21.

Mass. Northampton—Smith College has awarded the contract for the construction of a 2-story, 45 x 120 ft. laundry and garage on the College campus. Estimated cost, $75,000. Noted Dec. 1.

Mass., Southbridge—C. H. Knight, 143 Main St., plans to construct a 1-story garage and sales station on Hamilton St. Estimated cost, $40,000. Architect not selected.

Mass., Springfield—E. T. Davis, 348 Bridge St., has awarded the contract for the construction of a 1-story, 75 x 100 ft. garage on Taylor St. Estimated cost, $45,000.

MIDDLE ATLANTIC STATES

Md., Baltimore—The Continental Garage & Service Corp., 715 Gaither Estate Bldg., is having plans prepared for the construction of a 5-story garage and service station on Monument and Howard Sts. J. C. Tolson, Mgr. L. L. Wagner, Union Trust Bldg., Archt.

N. J., Trenton—E. R. Huddy, 755 Cass St., plans to construct a 2-story, 40 x 100 ft. sheet metal plant on Lexington St. Estimated cost, $25,000.

N. Y., Long Island City—The Interstate Land Holding Co., c/o F. S. Parker, Archt. and Engr., 44 Court St., Brooklyn, has awarded the contract for the construction of a 2-story service station on William and 13th Sts. here. Estimated cost, $100,000. Noted June 16.

N. Y., New York—A. Lewinsohn & Sons, 61 Bway., will soon receive bids for the construction of a 2-story, 50 x 60 ft. garage on 185th St. and Bway. Estimated cost, $90,000. J. DeHart, 1041 Fox St., Archt. and Engr.

Pa., Turtle Creek—Struble & Riley have had plans prepared for the construction of a 2-story, 76 x 175 ft. auto service and sales station. Estimated cost, $150,000. S. C. Richards & Co., 430 Library St., Braddock, Archts.

Pa., Washington—The Tyler Pipe & Tube Co. has awarded the contract for the construction of a 1-story, 20 x 50 ft. boiler plant and 50 x 50 ft. gas producer plant. Estimated cost, $50,000. Noted Dec. 8.

MIDDLE WEST STATES

Ill., Decatur—C. A. Starr, 137 Park Pl., plans to construct a 1-story, 75 x 162 ft. auto repair shop, sales office and storage building. Estimated cost, $40,000. Architect not selected.

Ill., Rockford—The Allen Ice Cream Co., 327 South Winnebago St., is having plans prepared for the construction of a 2-story garage and warehouse. Estimated cost, $46,000. Peterson & Johnson, 406 Swedish-American Bank Bldg., 5th and 7th Sts., Archts.

Ill., Rockford—G. C. Brown and W. C. Gridley, 1826 Hoffman Blvd., are having plans prepared for the construction of a 1-story, 60 x 145 ft. garage, a 35 x 60 ft. repair shop and a 20 x 30 ft. boiler plant on Auburn Ave. Estimated cost, $75,000. C. E. Wolfley, 610 Steward Bldg., Archt.

Ind., Bloomington—W. C. Hottle, R. C. Wiles and K. C. May, are having plans prepared for the construction of a 2-story, 87 x 130 ft. garage and sales building on North College Ave. Estimated cost, $150,000. J. E. Kopf & Woolling, 402 Ind. Pythian Bldg., Indianapolis, Archts.

Ind., Mishawaka—The Lock Joint Tube Co. is having plans prepared for the construction of a 1-story, 45 x 90 ft. factory for the manufacture of metal products. Estimated cost, $30,000. Private plans.

Ind., South Bend—The Twentieth Century Garage, 121 South Lafayette St., is having plans prepared for the construction of a 2-story, 60 x 160 ft. garage. Estimated cost, $150,000. Austin & Shambleau, 111 North Lafayette St., Archts.

Mich., Ironwood—J. F. Gluck has awarded the contract for the construction of a 2-story, 30 x 115 ft. garage. Estimated cost, $40,000.

O., Cincinnati—J. Steinkamp, Archt., Mercantile Library Bldg. will open bids the end of December for the construction of a 2-story, 158 x 228 ft. garage on Gilbert Ave. and Linton St., for Mason Towle Co., 1038 Gilbert Ave. Estimated cost, $125,000.

O., Cleveland—J. N. Galvin, Society for Savings Bldg., is having plans prepared for the construction of a 1-story, 50 x 100 ft. garage at 6711 Detroit Ave. Estimated cost, $60,000. Private plans.

O., Cleveland—A. Horwitz, Society for Savings Bldg., has awarded the contract for the construction of a 1-story, 90 x 111 ft. garage at 2075 East 77th St. Estimated cost, $40,000.

O., Cleveland—A. Kohn & Sons Investment Co., 2380 Canal Rd., is having plans prepared for the construction of a 3-story commercial building and garage on Chester Ave. and East 20th St. Estimated cost, $40,000. P. Matzinger & Co., Caxton Bldg., Archts.

O., Cleveland—P. Matzinger & Co., Archts., Caxton Bldg., is receiving bids for the construction of a 1-story, 60 x 180 ft. factory on East 72nd St., for the Cleveland Refrigerator Co., 2996 East 72nd St. Estimated cost, $50,000.

O., Cleveland—H. Paley, 10806 Orville Ave., barrel dealer, plans to construct a 2-story, store, apartment and garage on East 105th St., near Superior Ave. Estimated cost, $40,000. Private plans.

Wis., Markesan—Folsom-Miller Co. plans to construct a 2-sory, 50 x 60 ft. washing machine factory. Estimated cost, $20,000. Probably private plans.

WEST OF MISSISSIPPI

Ia., Mason City—The Dennison Garage Co. is having plans prepared for the construction of a 2-story 50 x 130 ft. garage. Estimated cost, $50,000. G. L. Lockhart, 1353 University Ave., St. Paul, Minn., Archt.

Minn., Minneapolis—Potts Motor Co., 1017 4th Ave., S., plans to construct a 2-story garage. Estimated cost, $125,000. Architect not selected.

Vol. 55, No. 26 December 29, 1921 *25 cents a copy*

American Machinist

KENNETH H. CONDIT and FRED H. COLVIN, *Editors*
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WASHINGTON, D. C., Colorado Building
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LONDON, E. C., 6 Bouverie St.

Cable Address: "Machinist, N. Y."

Circulation of This Issue, 19,860

Change of Address—When change of address is ordered the new and the old address must be given. Notice must be received at least ten days before the change takes place.

Copyright, 1921, McGraw-Hill Company, Inc.

Published weekly.

Entered as second-class matter June 23, 1879, at the Post Office at New York, under the Act of March 3, 1879.

Printed in U. S. A.

Member Associated Business Papers, Inc.
Member Audit Bureau of Circulations.

WHO'S WHO

MR. JOHN ROY PORTER

ROY PORTER, General Manager of Marshall & Huschart Machinery Company, was born in Oxford (not England) Ohio, December 7th, 1874.

After going through the public schools there, he served his apprenticeship at the Niles Tool Works, Hamilton, Ohio.

He worked for the Hamilton Machine Tool Company for seven years, and then became associated with the Marshall & Huschart Machinery Company, with which concern he has been for seventeen or eighteen years, working up to his present position as General Manager.

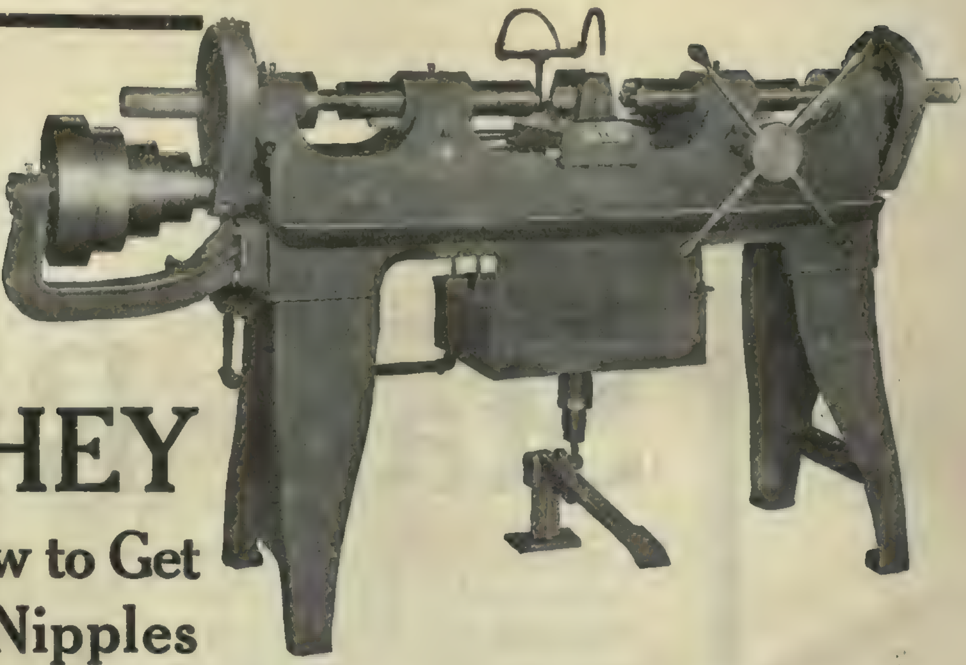
In addition to this position, he is President of the Machine Tool Dealers' Association of Chicago, President of the Machinery Club of Chicago, Director of the Employers' Association of Chicago, and President of the Machinery Transport Company of Chicago.

He is a member of the Illinois Athletic Club, the Colonial Club of Oak Park, Ill., the Western Ho Golf Club of Oak Park, the Oak Park Lodge A. F. & A. M., the Oriental Consistory, 32nd Degree, and the Mystic Shrine Medinah Temple A.A.O.N.M.S. of Chicago.

Next to that boy Paul of his (age twelve) he is proudest of his accomplishments on the golf course, especially when he visits Cincinnati.

He is one of the few men in the machinery line that Prohibition did not affect, as he has always been an absolute teetotaler. But he makes up for it by his long black cigars, which he constantly smokes.

Roy Porter is an open-natured, up-standing man, strictly on the square.



MURCHEY

Shows You How to Get Chamfered Nipples of the Highest Quality at a Low Cost

Murchey has gone and done something different again. Brought out an entirely new Nipple Reaming and Chamfering Machine that does what no one has ever tried to do before.

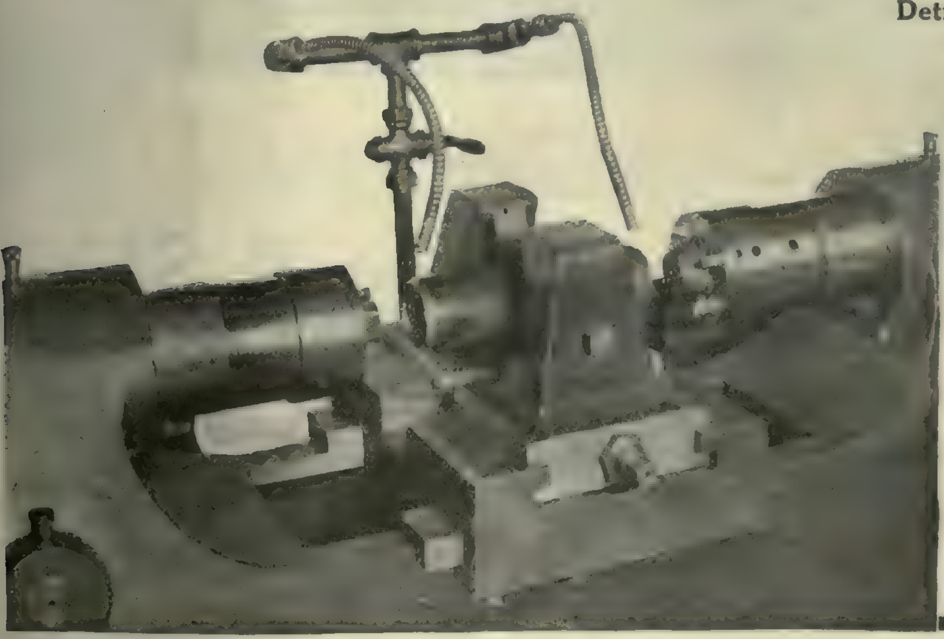
Lots of people have been clamoring for chamfered nipples of better quality. Nipple producers inform us that this new Murchey Reaming and Chamfering Machine produces such nipples at a lower manufacturing cost than it now takes to produce inferior nipples.

You know, on a threading machine the reaming and threading are done in one operation. This causes an undue strain on the dies and means a constant repairing and replacing of dies and die parts. Manufacturing costs as a result are necessarily increased.

Now on this new Murchey Machine you do the reaming and chamfering as one operation and the thread cutting as a separate operation. "But this increases the number of operations," you object. Yes, but it turns out BETTER nipples and *does it so rapidly* that the production cost is LOWER than by the present established method. A conservative estimate of the output is 650—¾ inch or 350—1½ inch reamed and chamfered nipples an hour.

You will certainly want to know more about this machine—how it operates and whether it is adapted to any other uses. So write for the Bulletin—it shows what a simple proposition it is.

Murchey Machine & Tool Co.
Detroit, Mich.



A close-up of the Murchey Nipple Reaming and Chamfering Machine. Capacity ½ inch to 2 inch pipe. Lengths, close nipple to 12 inch length. Note the stability of the chuck.

LATHES
Good Lathes Only

Start Right!

That's the thing—the start! If it is right, half what you intend to do is accomplished.

Years ago the French attempted to cut a canal through the Isthmus of Panama. They failed because they did not get started right. The equipment and methods used were entirely inadequate and that made the job appear almost impossible. If they had started right, with correct equipment, there is every reason to believe they would have succeeded.

The New Year is here. It's the time to make good resolutions. Start the New Year with the firm intention of keeping production costs to a minimum and YOU WILL.

Make up your mind now to be rid of all machinery that does not cut the *cost per piece* to the bone.

Investigate and get facts from manufacturers who have already invested in machinery that keeps the *cost per piece* from soaring. See what they have to say!

The Lodge & Shiple
Cincinna

LATHES
Good Lathes Only

LATHES
Good Lathes
Only

The Lodge & Shipley Manufacturing Lathe

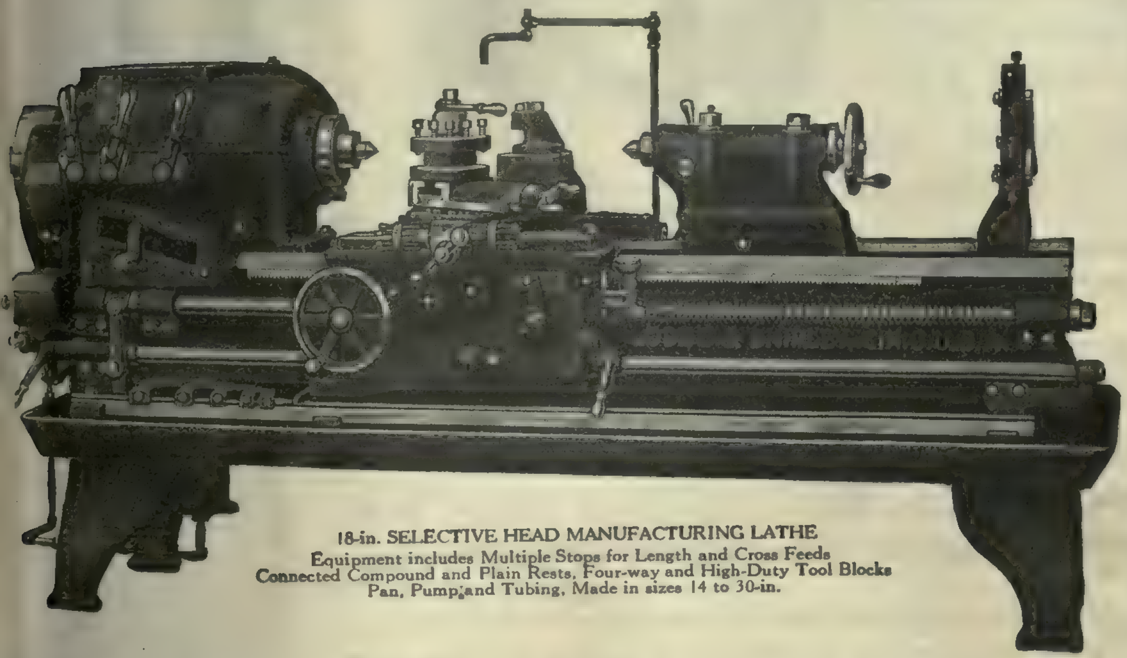
is one machine you can count on to keep your production costs down. Twenty-five to fifty percent of the time taken to turn duplicate pieces of work on the ordinary lathe can be saved by it.

And this is not just theoretical, it actually occurs!

With this timesaving it is possible to maintain a high standard of accuracy. The one big thing about this machine is, while it offers the advantages of the automatic, it retains its function as a single purpose tool. Standard lathe tools are always used, which of course means another big saving.

This lathe was designed to cut the *cost per piece* on duplicate work and *it does.* Not only do we say this, but hundreds of manufacturers now using it tell us so.

Start the year RIGHT—cut down the *cost per piece.* Send for literature.



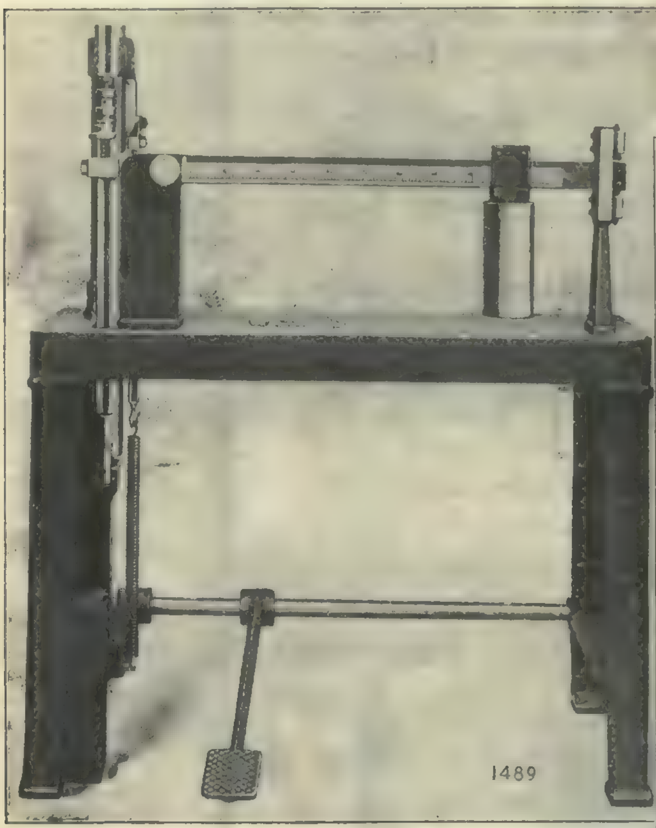
18-in. SELECTIVE HEAD MANUFACTURING LATHE
Equipment includes Multiple Stops for Length and Cross Feeds
Connected Compound and Plain Rests, Four-way and High-Duty Tool Blocks
Pan, Pump and Tubing, Made in sizes 14 to 30-in.

Machine Tool Co.

Ohio

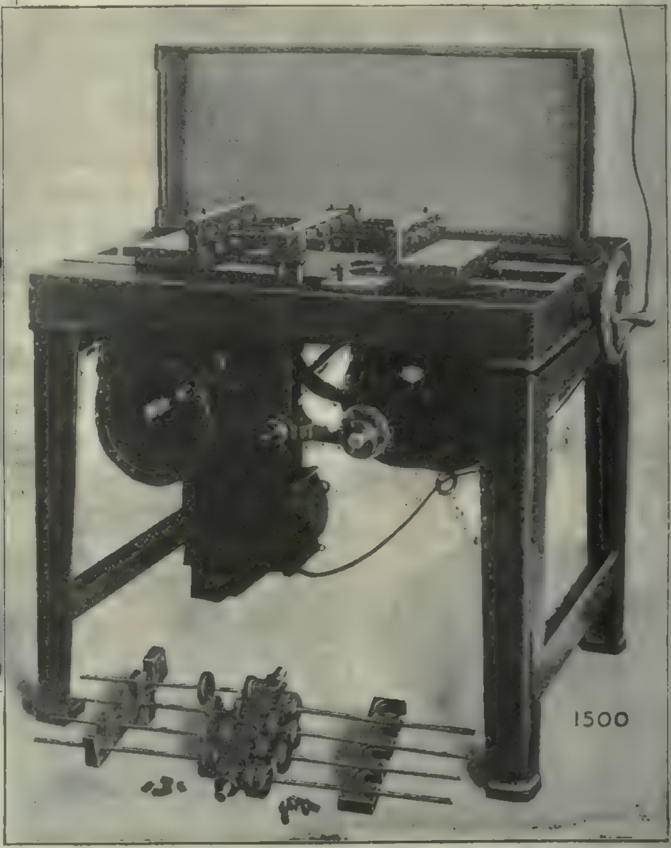
LATHES
Good Lathes
Only

Some refinements in manufacturing CINCINNATI MILLERS



Weighing machine for measuring the strength of springs

Fatigue test for loaded springs



Spring Reliability

Take the simple matter of springs, for instance. They are vital members in feed trip and safety mechanisms.

We give every one a "weigh" test and an endurance test. Thus we eliminate all those that are unfit. This may seem like needless refinement. We consider it important because it increases dependability.

Investigate Cincinnati details before you buy a Miller.

The Cincinnati Milling Machine Co.
Cincinnati, Ohio

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI OHIO

Why do you use Case-hardened Parts?

Foolish question? Not if the Carbonizing is done in short-life containers that grow, warp, crack and change in other ways that interfere with uniform heat penetration or cause soft spots. Soft spots not only defeat the purpose of case-hardening but add to the cost.

Cast Nichrome Containers and furnace parts are used in Carbonizing for the same reason as case-hardened parts are used in machinery—for efficiency, for service, for economy.

Service records of Nichrome Castings at 1800° F. reach into thousands of hours. The proof is in hundreds of plants. Your economy is doubly assured by the Nichrome guarantee. Booklet N-21 tells more about this high-temperature Alloy, Nichrome, and shows Cast Nichrome stock patterns in hundreds of sizes.

Manufactured under HENDERSON Patents by

DRIVER-HARRIS COMPANY
HARRISON, NEW JERSEY
Chicago - Detroit - Canada - England - France

A Difficult Problem— Solved with a Landis Threading Machine

THIS material, as the man in the shop would say, "is funny stuff." It is quite hard, yet so tough that a lot of hammering only bends it a little. Given enough power and one of these pieces can be tied in a knot, yet it won't break. It is the stuff that is put into airplanes.

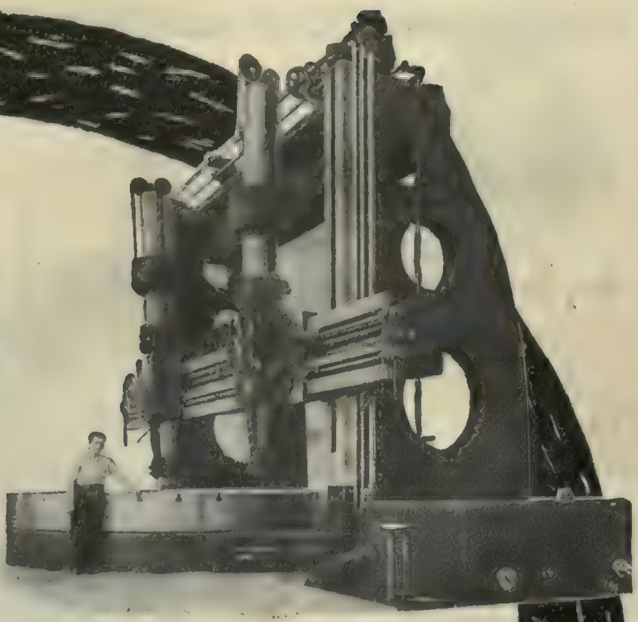
Imagine trying to thread it on a quantity-quality basis. The superintendent here tried it without success, until the Landis Threading Machine arrived. That was over a year ago, and now all's changed; the work proceeds without a hitch. There are 24 threads per inch, diameter is 5/16 in., and length of thread ⅝ in. Approximately 3,000 pieces are turned out each eight hour shift.

Get the Catalog

Landis Machine Company, Waynesboro, Pa.

HEAVY **BETTS** DUTY

Here is a Point Worth Thinking About



If a Boring Mill has just strength enough to do a job of the swing and weight capacity of the Mill it will not do a good job.

It is not the strength in a Boring Mill that will give good satisfaction.

It is *rigidity*

By rigidity we mean that the tool should be backed up by sufficient mass so that it will not vibrate.

As soon as a machine begins to vibrate you will not **be able** to turn out the proper class of work.

Betts Tools have **rigidity** to the limit of **their capacity.**

Send us your inquiry

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Horizontal Boring, Drilling and Milling Machines

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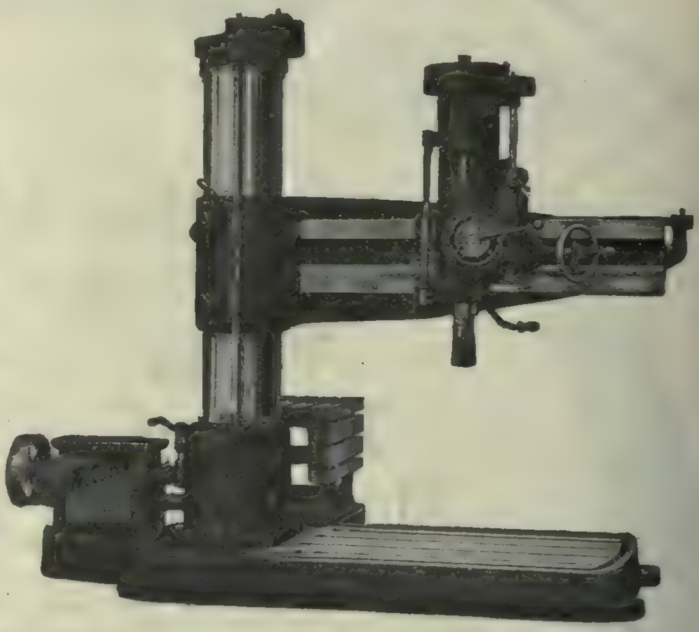
BETTS MACHINE TOOLS

THE
CINCINNATI BICKFORD



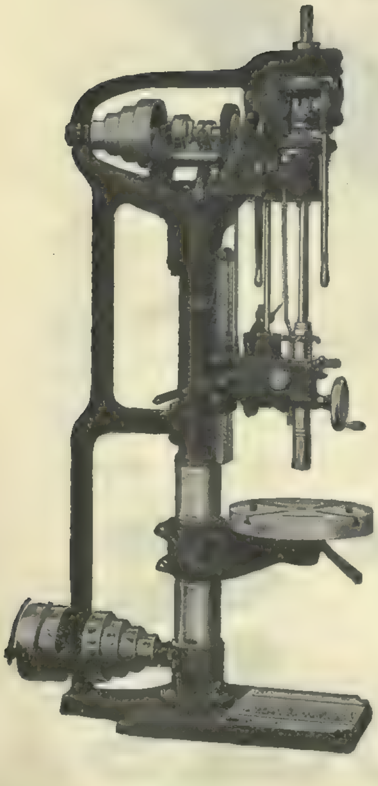
4-, 5-and 6-foot Plain Radial Drilling Machine

The growing value of time can be traced in the evolution of *Cincinnati Bickford* Radial Drilling Machines from their original form to their present highly developed types.

This machine requires a minimum number of operations in drilling a hole. Those operations that are required have been developed so as to take a minimum amount of time—one result of our years of experience and concentrated effort.

The Cincinnati Bickford Tool Company

Oakley, Cincinnati, Ohio, U. S. A.
Founded 1874



THE
CINCINNATI

Gives You the Benefit of 48 Years' Experience

We have been manufacturing drills for over forty-eight years. The refinements of design and construction that characterize our machines come as a result of great care and much costly experimentation on our part. Every user of a *Cincinnati profits by our experience.*

The machine shown is our 21-inch, Sliding Head, Heavy Pattern Drill. The Patent Geared Tapping Attachment is furnished or not as desired. These drills have many excellent features that will help reduce your drilling costs.

No. 6

For Either Hand or Machine

Geometric Solid Adjustable Tap

GEO MET RIC

Right in the Lead

Here's the threading tool that is "making good" in the reduction of producing costs—the **Geometric Solid Adjustable Tap.**

It is especially valuable on machines having no means of closing a Collapsing Tap or for some other reason not permitting the use of a Collapsing Tap.

The Geometric Tap has the advantage of use either as a hand tap or as a machine tap.

The Tap is not equipped with the collapsing device, but has all the other advantages of a Collapsing Tap. Being adjustable, correct size is always maintained.

Chasers are readily removed for regrinding, and when finally necessary to renew the chasers, this can be done at slight cost. A great saving over renewing the entire tap.

Each size tap accommodates chasers for a range of diameters.

Reducing production costs is no new occupation for Geometric Screw Cutting Tools and Machines.

Let us prove it.

The Geometric Tool Co., New Haven, Conn., U. S. A.
Chicago Office, 627 Washington Blvd.

HARTNESS FLAT

Speed Up Production

TRUE speed for the purpose of increasing output does not consist in the undue hurrying or overworking of the machine tool operator. On the contrary, it means saving the operator all unnecessary effort and false moves by providing such convenient control that the machine will be operated at its maximum efficiency under all conditions.

The Hartness Flat Turret Lathe fully meets these requirements for greater production by reason of its centralized control, positive quick feed changes and friction speed changes.

The operator of a "Hartness" readily selects any desired speed or feed while the machine is running under cut, without changing his working position or even slowing down the machine. That is why the "Hartness" can and will speed up production in your shop. It is also the reason why the "Hartness" is the standard for quantity as well as quality production in railroad shops throughout the country.

JONES & LAMSON

Springfield, Vermont, U.S.A.

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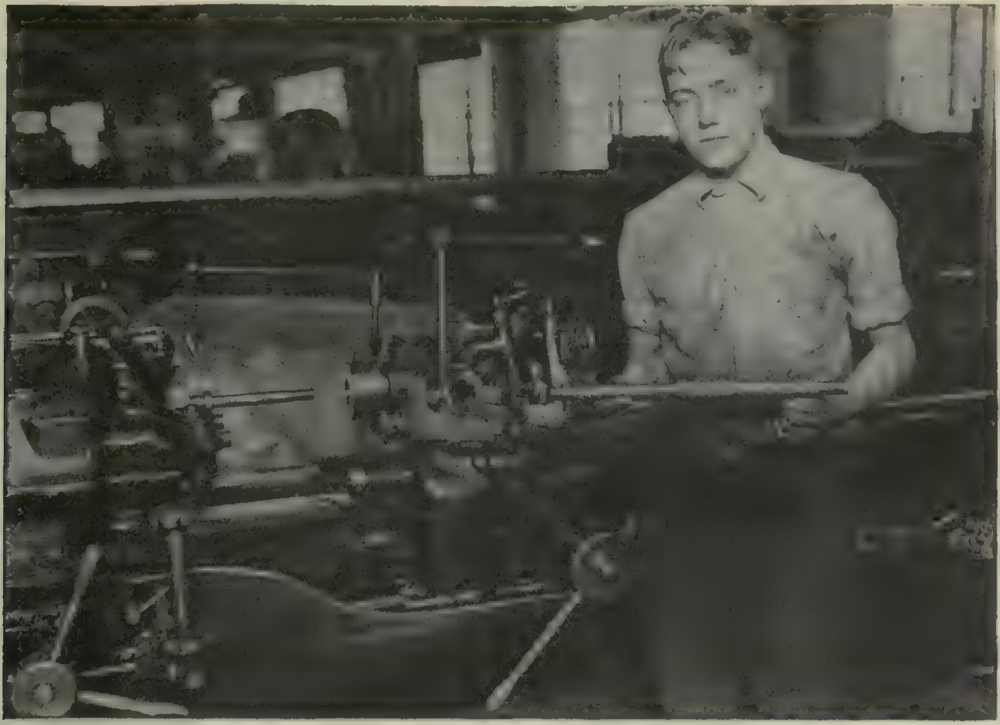
Holland—Spliethoff, Beeuwkes & Co.,
Leuehaven, wz 159 Rotterdam.

AGEN

TURRET LATHES



Increase Economy

NOW is the time to avail yourself of the opportunities for greater and more economical production offered by the Hartness Flat Turret Lathe. There is no better way to meet the present demand for economy in your particular shop, than by installing Hartness Flat Turret Lathes to handle the innumerable chucking and turning jobs that come within their range.

Whether it be the regular routine class of work such as the threading of bolts as shown in the illustration at the left, or the unusual or unexpected job such as machining the emergency valve stem shown on the right hand page, you'll find the "Hartness" always ready to turn out a first class job in a hurry and at minimum cost.

Let us explain in detail how a "Hartness" will boost production and cut the costs in your shop.

Write today for full information.

ACHINE COMPANY

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554 Collins St., Melbourne

Sweden—A. Bol. Oscar Lindbom,
Stockholm—Post Box 420

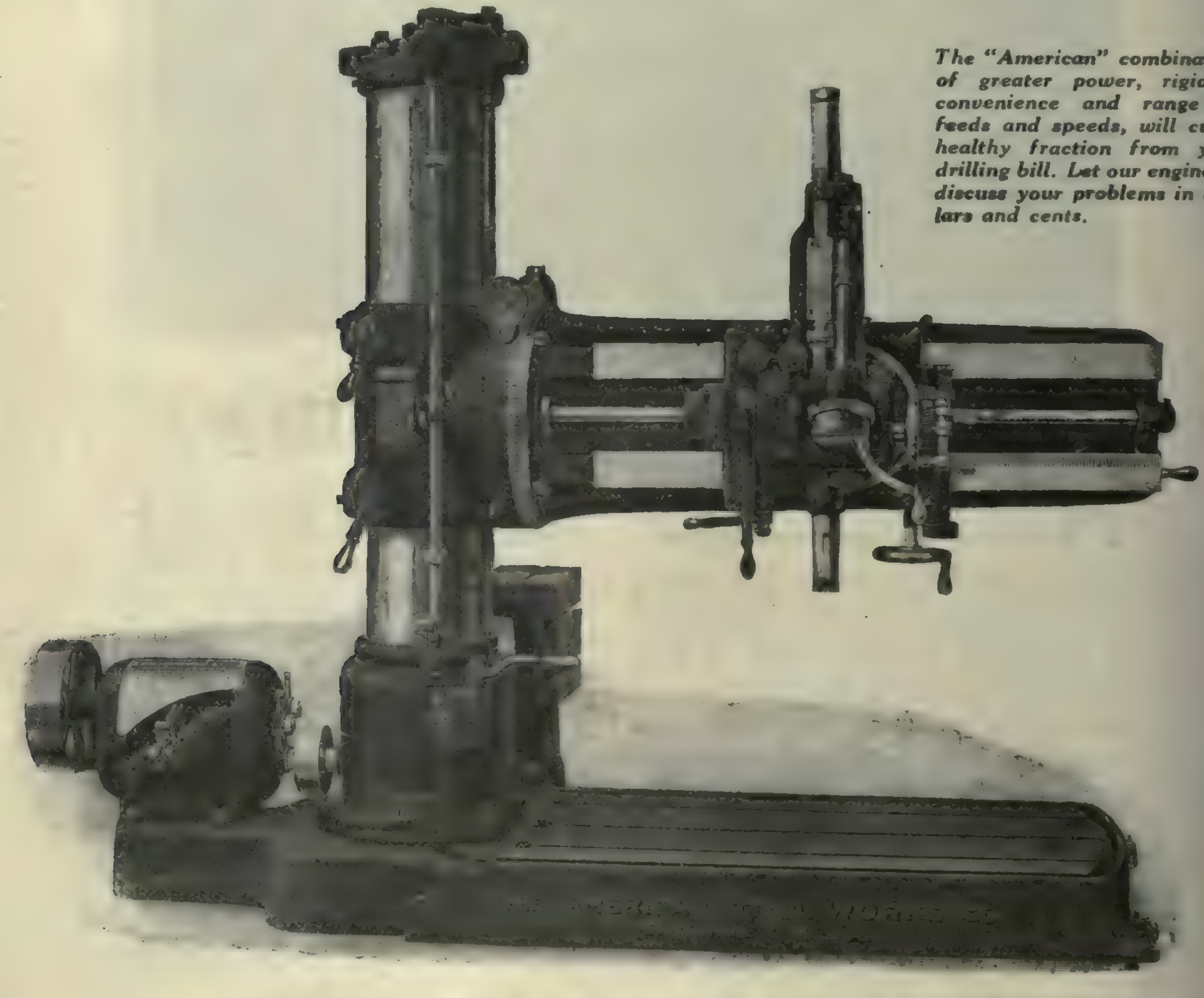
AMERICAN

A Universal Radial Built to Stand Gruelling Service

Suppose that reputable engineers announced that in one machine they had combined all the adaptability of the finest Universal Radial, with the staunchness and power of the world-famous AMERICAN Triple Purpose RADIAL!

Wouldn't you at least put their claims to the test—knowing what a trouble-proof "Universal" would mean in hole-production?

Below is a picture of such a machine—on the opposite page is a story of what it can do. This machine doesn't need to step back for any plain-arm Radial when a severe job comes along. Its distinctive design enables it to hold its own with the best high-speed steel under any conditions.



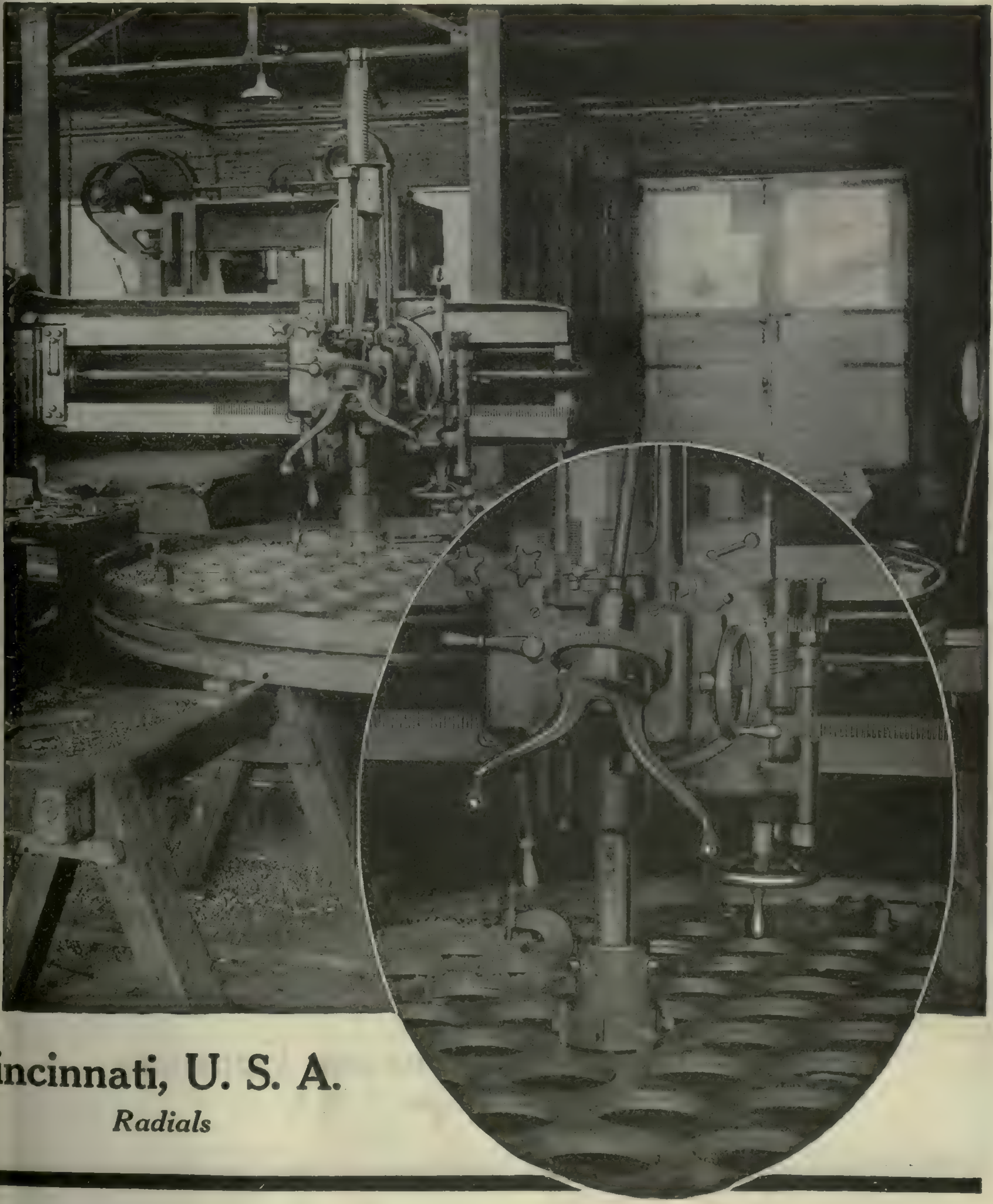
The "American" combination of greater power, rigidity, convenience and range of feeds and speeds, will cut a healthy fraction from your drilling bill. Let our engineers discuss your problems in dollars and cents.

The American Tool Works Co

Lathes *Planers* *Shape*

One Hole Every Four Minutes

The photographs show a 6-ft. "American" Universal Radial trepanning 8-inch holes in condenser heads one inch thick. One hole complete every four minutes, is the production schedule—every hole clean-cut and tool breakage practically eliminated.



Cincinnati, U. S. A.

Radials

CUT GEAR COSTS

with the

New Production Gear Shaper

The new production Gear Shaper, illustrated on the opposite page, has been designed to cut gear costs. It incorporates every feature necessary in a gear cutting machine to obtain this result; and still one of the outstanding features of the Gear Shaper principle—accuracy has been maintained.

It is designed to cut one gear at a time and at a speed which eclipses all other methods.

All operating levers are at the front of the machine, permitting a number to be bolted together and operated as a unit, one 6 H.P. motor furnishing ample power for 10 machines.

It incorporates to the fullest extent the three principal requirements of production—high speed, accuracy and simplicity of operation.

See illustrated articles in all technical magazines.

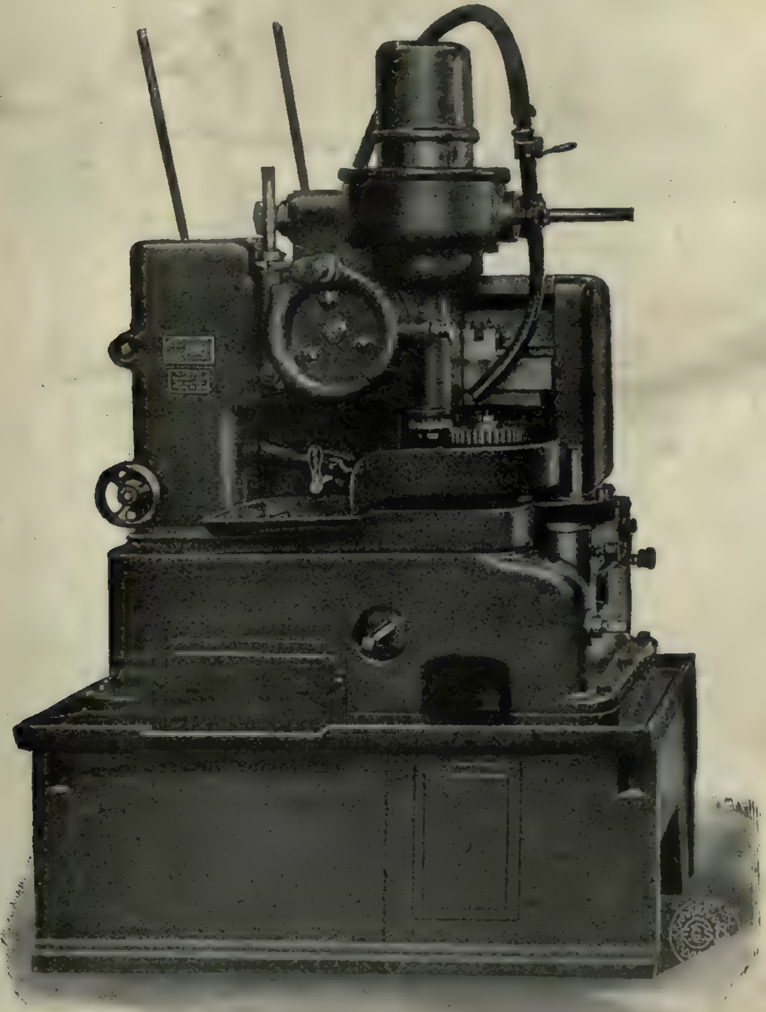
Send for our booklet "A New Development in Gear Cutting," which has been prepared for the benefit of Engineers and Production Managers interested in the best gear cutting equipment available.

Write for your copy now. Address:

The Fellows Gear Shaper Company

Springfield, Vermont, U. S. A.

The New Production Gear Shaper, which operates at sewing machine speed, and cuts gears of great accuracy—representing the greatest advancement in the art of gear cutting in the past 20 years.

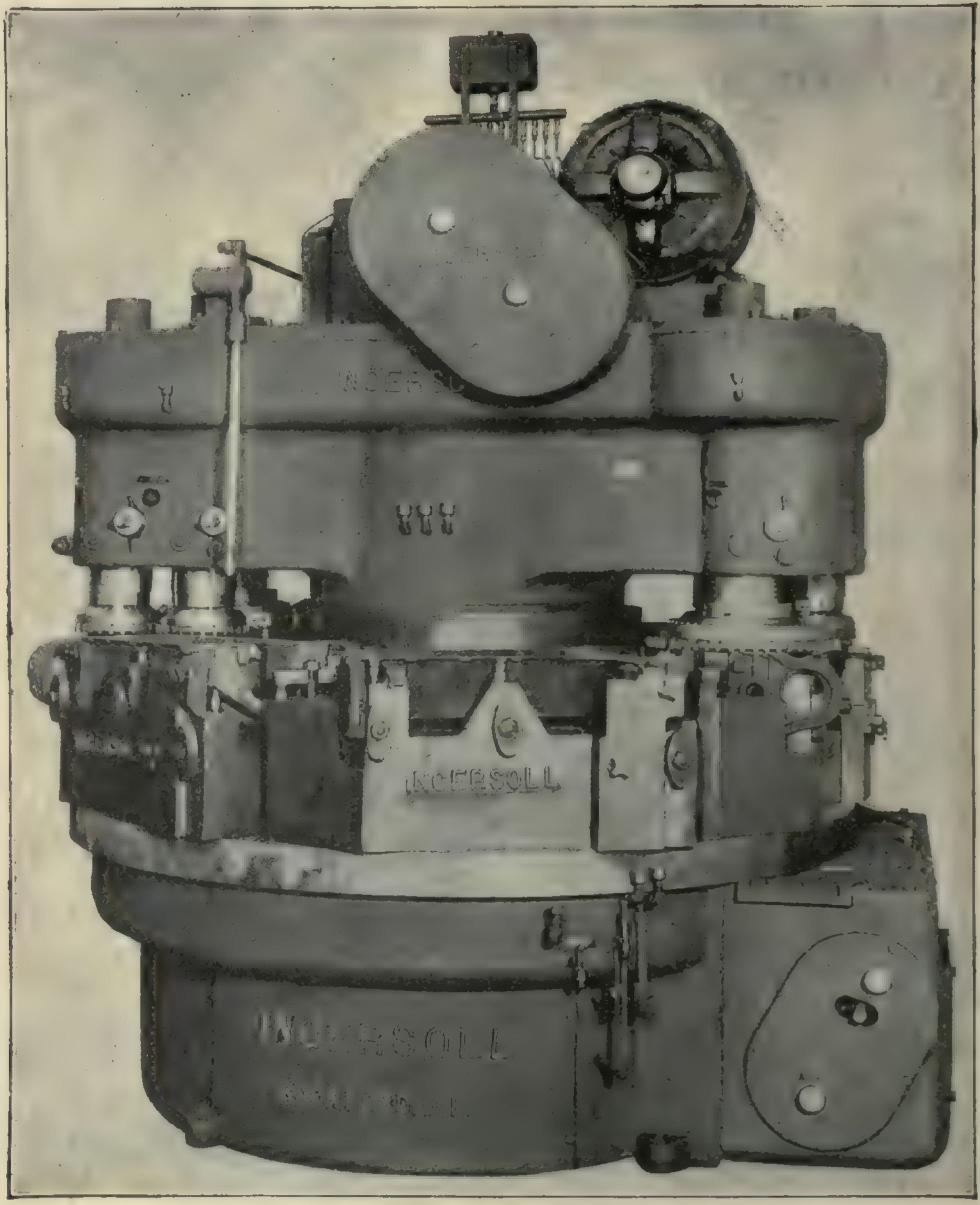


The Fellows Gear Shaper Company

Springfield, Vermont, U. S. A.

Foreign Agents: Alfred Herbert, Ltd., Coventry, England; Societe Anonyme Alfred Herbert, Paris, France; Societa Anonima Italiana Alfred Herbert, Milan, Italy; Alfred Herbert, Ltd., Yokohama, Japan; Societe Anonyme Alfred Herbert, Barcelona, Spain; Societe Anonyme Belge Alfred Herbert, Brussels, Belgium; Alfred Herbert (India), Ltd., Head Office, Calcutta, India. *Pacific Coast Representatives:* Eccles & Smith Company, Portland, Oregon; Seattle, Washington; San Francisco and Los Angeles, California.

INGERSOLL



Milling Crank Cases on a Circular Ingersoll Continuous Milling Machine

The bottom surface of the crank case of a four cylinder motor is milled on a Circular Ingersoll Continuous Milling Machine. The machine is equipped with two sets of spindles. Each set consists of two roughing spindles and one finishing spindle.

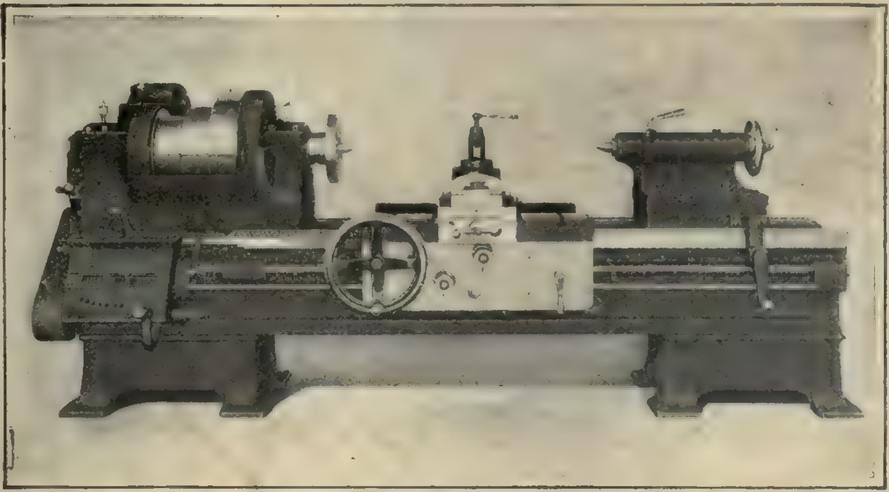
There is a loading station on each side of the machine between the two sets of spindles. Each station is tended by an operator, who keeps watch of one set of spindles and replaces the castings finished by them with rough ones which will be machined by the other set of spindles. At each revolution of the table twelve finished castings are produced, two from each fixture.

This is truly a Continuous Milling Machine in that the operators can in no way affect the relative position of the fixtures, nor can they delay the steady production of the machine. Working on an 85% efficiency basis, this machine, running with a 15-inch feed, produces 375 finished castings in an 8-hour day. It is equipped with a 30 H.P. motor, and weighs 33,000 pounds.

The Ingersoll Milling Machine Co.

Milling Machines and Their Equipment

Detroit: David Whitney Bldg. ROCKFORD, ILLINOIS 50 Church St., New York



FLATHER 24 in. Double Back Geared Lathe

FLATHER

Take the First Step With Care and the Journey Will Be Easy

Commonplace equipment promises a troublesome manufacturing journey. Constant supervision, repair losses, time out —all are obstacles to comfortable profit.

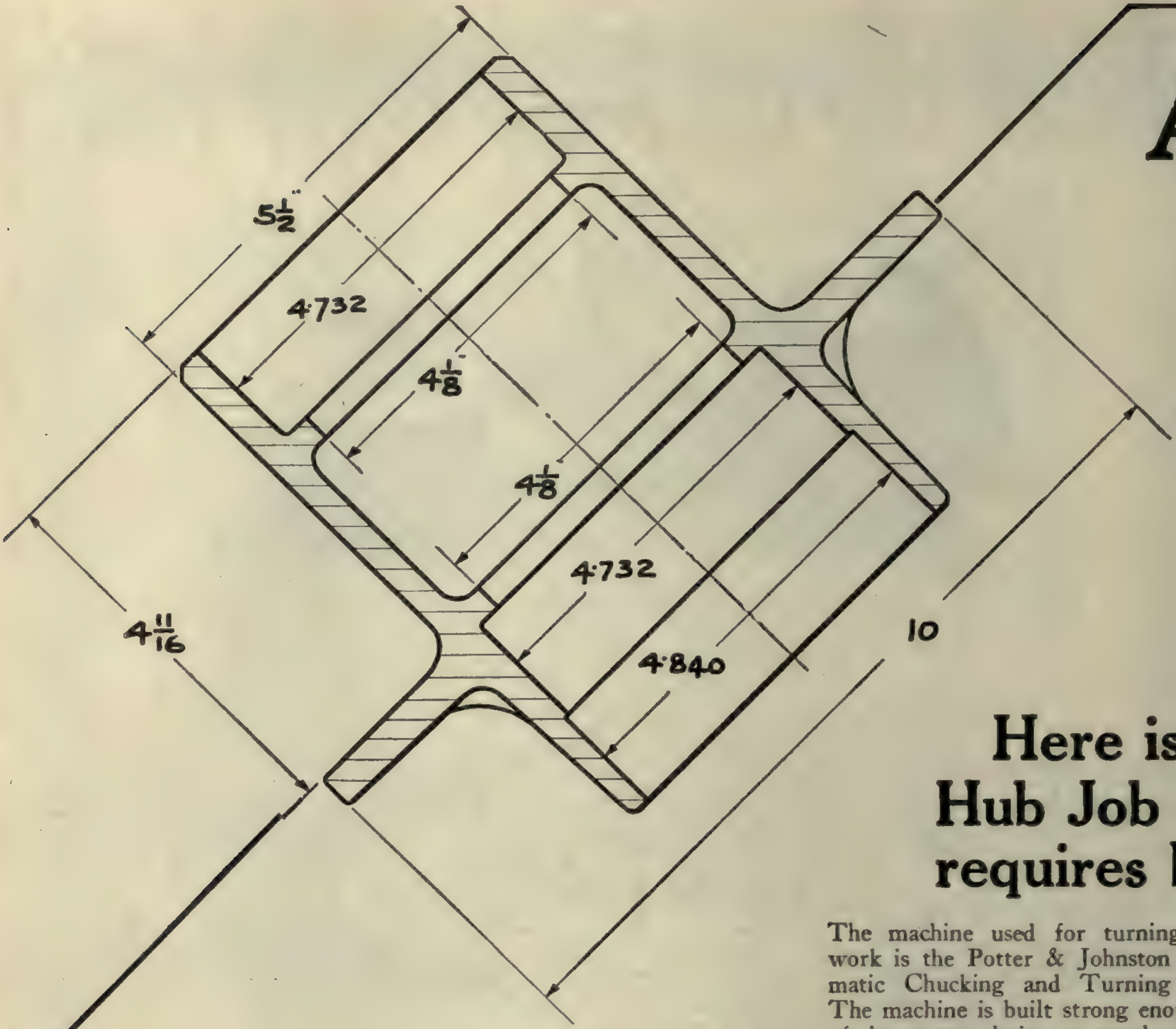
Flather Lathes assure the acme of satisfaction. We have designed one for each of your particular needs and feel confident that it will do your work a little better.

It has in every other instance.

Let us tell you about it.

Flather & Co., Inc., Nashua, N. H.

Ar



Here is a Hub Job that requires both

The machine used for turning out this work is the Potter & Johnston 8B Automatic Chucking and Turning Machine. The machine is built strong enough and is of the correct design to stand up and produce all that is required both for accuracy and production.

The Hub which is made of malleable iron is completed in two holdings, no further operations being required, as all dimensions are to size:

First Holding

1st T. F.—Rough Bore, Turn and Face Flange
2nd T.F.—Finish Bore, Turn, Face Flange and Chamfer Hub
3rd T. F.—Ream 4.732 diam.

Second Holding

1st T. F.—Rough Bore, Turn and Face Hub
2nd T. F.—Finish Bore, Turn, Face and Chamfer Hub
3rd T. F.—Ream 4.732 diam.

Output per machine is:

First Holding—86 per day of nine hours.
Second Holding—86 per day of nine hours.

One attendant operates three machines on this class of work

New York Office: Hudson Terminal Bldg., 50 Church Street, Walter H. Foster, Manager. Detroit Office: The Potter & Johnston Agency Co., 535 Bates St. Chicago Office: 1001 McCormick Bldg., Chas. H. Shaw, Manager. Pacific Coast Offices: Title Insurance Bldg., Los Angeles, 75 Fremont St., San Francisco, Louis G. Henes, Manager. Toronto Office: 11 Wellington Street, East, E. C. Roelofson, Manager.

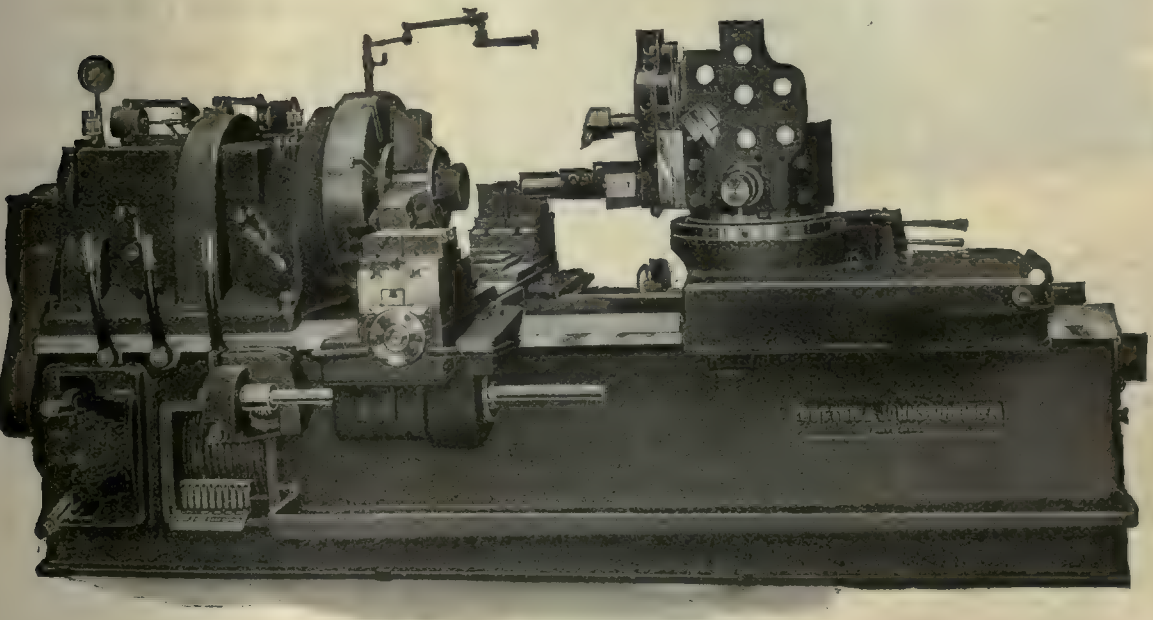
POTTER

PAWTUCKE

You Getting Accuracy with Production?

If *you are getting both* you may be interested in a way of improving your present method of machining and thereby jumping up your production and at the same time retaining your accuracy.

If *you are not getting both* you should investigate the proposition right away and get on the track to improve your methods of manufacture. Send your drawings or samples along and we will outline what we can do for you.



JOHNSTON

RHODE ISLAND

Foreign Offices and Representatives: Office for Great Britain, France, Italy, Belgium, Switzerland, Spain and Portugal: Potter & Johnston Machine Co., 68 Ave. de la Grande Armee, Paris, France, J. Ryan, Manager. Chas. Churchill & Co., Ltd., London, Birmingham, Manchester and Newcastle-on-Tyne, England, and Glasgow, Scotland. Ercole Vaghi, Corso Porta Nuova, 34 Milan, Italy. Rylander & Asplund, Stockholm, Sweden. Yamatake & Company, No. 1 Yurakucho, Ichome, Kojimachiku, Tokyo, Japan.

When You Talk of Profits

Earned by Savings in Cost, You Will Find No Better Example Than

MULT-AU-MATIC Economy

Mult-Au-Matic Economy in two recent installations shows the following comparisons of Unit Production Cost.

Former Method	0.283	0.422
Bullard Method	.064	.187
SAVING PER PIECE...	0.219	0.235

Figure your present costs on chucked work down to bed rock—cut the last minute of excess time from your operations—then get a complete report of Mult-Au-Matic economy on your work.

Mult-Au-Matic costs show a saving in floor space, smaller power consumption, reduced maintenance, easier inspection and supervision and a lower labor cost.

The processing of all operations at once—the longest cut in the shortest time and all other cuts in the same time—and the automatic indexing of the machine which paces the operator in chucking the work, insures consistent continuous production.

If you can meet competition by other methods you can Make Profits the "Mult-Au-Matic Way"

BULLARD

Bridgeport, Connecticut

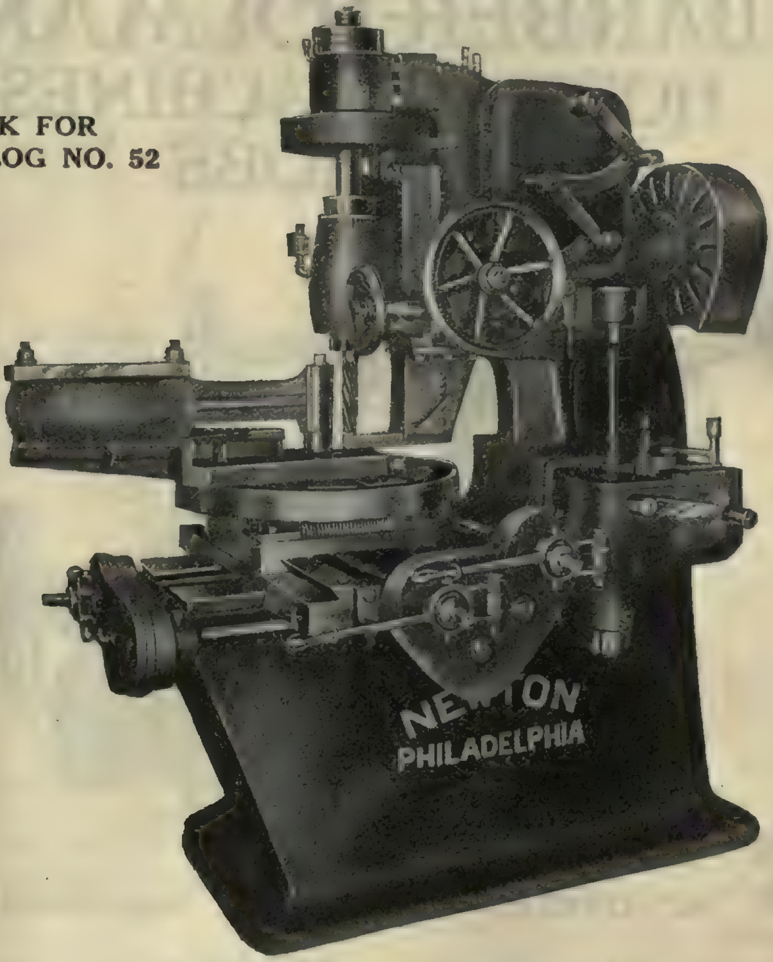
Builders of the Mult-Au-Matic, the Vertical Turret Lathe and the Maxi-Mill

NEWTON

(Registered Trade Mark)

VERTICAL MILLING MACHINES

ASK FOR CATALOG NO. 52



MILLING THE PISTON END
OF ECCENTRIC STRAPS

NEWTON MILLING MACHINES

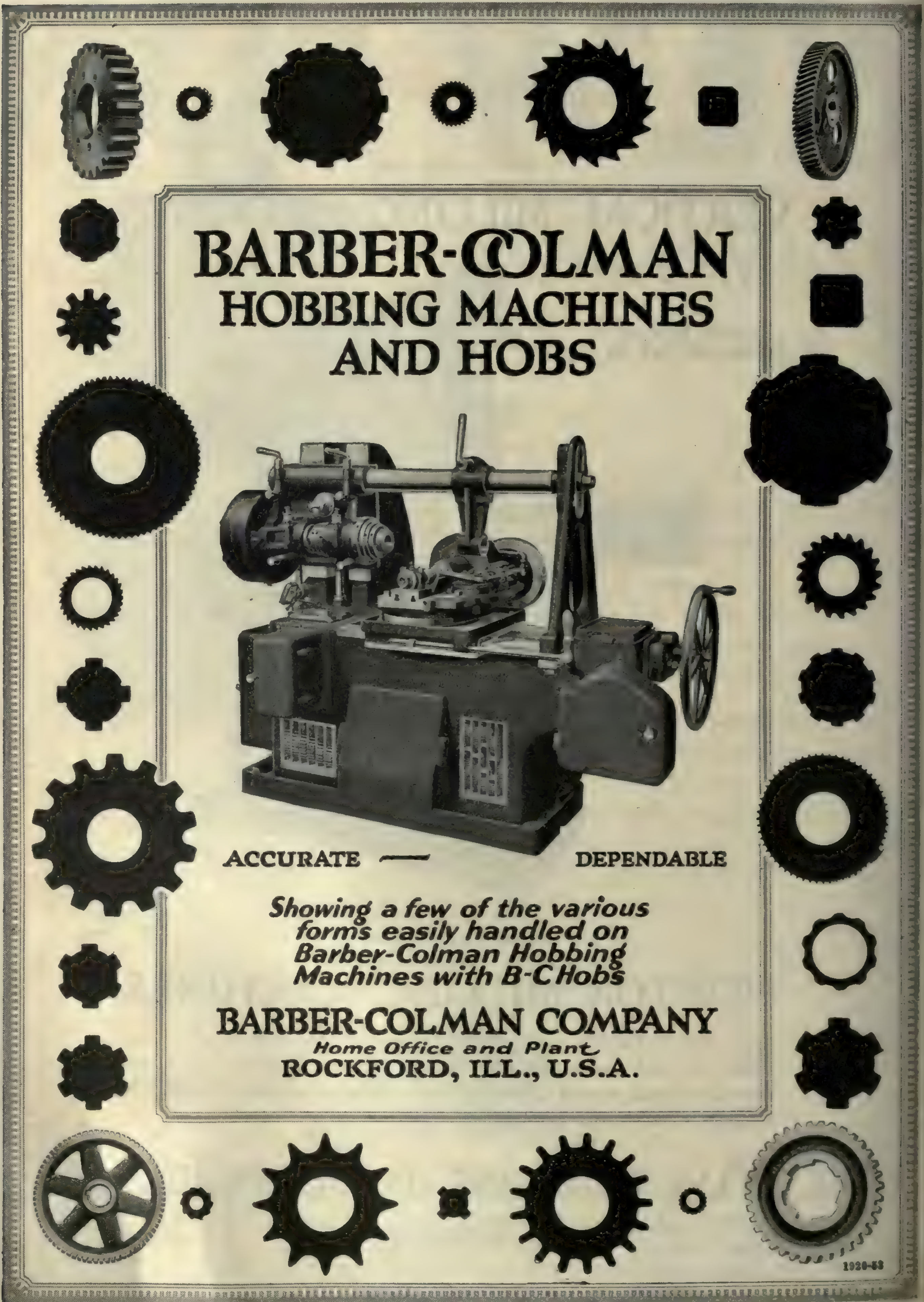
have the WEIGHT and SURPLUS POWER which eliminate vibration and insure steady, smooth cutting, together with the necessary feed, speed and control mechanism to give MAXIMUM PRODUCTION AT MINIMUM COST.

NEWTON MACHINE TOOL WORKS, Inc.

MILLING MACHINES
23rd and Vine Streets

Manufacturers of
SLOTTING MACHINES
ROTARY PLANING MACHINES
CRANK PLANING MACHINES

COLD METAL SAWING MACHINES
Philadelphia, U. S. A.



BARBER-COLMAN
HOBBING MACHINES AND HOBS

ACCURATE — DEPENDABLE

Showing a few of the various forms easily handled on Barber-Colman Hobbing Machines with B-C Hobs

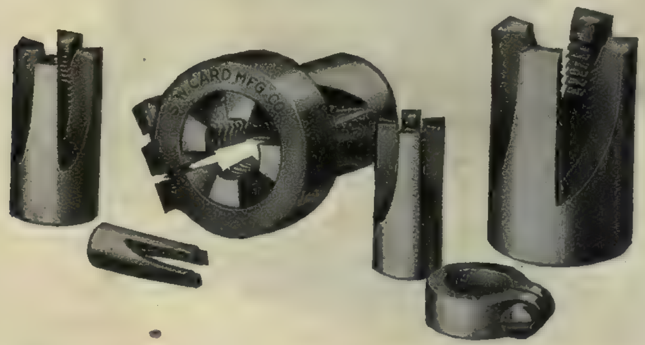
BARBER-COLMAN COMPANY
Home Office and Plant
ROCKFORD, ILL., U.S.A.

1920-53

CARD

Dies for the Screw Machine

Card Spring Screw Threading Dies will show you real results in screw machine threading.



Troubles usually experienced in the use of the ordinary spring dies are principally caused by the prongs closing in the hardening operation. If this takes place, the fingers of the dies are often not opened uniformly and therefore cannot be closed properly when adjusted to size by the use of the clamp collar.

By a special process in the heat treatment these troubles have been eliminated.

Card Spring Dies are relieved like a hand tap. They can be readily sharpened when dull by grinding the cutting faces and the muzzle end of the die. Users say they have longer life, produce a better quality of work, and are more durable than round dies.

Try these dies and you will order more—they repeat.

Catalog No. 30 upon request

The CARD Quality

S.W. CARD MFG. CO.
DIVISION OF UNION TWIST DRILL CO.
MANSFIELD, MASSACHUSETTS, U.S.A.

FOREIGN AGENCIES: CHARLES CHURCHILL & CO., London, Birmingham, Manchester, Glasgow, and Newcastle-on-Tyne. V. LOWENER, Verterbrogade 9 B, Copenhagen, Denmark. AUX FORGES DE VULCAIN, General Office and Salesroom, 3 Rue St. Denis, Paris; Important Branches and Showrooms, Lyons, Bordeaux, Lille. V. LOWENER'S MASKINFORRETNING, Sverre Mohn, Christiania, Norway. C. CIVITA, Milano, Italy. R. S. STOKVIS & ZONEN, LTD., Rotterdam. J. LAMBERCIER & CO., Geneva, Zurich. V. LOWENER, Drottinggatten 90 Stockholm, Sweden. HIJO DE MIGUEL MATEU of Barcelona and Bilbao, Spain. R'AULIGNAC, Barcelona, Spain. ATELIERS DEMOOR, Brussels, Belgium. A. M. PAPASIDERIS & CO., Athens, Greece. ANDERSON, MEYER & CO., LTD., Shanghai, Changsha, Hankow, Harbin, Hongkong, Kalgan, Pekin, Tientsin, Vladivostok, China. M'ESTRE & BLATGE, Rio de Janeiro, Brazil, Buenos Aires, Argentine Republic.

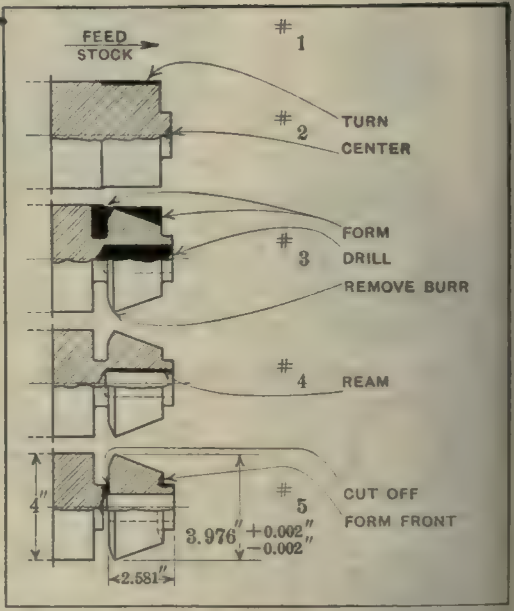
Foote Brother
Shortest Rout

½" TO 6" 18" FEED
LEVELAND'S
APACITY UNEQUALED

30 Bevel Gear Blanks Per Day Machined Complete from the Bar

These blanks are made from 4-in.—25-point carbon stock—formed, finished and cut off complete in five operations as indicated in the accompanying sketch. No second or "finishing" operation is required. They go straight from this machine to the gear tooth generator.

This operation is typical of the service Cleveland Automatics perform for Foote Brothers.



Allow us to quote outputs on your work.

THE CLEVELAND AUTOMATIC MACHINE CO.
Cleveland, O., U. S. A.

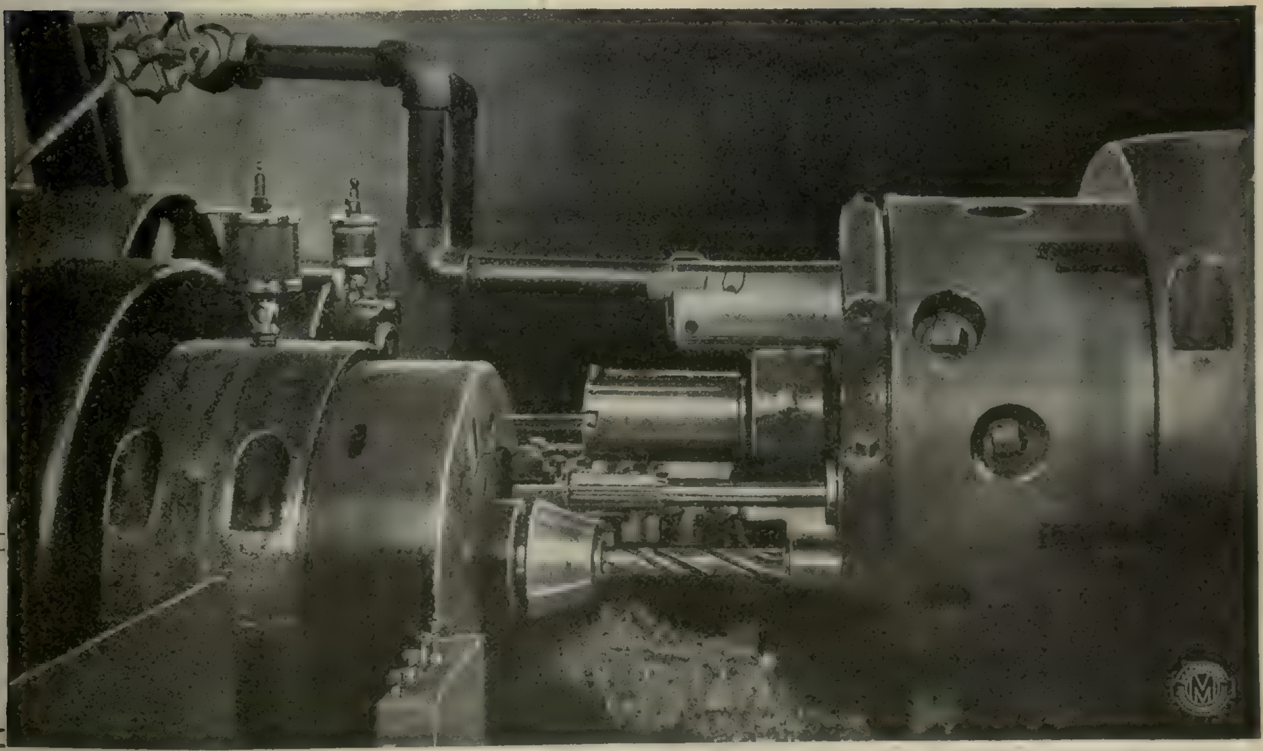
ind Eleven CLEVELAND Automatics the etween Stock Room and Gear Generators

The First One, Seven Years Ago "Sold" Ten More

From the very start (1910) Cleveland Automatics have made good in the busy, up-to-date plant of Foote Brothers Gear & Machine Co., Chicago. Gears, clutch hubs and other transmission parts have been their chief work.

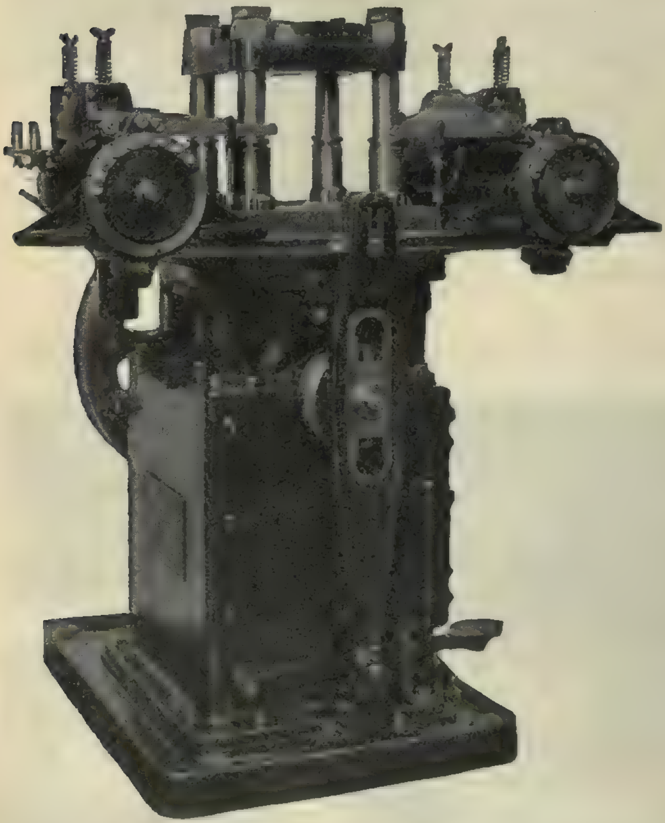
Not only does this line of speedy, sturdy machines have a wide range in size, but in their range of usefulness they have no equal.

They are easily set up and one man usually operates several machines. They are designed to produce all kinds of duplicate parts from bar stock and are readily adapted to handle castings, forgings and other second-operation work within their range. The quickness with which the magazine attachments can be applied gives every "CLEVELAND" a remarkable flexibility.



Features of the New Wright Dieing Machine that Revolutionizes Punch Press Work

The Dies are Unusually Accessible and Well Lighted



HERE is another big advantage over the old-style punch press. With the flywheel and crankshaft located below the dies there is no obstruction to light and the dies are readily visible and easily accessible for adjustment.

The feeding rolls seen on each end of the machine can be swung back making the setting of tools still easier.

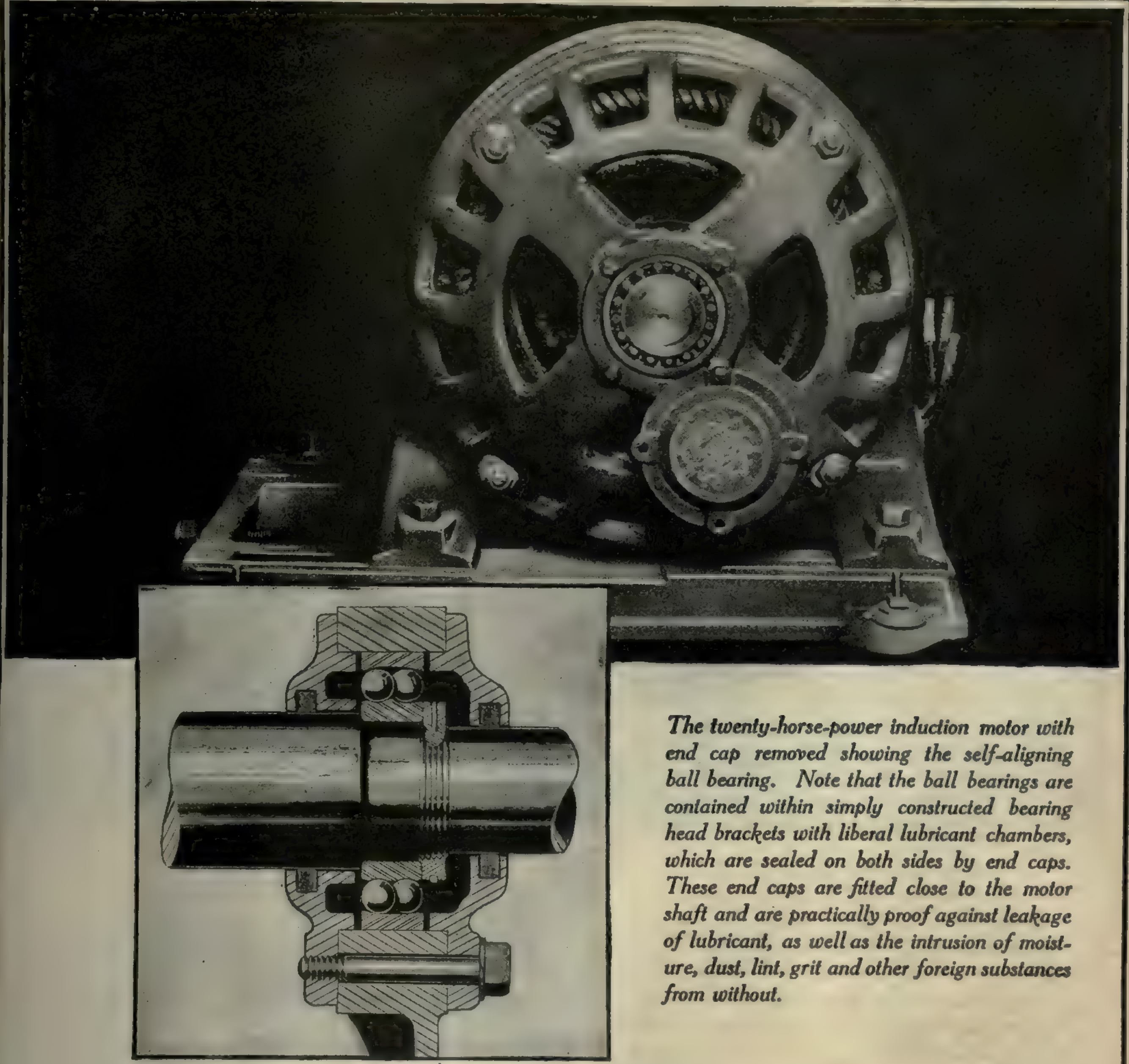
There is an automatic arrangement of the operating treadles that makes the setting of tools a safe operation.

Let us tell you all of the many other big advantages of this new, correct-design dieing machine. If you do any punch press work it will mean, for you, greater production at less cost. Write today.

The Henry & Wright Manufacturing Co.
760 Windsor Street, Hartford, Conn., U. S. A.

Makers of

DRILLING MACHINES DIEING MACHINES



The twenty-horse-power induction motor with end cap removed showing the self-aligning ball bearing. Note that the ball bearings are contained within simply constructed bearing head brackets with liberal lubricant chambers, which are sealed on both sides by end caps. These end caps are fitted close to the motor shaft and are practically proof against leakage of lubricant, as well as the intrusion of moisture, dust, lint, grit and other foreign substances from without.

The use of ball bearings in electrical machines—

has been a continuous growth and is fast coming to be considered vital to the best mechanical practice in the design of electrical machinery. So marked is this fact that today the leading manufacturers of electrical machinery have a standard line of ball bearing motors.

Self-aligning ball bearings marked **SKF** are particularly adapted for motor uses and are so nearly frictionless that wear is practically eliminated. This insures perfect rotor alignment almost indefinitely with a constant high efficiency air gap for maximum motor life. And because they are wear-free, the bearings run cool and require a minimum of lubrication and attention.

The engineering experience of our organization is at your disposal. You are urged to submit your bearing problems to us for careful and impartial consideration.

The Skayef Ball Bearing Co.

Supervised at the Request of the Stockholders by

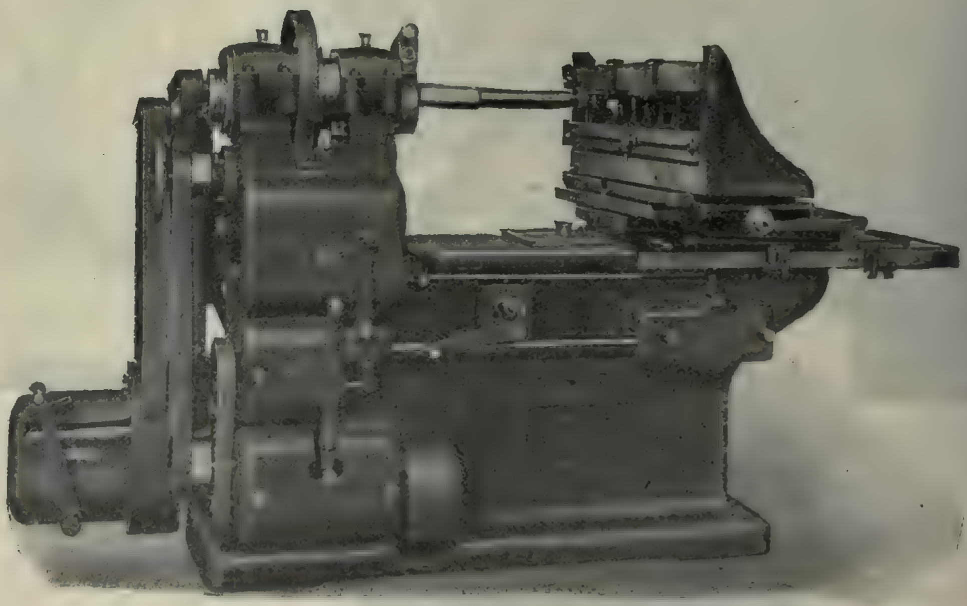
SKF Industries, Inc.

165 Broadway, New York City

MAIN STRE

Reveals the Facts

HEALD
No. 65
Cylinder
Grinder



Whether your shop is in the big city or the average town, there is one field of profit that is steadily growing and you have hourly evidence of it right on your own "Main Street."

We refer to cylinder regrinding, which is not confined to the garage or service station. In fact, it is more logical work for the small machine shop who is equipped with practically all of the required tools and needs but a Heald grinding machine to turn the hit-or-miss profits into a steady income. Established and with skilled workmen, nothing offers so simple and economical an opportunity as that of regrinding automobile cylinders.

Your town has its quota of the 10,000,000 cars now registered in this country and your shop, when equipped with a Heald, will keep busy on a share of these cars.

Remember that 75% of all the automobiles registered in the United States are in towns of less than 50,000 population and that there is more profit derived from grinding Ford blocks at a special price than higher class cars at big figures.

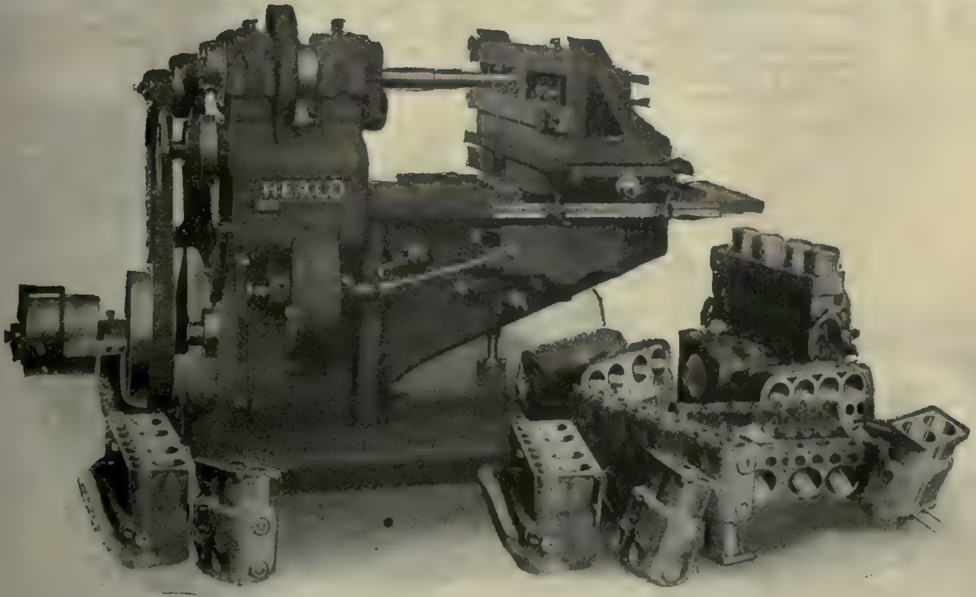
We can offer you two styles of machines—one the Style No. 55, a simplified machine with maximum range which is an ideal proposition for a small machine shop just starting in the business.

The Style No. 65 was primarily built for automobile manufacturers. It is unusually rigid and massive with extra speeds and feeds, and fitted with the Heald universal jig it is ideal for regrinding.

Take a look up "Main Street" and then ask us how you can secure the business you see rolling by.

ET

HEALD



HEALD No. 55 Cylinder Grinder

The Heald Machine Co.

35 New Bond Street, Worcester, Mass.

Branches: New York, 839 Singer Bldg.; Philadelphia, 1302 Stephen Girard Bldg.; Chicago, 26 South Jefferson St.; Detroit, 400 Marquette Bldg.; Cincinnati, 311 Provident Bank Bldg.; Cleveland, 721 Engineers Bldg.; Buffalo, 331 Jewett Ave. **Agents:** Eccles & Smith Co., San Francisco, Los Angeles, Portland and Seattle; Salt Lake Hardware Co., Salt Lake City; Hendrie & Bolthoff Mfg. & Supply Co., Denver; F. E. Satterlee Co., Minneapolis; The Oliver H. Van Horn Co., New Orleans; The Russell Hardware Co., McAlester, Okla.; The Young and Vann Supply Co., Birmingham; G. Norman Baughman Co., Tampa; The Walraven Co., Atlanta; The Cameron and Barkley Co., Charleston, S. C.; Greensboro Supply Co., Greensboro, N. C.; Benjamin T. Crump Co., Richmond; Geo. F. Foss Machinery Co., Montreal, Can.; H. W. Petrie, Ltd., Toronto, Ont., Can.

Speaking of Ten Operations and the "ACME Way"

All ten of the operations on this 1¼ in. brass piece were performed on the Acme in the time it would take you to FORM the piece by any method that you could use.

This is a simple example of what it means to costs when enough tools can be used to do the maximum of operations on your screw machines. This means simply that on Acme Automatics you substitute the small expense of extra tools for the big expense of machinery and labor for rehandling the work.

We suggest that you pick up some of your screw machine work on which operations are now being handled on secondary machines, tell us how accurate you want them, ask us if they can be done on Acme Automatics, and what guaranteed production figures we can quote.

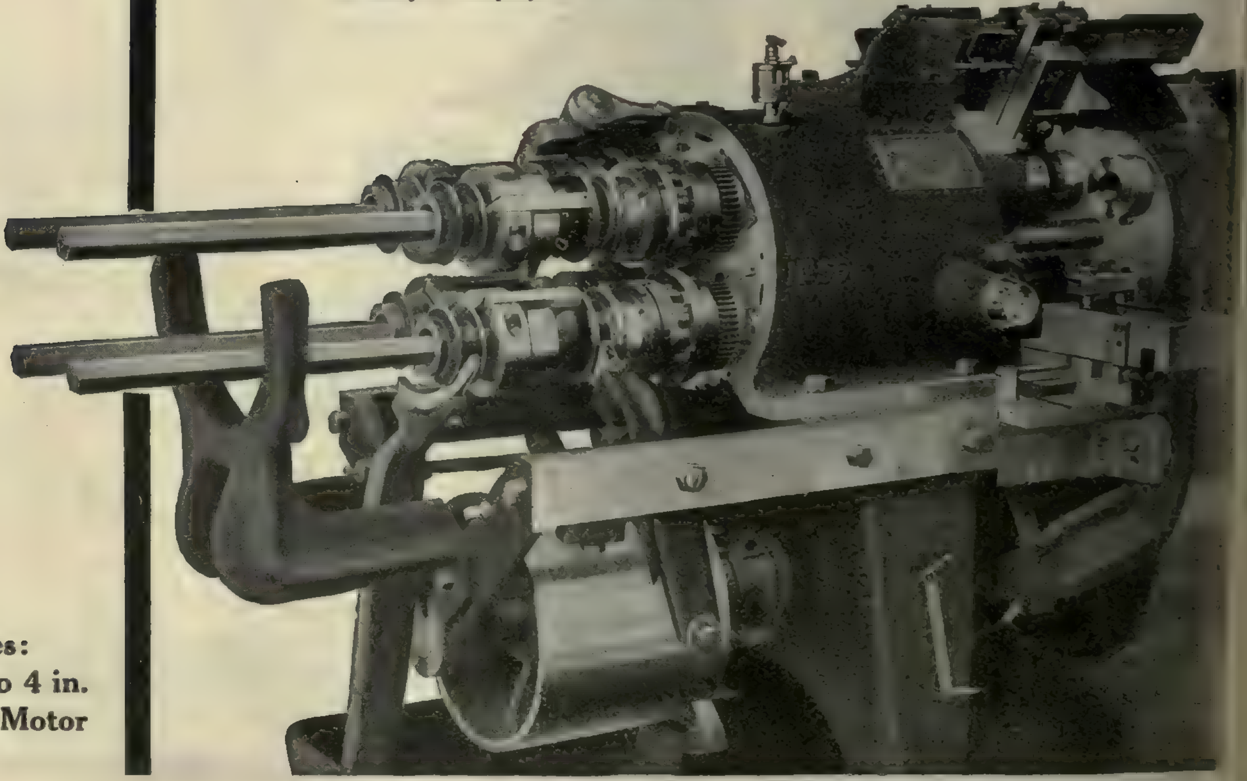
Find out Acme costs. No obligation.

THE NATIONAL ACME COMPANY

CLEVELAND, OHIO

New England Plant, Windsor. Vt. Canadian Screw Plant, Montreal, P. Q.
BRANCH OFFICES: NEW YORK BOSTON CHICAGO DETROIT BUFFALO
WAREHOUSES: NEW YORK AND CHICAGO

Foreign Representatives: Great Britain, Chas. Churchill & Co., Limited. France, Belgium, Switzerland, Spain; for Gridleys, Potter and Johnston; for Acmes, Etablissements Horstmann. Sweden, E. Trobeck, Australia, Benson Brothers. Japan, Yamatake & Company. South Africa, D. Drury & Company.



Sizes:
¾ in. to 4 in.
Belt or Motor

Complete Line of 8 inch to 50 inch Swing (with or without Tapping Attachment)

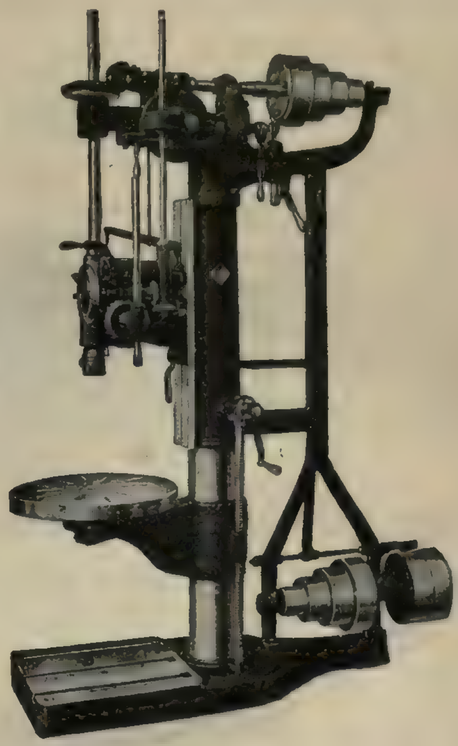
Upright DRILLS
Horizontal DRILLS
Gang DRILLS

Convenience of Operation
Accuracy—Strength

TRADE MARK W.F. AND J.Co

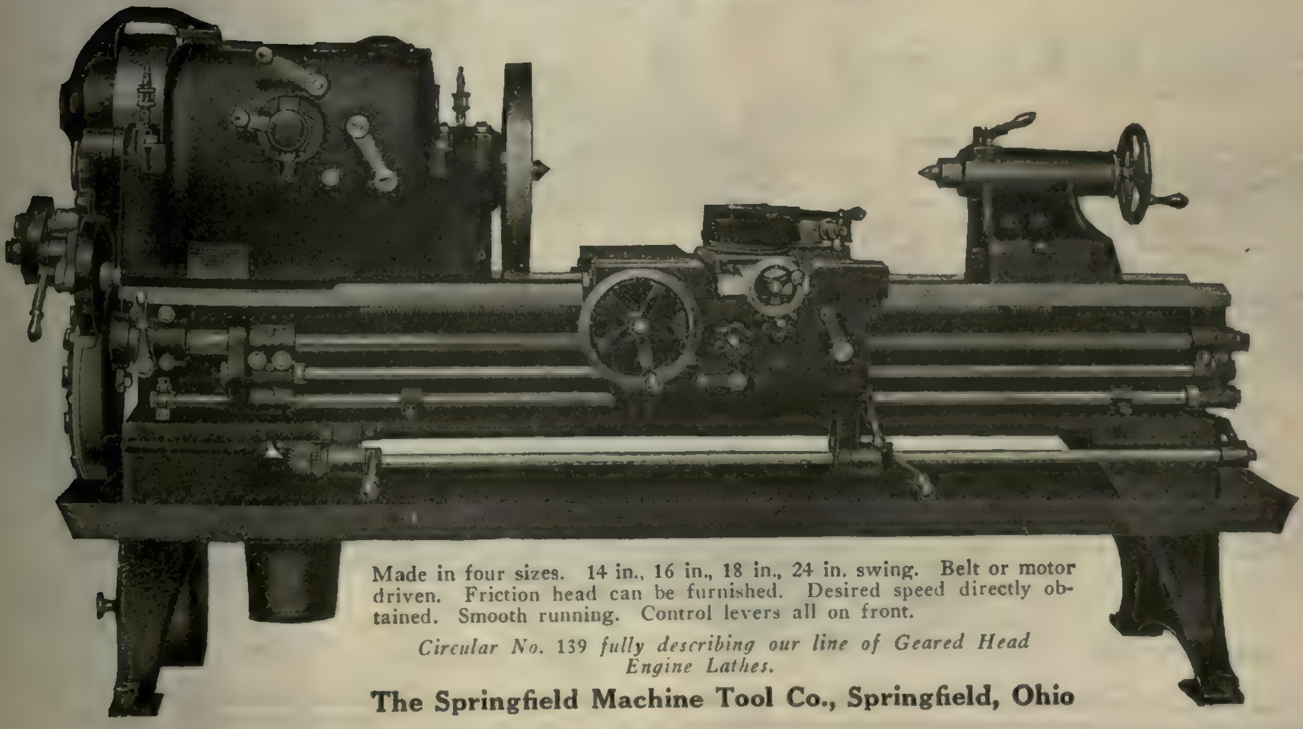
Made by

W. F. & JOHN BARNES CO.
1995 Ruby Street, Rockford, Ill., U. S. A.



SPRINGFIELD—IDEAL

A Geared Head Engine Lathe of High Power, Correct Speeds, Rapid Change Gearing Facilities, High Efficiency Together with Long Life

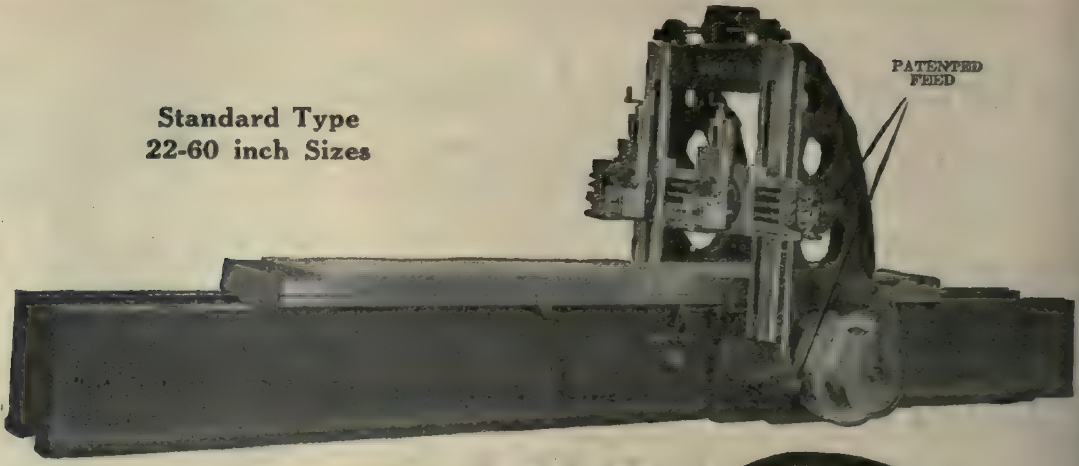


Made in four sizes. 14 in., 16 in., 18 in., 24 in. swing. Belt or motor driven. Friction head can be furnished. Desired speed directly obtained. Smooth running. Control levers all on front.

Circular No. 139 fully describing our line of Geared Head Engine Lathes.

The Springfield Machine Tool Co., Springfield, Ohio

Standard Type
22-60 inch Sizes



Liberty SERVICE is Also Wrapped Up in a Liberty Purchase—

LIBERTY engineering service, supplied by planer experts, is as distinctive as the LIBERTY PLANER itself.

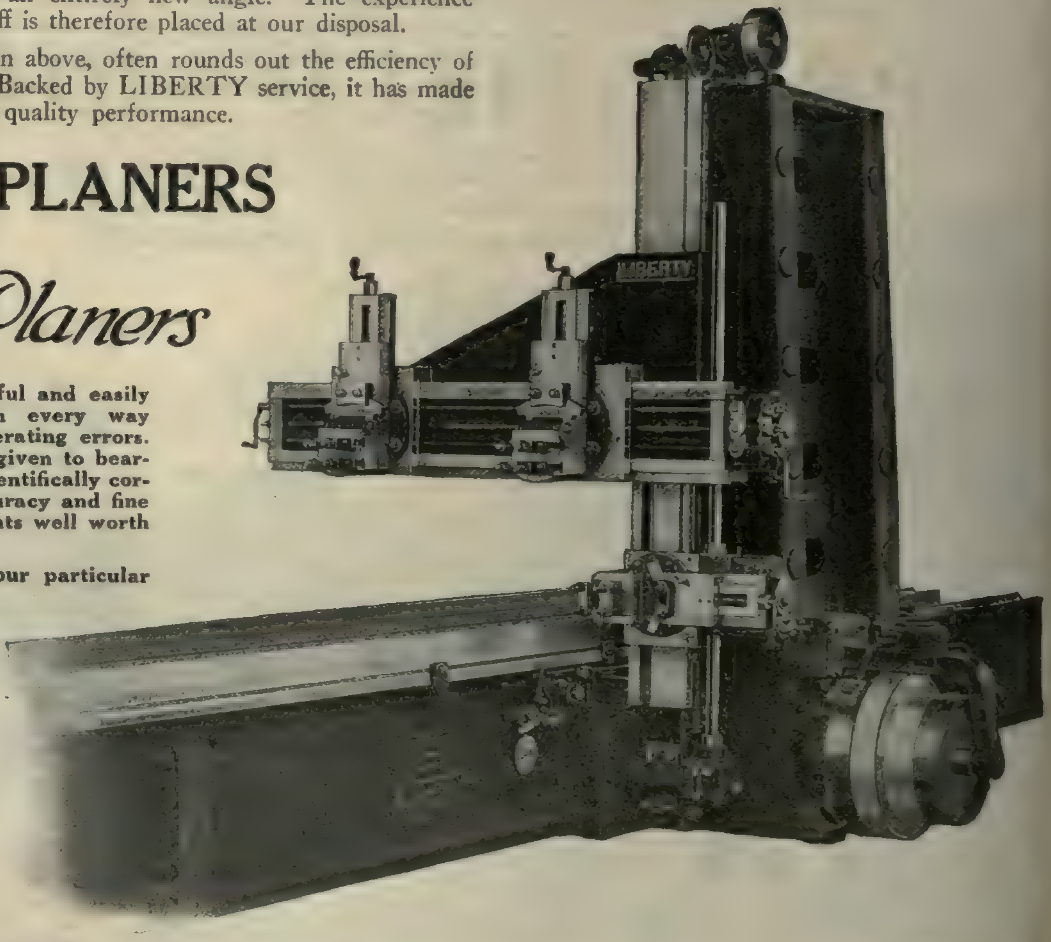
When you buy a "QUALITY PLANER" not all of your purchase comes on the skids or in crates, loaded from our shipping platform. Many "LIBERTY" owners have found short cuts to production through the combination of *"LIBERTY Service,* and the LIBERTY PLANER.

Because of its remarkable capacity, brute strength and time-saving refinements, the Openside Planer shown can tackle many difficult machining problems from an entirely new angle. The experience and advice of our own staff is therefore placed at our disposal.

The Standard Type, shown above, often rounds out the efficiency of your planer department. Backed by LIBERTY service, it has made a record for economy and quality performance.

LIBERTY MACHINE
L
TOOLS

Open Side Planers
24-60 inch Sizes



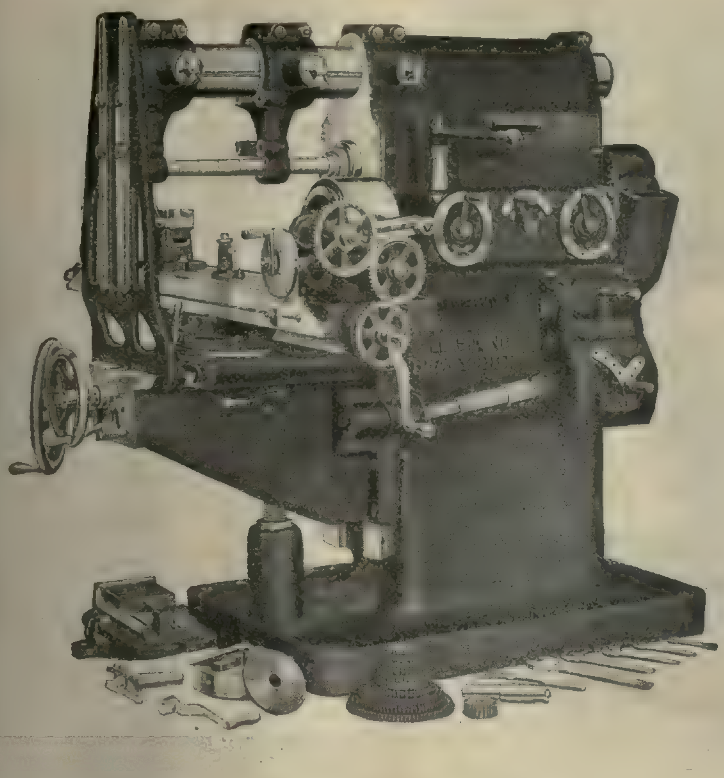
LIBERTY PLANERS
are Quality Planers

Quality Planers are powerful and easily operated—are guarded in every way from the possibility of operating errors. The patent feed, the care given to bearings and lubrication, the scientifically correct proportioning, the accuracy and fine finish of each part are points well worth your attention.

May we advise you on your particular problems?

Liberty
Machine Tool
Co.

Hamilton, Ohio



Le Blond Heavy Duty Milling Machines

Plain or Universal
Cone or Gear Drive
Sizes No. 0 to No. 5

Have right-hand centralized control system.

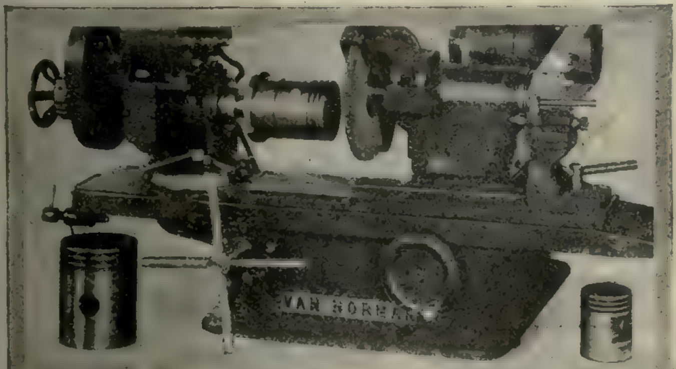
Patent self-aligning arbor support, with unusually large over arm.

Centralized oiling.
Hardened spindle bearings.
One-piece column.
Unit feed box.
Two-lever control.

Broader bearing surfaces and larger dimensions contributing to increased production and reduced depreciation.

The R. K. Le Blond Machine Tool Co., Cincinnati, Ohio

Its Versatility Keeps It Busy



The Van Norman "Re-li-o" will prove to be the busiest machine in your garage, service station or repair shop.

It combines the machining virtues of a lathe and grinding unit—both external and internal.

It will quickly prove its ability to speedily and accurately handle a major portion of all the small turning and grinding work that comes your way.

Set-ups and adjustments are simple and easy; both internal and external grinding operations can often be performed with one chucking of the work.

Let us tell you how you can enhance quality and lower cost by installing the "Re-li-o."

The
Van Norman
"Re-li-o"

Grinds and turns pistons, valves, wrist pins, commutators, etc.

Regrooves pistons.

Grinds externally and internally.

Van Norman Machine Tool Company
Office and Factory:
160 Wilbraham Street
Springfield, Mass., U. S. A.

WHEREIN CARBOFRAX MUFFLES EXCEL

The remarkably high heat conductivity and thin wall construction of Carbofrax muffles permit quick heating; a few hours only are required to bring a cold muffle to working temperature.

The high heat conductivity of Carbofrax muffles results in fuel saving during operation, as a lower flue temperature can be maintained. The average temperature difference between flue gasses and inside muffle is 200°F. Fuel is also saved because furnace can be shut down over week end.

A more uniform temperature is maintained within a Carbofrax muffle. Keeping the temperature within ten degrees is not uncommon.

The life of a Carbofrax muffle is many times that of clay because of its greater mechanical strength and refractoriness.

The low temperature in combustion chamber and flues means a longer life for all of the furnace brickwork.

Sounds Like a Bit of Industrial Fiction

The reports we are getting on the success of Carbofrax muffles in enameling furnaces seem almost too good to be true.

One such report comes from The Creamery Package Company of Wisconsin. There they installed a Carbofrax muffle in a Stewart furnace used for enameling 550 pound bases for ice cream freezers.

With a fire clay muffle, it took them twenty-eight hours to bring the furnace to enameling heat. With the Carbofrax muffle it now takes them just five hours to reach the same temperature—twenty-three hours faster on heat pick up. The reason for this is, of course, the remarkable heat conductivity of Carbofrax. It is nine times that of fire clay.

This Carbofrax muffle not only saves time and fuel but will outlive any fire clay muffle by months.

In this particular instance production has been increased 100%. It should be remembered, however, that they are firing unusually large castings.

Many such stories of the proved efficiency of, not only Carbofrax muffles, but the other Carborundum Refractories, are constantly coming to us.

Glad to let you have full details.

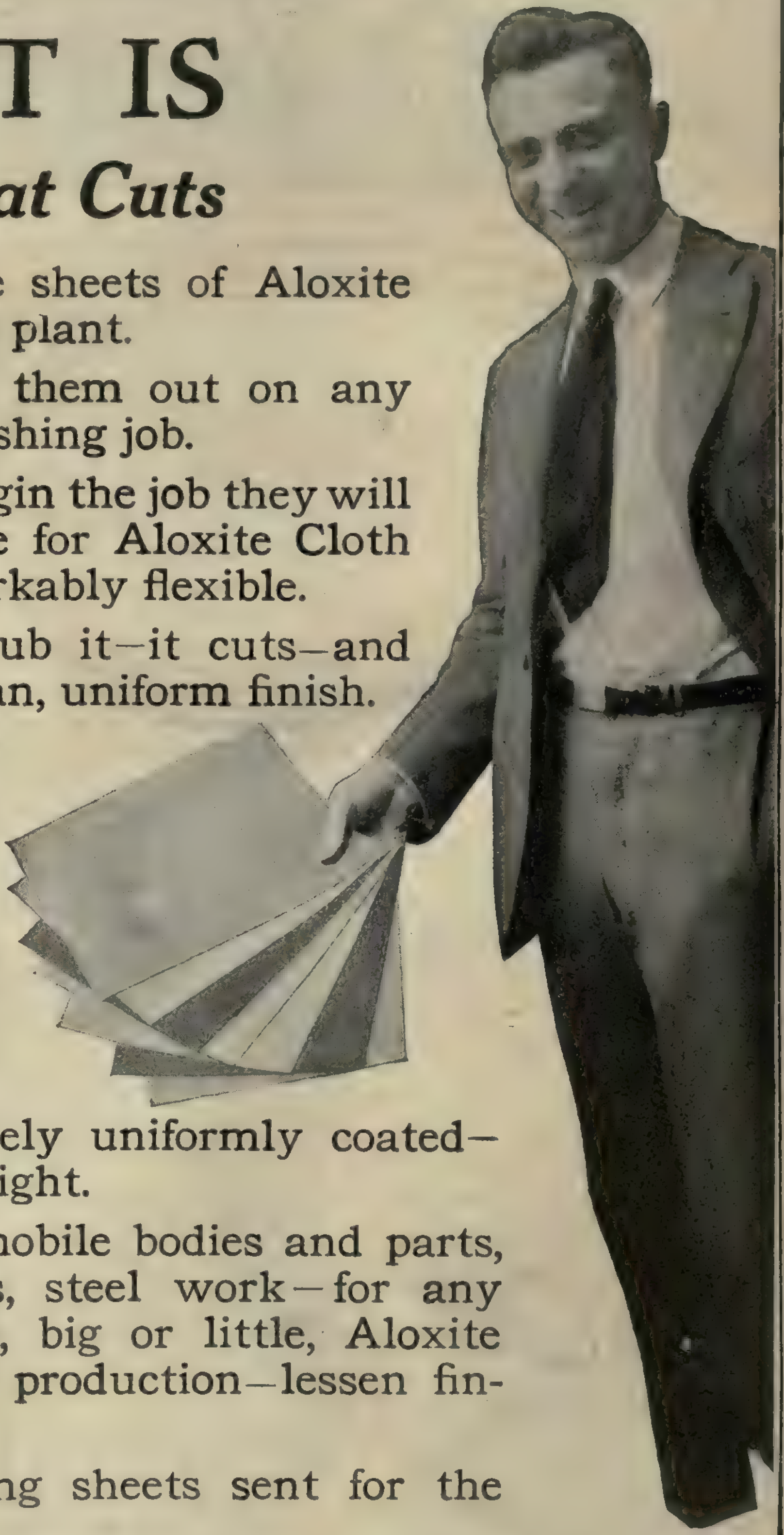
Carborundum Refractories

Brick Tile Muffles Retorts Cements

The Carborundum Company, Perth Amboy, N. J.

HERE IT IS

The Cloth that Cuts



GET these sample sheets of Aloxite Cloth into your plant.

Have the men try them out on any kind of a metal finishing job.

The minute they begin the job they will "feel" the difference for Aloxite Cloth Cuts and it is remarkably flexible.

It doesn't merely rub it—it cuts—and always leaves a clean, uniform finish.

Aloxite Cloth not only out-cuts but it out-lasts any other abrasive cloth.

It does these things because it is coated with the selected Aloxite grain—because it is absolutely uniformly coated—because it is made right.

For finishing automobile bodies and parts, machine tool parts, steel work—for any metal finishing job, big or little, Aloxite Cloth will increase production—lessen finishing costs.

The sample working sheets sent for the asking.

Made in all standard grits in sheets, rolls and belts

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

New York, Boston, Philadelphia, Chicago, Cleveland, Cincinnati, Milwaukee,
Pittsburgh, Grand Rapids, Detroit

20 Years Conti

Time was when men believed that if you built a better mouse trap than your neighbor, though you lived in the woods, the world would make a beaten path to your door...... No doubt it would, if you gave the world time. But we of this generation are more impatient than our forefathers. For example, we publish here letters from concerns that have been "telling the world" for the past twenty years or more in the American Machinist how to follow the blazed trail to the homes of reliable products.

Mr. R. W. Van Hyning, *Manager,* Bignall & Keeler Mfg. Co.

"Twenty odd years ago this company began advertising in the American Machinist. Space has been used every week during this time. Several managers have been on the job since the first contract was signed, and all the succeeding managers have agreed that the contract should be renewed from year to year, and the space has even been increased.

"All this proves that we consider the American Machinist a good medium in which to advertise our pipe machines."

Mr. Hugo Bilgram, The Bilgram Machine Co.

"I have been reading the American Machinist since 1879, and, particularly during the earlier time, have found it a great help. Indeed, one of the Chordal Letters, published for a number of years by you in regular succession, encouraged me to develop an invention I had previously conceived and which I was told by an expert, could not compete with machines that were used for the purpose before.

"I may therefore, say, that in a measure, I owe my success in business to the American Machinist."

Mr. Eugene Adams, *President,* The Adams Company.

"The American Machinist has had our advertising continuously for over twenty years. During all that time our relations with them have been perfectly satisfactory in every respect. They have assisted us greatly in forming our advertisements."

Mr. F. A. Collins, Jr., Auburn Ball Bearing Co.

"Members of our organization have been brought up on the American Machinist. Our Superintendent contributed articles to it twenty-five years ago. The writer, when studying seventeen years ago, well remembers the American Machinist being mentioned among selected technical magazines as one that should be read by the factory executive. My predecessors used to read it and I make it a point to look over every issue.

"We think your magazine is gotten up in an original and attractive way. The articles are timely and interesting. We clip and file subjects, both articles and advertisements, of value to us.

"We know that the American Machinist is read by the people we want to reach, from actual observation. The writer has been in the offices of many factory and shop executives, and has found it always in evidence.

"From closely checked returns years ago, we found it paid us to increase our advertisement from a small card to sufficient space to tell our story.

"We would as much think of giving up advertising in thel American Machinist as refuse an order at this time. Returns indicated by our advertisement key have consistently shown that we must continuously advertise in it."

Mr. Geo. F. Stewart, The Bradford Machine Tool Co.

"The fact that we have been advertising in the American Machinist for over twenty years, we believe, speaks for itself.

"We have watched this publication grow from a very small book to its present dimensions and have noted that you have held all of the old-time advertisers like ourselves, so you must have given results, for after all results are what we all look for."

Mr. Z. Chafee, Builders Iron Foundry.

"To one who can look back at the earlier numbers, the growth of the paper is especially significant and impressive.

"The Founders did their work well and their successors have built satisfactorily.

"The number of the advertising pages and the size of the circulation list are appropriate comments on the usefulness and the value of the paper."

Mr. W. B. McSkimmon, *Secretary,* S. W. Card Manufacturing Co.

"The S. W. Card Mfg. Company is one of the oldest advertisers in your paper. Our company here has always felt that the American Machinist is to the metal-working trades what the New York Sun years ago was to the thinking readers all over the country.

"Outside of the high personal regard which I have had for many years for the management of the American Machinist, there is the fact that we regard the American Machinist as the leader in its field and a staunch, loyal, helpful friend to all of us who are engaged in the manufacture of machinery or tools.

"We all highly appreciate the service you have rendered to mechanics in general during the entire life of your paper. One fact that stands out with the writer is that the American Machinist has always stood for something definite and it has been particularly fortunate in the choice of the people who have represented it.

"I know that when we think of advertising

AMERICAN MACHINIST-

uous Advertising

in our line in any of the various lines in which we are connected, I think first of the American Machinist, and I believe that is about the highest testimonial that one could give you."

Mr. Francis D. Bowman,
Advertising Manager,
The Carborundum Company.

"First of all, please let us congratulate the American Machinist on completing forty-four years of helpful endeavor. For over twenty-five of these forty-four years The Carborundum Company has been advertising in your publication and in all that time there has never been anything but a condition of ideal relationship between your concern and ours.

"Aside from the pleasure of dealing with men always holding the highest ideals of business, as typified by those men of the staff of the American Machinist, we have always considered the American Machinist as a most profitable business asset.

"From the very early days when we first offered you a contract, and the then new product, Carborundum, was closely investigated by your people before accepting our business, until now, we have gradually increased our space, believing as we do in the splendid influence which your publication exerts in its field.

"We hope to long continue our business relations with the American Machinist and at the same time, it is my wish that the personal friendships that have been made during such relationship be further strengthened.

"We believe in American Machinist absolutely. The best evidence of that is found in the fact that we are now using fifty-two pages a year."

Mr. Jack C. Carlton, *President,*
The Carlton Machine Tool Company.

The fact that we, with our predecessors, have been advertising in the American Machinist for the past twenty years expresses the high opinion we have for your paper which we believe is at least the equal, if not the leading machine tool trade paper published in the World today.

"The writer's previous position in which he had to travel a great deal both in this country and abroad, enabled him to come in contact with almost all of the large users of machine tools and every one of them use the American Machinist as a guide to keep them up-to-date on this subject, as well as other interesting subjects published in your paper. This is particularly so in Europe as the writer was very much surprised at the popularity of the American Machinist, not only with the Buyers of machine tools, but also the men in the shops. In this way they were able to keep up with the advance designs of the American machine tool manufacturers."

Mr. August H. Tuechter, *President,*
The Cincinnati Bickford Tool Co.

"It gives me very much pleasure indeed to note this particular anniversary of the American Machinist and to make a statement in connection relative to my experience as an advertiser. In order to do this I must go back quite a little time, and will explain that The Cincinnati Bickford Tool Co. is the successor of the former Bickford Drill & Tool Co., and Cincinnati Machine Tool Co.

"When these two companies were brought together under the name of The Cincinnati Bickford Tool Co., advertising in the American Machinist was steadily continued, two pages being finally used, all of which will clearly indicate that the value of the American Machinist as an advertising medium was appreciated and regarded more and more as time went on.

"I wish the American Machinist for the future the same success that it has enjoyed in the past, and I wish to thank those associated with it for their courtesy and attention which they always extend to their patrons."

Mr. B. B. Quillen, *President,*
The Cincinnati Planer Company.

"When I went to work in a machine tool plant back in 1892, the American Machinist was brought to my attention by the 'boss' as the leading mechanical paper in the World, and he impressed upon me the importance of reading it regularly and thoroughly. So from the start, I learned to have a very high regard for the American Machinist, and when I entered into business for myself in 1898, as The Cincinnati Planer Company, I immediately put an ad in the American Machinist, and we have advertised continuously since that time.

"I not only became well acquainted with the American Machinist itself, but also with the President, Manager and Editors, and the better I knew the paper and its personnel, the more I appreciated its value in the Mechanical World, and by reason of its splendid service, it is only natural that it should be a valuable advertising medium in this field.

"Your policy is absolutely fearless and independent. No fake 'ads' or write-ups tolerated; rates, service and consideration the same to everybody.

"The American Machinist is as much a part of our business as the labor and material that enters into the product."

Mr. P. G. March, Jr.,
Secretary and Treasurer,
The Cincinnati Shaper Company.

"You can rest assured that we hold a high opinion of the American Machinist and it is our intention to resume our advertising to a larger extent as soon as we feel that conditions permit."

Mr. J. P. Brophy,
Vice President and General Manager,
The Cleveland Automatic Machine Co.

"It has just come to our notice that in November the American Machinist will be forty-four years old and such being the case our minds revert back to our being a constant advertiser in your paper for over twenty years, and perhaps you would like to hear that the results we have obtained from this advertising have been exceptionally satisfactory.

"We want to compliment you on one fact and that is that you have worked with us in a very agreeable manner in every way possible to make our advertising interesting, and we can say this much, that our men in traveling around nearly all over the United States discover that the American Machinist is in the office of most managers, regardless of their being in lines of business where you would think they would not make use of such a publication as the American Machinist, but it seems that wherever machinery of any kind is used that they are regular subscribers to the American Machinist, for the information it contains in various ways that is helpful, both from a standpoint of information secured by the reading of that which is sent in by your correspondents and also from the standpoint of being able to ascertain what is on the market in machine tools and various small tools of all descriptions.

"We might add that it is very common for us to receive letters from prospective customers in this country and abroad where

The Market Place of the Machinery Industries

20 Years Conti

they explain to us that they have read our ad in the American Machinist and they are after more information in reference to our ability to produce certain parts that they had in mind by sending us along their sketches or blueprints. This has been quite a common experience with us for a great number of years past, which proves conclusively that mechanical men are interested in what the American Machinist contains.

"It is a great pleasure to us to be able to write you in this way, and considering the number of years we have been doing business with you, our relations have been exceptionally satisfactory; so we thought it was due you to send along a letter of this kind to show how satisfied we have been with the results of our advertising in the American Machinist for the last twenty years."

Mr. F. A. Errington,
Errington Mechanical Laboratory.

"An advertisement in the American Machinist was my early ideal of 'Going into business for myself'; and I still consider it the criterion by which the public determines whether a concern is 'keeping up with the procession.'

"Moreover, whenever I am 'stuck' for any technical or other knotty point that may come up, I early acquired the habit of going to 'Old Man Hill' of the American Machinist, and I have seen him (and his organization after him) 'get away with anything from handing out just the proper 'shop kink,' to raising—in one instance I remember—$1,250,000 cash capital for one concern who went to Mr. Hill in distress.

"In these days when everyone of us is compelled to carry the government on our pay roll as a 'Senior Partner' with a corresponding excessive and uncertain overhead, even the 'old timers' find the foundations of their experience swept away by new conditions, and we all must rely upon our trade journals as the best rallying point from which to gather data as to present conditions from which to launch our individual campaigns to meet future conditions, that are ever pressing upon us for solution."

Mr. Herbert L. Flather,
Treasurer and Superintendent,
Flather & Company, Inc.

"Our experience in advertising is that it is unwise to advertise machine tools except **in such papers as have a national or** international reputation, the American Machinist being a leading example of this kind.

"For about twenty years we have been a constant advertiser in your paper, and an intermittent one before that, and during all this period we are very glad to be able to say that the treatment which you have accorded us has been one of great satisfaction to us and we have had no occasion to regret placing the major part of our advertising with you.

"Although at the present time the business outlook is very discouraging, we have thought it wise to carry our full amount of advertising, and this fact in itself is the best indication we can point to, as to what we think of the value of your paper as an advertising medium."

Mr. Howard E. Adt, *President,*
The Geometric Tool Company.

"It is perhaps needless for me to say anything about my very high regard for the American Machinist, either as an advertising medium or of its high-grade and progressive standards as a technical journal, for I have read the American Machinist, almost from its first issue, and have used its advertising columns increasingly during the past thirty years, and it is needless therefore for me to express to you my very high regard for the American Machinist, but it is a pleasure nevertheless, to be able to congratulate you, which I do most heartily, upon the very great success to which the American Machinist has been brought upon the occasion of its forty-fourth anniversary, and to predict for it, under its most able and efficient management, many years of increasing prosperity and ever-increasing popularity."

Mr. Geo. Gorton,
George Gorton Machine Company.

"Personally I have several very good friends publishing other mechanical papers and have from time to time run advertising with such during the past twenty-five years.

"However as you may have noted, we have as often discontinued such ads, but have never felt we could afford to quit American Machinist. The reason is, we got business from each dollar spent with you, that we have always been unable to get from any other paper—and several of them are good journals of course."

"No paper has ever seemed to fit our requirements as does American Machinist.",

Mr. J. J. Lannon, *Treasurer,*
Grant Gear Works.

"When we say that we have been continuous advertisers in it for upwards of twenty years, we probably say all that is necessary; but can add that we have always been very well satisfied with the results obtained from our space in the American Machinist.

Mr. C. A. Hoefer,
Hoefer Manufacturing Co., Inc.

"We do not recall just when our first ad appeared in the American Machinist, but we know that it is over twenty years ago, and we do not think that we have been out of the paper since that time.

"The very fact that we started in with a sixteenth page and have increased until we are using full pages, shows on the face of it, what we think of the advertising value of the American Machinist.

"We know that when we have added some special detail, that we get many letters which mention the American Machinist as the source of their information.

"We feel that the means for reaching people we want to reach is the American Machinist, and it is for that reason we so consistently take space in your paper."

Mr. R. K. LeBlond,
The R. K. LeBlond Machine Tool Co.

"We have been advertising in your publication since 1895, a matter of some twenty-six years; and we are more than satisfied. It is a hard matter to trace the results of advertising, but, after careful analysis and experience, from tracing and keying advertisements, we have come to the conclusion that the American Machinist is one of the very best advertising mediums for the machine tool manufacturer."

Mr. J. Wallace Carrel,
Vice President and General Manager,
The Lodge & Shipley Machine Tool Company.

"We congratulate the American Machinist on reaching the ripe age of forty-four years in which this paper has done a wonderful work for the machine tool industry in America and also throughout the World.

"We have been advertising in the

AMERICAN MACHINIST-

ous Advertising

American Machinist ever since we commenced business and we feel that a great portion of our success is due to the publicity obtained through this publication. The best proof of our complete satisfaction is the fact that we increased our advertising with you this year from one to two pages per issue."

Mr. L. E. Honeywell,
Advertising Manager,
The National Acme Company.

"From our standpoint, the American Machinist is to the user of machinery and tools as the teacher is to the school boy, or as the newspaper is to the community it serves.

"In other words, to us it is a medium through which the advertiser may educate his customers and prospects as to the purpose, new developments and specific efficiency of the product he offers.

"The fact that we have been using the American Machinist for more than twenty years should in itself indicate our belief that it performs its part well as a medium."

Mr. Harry W. Champion, *President,*
Newton Machine Tool Works, Inc.

"My personal regard for the American Machinist has always been very high.

"I believe that in our line of business that it is almost part of your fixed charges to carry an advertisement in your paper, and I feel that we reach a very large field of our customers through your paper."

Mr. F. H. Deisher,
President and Treasurer,
Royersford Foundry & Machine Company, Inc.

"It has been a pleasure to have been one of your customers for twenty consecutive years, during which time the service has been everything we could expect and the results very satisfactory. Many of our inquiries from foreign countries read, "We saw it in the American Machinist."

Mr. A. G. Spencer,
Vice President and General Manager,
The Safety Emery Wheel Company.

"As you state, we have been continuous advertisers in this journal twenty years or over and we have always had good service and satisfactory results. Otherwise, we would not have continued with you as long as we have.

"If we ever have occasion to cut down our line of advertising, we know that the American Machinist would be the last medium we would think of discarding.

"You would have to treat us very shabby indeed to cause us to discontinue advertising in the American Machinist."

Mr. Robert B. Skinner,
Assistant Secretary,
The Skinner Chuck Company.

"Having advertised in the American Machinist for a period of over twenty years and finding the results so far as they can be ascertained, very satisfactory, we are taking this occasion to express our appreciation for the services received from your organization and particularly from your New England Manager, Mr. Fred S. Weatherby.

"When business a few months ago made it seem advisable to curtail our advertising appropriations, one of the last papers to feel the reduction was the American Machinist. We would not consider discontinuing our advertising in this paper as long as we continued to manufacture and sell Skinner Chucks."

Mr. Donald McSkimmon,
J. T. Slocomb Company.

"The writer wishes to say that he has always considered the American Machinist the foremost medium of its type published.

"As you know, we have advertised in your paper for over twenty years and we feel that we have been amply repaid for whatever expenditures we have made because of the fact that we have secured many new accounts in one way or another thru our advertisements. Not only have we been successful in obtaining new accounts from manufacturers and dealers, but also from toolmakers, machinists and the like who request catalogs and literature stating, "I saw your ad in the American Machinist." We have every reason to believe that we shall have further inquiries from time to time thru our advertisements in your paper.

"In conclusion, we wish to say that we heartily recommend the 'American Machinist' as an advertising medium for all concerns in any way connected with the metal trades not only for its advertising possibilities, but also for the extremely interesting articles which appear in each issue."

Mr. J. E. Mills, *President,*
The Smith & Mills Company.

"We have been advertising in the American Machinist for something over twenty years, and have always found this medium of constantly keeping our tools before the trade very successful. In fact, we could trace direct results of advertising in your paper if we cared to take the trouble of going over our records, and we think a great deal of credit is due you for the splendid manner in which our products have been so long displayed."

Mr. C. E. Whitney, *President,*
The Whitney Mfg. Company.

"You, of course, know that we have a high regard for your Journal. The many years we have been with you is alone a strong endorsement."

Mr. Hugh Alkman,
Publicity Manager,
J. H. Williams & Company.

"For nearly a quarter of a century our advertisements have appeared regularly in the American Machinist. We have always regarded this publication very highly and shall continue to give it a preferential position on our list of advertising media for we are confident it reaches a class of trade very valuable to us. The fact that for so many years we have consistently used space in your magazine speaks louder than words as to our opinion of its importance to us."

Mr. Horace P. Dix,
Secretary and General Manager,
Wilmarth & Morman Company.

"Good advertising copy, made up well in advance (copy which presents something other than a picture of the manufacturer's product over the manufacturer's name and address) will bring home results, and the American Machinist is naturally a logical source for machine tool manufacturers and manufacturers of machinery accessories to present their publicity."

Mr. E. M. Woodward,
President and Treasurer,
Woodward & Powell Planer Co.

"The writer of this letter has been acquainted with the American Machinist from its infancy, when it was three years old.

"Having advertised in the American Machinist for over twenty years, it is self-evident that we believe that the American Machinist is one of the best mechanical papers in which to advertise our line of metal working machinery."

The Market Place of the Machinery Industries

BAUSH METAL

DURALUMIN

A Few Advantages

MACHINING

Better than aluminum.

Cost greatly reduced when compared with iron or steel.

Taps and threads well.

RECIPROCATING PARTS

Weight reduced without loss of strength.

Acceleration increased.

Inertia decreased.

Polishes easily.

Resists atmospheric conditions.

No plating required.

Can be rolled, forged, drawn, heat treated and annealed.

Hot and cold worked.

A QUALITY METAL

Duralumin is an alloy produced after years of systematic endeavor to meet the demand for a metal which shall be as light as Aluminum and as strong as mild steel, yet without the many disadvantages of Aluminum in its pure state.

Duralumin is the only light metal that can replace steel in forgings. With a two-thirds saving in weight, heat treated Duralumin Forgings approximate mild steel forgings in strength.

Wherever weight is a deciding factor Duralumin is the most satisfactory metal for most articles made by hot working or forging. Naturally, Duralumin Forgings are especially desirable for reciprocating or moving parts where inertia, due to their own weight, forms a large part of the total stress.

Minimum Physical Properties of Rolled or Sheet Metal (heat treated) and of Forging Metal are:

Tensile	55,000 lbs. per sq. inch
Elastic Limit	30,000 lbs. per sq. inch
Elongation	18%

BAUSH MACHINE TOOL COMPANY

Metals Division

SPRINGFIELD, MASS., U. S. A.

Manufacturers of

BAUSH
DURALUMIN

BLOOMS—SLABS—BILLETS—SHEETS—FORGINGS

BAUSH CASTING METAL INGOTS

Aluminum Alloy of High Tensile Strength

Rolling Mill and Drop Forge Works
SPRINGFIELD, MASS.

Detroit Office:
1825 Dime Savings Bank Bldg.

THE NEW GRAY MAXIMUM SERVICE PLANERS

"RAIL-LOCK"

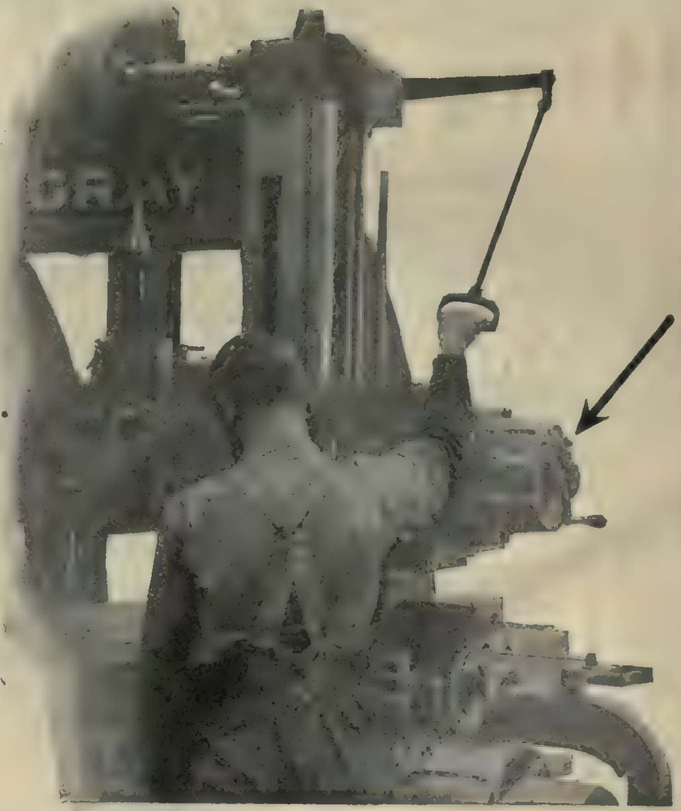
(Patent applied for)

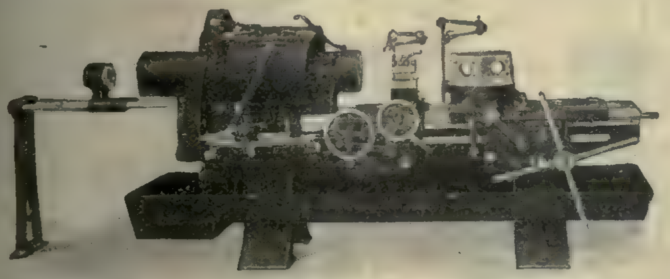
Turning the crank locks the rail firmly and equally to the inside of both housings. This stiffens the rail by shortening the length subject to torsion.

On old style planers the operator had to walk around the planer to loosen the clamp on the rear side. Why waste time walking around the planer?

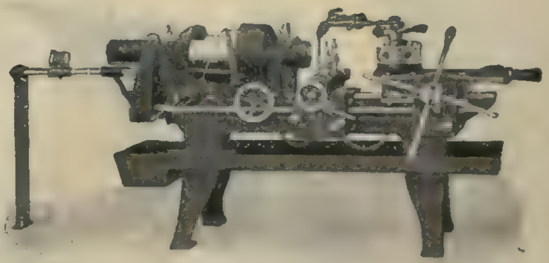
This and a dozen other important productive features are described in our new catalog. Send for your copy.

The G. A. Gray Co.
Cincinnati, Ohio





Foster Univ. Turret Lathes—3 Sizes



Foster Screw Machines—5 Sizes

W. A. Barker Wrenchless Chuck

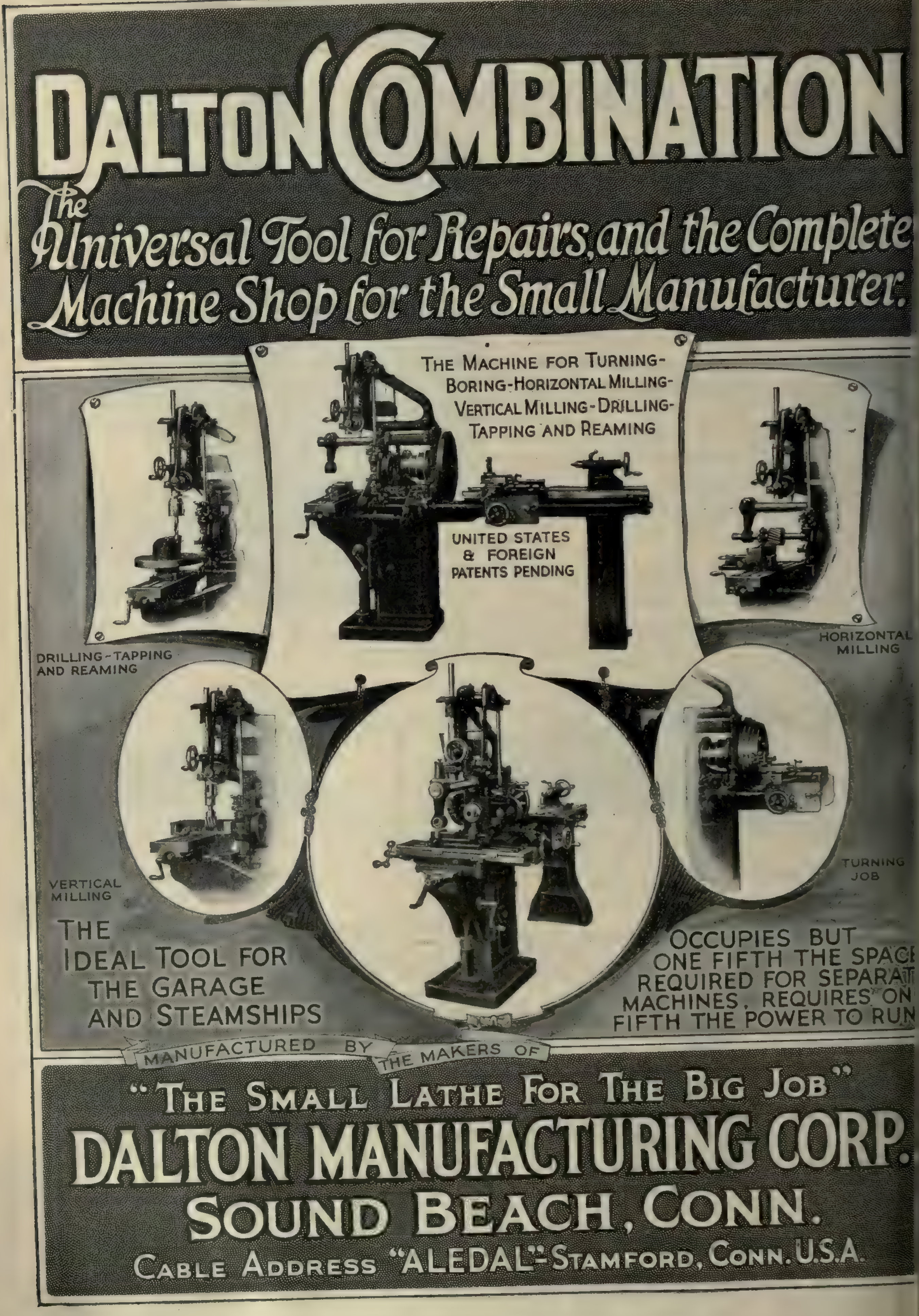
Every moment and movement productive

Each and every machine of the "Foster" line has established a reputation of winning complete and instant acceptance on its first showing.

Their elements of exceptional value as money and time savers are bound to impress you favorably and forcefully. They have already done so to scores and hundreds of users.

Our engineers are constantly solving production problems. It's their job. Why not submit blue prints of some of your tough jobs? It's well worth while, and puts you under no obligation whatsoever.

FOSTER MACHINE CO., Elkhart, Indiana



DALTON COMBINATION

The Universal Tool for Repairs, and the Complete Machine Shop for the Small Manufacturer.

THE MACHINE FOR TURNING-BORING-HORIZONTAL MILLING-VERTICAL MILLING-DRILLING-TAPPING AND REAMING

UNITED STATES & FOREIGN PATENTS PENDING

DRILLING-TAPPING AND REAMING

HORIZONTAL MILLING

VERTICAL MILLING

TURNING JOB

THE IDEAL TOOL FOR THE GARAGE AND STEAMSHIPS

OCCUPIES BUT ONE FIFTH THE SPACE REQUIRED FOR SEPARATE MACHINES. REQUIRES ONE FIFTH THE POWER TO RUN

MANUFACTURED BY THE MAKERS OF

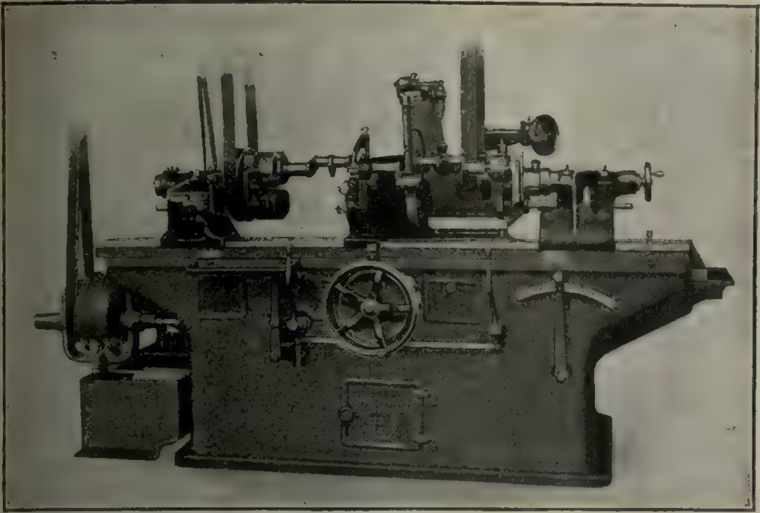
"THE SMALL LATHE FOR THE BIG JOB"

DALTON MANUFACTURING CORP.

SOUND BEACH, CONN.

CABLE ADDRESS "ALEDAL"-STAMFORD, CONN. U.S.A.

The Careful Motorist Asks: "Have you a Landis?"



Getting the entire motor overhauling job done under one supervision is a mighty big advantage.

It saves the car owner valuable time by preventing several trips to various shops that are equipped to replace and repair certain parts only.

The Landis 4-A Special Grinding Machine gives you complete grinding equipment in a single unit. It grinds crank shafts, pistons, wrist pins, piston rings, valves, valve stems, transmission gears, etc.

Your business will increase from the day you install the

LANDIS

No. 4-A Special Grinding Machine

See Exhibit at the New York Automobile Show.

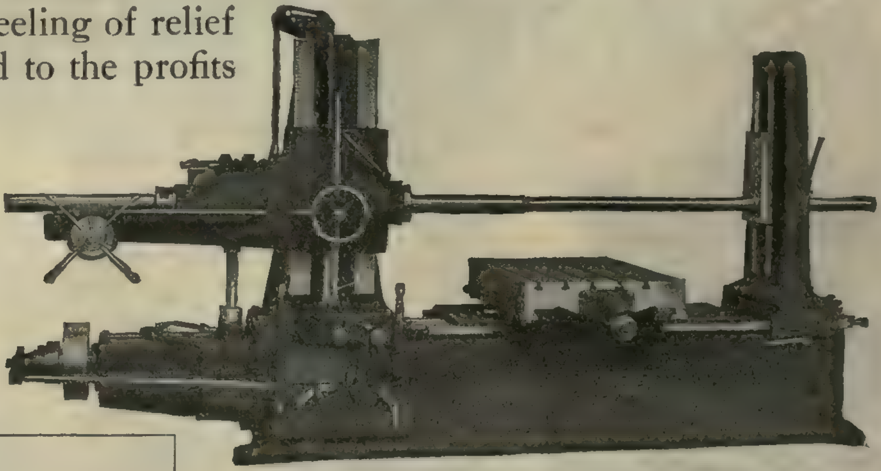
LANDIS TOOL COMPANY, Waynesboro, Pa.

New York Office: 51 Chambers St.

DOMESTIC AGENTS—Hallidie Machinery Co., Seattle; Harron, Rickard & McCone, San Francisco and Los Angeles; Seeger Machine Tool Co., Atlanta. **CANADIAN AGENTS**—A. R. Williams Machinery Co., Toronto; Williams & Wilson, Ltd., Montreal. **FOREIGN AGENTS**—Allied Machinery Co., Paris, Turin, Barcelona, Brussels, Zurich and Lisbon; Andersen, Meyer & Co., Ltd., Shanghai; Andrews & George Co., Ltd., Tokyo; Benson Brothers, Sydney and Melbourne; Burton, Griffiths & Co., Ltd., London; Wilh. Sonesson & Co., Malmo and Copenhagen.

No man has the right

to end the year as he entered it. He must add something to it. We close the 1921 book with a feeling of relief because we have added to the profits of the users of the



"PRECISION"
Boring, Drilling
and
MILLING
MACHINE

WE ALSO MAKE THE
LUCAS POWER
Forcing Press

Lucas Machine Tool Co.

Cleveland, Ohio

NOW AND ALWAYS OF

AGENTS

Alfred Herbert, Ltd., Coventry; Societe Anonyme Belge, Alfred Herbert, Brussels; Aux Forges de Vulcain, Paris; Allied Machinery Co., Turin, Barcelona, Zurich; Benson Bros., Sydney, Melbourne; V. Lowener, Copenhagen, Christiania, Stockholm; R. S. Stokvis & Zonen, Rotterdam; Andrews & George Co., Tokyo.

CINCINNATI-ACME

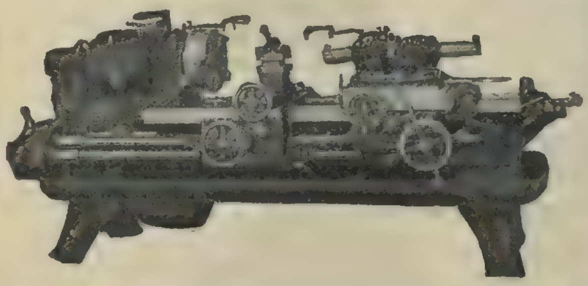
The Message of Economy

There is surely no more important problem at the present time than that of **economy in production.** We can offer you an immediate solution of this problem. On multi-operation jobs, Cincinnati-Acme Turret Machinery (Flat Turret Lathes, Turret Lathes and Screw Machines) can **unquestionably** cut the cost of production to the bone. The saving in time and labor is enormous.

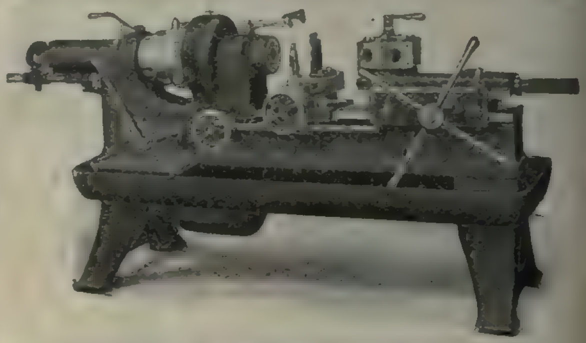
Let us help you make more money.

Write for "Cincinnati-Acme Efficiency" today

The ACME Machine Tool Co., Cincinnati, Ohio, U. S. A.



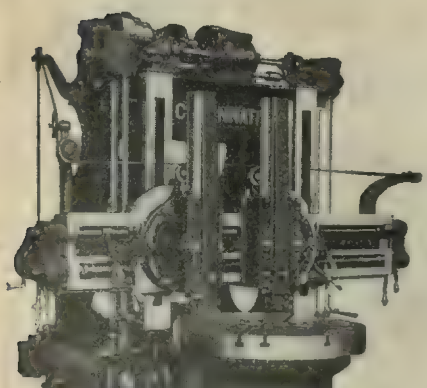
Cincinnati-Acme No. 3 Universal Flat Turret Lathe



1½ in. x 9 in. Friction Back Geared Screw Machine

CINCINNATI

PLANERS *Original Thru out* BORING MILLS

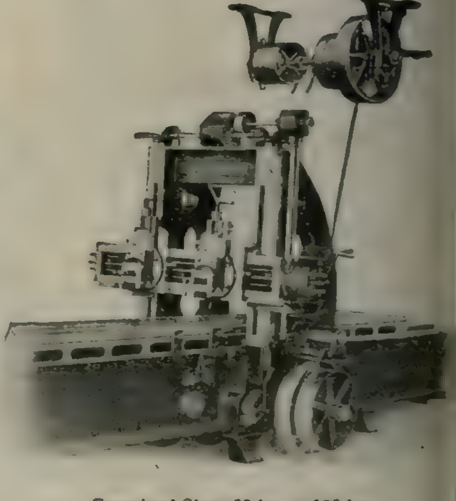


Sizes 42 in. to 12 ft.

For Many Years

The improvement recently made in the design of these tools will remain new—and then—they will be recognized as absolute requirements. We believe in ease of operation, relieving operator of responsibility for upkeep, and doing mechanically that which is usually done physically.

Our catalog tells the whole story.



Standard Sizes 22 in. to 120 in.
Open Side Planers 30 in. to 72 in.

The Cincinnati Planer Co.
Cincinnati, Ohio, U. S. A.

BRUBAKER

Special Tempered Relieved Staybolt Taps

Brubaker Staybolt Tap

The Tap with the Continuous Taper

Designed so you can't tell where the taper thread enters the straight which distributes the cutting strain.

Beginning Right

Start the youngster with right tools, and he'll rise to be a credit to his craft. Brubaker-Staybolt Taps are right. They are tempered with scientific skill and possess a relief that insures clean, free cutting.

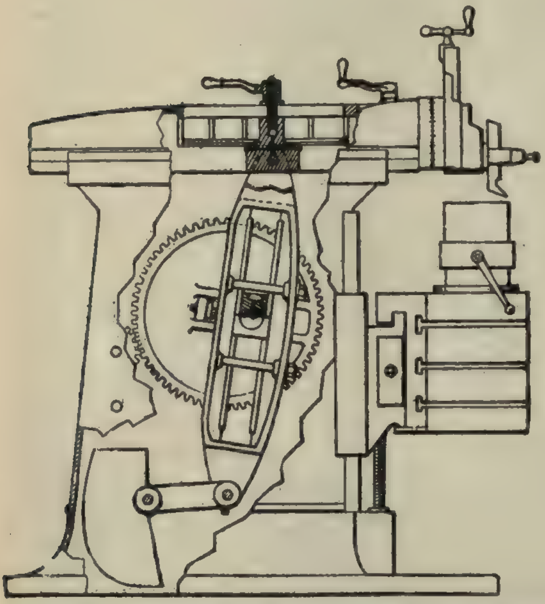
The highest motor speeds are possible, thus more holes are tapped per shift. If you are interested in a tap that will give a full 20% more holes, get in touch with us.

W. L. BRUBAKER & BROS. CO.

50 Church Street New York

Factory: Millersburg, Pa.

A High Class Shaper with an Exceptional Feature



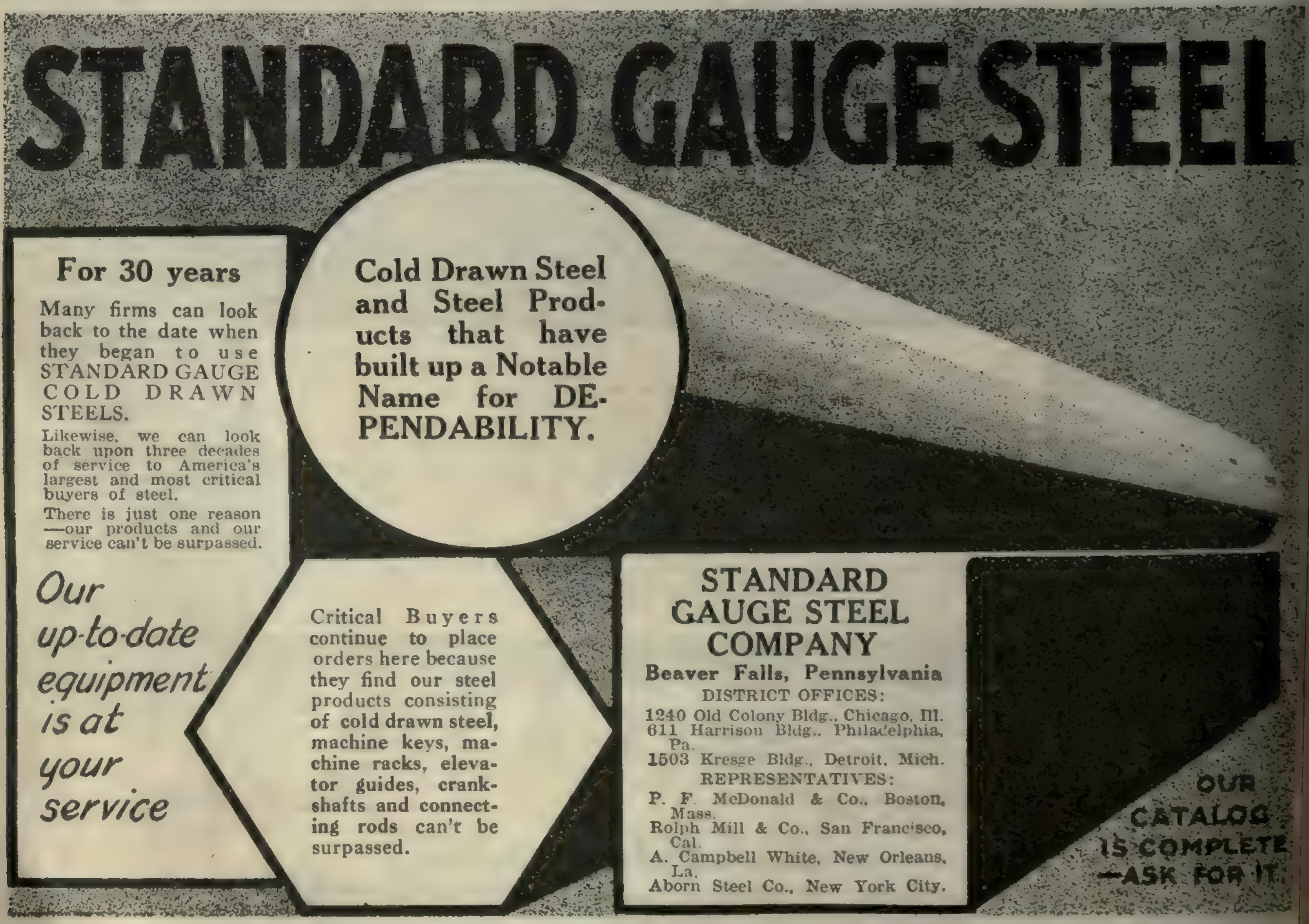
AVERBECK

The best shaper buy on the market today—because—
In design and construction it is as fine a shaper as any manufactured.
It has a patented feature that reduces materially the power consumed and makes faster speeds possible.
It is counterbalanced and operates as smoothly as a balanced engine.

Investigate. Write for full details today.

The Steel Products Engineering Co.
Springfield, Ohio, U. S. A.

SALES REPRESENTATIVES:
Hess-Schenck Co., Cleveland, Ohio
J. L. Lucas & Sons, Inc., Bridgeport, Conn.
W. H. J. Fitzgerald & Co., Boston, Mass.
W. J. Baird Machinery Co., Detroit, Mich.
McCoy-Brandt Machinery Co., Pittsburgh, Pa.
Scott-Bansbach Machinery Co., Chicago, Ill.
The Day Machinery Co., Buffalo, N. Y.
M. J. Walsh Machinery Co., Milwaukee, Wis.



STANDARD GAUGE STEEL

For 30 years

Many firms can look back to the date when they began to use STANDARD GAUGE COLD DRAWN STEELS.

Likewise, we can look back upon three decades of service to America's largest and most critical buyers of steel.

There is just one reason—our products and our service can't be surpassed.

Cold Drawn Steel and Steel Products that have built up a Notable Name for DEPENDABILITY.

Our up-to-date equipment is at your service

Critical Buyers continue to place orders here because they find our steel products consisting of cold drawn steel, machine keys, machine racks, elevator guides, crankshafts and connecting rods can't be surpassed.

STANDARD GAUGE STEEL COMPANY
Beaver Falls, Pennsylvania
DISTRICT OFFICES:
1240 Old Colony Bldg., Chicago, Ill.
611 Harrison Bldg., Philadelphia, Pa.
1503 Kresge Bldg., Detroit, Mich.
REPRESENTATIVES:
P. F. McDonald & Co., Boston, Mass.
Rolph Mill & Co., San Francisco, Cal.
A. Campbell White, New Orleans, La.
Aborn Steel Co., New York City.

OUR CATALOG IS COMPLETE —ASK FOR IT.

A New Drill for a Neglected Field
MEZZO

A New Drill for a Neglected Field

FOR YEARS there has been a neglected field to which drill manufacturers have not given sufficient attention. This field is the shop which could not obtain production with Carbon Drills and yet was not equipped to realize full efficiency from High Speed Drills, and therefore could not use them satisfactorily.

These shops demanded a drill which would stand higher speeds and feeds, give far greater drilling capacity than Carbon Drills and still sell at a moderate price.

To meet this demand, we present

MEZZO

Heating the cutting edge of "MEZZO" even to a dark blue color will not draw its temper. "MEZZO" works at its best efficiency this way.

"MEZZO" was developed after months and months of research involving not only the use of a new steel but also new hardening and heat treating processes.

We believe that we have extended our leadership into a new field—but not with an untried product.

"MEZZO" has been tested and re-tested—a drill on which we are proud to place our name.

Write for the *"Story of Mezzo."* It is a most interesting little booklet which gives full information on "MEZZO" and its uses.

The **CLEVELAND** **TWIST DRILL COMPANY**
CLEVELAND
NEW YORK - CHICAGO - LONDON

TRADE MARK REG. IN U. S. AND FOREIGN COUNTRIES

COLBURN

No. 2 Manufacturing Heavy Duty Drill Press

This machine is essentially a production tool for duplicate operation work. It is being used with great success in automotive and accessory plants where accuracy and rapid production are essential.

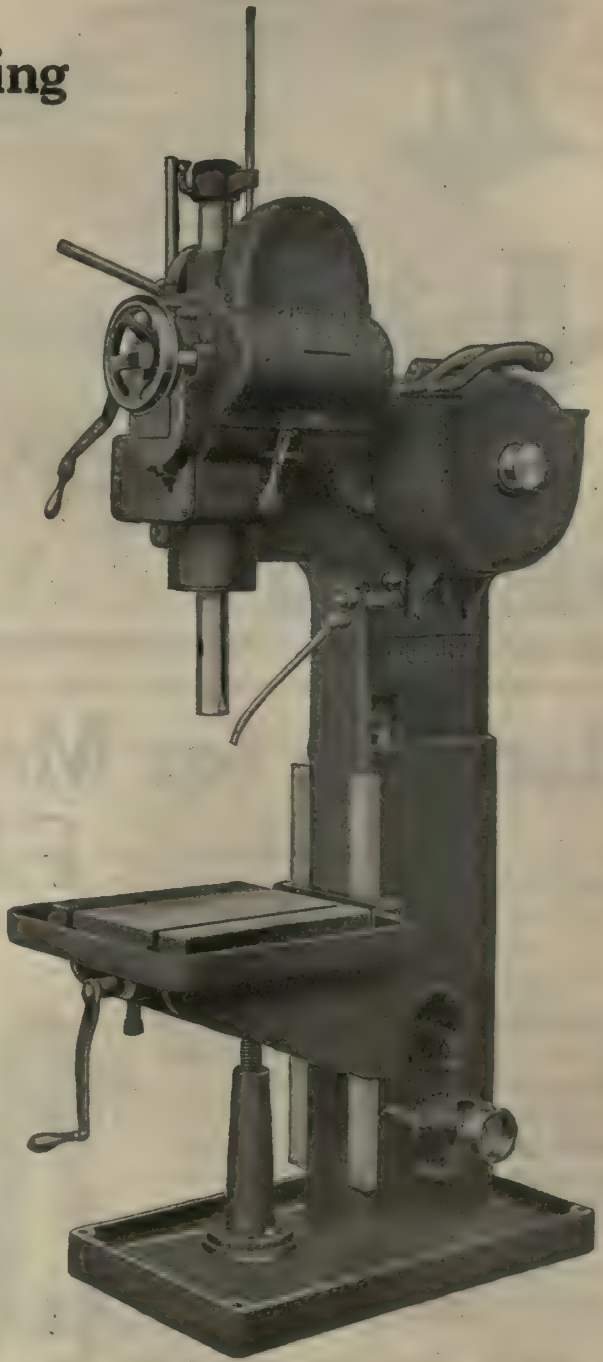
However, it is not a single purpose machine due to the *patented* feed and speed transposing gear feature which gives an unlimited number of feed and speed changes by simply using different combinations of gears. The feed gears are located at the front and the speed gears at the side of the machine, convenient for the operator.

The No. 2 is built singly or in gangs of two, three and four spindles. In operation each head is driven and controlled independently.

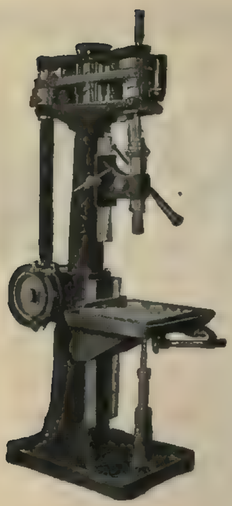
Capacity up to 1¼ in. in solid steel.

Swing 20 inches.

Bulletins giving a complete description and illustrating the features of this or any of the other types of Colburn Heavy Duty Drill Presses will be sent upon request. No obligation.



THE COLBURN MACHINE TOOL COMPANY
1038 IVANHOE ROAD, CLEVELAND, OHIO
Builders also of Colburn Boring and Turning Mills



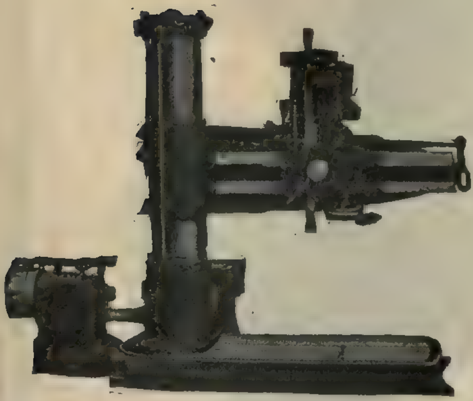
FOSDICK

TRADE MARK REG. U.S. PAT. OFF.

THIS mark is a little thing to look for, but it's a *big thing to find* on Drilling and Tapping Machines.

Because every detail in the making of FOSDICK Sensitive Drills and Radials is carefully worked out—each finished machine is thoroughly tested—the excellent workmanship and finish make a finished product that checks up right in service. Buy by the mark, it pays.

Write us or our nearest agent for further information



The Fosdick Machine Tool Company

Cincinnati, Ohio, U. S. A.

AGENTS: Biggs-Watterson Co., Cleveland, Ohio; Colcord-Wright Machinery & Supply Co., St. Louis, Mo.; Eccles & Smith Co., San Francisco, Calif., Los Angeles, Calif., Portland, Ore.; Barbour, Love & Woodward, New York, N. Y.; E. A. Kinsey Co., Cincinnati, Ohio, Indianapolis, Ind.; Peninsula Machinery Co., Detroit, Mich.; Homer Strong, Rochester, N. Y., Buffalo, N. Y.; H. A. Smith Machinery Co., Syracuse, N. Y.; Swind Machinery Co., Philadelphia, Pa.; (Somers, Fitler & Todd Co., Pittsburgh, Pa., for Radials only); Stocker-Rumely-Wachs Machinery Co., Chicago, Ill.; Milwaukee, Wis.; Taylor Machinery Co., Boston, Mass.; A. R. Williams Machinery Co., Toronto, Ont., Canada; Burton Griffiths & Co., London, England; Fenwick Freres & Co., Paris, France; Wynmalen & Hausmann, Rotterdam, Holland; Rylander & Asplund, Stockholm, Sweden; Wilh. Sonesson & Co., Malmo, Sweden, Copenhagen, Denmark; Alfred Herbert, Ltd., London, England, for Japan, Manchuria, Korea, Formosa, Burmah and Ceylon.

Machines for Making Tungsten Filament Wire

Langelier Tungsten Hot Swaging Machines take the square ingot and reduce it the required wire size to as small as .018. These machines are especially designed for the swaging or reducing of tungsten wire. We have been making these machines ever since tungsten wire has come into commercial use and they have proved to be practical and most efficient for this purpose.

Automatic Wire Roller Feed can be furnished when desired.

The Dies for these machines are made of High-Speed Steel and we will furnish additional Dies for our machines at any time promptly.

If you are interested in making Tungsten Filament Wire it will pay you to investigate these Langelier Tungsten Hot Swaging Machines.

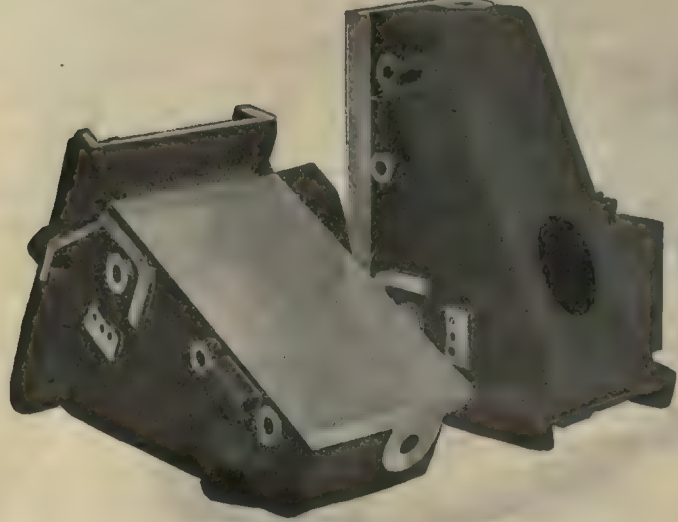
LM Co.

LANGELIER MANUFACTURING COMPANY

Arlington, Cranston, R. I., U. S. A.

MILWAUKEE MILLING MACHINES

KEARNEY & TRECKER
MILWAUKEE
MILLING
MACHINES



The Solid Top Knee—

and how it adds to the rigidity and gives greater strength to the Milwaukee Milling Machine

The knee of a milling machine is subject to great strain. Not only must it sustain the weight of the saddle, table and work being machined as well as the downward thrust caused by the action of the cutters, but in cases where the cutter is operating high above the table it is also subjected to twisting strains.

In many cases the twisting strain is greater than the down thrust of the actual weight imposed. So the knee, then, should be sufficiently strong to withstand both the downward thrust and twisting strain.

With this point in view, the Box Section, Solid Top Knee of the Milwaukee was designed. All engineers know that a box section resists torsional strain better than any other form. And the Solid Top has no slots or holes to close and impair alignment. It also prevents dirt and chips from entering the mechanism within the knee.

Let us tell you of the other advantages of Milwaukee Milling Machines. Send for catalogues.

KEARNEY & TRECKER
CORPORATION
MILWAUKEE, WIS., U.S.A.

CHICAGO OFFICE 631 WASHINGTON BLVD.
CLEVELAND OFFICE 738 SUPERIOR AVE N.W.
NEW YORK OFFICE 50 CHURCH STREET

THE JOHNSON FRICTION CLUTCH

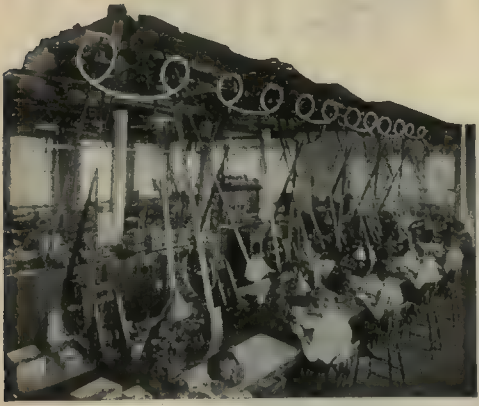


Illustration by courtesy of The New Departure Manufacturing Co., showing bench presses in operation at their Elmwood Plant.

It's a Johnson Line Shaft Drive

A battery of twelve light presses, all on a bench about 30 x 5 driven from one line shaft with Johnson Clutches controlling the machines.

Compare It for First Cost

Twelve clutches against twelve complete countershafts, or twelve individual motors.

Compare It for Efficiency

Quick, smooth control against the sluggish tight and loose pulley. Or one motor consuming current instead of twelve.

Compare It for Service

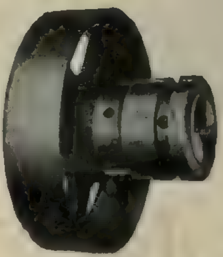
You know the failings of belts—the continual attention they require, especially when they are shifted.

If you don't know Johnson Clutch Service, just give it a trial.

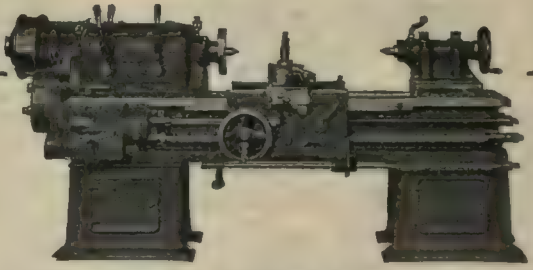
Write for our Stock List and Blue Catalog.

Friction Control Means Better Machinery

We specialize in applying the proper type of friction clutch on any sort of an installation. Standard Clutches available from stock, and special models developed to suit conditions.



THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN



WHERE EXTREME ACCURACY IS REQUIRED

As concerns tool equipment, the trend of the times points only in one direction and that is to the absolute necessity of using modern machine tools of the highest producing value.

Reed-Prentice Geared Head Lathes are entirely modern in design and give the production that conditions demand. Furthermore they will meet the most exacting standards of accuracy and durability.

They are built in sizes from 12 in. to 27 in. and can be arranged for belt or gear connected motor drive.

LATHES—PLANERS—MILLING MACHINES—MILLING CUTTERS—RADIALS—VERTICAL SURFACE GRINDERS—PORTABLE SHAPERS

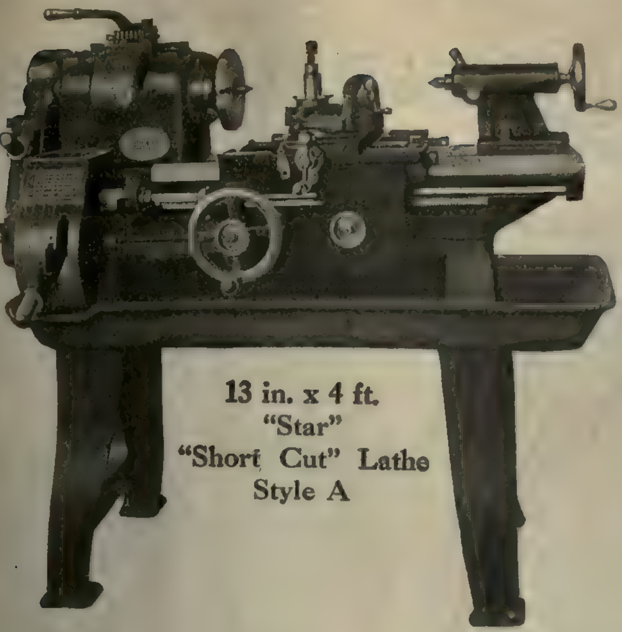
BECKER-MILLING MACHINE COMPANY **REED-PRENTICE CO.** **WHITCOMB-BLAISDELL MACHINE TOOL CO.**

677 CAMBRIDGE STREET, WORCESTER, MASS.

Sales Offices: Cleveland, Indianapolis, Detroit, New York. *Agents:* Dale Machinery Co., Chicago, Ill.; Normoyle & Lapp, 514 Liberty Bldg., Philadelphia, Pa.; M. D. Larkin Supply Co., Dayton, Ohio; O. R. Adams, Buffalo and Rochester, N. Y.; H. A. Smith Machinery Co., Syracuse, N. Y.; W. M. Pattison Supply Co., Cleveland, Ohio; McCoy-Brandt Machinery Co., Pittsburgh, Pa.

Whitcomb-Blaisdell Agents only: Fairbanks Co., Pittsburgh and St. Louis; Badger, Packard Machinery Co., Milwaukee, Wis. *Becker Agents only:* F. E. Satterlee Co., Minneapolis, Minn. *Cutter Agents:* J. L. Stone-Leidy Co., Machinery Hall, Chicago; M. D. Larkin Supply Co., Dayton, Ohio; Normoyle & Lapp, 514 Liberty Building, Philadelphia, Pa.

Sales Offices and Agents have stock of cutters for prompt deliveries



13 in. x 4 ft.
"Star"
"Short Cut" Lathe
Style A

It's the Busiest Machine in the Shop

TAKE a survey of your products and you will find that a majority of them are under 7¾ in. in diameter and less than 19 in. long. All such turning work can be profitably produced on the "STAR" Short Cut Lathe.

In the majority of shops the **"STAR" Short Cut Lathe** will readily produce more than 50% of the duplicate part work ordinarily put on larger machines.

It offers the greatest possibilities for the investment.

The **"STAR" Short Cut Lathe** has maximum power and covers an extremelv wide range.

This machine can be supplied fully equipped with tools ready for work. No hold-ups waiting for tools.

Built to Endure
They have—
They do—
They will

Star
Short Cut
Lathe

Write us your problems. We are also manufacturers of the famous line of "STAR" Lathes.

The Seneca Falls Mfg. Co., Inc.

387 Fall St., Seneca Falls, N. Y.

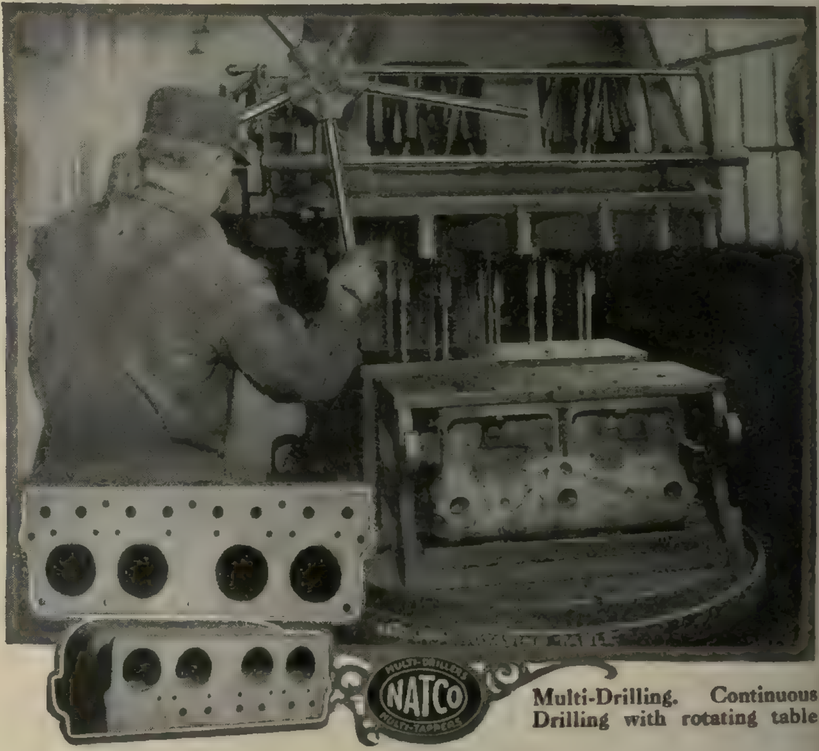
Exclusive Agents for Short-Cut Lathes

Ogden R. Adams, Syracuse, N. Y.; Ogden R. Adams, Rochester, N. Y.; Ogden R. Adams, Buffalo, N. Y.; Blackman-Hill McKee Company, St. Louis, Mo.; Cameron & Barkley Company, Jacksonville, Fla.; Coghlin-Kirkby Machinery & Supply Co., Toledo, Ohio; Eccles & Smith Company, San Francisco, Calif.; The English Tool & Supply Company, Kansas City, Mo.; Marshall & Huschart Machinery Company, Chicago, Ill.; The Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.; The Lynd-Farquhar Company, Boston, Mass.; Northern Machinery Company, Minneapolis, Minn.; The Perine Machinery Company, Seattle, Wash.; F. C. Richmond Machinery Company, Salt Lake City, Utah; The Seifreat & Woodruff Company, Dayton, Ohio; The Sherritt & Stoer Company, Philadelphia, Pa.; Smith-Booth-Usher Company, Los Angeles, Calif.; The Gang Machinery Company, Cincinnati, Ohio; Somers, Fitler & Todd Company, Pittsburgh, Pa.; Standard Machinery Company, New Haven, Conn.; Strong, Carlisle & Hammond Company, Cleveland, Ohio; Strong, Carlisle & Hammond Company, Detroit, Mich.; Messrs. Kernan & Swift, 45 West 18th St., New York City.

MULTI-DRILLERS NATCO MULTI-TAPPERS

THE HOLE STORY IN ONE WORD

Do You Know



Multi-Drilling. Continuous Drilling with rotating table

That the NATCO Multi-Driller is the only machine with Patented Independent Change of Speed to each Individual Drill? This patented feature permits the drilling of different size holes at the same operation, each spindle running at its correct cutting speed.

That the NATCO has one nut Adjustable Arms?

That the NATCO has patented Universal Joints?

That the NATCO has three speed changes and sliding gear transmission running in oil?

That the NATCO has six changes of feed for each spindle speed?

That the NATCO is equipped with HYATT High Duty Roller Bearings?

That the NATCO may be equipped with special Cluster Plate, Box, or Rotating Table?

That the NATCO will Drill, Tap, Spot-face, Ream or Counterbore? A machine particularly adapted to all classes of work.

That the NATCO can be used for either Drilling or Tapping?

That competition is increasing in your line the same as in every other line, and costs must be cut down to meet this competition?

NATCO Multi-Drilling and Tapping will reduce your costs as it has those of hundreds of ***NATCO*** users.

Send us your blue prints and we shall be glad to submit propositions for your approval; or write us if interested, and we will have a ***NATCO*** representative call and make a study of your drilling and tapping requirements without any obligation on your part.

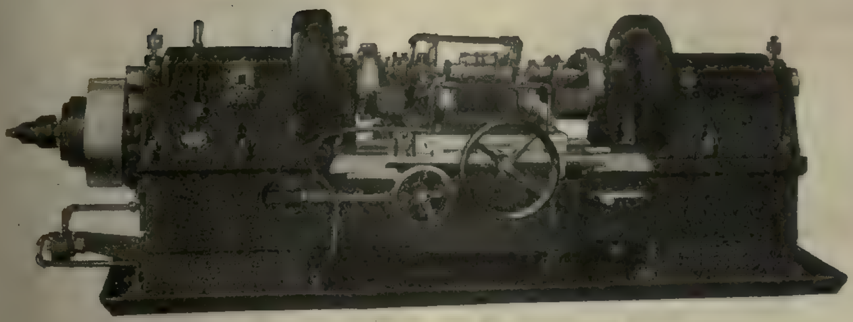
Fixtures in connection with NATCO Multi-Drillers and Tappers made by NATCO if desired.

The National Automatic Tool Company, Richmond, Ind., U. S. A.

Largest exclusive manufacturers of Multi-Drillers and Multi-Tappers

The Wickes Duplex Crankshaft Lathe

Designed for Turning Two Pins Simultaneously



The Wickes Duplex Crankshaft Lathe is designed for turning two pins simultaneously. It is similar in all respects to the Universal Type, aside from the fact that it is a specialized machine for this class of work. It is furnished with complete equipment, tooled up for your job.

Wickes Brothers

220 Water Street, Saginaw, Michigan
501 Fifth Ave., New York
736 White-Henry Bldg., Seattle, Wash.

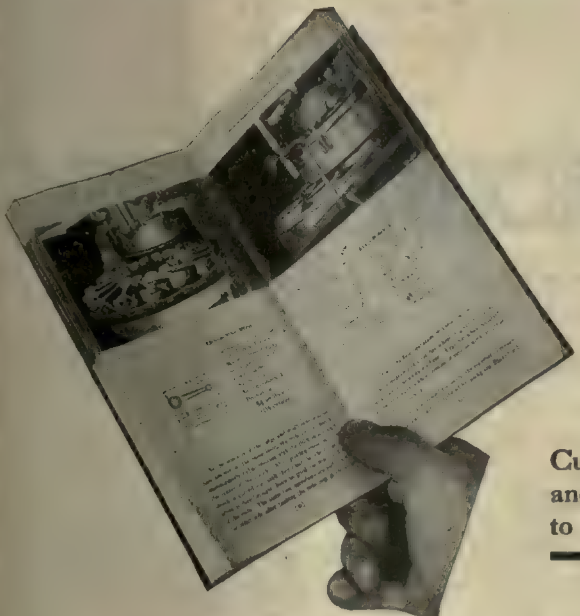
Builders of

Heavy Duty Plate and Structural Tools, Heavy Duty Engine Lathes, Special Production Lathes and Crankshaft Turning Equipment, Blueprint Machines.

WICKES

"BLANCHARDIZING"

Do *You* Know What It Means?



Cut this off and mail it to us. →

....
(Date)

THE BLANCHARD MACHINE CO.
64 State Street,
Cambridge, Mass.

Gentlemen:

I should be pleased to receive a copy of the Blanchard Grinder Data Book, showing fifty examples of "Blanchardized" work and giving production data obtained in shops of users.

Yours very truly,

....

Address...

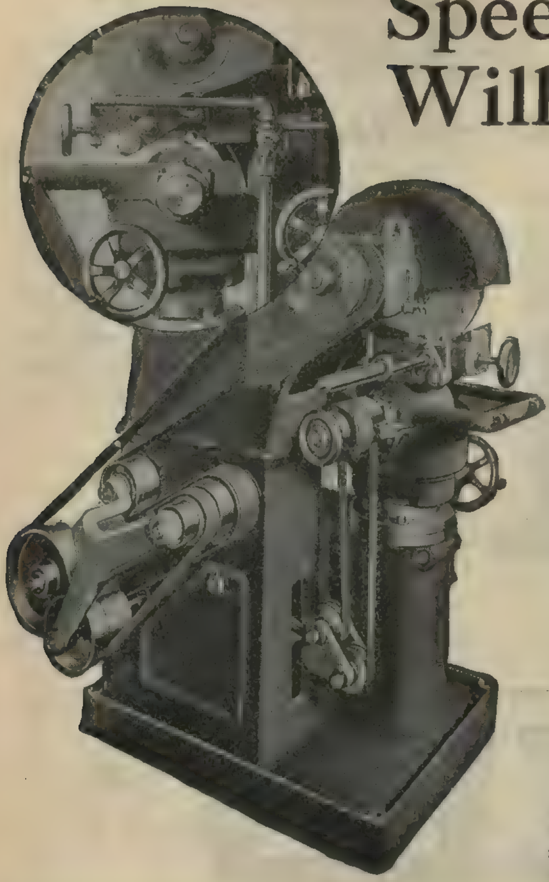
....

American Machinist—12-29-21

REPRESENTATIVES:

UNITED STATES: Henry Prentiss & Co., Inc., Motch & Merryweather Co., Marshall & Huschart Machinery Co., W. E. Shipley Machinery Co., Kemp Machinery Co., Robinson, Cary & Sands Co., Pacific Tool & Supply Co., The Hendrie & Bolthoff Manufacturing & Supply Company. CANADA: Williams & Wilson, Ltd., F. F. Barber Machinery Co. GREAT BRITAIN: C. W. Burton, Griffiths & Co. FRANCE: Aux Forges de Vulcain. ITALY, SWITZERLAND, BELGIUM, SPAIN and PORTUGAL: Allied Machinery Co. of America. SWEDEN: A. B. Rylander & Asplund.

Speed and Precision Will Gain the Contracts



The one way to meet competitive figures on cylindrical grinding work is to produce more parts of a better quality per hour. We know of many instances where machine shop proprietors have been asked to bid on short-time contracts because they were equipped with

Detroit No. 4
Heavy Duty Centreless Grinders

This new machine possesses many up-to-the-minute features. Positive rotation of work at all times. Three work rotating speeds to select from. It grinds the work only when there is metal to be removed, supporting the work accurately as it is being ground. Any speed or feed which you found best when grinding work between centers can be obtained in this machine.

From 200 to 500 feet of work is the **Detroit** hourly production. There is a **Detroit** representative in your vicinity. Let him give you full data.

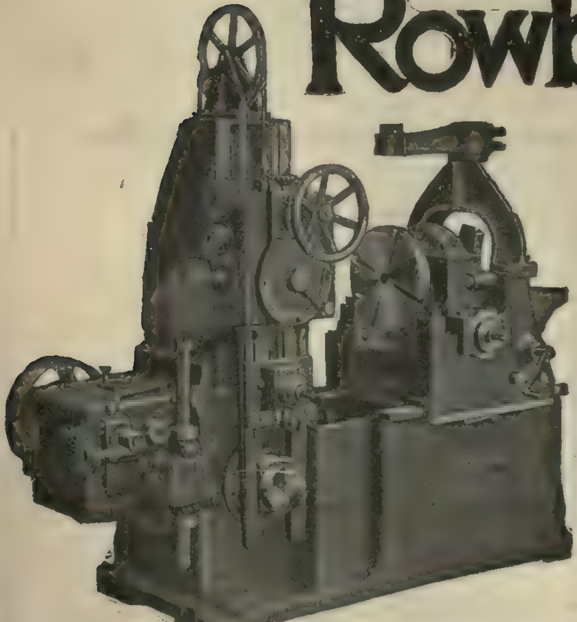
DETROIT MACHINE TOOL CO.,
6523-45 St. Antoine St., Detroit, Mich., U. S. A.

If you would learn more about the machine having an hourly metal removing capacity of 60,000 sq. in., get in touch with us.

Yours for Smoother Operation

Hundreds of manufacturers know that machines incorporating cam movements can be made more efficient by insisting that designers specify

Rowbottom for Cams



The Rowbottom Universal Cam Milling Machine cuts cams to the closest tolerances in minimum time.

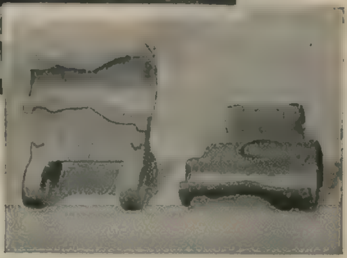
All styles are included in its repertoire—face, box, side or barrel.

Rowbottom cut cams give an extra measure of value to your product. They aid in creating demand and thus increase profits.

If your work doesn't warrant the purchase of a machine, we can offer you a cam service without a parallel.

How about our literature?

The Rowbottom Machine Co.
Waterbury, Conn.
Factory at Waterville, Conn.



Turret Lathes in the Glass Industry

A production man from a large factory which has a reputation for its up to date production methods put the problem to us this way.

"We must reduce the cost of finishing these moulds for electric light bulbs. It is not customary to finish them on turret lathes, but we think *your* turret lathe can do the work as well and in less time."

(They have Warner & Swasey turret lathes in their shop doing other work.)

The turret lathes and tools we furnished do the work in one fifth the previous time. And their operator expects to do better than that when he becomes accustomed to the job.

You have jobs that should cost less. Send us blue prints of them. You'll be surprised at the saving we can show you.

The Warner & Swasey Company

Cleveland, U. S. A.

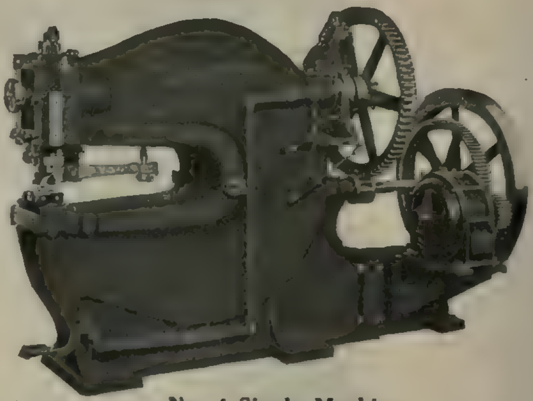
BRANCH SALES OFFICES:
NEW YORK: Singer Bldg. BUFFALO: Iroquois Building BOSTON: Oliver Building DETROIT: 5928 Second Boulevard
CHICAGO: 618-622 Washington Boulevard MILWAUKEE: 209 Sycamore Building
DAYTON: 518 Mutual Home Building INDIANAPOLIS: 940 Lemcke Annex

For Economical Punching and Shearing

This illustration shows an up-to-date machine with 36-inch throat which permits the handling of especially large sheets. It will punch ¾ in. hole through ¾ in. plate, and shear 4 by ¾ in. flat, or 1¼ in. round bar, or 3 x 3 x ¼ in. angles.

Our line comprises a practically unlimited choice of machines made in different sizes and styles to meet your exact needs for punching, shearing, hammering, etc.

Consult us for advice as to the machine best suited to meet your requirements.



No. 4 Single Machine

THE LONG AND ALLSTATTER CO.

POWER PUNCHING & SHEARING MACHINERY

HAMILTON, OHIO, U.S.A.

AMERICAN PUNCH & SHEAR WORKS

THE QUALITY LINE

For facing such work as water gates or valves, tees, elbows and the like, the Barrett Three-Way Facing Machine is designed to operate on three surfaces at the same time, thereby shortening the innings and making the game more interesting. Barrett performance doesn't depend on support at all. It will make a single put out, double or triple play any time you've tired of watching the other fellows play.

Ask for literature on this machine

Barrett Machine Tool Co., Inc.
Meadville, Pa., U. S. A.

A STORY handed down from Antiquity tells how three blind men were taken to "see" an elephant.

The first one grasped the swinging trunk and asserted that an elephant was like a snake.

The second put his arms around a huge rigid leg and said "how like a tree!"

Third blind man, running his hand along the broad, rough side of the animal said both were wrong, as an elephant was indisputably like a wall.

And then they wrangled.

The trouble was that they could not combine their knowledge.

Nor did they consult some one who could see the elephant in its entirety and give them the whole picture.

Today the need for exchanging ideas is met by Business and Trade Associations and Periodicals which cover almost every field of human and industrial activity.

Some little time ago there was no comprehensive Clearing House for the exchange of data on the Science of Lubrication.

Ten years ago, our magazine "Lubrication" was designed to meet that need.

And the large number of communications received and the actual service rendered have proved the worth of this idea.

But remember that there is a more immediate service and a more personal presentation of "the whole picture" in the daily work of Texaco Lubrication Engineers.

They are out in every field of industry covering every phase of lubrication as it applies to the production, transmission and utilization of Power.

Part of their work consists in making detailed reports. Hundreds are received daily. These reports are carefully digested and anything new or salient is transmitted to the whole force.

Thus, with our finger on the pulse of the industrial world, we are able to diagnose successfully every lubricating condition, and with the complete line of Texaco Lubricants at our disposal, we are ready to prescribe the right lubricant to take care of every mechanical condition.

For every power unit or machine, new or old, there is a Texaco Lubricant exactly suited to the work, and our Engineers know how to apply them in the right amount—no more, no less—to secure the most economical and efficient results.

On this basis we have built up an extensive, growing business in all classes of lubricants.

The plants, shops, mines and mills, who have benefited by Texaco Service cover the country and embrace every industry—yours included.

Call on us when you need lubricants, or Texaco Service.

There is a Texaco Lubricant for Every Purpose

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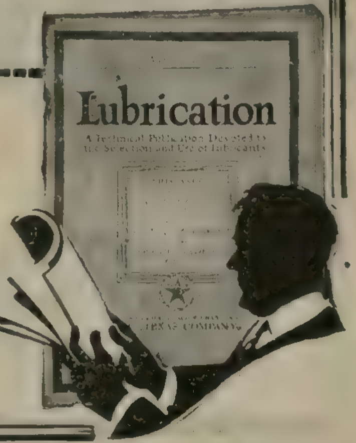
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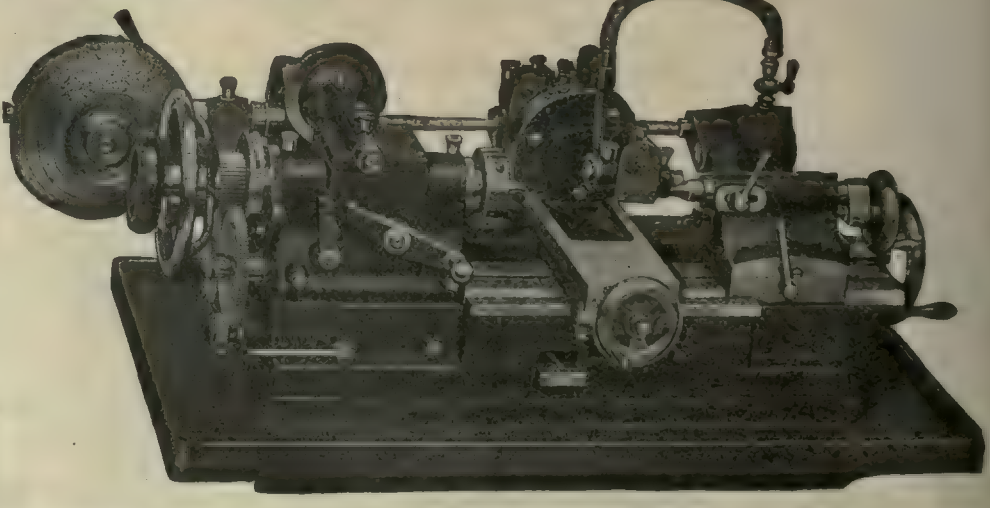

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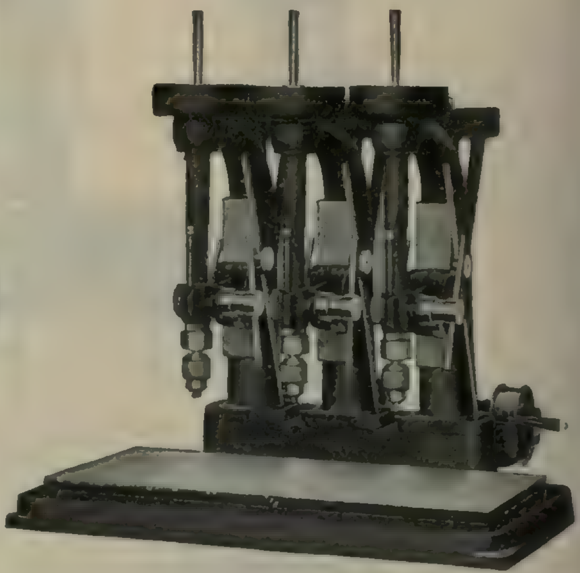

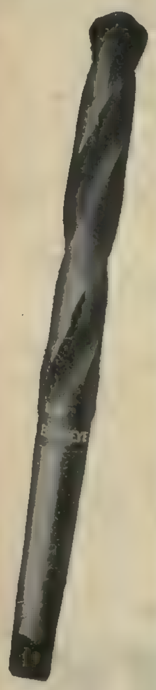

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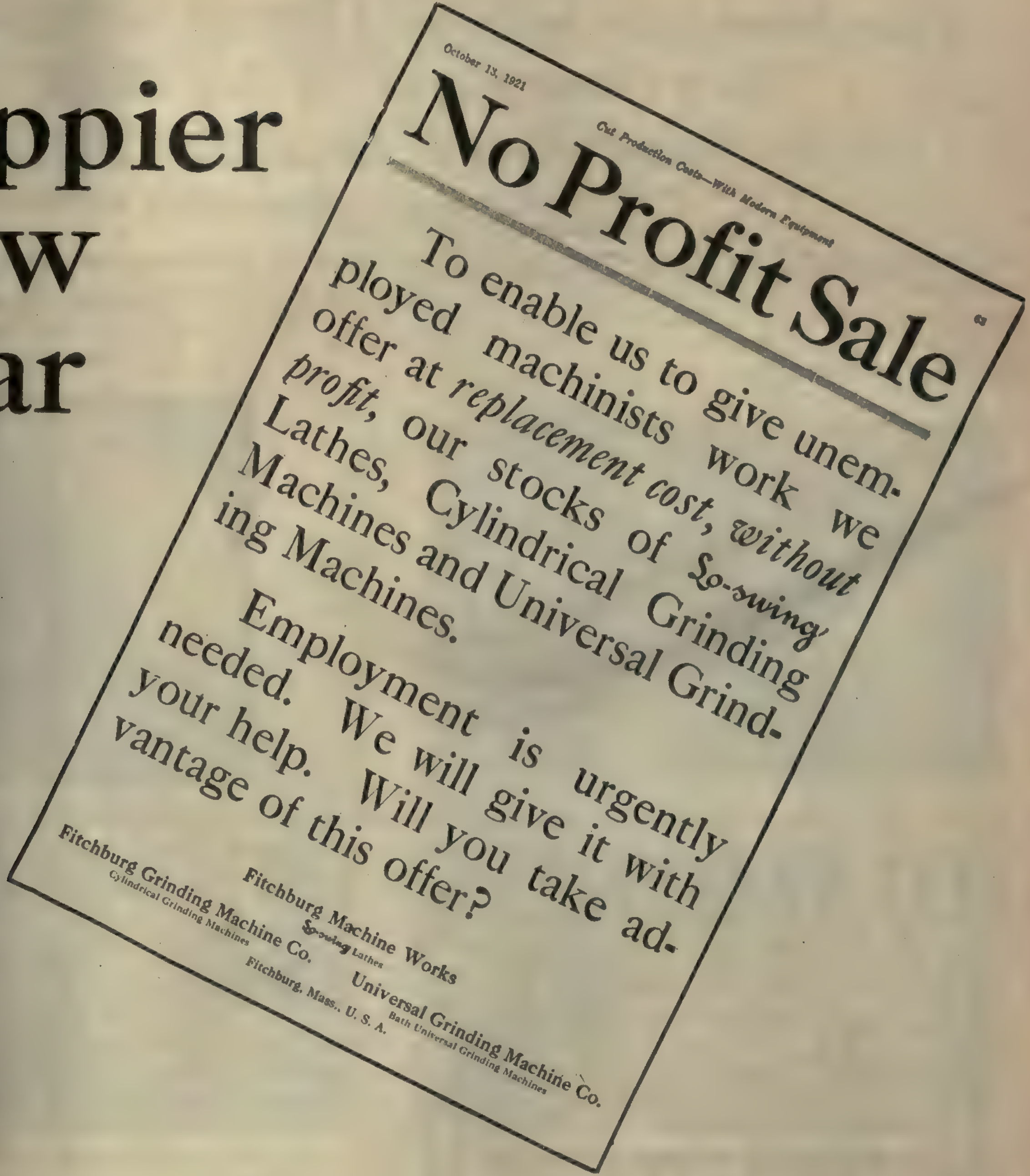

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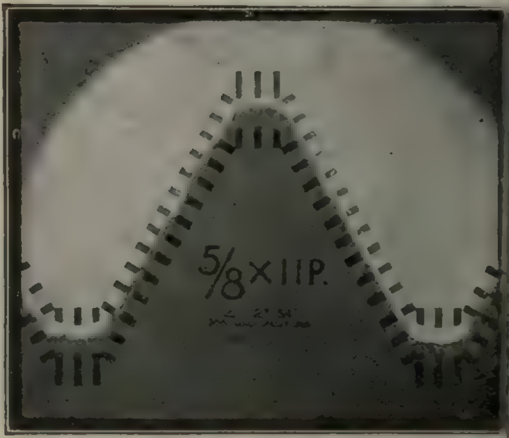

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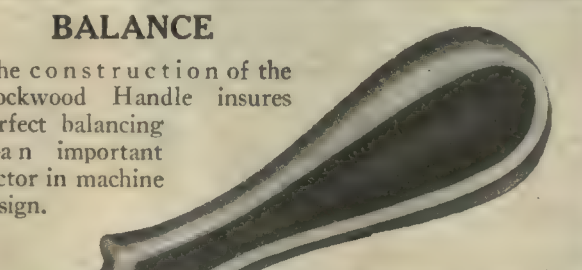

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American Machinist

Volume 55 NEW YORK, DECEMBER 29, 1921 Number 26

Employment of War-Blinded in German Industries

Methods Used to Enable the Blind Ex-Soldiers to Live Independent of Charity —Machine Operation in Manufacturing Plants

BY HUBERT HERMANNS

THE problem of employment for the blind is one which has existed for many years in all the civilized countries of the world, but up to recent years the solution has been left mainly to the State and private institutions. The recent war has, however, given the matter a national aspect, since so many soldiers had the misfortune to lose their eyesight in a national cause. Their number in Germany amounts at the present time to 3,122, as compared with about 34,000 blind in civil life. To occupy the blind ex-soldiers in such a manner that their hard lot is eased as far as possible and that they need not consider themselves an encumbrance or feel themselves humbled by receiving charity, is the honorable duty of every nation.

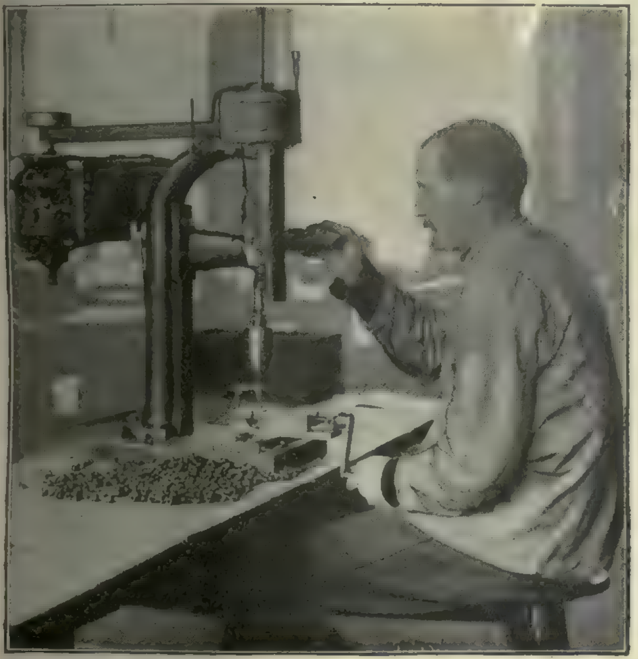


FIG. 1. A BLIND OPERATOR ON A BENCH DRILL

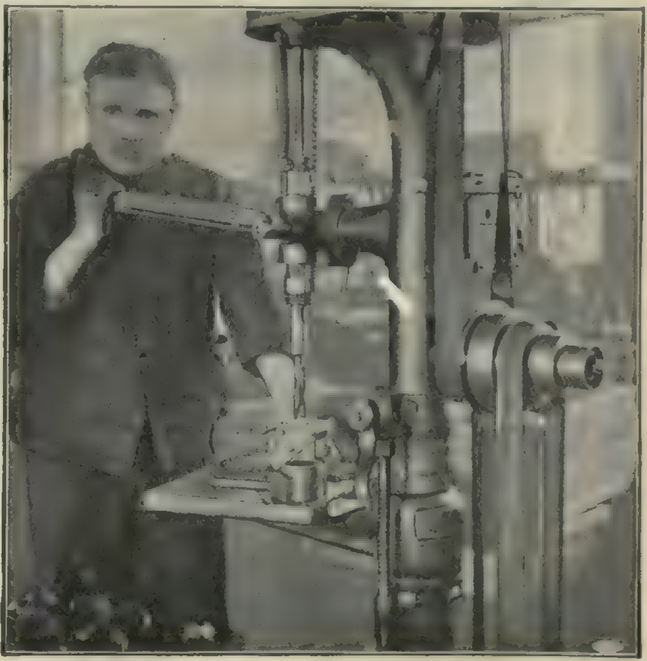


FIG. 3. BOTH HANDS ENGAGED PREVENT INJURY

All the experiences which have been or may be gained in the various countries in regard to the care of the blind should be made available to the whole world. To this end the following article has been written concerning the experiences gained at the Siemens-Schuckert Works of Siemensstadt, near Berlin, where the blind are employed at machines in mass production.

In Germany the law prescribes that large undertakings must employ up to 10 per cent invalids from the war as workmen or officials at their works or offices. Naturally it is most difficult to find suitable employment for the blind in industrial works without charging the undertaking with an economical burden, as the blind must be treated quite differently than the other workmen. By the untiring efforts of Mr. Perls (one of the directors) the Siemens-Schuckert Works have succeeded in employing a considerable number of the war-blinded on useful work which enables almost all of them to make a good living. Experience has shown that there are many operations in mass production on which the blind can be employed.

Especially suitable are operations which are carried out by machinery. In every case it is, as a matter of course, necessary that the moving parts of the machine be carefully covered so that injury to the blind is impossible. The blind man must have the absolute assurance that he is not liable to injury while at work. As the nervous system of the blind and of the war-blinded in particular is very sensitive careful consideration must be given to this point.

How completely successful the efforts in this direction have been, will be proved by the fact that although the Siemens-Schuckert Co. has already trained more than 150 blind to be skilled machine operators, not a

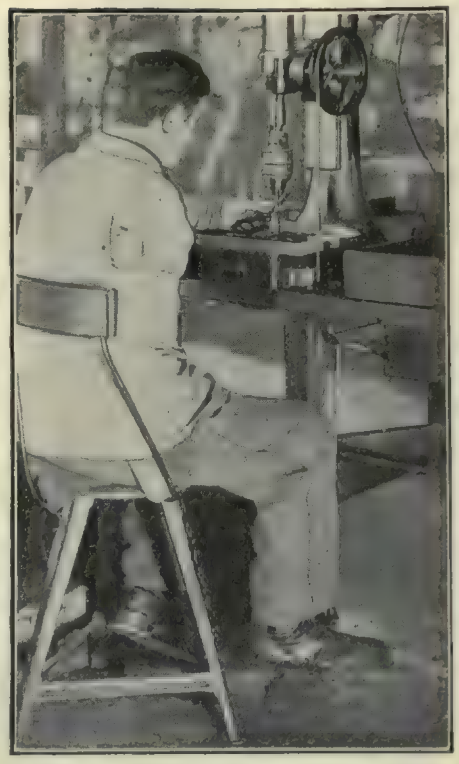


FIG. 2. OPERATING A DRILL WITH THE FOOT

single accident has happened to them up to now. The importance of this fact will be evident when it is known that in Germany the labor associations, which are the guardians of the official prevention of accidents, have a far-reaching veto against the employment of workmen in unsuitable and dangerous work places. Now that the officials of the labor associations have become convinced that the danger of accidents to the blind is not only not greater but actually less than for other workmen employed at machines, the associations have undertaken the full risk against accidents.

Out of the great number of different branches of work in which at the present time the blind are employed at the Siemens-Schuckert Works, this report will only extend to the employment of the blind at drilling machines. Drilling work has proved particularly suitable for the employment of the blind. Irrespective of the fact that the machines must be carefully safeguarded, provisions must also be made that faulty work and resulting economical losses for the undertaking are prevented as far as possible.

Fig. 1 shows the drilling of holes in cylindrical bodies by means of a table drilling machine. The piece is clamped into a suitable chuck and then the lever with the drill is pulled down to a stop. During the operation, the workman keeps his right hand on the drill lever and the left hand upon the crank of the chuck, which minimizes the danger of accident from the drill.

The machine is driven by a small built-in motor, as the individual motor drive has proved itself by far the best for machines served by the blind, owing to the absence of line shafts and driving belts.

Fig. 2 illustrates the operation of a table-drilling machine by a one-armed blind man. This man, having lost his right arm by a shell explosion, uses the left hand for the insertion of the piece of work, while he operates the lever with the right foot by the aid of a cable. In such drilling work the wishes of the blind with regard to seating accommodation should be considered. As will be seen from the illustration, a simple three-legged stool with a rounded back-rest is provided for this purpose.

Fig. 3 illustrates the operation of a pillar drilling machine by a blind man. The piece to be drilled is inserted in a jig which is held against a stop by the left hand, while the right hand is used to pull the lever down. The moving parts are thus out of reach of th
blind.

The simultaneous operation of two semi-automat
drilling machines by one blind man has also prove
quite successful, as shown in Fig. 4. The pieces to
drilled are held in a jig which is fastened to the machi
table. The jig must be so constructed that the insertio
of the piece of work can easily and quickly be effected.

In all drilling operations performed by the blind t
drill jig plays a very important part. On multipl
spindle drilling machines with which a number of hol
are to be drilled in a piece of work, a special jig gui
is provided on the drilling table. As shown in Fig.
the drill jig is located by the apertures in the guide,
that the drill always strikes the hole correctly.

In Fig. 6 is shown the operation of a multiple-spind
semi-automatic drilling machine which performs t
operations. Special care must here be taken that
blind does not injure himself by coming in contact wi
the projecting corners of the machine. A thick wra
ping of textile fabrics renders excellent service in t
direction.

In conclusion some brief general remarks about
employment of the blind in mechanical industries
Germany will be added.

It has been proved conclusively that the employme
of the blind on common labor does not give satisfacto
results. The noise made by machinery appears to ha
a beneficial effect upon the blind and to convey to th
a proper understanding of the work they perform.
further important fact is that it has been ascertain
without a doubt that it is a mistake to put the bli
in a special room, apart from their fellow-workers w
are capable of seeing. The blind only does his b
if he can compete with ablebodied workers and sha
with them the many daily small events happening
the workshop. Experience has shown that if all th
circumstances are taken into full consideration, the bli
worker, provided he is willing, is quite capable of ho
ing his own in turning out entirely satisfactory work
the average class.

It is always assumed, however, that in the blind
feeling is aroused and maintained that he does
receive charity, but well-earned wages for servi
rendered which are economically valuable. The pay
piece work for the blind must be built up on the sa
principles as for other workers. Every facility m

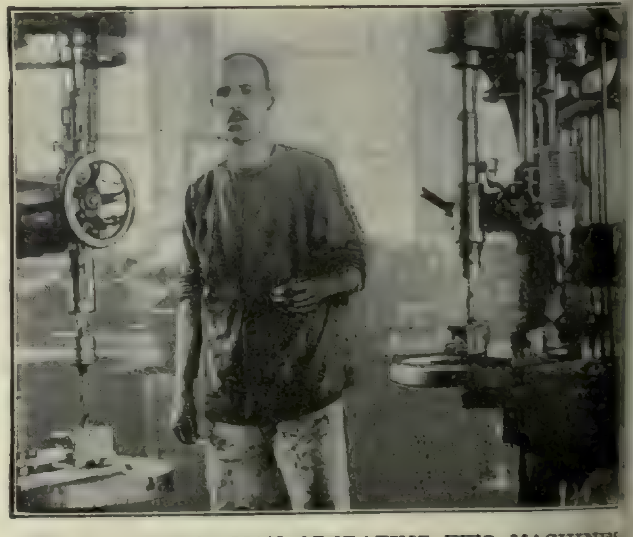
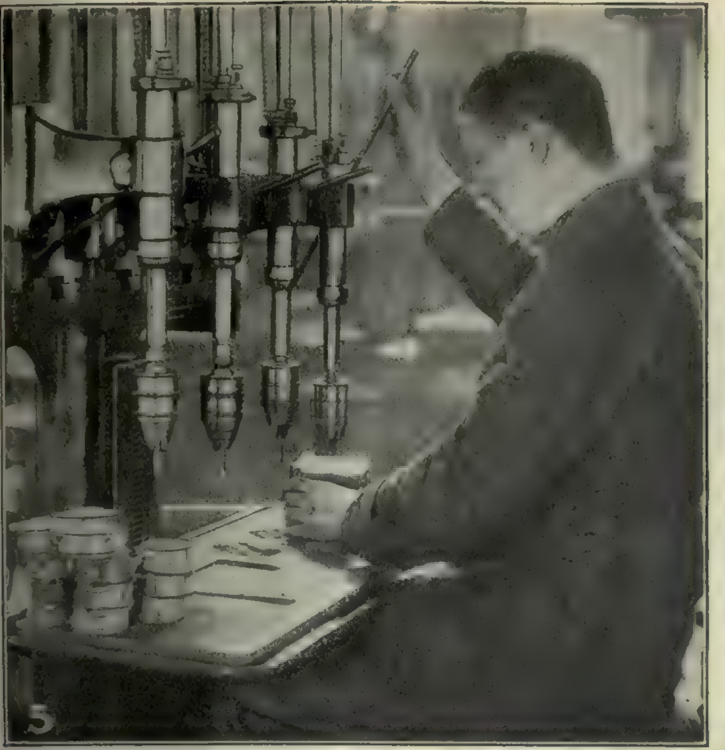


FIG. 4. A BLIND MAN OPERATING TWO MACHINE



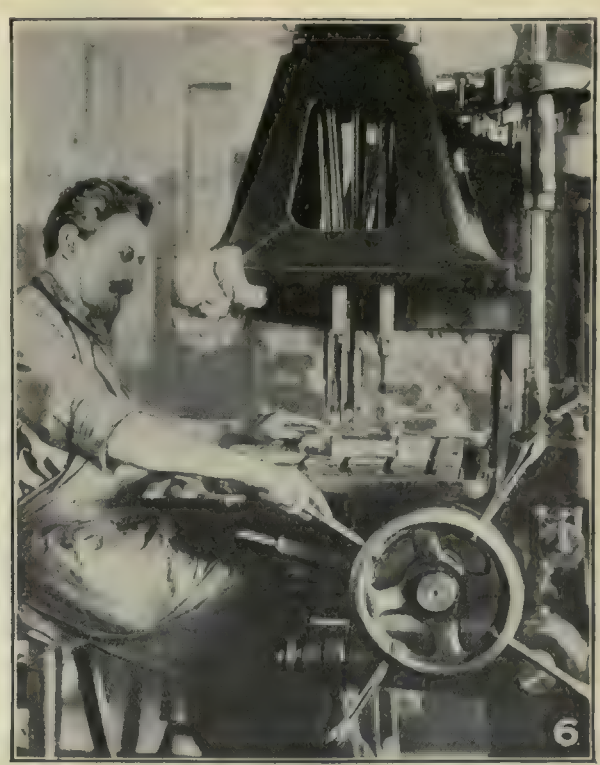


FIG. 5. A SHEET-METAL GUIDE INSURES CORRECT PLACING OF THE JIG. FIG. 6. PADS ON PROJECTING CORNERS PROTECT THE WORKER FROM INJURY

be provided which will enable them to earn the usual pay for the work performed. For special emergency cases a fund should be formed from which the blind and their families could receive assistance in time of need. It is of great importance that the management have a thorough understanding of and be in full sympathy with the peculiarities of the blind, regulating its treatment accordingly. The manager should take a personal interest in the private affairs of the blind and assist them in the solution of their problems. The sympathetic manager will always be able to find new work which the blind can perform or work suited to their needs.

The Question of Accuracy in Micrometer Measurements

By William S. Rowell

On page 562 of *American Machinist*, Mr. Sheldon asks the question: "How close can you measure with your micrometer, assuming the micrometer itself to be free from errors?" It is not only a good and timely question to ask, but all of us should thoroughly try out anything that points toward the correct answer and promises better work. He tells us of some rather remarkable results of an attempt to determine variations due to the personal element in small outside micrometer measurements.

Though we may speak of "tenths" today as lightly as the machinist of a generation ago did of thirty-seconds, we must admit a lack of real knowledge, and also that we cannot with ordinary instruments be sure we are right to one ten-thousandth of an inch. Difficulties attending the use of the more refined measuring instruments prevent the extensive use of such instruments in actual production, but it would seem no more than right or reasonable that the workman should have measuring instruments that are at least as good as those used in inspecting his product.

The checking of measuring instruments for inaccuracies, both original and those produced by wear, has always been practiced by intelligent men. The Western Electric Co. did something at it more than ten years ago. This company bought for its employees many micrometers, hardened squares, etc., and none were turned over to the workman until approved by the test laboratory. Micrometers were tested on Johansson gages at not fewer than five points.

My belief is that most men of experience along these lines will agree that an extreme variation of 0.0001 in. among twenty men is remarkable proof of ability to measure closely. Where it is stated that "a lesser number underestimated the length from one quarter to three-quarters of one ten-thousandth," the reader finds himself wondering what micrometer was used that made the reading of these small amounts possible. If this statement stands, then and then only can we say that we are as sure of ten-thousandths of an inch, as the men of thirty years ago were of thirty-seconds.

The mechanic of thirty years ago could readily split the thirty-second into ten parts with his caliper and "scale." The writer still has a *Darling* Brown & Sharpe steel rule that may be depended on to give a trained user a tenth of an inch much more accurately than ordinary outside micrometers will indicate one ten-thousandth of an inch. This leaves the present-day mechanic working among still greater uncertainties in attempting to measure a "tenth," with his "mike," than his father encountered in attempting to measure 0.010 in. with his caliper and "scale."

A little more detail of this test, especially in the matter of insulating against temperature variations, would be of interest and, in view of the much greater difficulty involved in taking internal measurements, so also would be a similar test of the ability of this same twenty men to decide the sizes of bores of one inch and less.

Automotive Service Methods and Equipment

V. Servicing the Rolls-Royce—An Interesting Grinding Job—A Hand Pipe Expansion Too —Kelly-Springfield Truck Service Methods and Tools

By HOWARD CAMPBELL
Western Editor, *American Machinist*

Although the Rolls-Royce car is undoubtedly so designed and constructed that a minimum amount of service is necessary, that minimum is expedited by the use of special equipment, some of which is described herewith.

In Fig. 1 is shown a fixture for testing the straightness of pistons after they have been assembled in the car. As the pistons vary in size, due partly to the fact that oversize pistons are used whenever a cylinder is rebored, the pins *A* have to be adjusted frequently. The upper end of the piston is somewhat smaller than the rest of the piston, also. This is done, as shown, by resting the fixture on a faceplate and aligning the pins *A* with a square. There are four of these pins, two in each of the parts *B* and *C*. After aligning the pins, the fixture is placed on the motor as shown in Fig. 2, and the space between the pins and the piston gaged with feelers. Due to the fact that the top end of the piston is smaller than the body, all four sides of the piston are gaged. If the fixture shows an error, the rod is straightened and gaged again until the piston is absolutely straight.

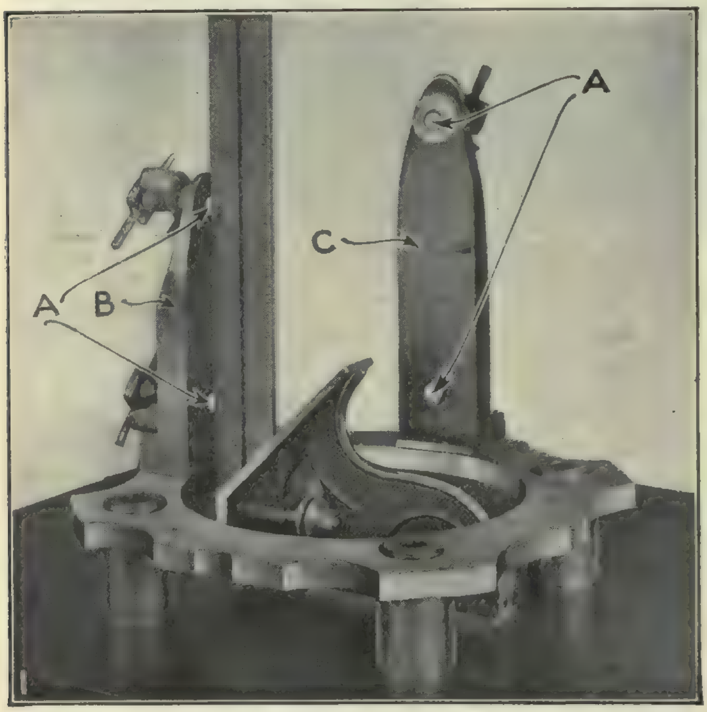


FIG. 1. TOOL FOR TESTING STRAIGHTNESS OF CONNECTING ROD.

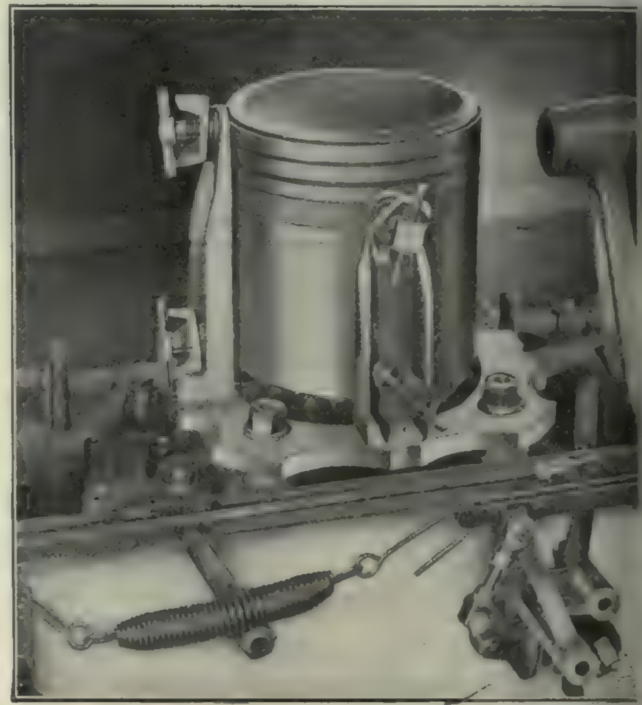
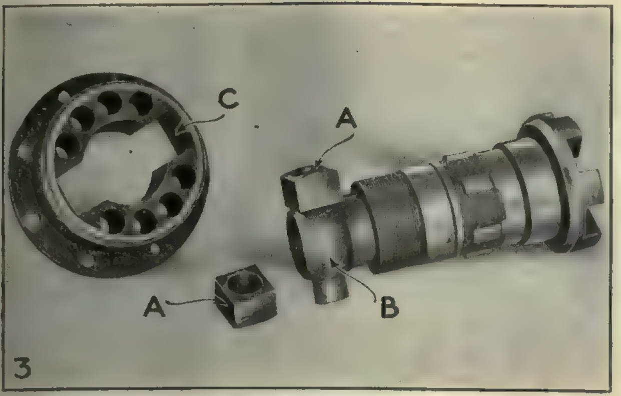


FIG. 2. GAGING PISTON FOR STRAIGHTNESS

The principal parts of a Rolls-Royce universal joint are shown in Fig. 3. When these are assembled, the blocks *A* assembled to the pin and shaft *B*, must be a "push" fit in the slot *C*. These blocks also have a radius ground on them where they come in contact with the inside of the collar, this radius being the radius of a circle of which the length of the slot is the diameter. Fig. 4 shows how these blocks are ground. The two blocks are put on to a special mandrel made from one of the shafts, and ground with a portable grinder that is clamped into the toolpost of a lathe. To grind out th slot in the collar, this same grinder is attached to a angle plate and the angle plate is bolted to the slide-rest of the lathe with the grinder in a vertical position as shown in Fig. 5. An emery wheel mounted on plate is attached to the grinder in such a position tha the wheel can be driven from the spindle of the grinder Then the collar is placed in the chuck with the slo practically horizontal. While in this position, one sid of the slot is ground. Then the chuck is revolved unti the slot is again horizontal and the ground surface i tested with both sides of the hole. When the piece ha been adjusted so that the ground surface is absolutel horizontal, the opposite surface is ground until the slo is of the desired width.

Setting a Rolls-Royce Axle Pin

An operation which is undoubtedly peculiar to th Rolls-Royce is shown in Fig. 6. The axle must b assembled to the car so that the axle-pin *A* slants 17 deg. backward from the perpendicular. The tool has a screw *C* in the bottom end which is pointed s that it will fit into the center in the end of the axle pi A similar center is attached to the tool at *D*. Thi center sets into the center in the upper end of the pi When these two centers are in place, the top of th tool is exactly at right-angles to the pin. Another to composed of two parallel bars hinged together at on end, as shown at *E*, is now placed on the upper part o the tool. To the lower of these bars is fastened a gradu



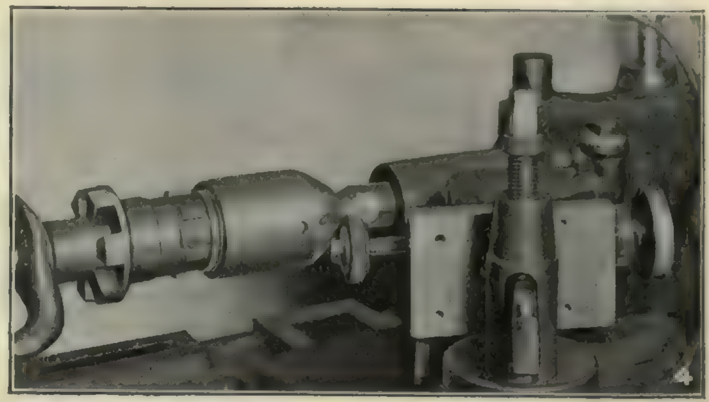


FIG. 3. UNIVERSAL JOINT PARTS (ROLLS-ROYCE). FIG. 4 GRINDING UNIVERSAL JOINT BLOCKS

ated scale *F*; on the upper bar is placed a level. The upper bar has to be raised at the open end to a certain mark on the scale *F*, then when the axle has been turned so that the upper bar is shown to be perfectly level, the axle-pin *A* will slant at the desired angle.

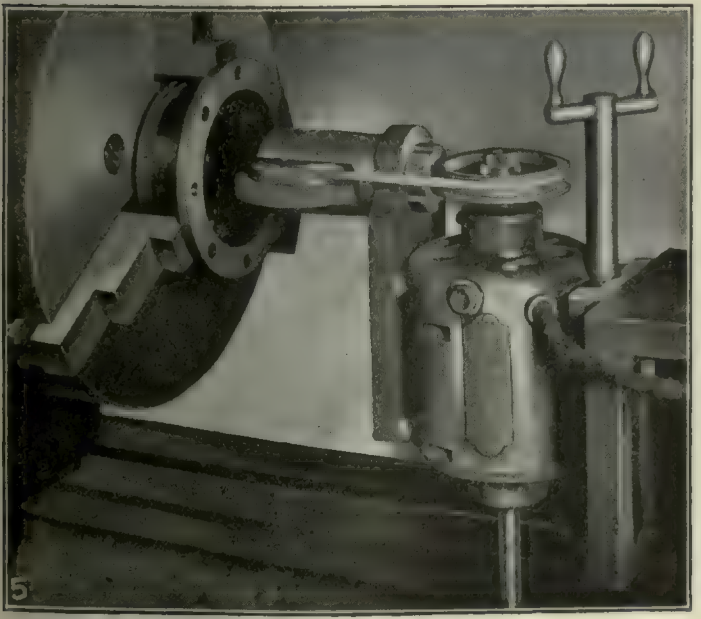
A tool for performing an unusual expanding operation is shown in Fig. 7. This is used for expanding the exhaust stand pipe at a point about 3 in. back from the end. Thus the pipe is tapered with the small end of the taper at the end of the pipe so that it will fit into the exhaust chamber. The bottom end of the spindle *A* is tapered with the large end of the taper at the end of the spindle. The three sections of a cylinder *B* are attached to the ring *C* by screws which enter through slots in the ring. These slots are loose enough so that when the spindle is drawn up through the segments *B*, these segments will be spread apart at the bottom. When the tool is placed in the end of the pipe, part *D* rests on the top of the segments, and the shoulder *E* rests on the top of part *D*. Then when the handle *F* is turned, the spindle is pulled up through the tool, expanding the pipe at the lower end of the segments. The operation of the tool can be seen in Fig. 8, only the end which is to be expanded being shown. The pipe is held in a vise for the operation.

The service station of the Enterprise Motor Corporation, New York distributors for the Kelly-Springfield Motor Truck Co., has some interesting equipment. Included in which is the motor stand shown in Fig. 9. A stand of this or a similar type is one of the most necessary articles in a modern service plant. The motor which is to be repaired or overhauled is bolted into this stand, which is so arranged that the motor can be swung to any position, making it possible to work on either the top or bottom of the motor; or it can be set vertically so that the crankshaft and camshaft gears are easily accessible.

At *A* and *B* in Fig. 9 are the motor supports by which the motor is hung in the truck chassis. These are removed from the chassis with the motor and bolted to the side-arms *C* and *D*. Each side-arm carries a $1\frac{3}{4}$-in. stud which rests in a bearing as shown at *E*, which makes it possible to swing the motor to any position. The motor is locked in a horizontal position by means of the clamps *F* and *G*, each of which is held in position by a bolt and nut. A slot in the clamp makes it possible to slide the clamp horizontally under the side-arm, the two clamps holding the motor so that it cannot tip.

In Fig. 10 is shown a unique type of crankshaft pin turning tool. This is a commercial article, made by Peters, Inc., Philadelphia, Pa. The interesting feature of this tool is that it can be used for truing up a crankpin without removing the crankshaft from the motor.

The tool consists of eight steel cutters held in an



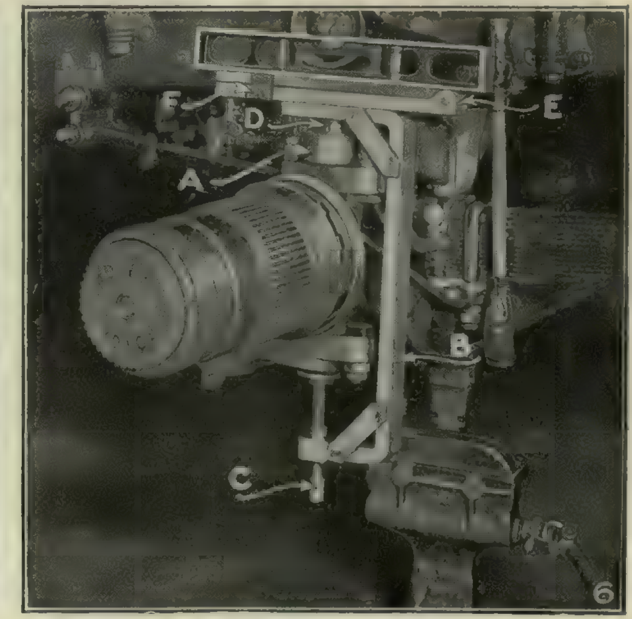
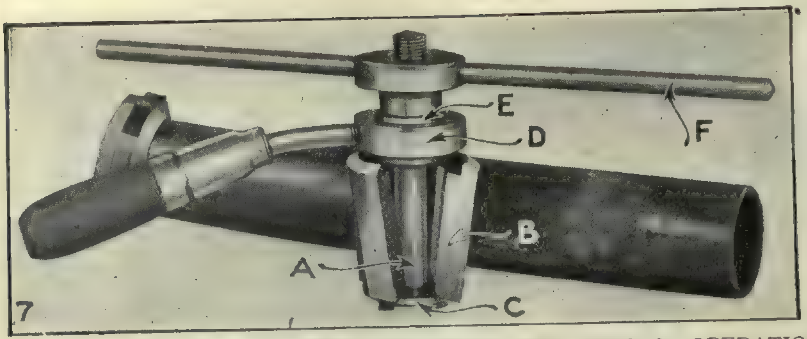


FIG. 5. GRINDING SLOT IN UNIVERSAL JOINT COLLAR. FIG. 6. ALIGNING THE AXLE PIN



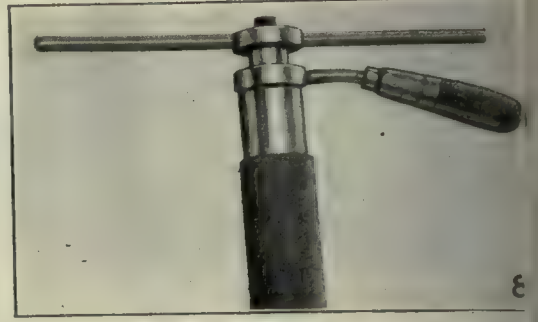


FIG. 7. PIPE EXPANSION TOOL. FIG. 8. OPERATION OF PIPE EXPANSION TOOL

adjustable screwplate, all of which are enclosed in an aluminum chuck-like housing approximately 1¼ in. wide and 9 in. in diameter. The screwplate is operated by means of a spanner-wrench, the action of turning the

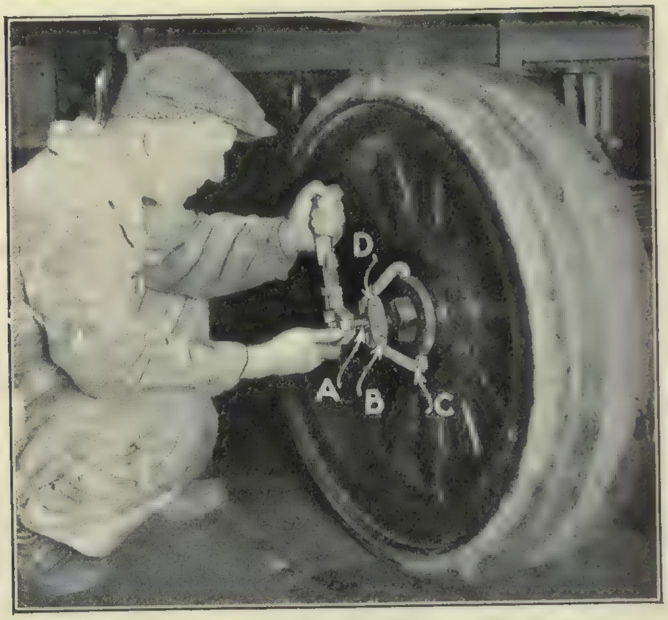
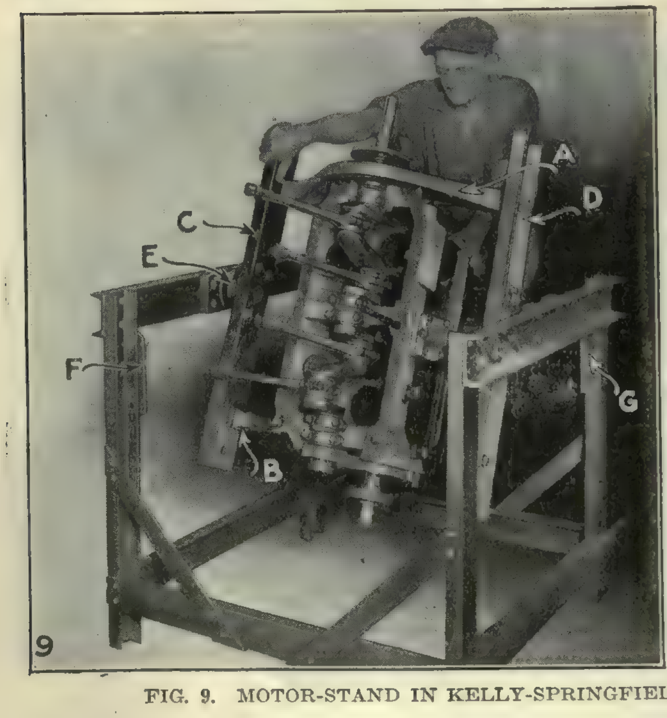


FIG. 11. USING A WHEEL-PULLER TO REMOVE A TRUCK WHEEL

plate moving all cutters to or from the center univer
sally.

The housing is made in two halves, hinged togethe
so that the tool can be opened and placed in positio
around the crankshaft pin, which can be done while th
crankshaft is in the motor. Then the screwplate is s
so that the cutters rest on the metal of the crankpi
and the tool is revolved by hand. After the high-spo
are taken off, the screwplate is again adjusted and th
operation proceeds until the pin is turned to the si
desired.

Another very necessary tool for service station wo
is the wheel-puller, such as is shown in Fig. 11. Th
wheel is swung clear from the ground by jacking
blocking up under the axle and the puller applied
shown. The central screw *A* is a ¾-in. 10-thread se
screw, 3 in. long under the head. It screws throug
the part *B* and seats in the end of the axle, locating
the center hole which is usually found there. The le
C are ⅝ in. in diameter, and are held by the pins
which are ½ in. in diameter and 2¾ in. between center
The legs are approximately 4¼ in. long. The use of th
wheel puller saves the felloes and spokes from defac
ment and puts the strain near the seat of contact of t
bearing. The two legs are catching back of the hub
this case, although the ends are formed so that they c
be dropped into holes if desired. The shop superinte
dent states that three tons could be pulled with th
small tool without any trouble.



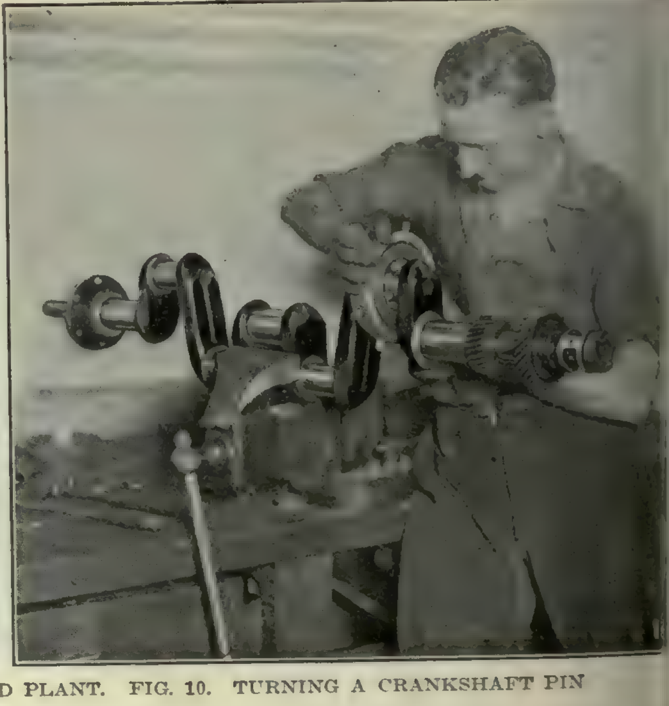
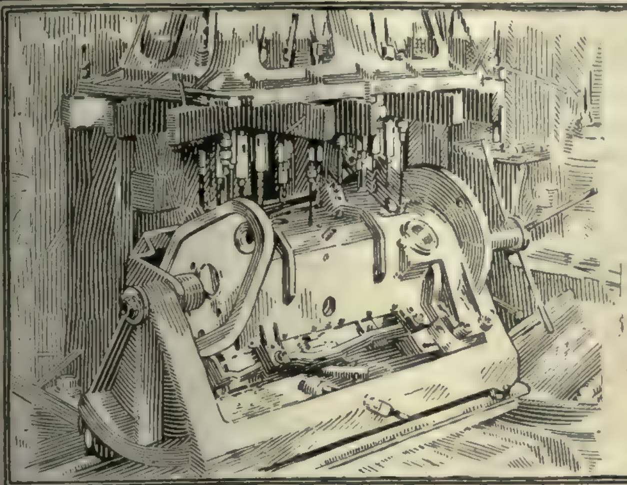


FIG. 9. MOTOR-STAND IN KELLY-SPRINGFIELD PLANT. FIG. 10. TURNING A CRANKSHAFT PIN



Tool Engineering

By

Albert A. Dowd and Frank W. Curtis

President and Chief Engineer

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Turning Tools for Turret Lathes Concluded—Box, Universal and Overhead Tools—Methods of Holding Tools—Advantages of Piloting for Rigidity and Alignment

IN MAKING up box tools for turning bar stock, care must be taken to avoid too much depth below the center of the turret hole. All turret tools must be indexed with the turret, and they are likely to strike the back of the turret slide if made too deep. The tool must be made adjustable, and the back rests should be so designed that they can be used either ahead or behind the cutter. A very good type of box tool is shown at *A* in Fig. 292. The portion *B* is made so that it can be fastened to the turret and suitably located in the turret hole. The overhanging portion *C* is fitted with a toolblock *D*, in which a tangent tool *E* is placed. The tool can be adjusted to the required diameter by moving the block *D*. The rollers *F* and *G* are mounted on adjustable blocks *H* and *K*. They are provided wtih screws at *L* for adjustment and can be locked in place by the nuts at *M* and *N*. This is a clean-cut design, with plenty of provision for chips, so that they are not likely to clog and tangle up on the tool.

When work is of small diameter, it is not always possible to use roller back rests, because they cannot be brought in very close to the center. A V-type of back rest like that shown at *O* can be used when such a condition is encountered. The two pieces are adjustable on the slide *P*, and are locked in place by means of the nut *Q*. In designing multiple box tools, this type of back rest is frequently used, because it takes less space than the roller type. Several blocks like that shown at *P* can be made up, and the back rests adjusted according to the requirements. They are located by means of a tongue *R* in the body of the holder. Toolblocks for multiple cutting can be made as shown at *S*, and several of them can be applied to one holder for cutting different diameters. The holder may be extended as shown by the dotted lines at *T* to accommodate several blocks.

If shoulders on the work are very close together, it may be necessary to place two or more tools in one block, and also to do away with the bolt *U* and provide a different method of fastening. This last may be accomplished by tapping into the block from the underside and using collar-head screws for holding. The designer of turret tools is not frequently called upon to design box tools, although there is an occasional demand for a tool to handle work which cannot be taken care of by the standard types. The information given here should be sufficient to bring out the principal points in connection with the design.

Another type of tool used for bar work is shown at *V*. It is a pointing tool, used for chamfering the ends of bar stock preparatory to turning. The design is very simple and consists primarily of a casting with a shank fitting the turret of the machine. A hardened conical bushing *W* is cut away at one side to allow the tool *X* to act against the work. The bushing, being tapered, supports the work and centers it while the chamfer is being cut.

UNIVERSAL TURNING TOOLS

An adjustable tool suitable for turning cylindrical work is shown in Fig. 293. The work *A* is to be turned on the two diameters *B* and *C*. It is possible to design a tool to handle work of this kind so that it will be adjustable for all diameters within its capacity. The tool holder, shown at *D*, is fastened to the turret of the machine by means of screws at *E*. It is machined with a dovetail as indicated at *F*, and a slide *G* is fitted to it. An adjustable gib is provided at *H* to take up wear. The slide is adjusted vertically by means of the screw *K*, which enters a hardened threaded bushing *L* in the body of the holder. The sliding member *G* has a tool *M* set at an angle of 30 deg., in order to allow working close to a shoulder.

A tool of this kind can be fitted with a graduated handwheel and a pointer, in order to permit of accurate adjustments. Combinations are occasionally made with a holder for drilling or boring, in connection with this tool. The holder can be placed in the hole *N*. If necessary, this portion of the body can be extended to form a rigid support. Tools of this general type can be fitted with a slide having a tangent tool for short cuts on bar work; but as the holder is not provided with back rests, it cannot be used for very heavy cutting.

By setting the slide at an angle, as indicated at *O*, space can be obtained for the two back rests, as shown at *P* and *Q*. These back rests are adjutsable by means of screws at *R* and *S*. They can be designed so that

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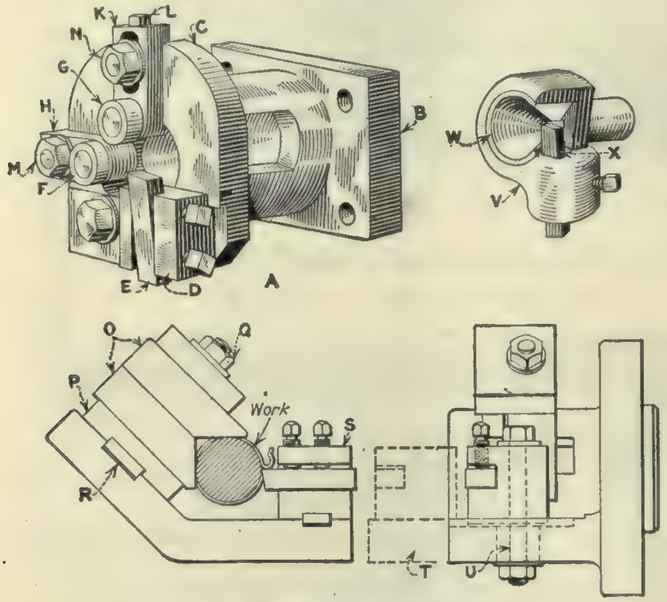


FIG. 292. BOX-TOOL DESIGNS

either leading or following rolls can be used. A detail of the construction of the slide is shown at *T*. The screw *U* is utilized to adjust the blocks toward the center or away from it. In designing tools of this sort, rigidity is an important consideration, as any vibration in the tool will cause chatter in the work. The amount of space available affects the design very strongly, and the greatest care must be taken to keep the various parts within the space permitted, so that no interference will be caused in the indexing of the turret or by the position of other tools on adjacent turret faces.

Tools of the overhead variety can be given additional rigidity by extending them entirely across the turret, as indicated at *A* in Fig. 294. These tools are applied to the flat form of turret. Two heavy brackets are provided at *B* and *C*, and through these a double-end bar *D* is passed. This bar is cut in the center at *E*, and one end is piloted and held in place in the other bar by a screw *F*. The brackets *B* and *C* are fastened to the turret by the screws *G*, and location is obtained by the tongue *H*, which fits a slot in the turret. Each end of the bar is slotted for the tools *K* and *L*. Backing-up screws may be provided for the latter, if desired. The amount of overhang at *M* is determined by the size of the bar and the work which is to be done. It is advisable to make the overhanging ends of larger diameter than the rest of the bar, if heavy cutting is to be done. The tie across the turret makes a very substantial construction, and gives greater rigidity than when single tools are used. The diameters which can be cut with a bar of this kind are limited, on account of the vertical position of the tool. Work of smaller diameter than that shown can be turned if the tool does not extend too much below the bar.

When larger diameters are to be cut, an arrangement can be used like that shown at *N*. Two brackets *O* and *P* hold a bar of similar kind to that just described, but the work is machined from the side instead of overhead. Some turret lathes have an adjustable head, while others use an adjustment on the turret. In either case the diameters are obtained by an adjustment of the relation between the turret and the spindle. When using bars of this kind, the method of holding the tool is important. If the bar is slotted, as shown at *Q*, a filler block *R* can be used to stiffen the end of the bar and prevent it from springing open. This gives a rigid and economical construction.

Tools of rectangular section, which can be purchased in standard stock sizes, should be used wherever possible. The portion of the tool which is not used for cutting should not usually be ground or finished in any way, but it should be held in the holder in the rough state. Consequently, slots for tools should be made from $\frac{1}{32}$ to $\frac{1}{16}$ in. larger than the specified size of tool which is to be used. In certain kinds of box tools for small work, tools are finished all over and carefully fitted to the holders; but on larger work this is seldom done, except in the case of a very complicated piece of work.

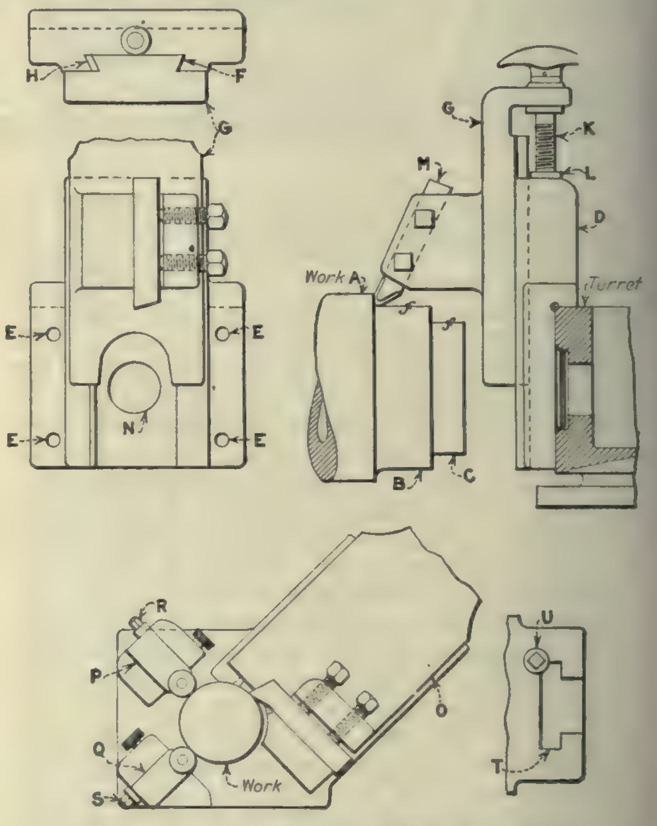


FIG. 293. UNIVERSAL TURNING TOOLS

At *A* in Fig. 295 is illustrated another matter of importance. The tool shown at *B* is held in an overhead turning tool made of cast iron. As the operator stands at the front of the machine, it is much more convenient for him to be able to make all adjustments from this position, than if he is obliged to walk around behind the machine for this purpose. Therefore, the setscrews *E* are conveniently placed at the front of the tool. This is not theoretically correct, because the thrust of the cut is in the direction indicated by the arrows, so that it must be taken by the setscrews instead of against the solid metal. This is a case where theory and practice do not coincide.

If the designer places the setscrews as shown, care must be taken to make the section *D* very heavy, so that there will be plenty of metal to absorb vibration. If made as shown, section *D* is too thin and section *C* much heavier than it needs to be. These conditions should be reversed, so that the appearance is more like that at *F*. The same thing applies to an adjustable toolblock which is mounted on a holder with tools arranged for the same kind of work. There is another point of importance in the method of holding tools. If they are made as indicated at *G* and *J*, it is wise to provide for a certain amount of play in the slot, as shown at *H*. This will permit tool *J* to be adjusted in a certain relation to tool *G*, even if there is considerable variation in the way each tool is ground. If both tools are fitted carefully to a slot, it is very difficult to set them for exact work unless they are ground to a gage.

A setscrew which is used to hold a tool in position appears to be a very simple matter, yet certain types have been found unsuitable. The cup-point screw, shown at *K*, is usually unsuitable for holding tools, because the cup point tends to make an impression in the tool. After the tool has once been ground, the setscrew will naturally find its way back to the original marks, thus making it very difficult to obtain a correct setting. The same thing applies to the use of a round-end screw, and neither of these types should be used in toolholders. In addition to these points, a setscrew having a head like that at *K* is not as convenient for the operator as a collar-head type of screw, because the wrench slips down over the head, thus causing delay and inconvenience. The ideal form of screw for holding tools is shown at *L*. It is a collar-head type with a flat relieved point *M*. There are certain cases where this type is objectionable on account of the collar, particularly when a number of screws are placed in a holder quite close together. In general, however, it is advisable to use it wherever possible.

The material from which screws are made has been the subject of considerable discussion, because the ordinary commercial screws often break under excessive use. The writers have found Hy-ten steel, suitably treated, to be admirably adapted for setscrews requiring severe service.

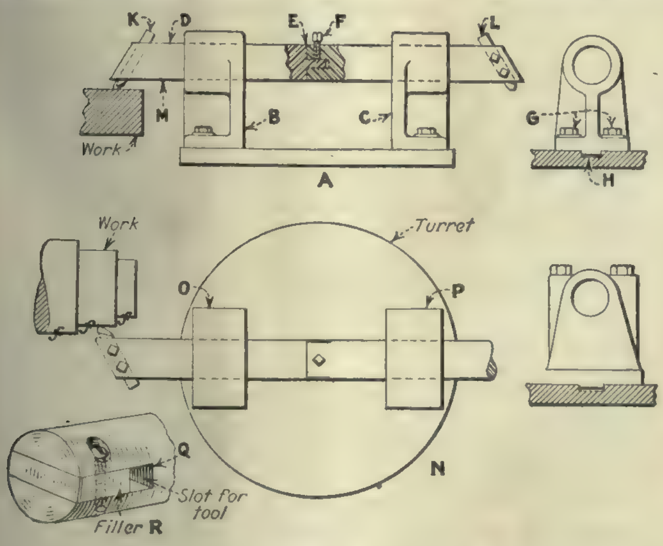


FIG. 294. OVERHEAD TURNING TOOLS

There are several forms of multiple toolholders which are capable of considerable adjustment, and can be used for quite a range of work. One of these is shown at *N*, this type being a casting having a center boss *O* and two holes *P* and *Q* at different distances from the center. Tools can be inserted in all three of these places, so that diameters approximating those shown by the dotted lines at *R* and *S* can be easily machined. Variations in the shoulder distances can be taken care of by longitudinal adjustment of the bars *P* and *Q*. A drill or boring bar can be inserted in the hole at *O*.

Another multiple tool is shown at *T*. This holder is provided with one central hole and three others arranged at different distances from the center. A rectangular slot is also cut at *U*, so that facing or turning tools of rectangular section can be held according to requirements. Another simple holder having four holes is shown at *V*. Its general principles are similar to those of the other holders.

Any multiple holder which is to be used as a standard tool and subject to considerable variation in the class of work to be handled, must be rigidly designed and proportioned in such a way that it will be as adaptable as possible. The bars used in the holder can also be standardized, so that they can be used for turning and boring. Holders of this general type are often purchased from turret lathe manufacturers.

ADVANTAGES OF PILOTED TOOLS

In order to obtain maximum production from turning or boring tools, they should be piloted so that all possibility of vibration is eliminated. Under these conditions only can high production be obtained, together with the essential degree of accuracy. In the piloting of turret tools two points are achieved, one of these being the additional rigidity obtained by the use of the pilot and the other the accuracy of alignment. It is not always possible to pilot a turning tool, due to some condition on the machine or the work.

In the example *A* shown in Fig. 296, the work *B* is to be turned by the tool *C* in a holder *D* on the face of the turret. In order to assist in aligning the tool, and to help in making it more rigid, a bushing *E* is placed in the chuck and the bar *F* is guided by it during the operation of turning. The bar can be furnished with a cutter for boring the hole. This method will give some additional stability to the tool; but, as its position is at the center of the work, it does not prevent sidewise vibration to any great extent.

A much better arrangement is shown at *G*, in which a smaller piece of work is being turned by the tool *H* in

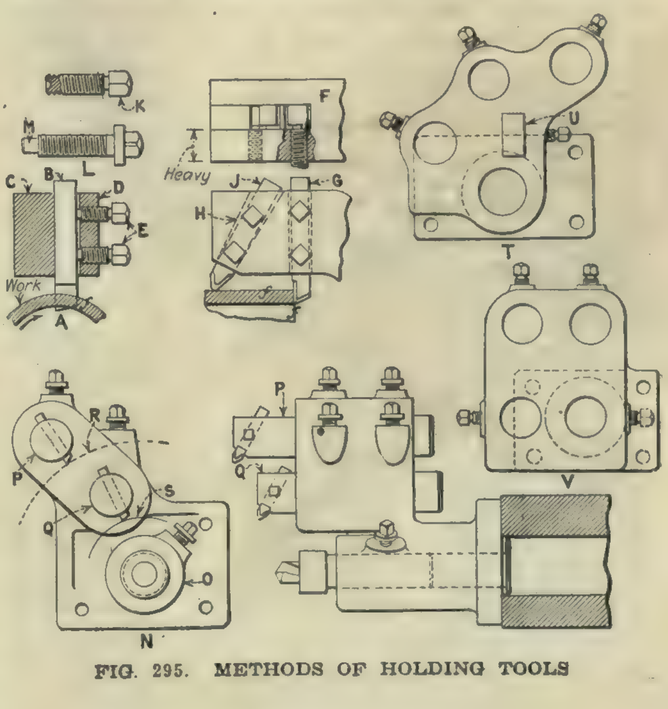


FIG. 295. METHODS OF HOLDING TOOLS

a holder *K*. The latter is furnished with a pilot bar *L* which is guided in a bushing *M*, the latter being held in a special bracket *N* on the spindle cap of the machine. This arrangement gives the tool an excellent support at the point where it is needed, and at the same time assists in the alignment.

The same piece of work could be bored at the same time by arranging the holder so that the boring bar *O* could be used in it. This boring bar being piloted in the chuck, as shown at *P*, would give additional support to the holder and make a very substantial device. There are usually slight inaccuracies in the indexing of the turret, and piloted tools assist greatly in correcting them, so that more accurate work can be produced in this way.

It may be objectionable for one reason or another to use a pilot on the turning tool itself. When this is the case, it is possible to use a bracket, as shown at *Q*, furnishing it with a pilot bar *R*, so arranged that it will enter a place provided for it in the holder at *S*. The work *T* can be simultaneously turned and bored by a tool of this kind. The turning tool is not shown, as it lies in a different plane from that of the pilot bar. This method of piloting is not as good as the other, because the alignment of the bar is dependent upon the short bearing obtained by the bracket at *X*. It is useful, however, for cases where the regular piloted tool cannot be used.

The brackets which are used on the spindle cap to support the bar of a piloted turning tool must be designed according to the headstock arrangement of the machine. Sometimes it is not possible to place the bracket directly over the spindle, and it may be necessary to select some other place for it. Several varieties of brackets are shown in Fig. 297. The example at *A* is a plain, symmetrical casting *B*, which is fastened to the spindle cap by means of four bolts at *C*. The bracket is furnished with a bushing *D* in which the tool is piloted. Usually this design cannot be used, because it is directly over the spindle, which would normally be in line with the position of the cutting tool. The pilot would more frequently be placed at the right- or left-hand side of the tool, as this would not require the bushing to be made so high above the spindle, and would allow greater latitude for the turning tools. When a pilot bracket is fastened to the spindle cap, the latter should be taken off and machined so that a good fit is obtained. It is advisable also to make sure that the cap is adjusted properly before doing any fitting of the bushing *D*. The bracket should be doweled in place in order to insure its proper alignment.

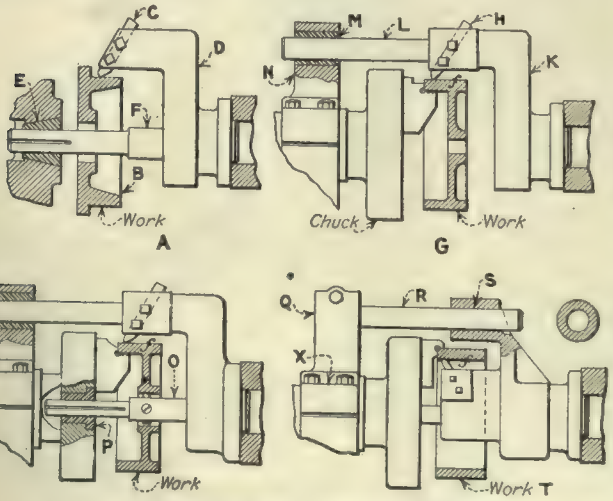


FIG. 296. EXAMPLES OF PILOTED TOOLS

The example at *E* shows a pilot bracket having a bushing *F* at the right of the spindle and considerably above it. In the example *G* the bracket forms a unit with the spindle cap itself, being designed specially to replace it. The position of the bushing *H* is at the left of the spindle in this example, and this is really the proper place for it to obtain the best results.

If we consider the cutting action of the tool, there is a slight lifting tendency, which is more or less counteracted by the pilot. There is at the same time a tendency to pull the tool toward the front of the machine, due to the direction of rotation of the work. As the bushing *F* is to the right of the spindle, the lifting action will not be counteracted to as great an extent in this case as in the example *H*, where the bushing is to the left. In the latter case, the pressure of the cut gives slightly more downward force.

A very good example of a rigid, piloted turning tool is shown at *K*. The work *L* has two shoulders which are to be machined with considerable accuracy, and a large amount of stock is to be removed. The turret is fitted with two brackets *M* and *N* on opposite sides. Each of these brackets has a heavy section of metal *O* which extends out from the face of the turret and carries the tools *P* and *Q*. A long tie bar *R* extends entirely across the turret and is fastened in each bracket. The pilots *W* and *X* pass through the bosses *S*, which are split so that the bars can be clamped in place by means of pinch binders at *T*. A bracket *U* on the spindle cap carries a bushing *V*, in which the bar is piloted. The construction is such that the two brackets *M* and *N* are tied together very rigidly, and the bar gives an excellent support for the turning tools. For large diameters, long work, and other pieces which require exceptional accuracy in machining, the use of piloted tools is indicated and will be found a decided advantage in increasing production and giving greater accuracy.

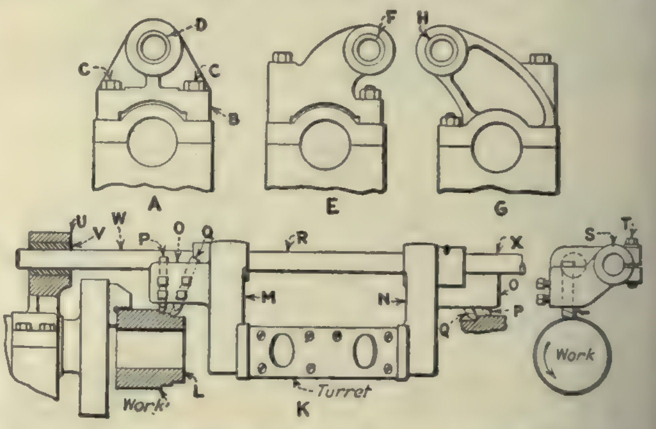


FIG. 297. PILOTED TURNING TOOL AND BRACKETS

Several forms of piloted turning tools have been illustrated, and their application to various kinds of work described. The principles of design are fundamental, yet they serve to make the subject clear by their simplicity. In order to demonstrate the value of the data given, two examples of piloted tools of improved design are shown in Fig. 298. The large casting *A* is to be turned at *B* and grooved at *C* and *D*. The tools used are designed so that they can be adjusted to handle another piece of work of the same kind, but 2 in. smaller in diameter.

The casting is held by the outside of the flange in a three-jaw chuck with special jaws. The turning-tool body *E* is of cast iron of substantial section, fitted and bolted to the turret face. The forward end of the tool body is provided with a heavy pilot bar *F*, which enters a bushing *G* in the bracket *H* on the spindle cap. The cutting tool *K* is mounted in the rectangular steel block tongued at *L*, so that it fits a slot in the casting, which acts as a guide when adjusting the block vertically for different diameters. The screws at *M* are used to hold it firmly after setting. Fine adjustment of the tool *K* is obtained by means of a backing-up screw not shown.

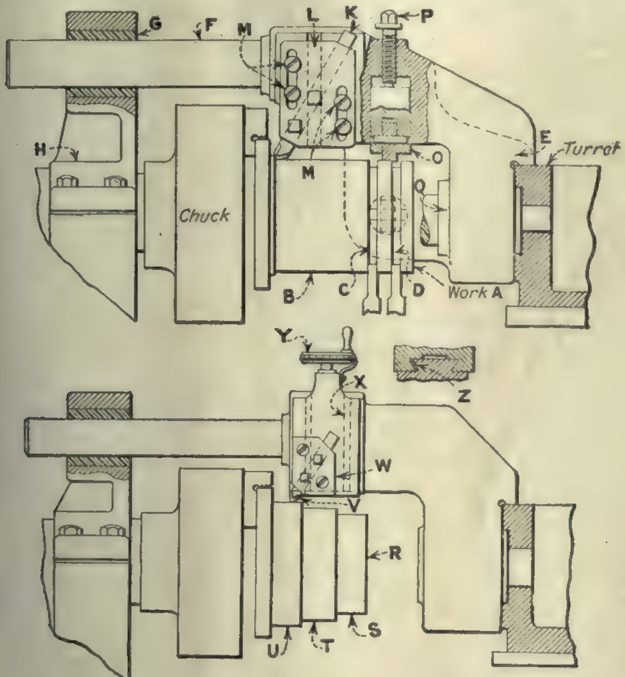


FIG. 298. ADJUSTABLE PILOTED TURNING TOOLS

The grooves at *C* and *D* are cut by two tools in the cross-slide toolblock. They are shown in the illustration 90 deg. from their actual position, in order to avoid complications in the drawing. In order to save time in the operation, the grooving tools are started before the turning is completed. Two roller supports are used to give stability to the work and steady it while grooving. One of the supports is shown at *O*, with an adjusting screw above it at *P*. The other is at the back of the work directly opposite the grooving tools, as shown only by the dotted lines.

This tool arrangement may be considered as a progressive design suitable for high production of accurate work. The general outline of the tool is pleasing to the eye and free from sharp corners and projections. The operator's convenience has been considered in the provisions for accurate adjustments, and its stability is apparent even to the casual observer. In fact "it looks efficient" as it really is. Adaptability to other work has been considered in the design, as shown by the central boss *Q*, which is bored out so that it can be used to hold a boring bar or cutter head, if desired.

Another overhead tool is shown in position for turning the work *R*. The pilot bar, bracket and body of the tool are quite similar to the one used for casting *A*, and the body is fastened to the turret in the same manner. This tool is designed for turning several diameters like *S*, *T* and *U*, successively and with precision. The cutting tool *V* is mounted in a block *W*, which is fastened to the dovetailed slide *X*. The latter is controlled by a graduated handwheel *Y* by means of a screw. The slide is furnished with an adjustable taper gib *Z*, as indicated in the sectional detail. Readings for various diameters can be easily obtained from the graduations on the handwheel. This tool should not be considered strictly as a high-production type; but for work of the kind shown, which is routed through the factory in lots of 100 pieces at a time, it will be found a great time saver.

Why Some Good Ideas Don't Work

BY J. E. BULLARD

A well known industrial expert while giving a talk to a body of engineers gave it as his opinion that bonuses, selling stock of the company to employees, suggestion boxes and profit sharing, were not as a general rule practical methods of creating greater interest in the work and in the company or in increasing production. He not only gave this as his opinion but backed it up by citing many cases that had come under his observation.

At that same meeting an executive told of the great success that had resulted from a bonus system that had been in operation in his own company for ten years. The bonuses ran high during good years; in bad years there was some bonus and production had very greatly increased without a comparable increase in the number of employees or the pay roll.

Some so-called employee magazines have never been a success. It has been almost impossible to get the employees to read them and if they do read them it appears to do but little if any good. Other employee magazines are very great successes from the start and everyone not only reads each issue from cover to cover but looks forward to the next issue.

No idea, no matter how good it may be, can be expected to work equally well in each of two different plants, not even in two different plants of the same concern. Sometimes it is perfectly obvious why this is so and sometimes it is hard to find the real reason.

In some plants the management has no difficulty in making it obligatory to wear certain safety devices or articles of clothing that tend toward safety. In other plants the men would strike if such a regulation was put into effect.

Systems are working to the advantage of everyone concerned in some plants which would completely disrupt the whole organization in others. Apparently there is no way of telling what may be expected in one organization from a system that has worked well in another.

This, however, is not the case to such an extent as is generally supposed. It is not the system that is at fault as a rule but the executives who carry out the system. Some systems require a great deal of leadership. This is especially the case with those which prove most successful in practice in one plant and fail completely in another.

It has been the leadership and not the system that has secured the desired results. The profit sharing, the bonuses, or whatever else may be a prominent feature, is not at the root of the success at all. It is merely an offshoot. It has been the leadership of the men at the top; of the officers of the company; of the superintendents and the foremen, that has gained the result. Give any other organization the same sort of leadership and the same plan will succeed in that organization. In fact with the right leadership, no innovation will be made until the rank and file of the employees are ready for it.

It is the editorial policy of many an employee magazine and the attitude of the editor towards the paper and its readers that causes many, if not most of those that fail, to miss their aims. The editor is probably not a good leader. He is too far away from the readers to understand their problems and their habits of thinking. In other words, he can't see them and as a result he misses the mark just as a person shooting at a target would be more than likely to miss it if he could not see it. Such an editor cannot make a success of the paper even if he has an advisory editorial board of the workmen themselves. He cannot understand them. He cannot think as they do. He is probably not in sympathy with any of their points of view. Probably some workman who has only a very limited command of English would make a far better editor of that magazine.

Until a new editor is found that paper can never succeed. One who can command the trust and the respect of the men; one whom they believe in.

It, however, is not always the fault of the editor that the paper fails. It may be the fault of his employers. They may not allow him to publish a paper that will prove of real interest to the men. They may insist too much upon their own personalities being placed in the paper.

An analysis of the employee magazines that do succeed will cause one to remember the words of Lincoln: "Of the people, by the people and for the people," and pharaphase them into: of the employees, by the employees and for the employees. Those that fail will usually measure up to the formula: of the employers, by the employers and for the employers, at least as far as their reaction upon the employees is concerned. They fail largely because they have at least the appearance of being published in the interests of the employer rather than of the employee. In fact they might be called employer magazines that circulate among the employees.

It matters not what class of publication it may be, it will never succeed unless it is of the readers, by the readers and for the readers. That is, it must deal with matters of the readers, matters in which they are interested. It must be by the readers to the extent that the editors get from them in one way or another the information, the news or the questions in which they are interested. It must be for them in that it helps them along the lines they want to be helped. It is only by a slow and gradual process that the habits of thinking of these readers can be changed.

Because this formula is not followed employee magazines fail. When it is followed they succeed. The magazine may be edited by the workmen themselves, it may be edited by foremen, or superintendents; it may be edited by one of the officers of the company or by a professional house organ editor. It does not really matter much who is the editor just so long as that editor has the right spirit and is able to make the workmen believe that they have an important voice in its policy; that the paper is of them, by them and for them.

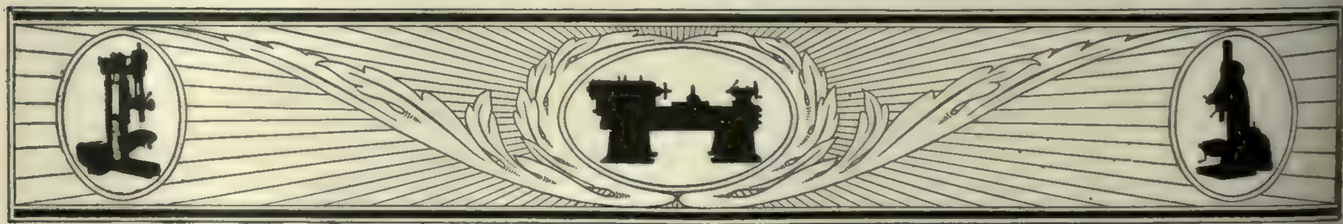
It is the spirit of the thing that counts and not the outward appearances. It is what is between the covers and not how it is printed. A few mimeographed sheets and the right spirit will go much farther than a costly prepared book and the wrong spirit. The employees will read the mimeographed sheets eagerly but will refuse to read the fine book unless they are forced to do so on the company's time.

A foreman or a superintendent may not have the right spirit, while an official or someone entirely outside the organization may have. On the other hand the official or the outside man may also lack the spirit. In any case as soon as the right man is found for editor and he is given a reasonably free hand that magazine is going to succeed. That editor will be able to lead his readers along the path he desires them to go but he never will be able to drag them or to push them.

It is always the man back of the idea that counts more than the idea. If some man suggests a good idea and the idea is his own it is often a good plan to set him at work to carry it out. If he does not make it work he will at least have to modify it. If he is given an opportunity to try to carry it out he will try much harder to make it a success than would anyone else. If it does fail and no obstacles have been placed in his way, but instead help has been extended to him, he can blame no one but himself.

After all the real problem is to find the man. A business man who has made a uniform success of his business from the time he started it stated that his sole problem was developing men and women for more responsible positions. He devotes practically his whole attention to that and has built up an extraordinarily successful business. He places the man first and the method second. If the man does not fit the method or the system, he is more inclined to change one or both to fit the man than to hunt around for a man to fit them.

Some excellent ideas fail because they do not fit the conditions where they are tried out. The ideas may fit big men and be tried out on small men or they may be small men ideas and be tried out on big men. In either case there is a misfit and dissatisfaction all around. There is nothing wrong with the idea any more than there is anything wrong with a suit of clothes that is made for a fat man, but that does not mean that the idea will fit all conditions any more than a suit for a fat man will fit all men. Some ideas are as out of place as the tools for a 48-in. engine lathe would be on a jeweler's lathe. Fit the ideas to the conditions and the men who are to carry them out, and those ideas will never completely fail. Overlook this important point and most of the new ideas applied will come to naught.



Gold-Dredge Bucket and Other Work

Manganese Steel Used for Lips—Oxy-Acetylene Torch Cuts Holes Located by a Jig—Operations on Other Parts—Repairing a Large Pulley

BY FRANK A. STANLEY

THE photograph, Fig. 1, shows a large number of gold dredge bucket lips in the yards of the Natomas Company of California, at Natoma, Cal.

This company operates a number of gold dredges and maintains at Natoma a machine plant and forge shop for repairing, overhauling and replacing various mechanical parts of its dredges. The bucket lips in Fig. 1 are only a part of the number to be seen at the plant. A gold dredge operating a chain of say, 80 to 100 buckets is working constantly under severe conditions of service and there is necessarily considerable wear on such members as bucket lips, bucket pins, ladder rollers, tumblers, sheave wheels and other parts. There is therefore much of interest to be seen in a shop devoted to the upkeep of equipment of this character.

In Fig. 2 a 15-ft. nickel chrome bucket is shown under a radial drilling machine for the drilling of the holes around the edge to receive the rivets for the lip. A bucket with the lip in place may be seen in Fig. 3.

Much of the work on buckets is accomplished with the oxy-acetylene torch. The lips are of manganese steel, and in fitting new lips to the buckets the lips are used as templets or jigs and the torch is applied through their holes to burn out the mating holes in the buckets. In stripping worn lips from their buckets the torch is used to equal advantage in burning off the heads of the rivets so that they may be knocked out of place.

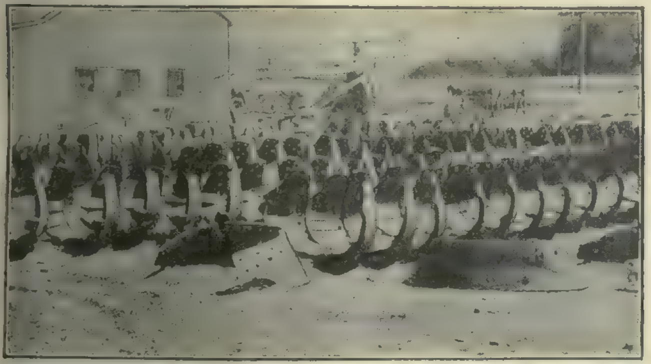


FIG. 1. MANGANESE STEEL LIPS FOR DREDGE BUCKETS

There are many other jobs of similar character around the works where the gas torch is applied to marked advantages. One operation of this kind is in reinforcing the side flanges of the tumblers over which is passed the heavy train of buckets when in operation on the dredge. These flanges, taking the side thrust of the bucket chain, are subjected to severe wear and as they are very heavy manganese castings they are expensive to renew. Consequently when the flanges have worn to a certain point, manganese steel plates are riveted on to the inner faces to form new wearing surfaces. The oxy-acetylene torch is here applied through the holes in the reinforcing plates to burn out rivet holes in the flanges proper, an operation which is accomplished very quickly.

Referring again to Fig. 3 an interesting feature of design in the bucket lip will be noticed. The front of the lip proper along the lower edge is offset in respect to the remainder at what might be termed the heel. This front portion of the lip therefore looks down over the upper edge of the bucket while the remainder of the lip immediately behind it fits inside of the bucket edge. Thus a broad continuous shoulder or ledge is provided along the lower edge of the lip, so that the heavy thrust of the lip when in service is taken directly against this contact shoulder instead of upon the rivets themselves, which are thus freed from shearing stresses.

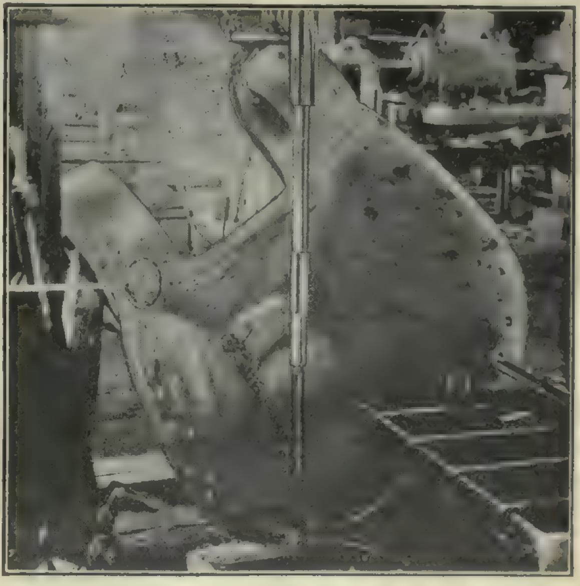


FIG. 2. DRILLING A BUCKET TO RECEIVE THE LIP

In Figs. 4 and 5 two shop operations are illustrated on sheave members. Fig. 4 shows a 24-in. shore-sheave wheel for a 1¼-in. cable, in the engine lathe where the operation of boring out the hub is being performed. The wheel is of cast steel. It is gripped in the lathe chuck as indicated and centered to run true, then bored through the hub by a single point cutter carried in a

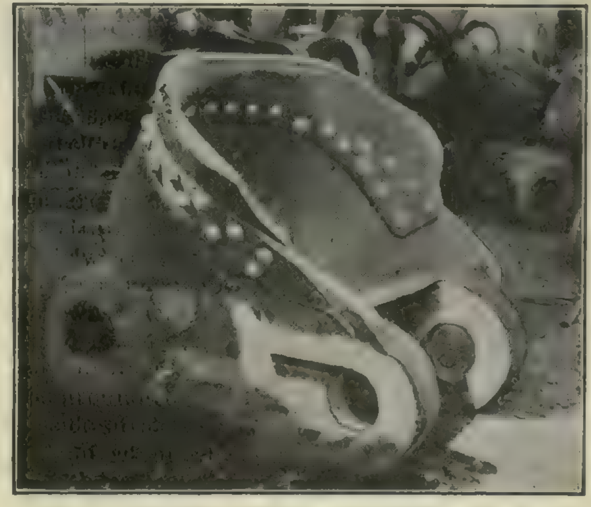


FIG. 3. BUCKET WITH LIP RIVETED IN PLACE

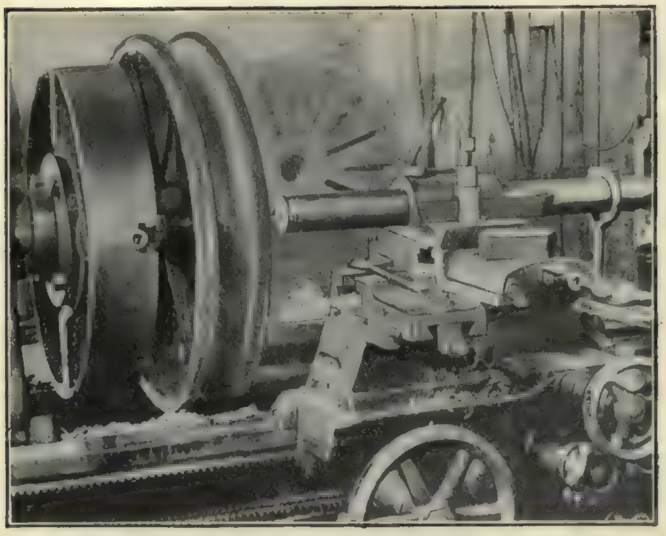


FIG. 4. BORING A SHEAVE

stiff boring bar. This bar is mounted in a heavy block of sufficient width to give a long bearing seat for the bar and the block is so fastened to the top of the lathe cross-slide as to provide for rigidity under the action of the cut. In Fig. 5 a method is illustrated for machining the housing for this sheave wheel. The housing is of cast steel and ordinarily there is about ¼ to ½ in. of metal to be removed across the edge and across the surface around the central bore. The area between these two finished surfaces is recessed in the casting to reduce the width of metal to be machined.

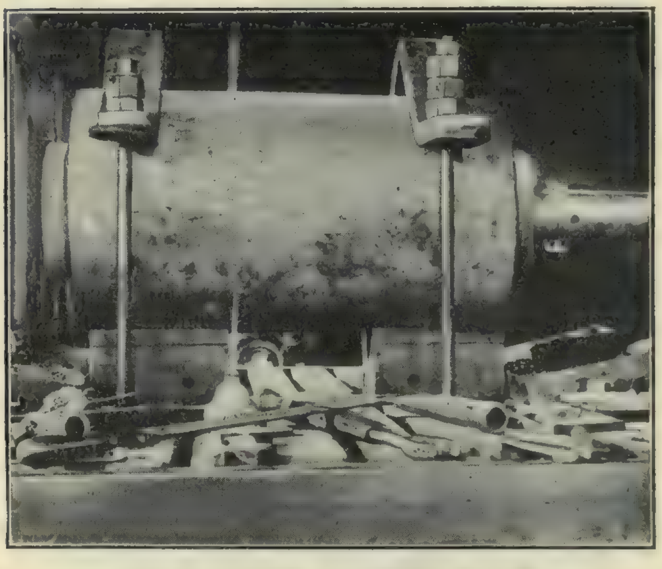


FIG. 6. BORING A LADDER ROLLER

The work is shown set up in a 72-in. vertical boring and turning mill. Faceplate chuck jaws are mounted in the slots of the boring mill table and grip the housing by its outer edge. Holding down straps are applied at three or four points around the edge, where they are so positioned as to be clear of the cutting tool during the rotation of the work. High-speed steel tools are used for the operation which is accomplished at about 70 ft. surface speed per minute.

The photograph reproduced in Fig. 6 represents a ladder roller being bored out to fit on its shaft. These rollers are steel castings 18 in. in diameter by 2 ft. 11 in. long overall. Other sizes of rollers are made for different dredges. The rollers take the weight of the buckets as they pass up into the dredge and thus act as idlers for supporting them. Owing to their heavy duty they have to be mounted on their shafts under high pressures. In the case of the roller illustrated the hole for the shaft is 5¼ in. in diameter and the length bored out at each end of the roller is 8 in. Between these bearing surfaces the rollers are cored out inside to clear the shaft. The total length of the shaft is a little over 5 ft. and the pressure under which shaft and roller are put together is approximately 100 tons. The illustration shows one of the rollers in position in a horizontal boring machine, where it is secured in two V-blocks on the table by heavy V-straps passed over the top and drawn down by through bolts slipped into the T-slots in the table. The boring cutter is a high-speed tool of the flat type, fitted in a crosswise slot in the boring bar.

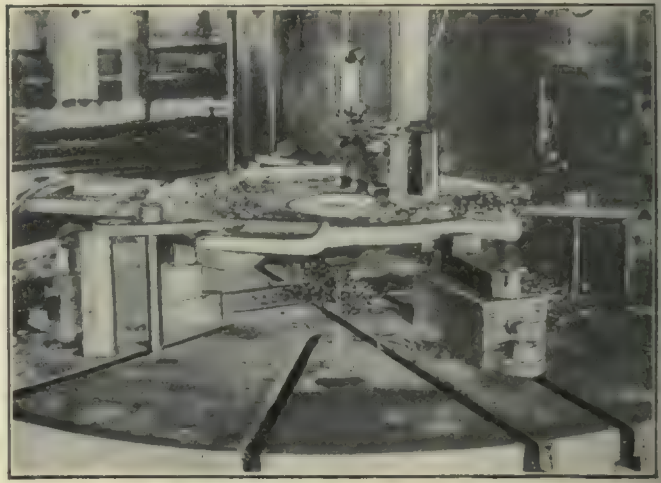


FIG. 5. MACHINING A SHEAVE HOUSING

Another class of work attended to at the shop is the repair of big driving pulleys such as the one shown in Fig. 7. This is a split pulley 14 ft. diameter, 36 in. face and 8 in. bore, and is used on the main drive of the dredge, the drive being geared down to the bucket train and other operating parts. The pulley is driven by a 32-in. belt, the span of the belt or the distance between pulley centers being about 40 ft. The drive is from a 350-hp. electric motor and the speed of operation is about 800 revolutions per minute.

The pulley is built up in the manner indicated, with arms of heavy flat section riveted to the rim of the wheel. The repair illustrated consists in putting reinforcing plates around the hub to extend for some considerable distance outwardly along the pulley arms.

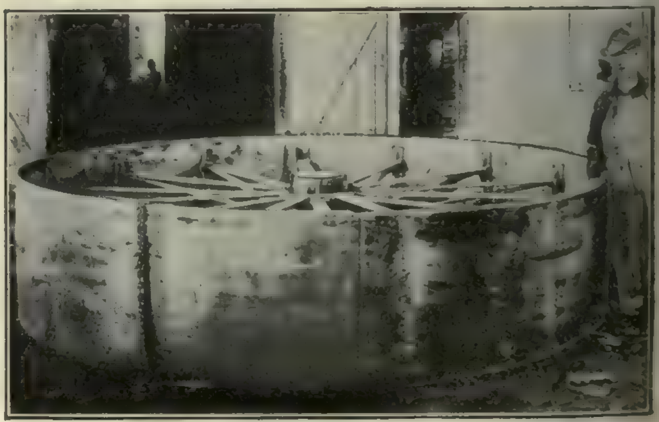


FIG. 7. REPAIRING A 14-FT. PULLEY

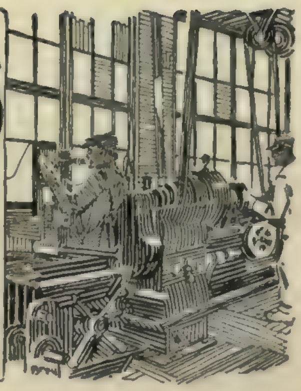
MODERN PRODUCTION METHODS

By

W R. Basset

of

Miller, Franklin, Basset & Co.



XXV. Special Cases of Time Study and Rate Setting

Sample Time Studies on Engine Lathe, Surface and Chucking Grinding Machines and Semi-Automatic Turret Lathe—Five Steps in Setting Rates

IT IS OBVIOUSLY impossible to describe the procedure for taking time studies on every job that can conceivably be done in a machine shop. The best that we can do is to present certain typical problems and show how they were solved. Then the individual machine shop executive must try to choose time study men who are ingenious enough to work out a solution for each puzzling problem. In the preceding articles I have outlined the fundamental methods of time study, the setting of standards and rate setting. It seems well in this article to touch upon some of the special considerations which apply to making time studies in various typical machine shop departments, which will indicate how the problems are attacked. All of the studies cited in this article are actual ones and are chosen because they present typical conditions.

A LATHE DEPARTMENT PROBLEM

Where the peculiarities of the stock introduce a variable for the same operation, several studies may be needed before the correct rate can be set. A case in point was the "cut off and recenter" operation on shafts in a certain automobile shop. Most of these shafts turned out in two operations, one turning on each end. It was most economical to have the blank somewhat in excess of the length of the finished shaft with the result that the operator took the finished shaft out at slightly varying distances from the ends of the blank. The excess stock must be removed in the operation "cut off and recenter." The amount of stock to be cut off on an end will vary, and whether or not the shaft must be recentered will depend upon the amount of stock removed, which in turn determines the time required and whether the performance "recenter" must be made. Obviously, we could not determine with any certainty what the standard time should be without knowing the average amount of stock to be removed and the average percentage of recentering to be done, for without knowledge of the average condition we could not say with certainty that any given study or group of studies would be representative.

To get a basis to work on, the man who inspected the finished shafts after turning was required to record the length of stock to be removed from each shaft, whether recentering was required, and the diameter of the dead stock. From this record, after a sufficient number of observations had been accumulated, it was found that the average length of dead stock was 0.0127 in. at a diameter of ⅝ in. and that recentering was required on forty-three out of every 100 shaft ends. With this information, the standards for all shafts could be built up by determining the standard time for a single cut, the amount of stock removed by this standard cut, and hence, the number of standard cuts to be allowed per shaft; adding to this 43 per cent of the standard time developed for recentering; and then fitting in the easily supplied standards on the other performances, such as "mount" and "dismount part."

A SURFACE GRINDING MACHINE PROBLEM

In one shop gears, collars and the like were ground to specification on the surface grinder. Regardless of the size of the parts themselves, the amount of stock to be removed in the grinder does not vary a great deal, since the limits of machining on the different parts are very nearly the same before the parts come to the grinder. The parts are mounted for grinding upon a magnetic chuck. Regardless of the size of the parts, the total surface ground at each grinding tends to be about constant, even though one time there may be several small parts and at another only a few larger ones. Therefore, the grinding time for any one part gives a guide to the grinding time on other parts. If, however, it appears from observation that the variation in actual grinding time between parts is enough to take account of, it will be necessary to take studies on each group of similar parts.

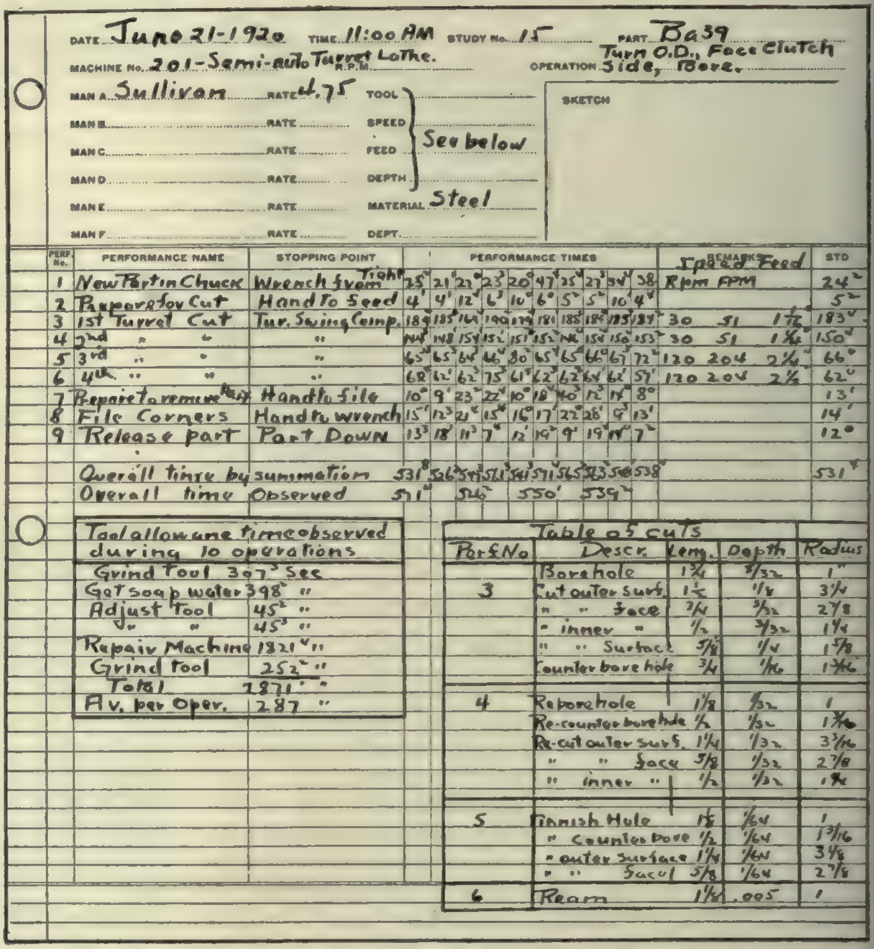
Since the parts are put on the chuck in varying quantities, a complication exists, for although the proper grinding time to allow may have been determined, we do not know how to proportion the amount to individual parts because we have no information of the number of parts that may be ground at once.

Roughly, we know that this will be a function of the size of the parts as compared with the size of chuck, and of the surface exposed to the power available. With this information, a table might be prepared showing the number of parts of each kind which could be mounted at once on the chuck. But study shows that there is another factor.

Most parts must be surfaced by the grinders on both sides. At first glance it might seem that a lot of collars ½ in. thick with a maximum variation of 0.010 in. could all be placed on the chuck up to its capacity, and the grinding then begun with the wheel hitting upon the highest part only until it was reduced to the thickness of the next part. Then the grinding would proceed on two parts until the thickness of the third part was reached and so on until the high part had been reduced by half the amount of the total variation and then the parts could be turned over and treated similarly on the opposite side.

A little further thought shows that the result would be to grind those parts whose variation was less than half of the maximum on one side only, whereas it is required that all parts be ground on both sides. If the grinding, as above, were continued to three-fourths of the maximum variation from the first side, those parts whose variation was less than one-fourth would be ground on one side only. And so on. It is therefore the practice, before putting the parts on the chuck, to measure and group them in accordance with the amount of variation and run in one group only those parts with approximately the same amount of stock to be removed. The same thing holds true for many parts that are ground on surface grinders.

The situation is similar to that with the "cut off" and "recenter" operation on shafts. The basis of times here must be a single grinding, and we must determine the average number of parts going into a grinding. Accordingly we accumulate data upon this point by having the operator record the number of parts of each lot at a run. The averages obtained from this data are corrected in accordance with considerations of size of parts in connection with size of chuck, and surface of parts in connection with available power, to obtain a proper average run of each part.



DATE June 21-1920 TIME 11:00 AM STUDY No. 15 PART Ba39

MACHINE No. 201-Semi-auto Turret Lathe. R.P.M. OPERATION Turn O.D., Face Clutch Side, Bore.

MAN A Sullivan RATE .75 TOOL

MAN B RATE SPEED

MAN C RATE FEED See below

MAN D RATE DEPTH

MAN E RATE MATERIAL Steel

MAN F RATE DEPT.

SKETCH

PERF. No.	PERFORMANCE NAME	STOPPING POINT	PERFORMANCE TIMES										REMARKS Speed Feed	STD
1	New Part in Chuck	Wrench from Tight	25^4	21^1	21^0	23^3	20^9	47^4	25^4	27^3	34^4	38	Rpm FPM	24^2
2	Prepare for Cut	Hand to Feed	4^1	4^1	12^4	6^3	10^4	6^0	5^2	5^2	10	4^4		5^2
3	1st Turret Cut	Tur. Swing Comp.	189	185	164	190	179	181	188	184	185	184	30 51 1 1/16	183^4
4	2nd " "	"	144	148	154	152	151	152	146	154	150	153	30 51 1 1/4	150^4
5	3rd " "	"	65	65	64	66	80	65	65	66	67	72	120 204 2 1/4	66^0
6	4th " "	"	68	62	62	75	61	62	62	64	62	57	120 204 2 1/2	62^0
7	Prepare to remove Key	Hand to file	10^0	9^1	23^2	22^4	10^0	18^4	40^3	12^3	14^0	8^0		13^1
8	File Corners	Hand to wrench	15^1	12^3	21^4	15^4	16^0	17^1	22^0	26^1	9^3	13^1		14^1
9	Release part	Part Down	13^3	18^1	11^3	7^4	12^1	19^2	9^1	19^4	14^0	7^2		12^0
	Overall time by summation		531^8	526	[illegible]	561	561	571	565	573	548	538		531^4
	Overall time Observed		571^4		546^2		550^1		539^2					

Tool allowance time observed during 10 operations	
Grind Tool	307^3 Sec
Get soap water	398^2 "
Adjust Tool	45^2 "
" "	45^3 "
Repair Machine	1821^4 "
Grind tool	252^2 "
Total	2871^1 "
Av. per Oper.	287 "

Table of cuts

Perf No.	Descr.	Len.	Depth	Radius
3	Bore hole	1 1/4	3/32	1"
	Cut outer surf.	1 1/2	1/8	3 1/4
	" " face	3/4	3/32	2 7/8
	" inner "	1/2	3/32	1 1/4
	" " Surface	5/8	1/4	1 5/8
	Counter bore hole	3/4	1/16	1 3/16
4	Rebore hole	1 1/8	1/32	1
	Re-counter bore hole	1/2	1/32	1 3/16
	Re-cut outer surf.	1 1/4	1/32	3 3/16
	" " face	5/8	1/32	2 7/8
	" inner "	1/2	1/32	1 3/4
5	Finish Hole	1 1/8	1/64	1
	" Counter bore	1/2	1/64	1 3/16
	" outer surface	1 1/4	1/64	3 1/8
	" " face	5/8	1/64	2 7/8
6	Ream	1 1/8	.005	1

FIG. 115. TIME STUDY RECORD OF CLUTCH IN TURRET LATHE

Having secured this data we are next confronted with the fact that the most of our performances will be the disposition of our known average number of parts, and therefore we cannot make a single part the basis of any of the studies. The procedure will be to give one performance time column on the time analysis form to each lot and compile a "post-mortem" analysis from the detailed observations on a series of lots, obtained by continuous time observation.

The method of attacking time studies on chucking grinders differs from that used on surface grinders. Take for instance the operation "grind hole" on a gear. The gears are placed in the chuck one at a time and the hole ground to fit a standard gage. The grinding is cooled with soap water, therefore the expansion of the part with the heat of grinding is not a factor, and the only concern is the amount of stock to be removed, which, within the limits imposed upon the preceding boring operation does not vary enough to prevent a series of ten observations from being representative. We therefore proceed with the study in the same way that we would with a milling operation—by the part, rather than by the lot as we decided to do on the surface grinder. We can divide the operation up into performances, and readily obtain the standards, on such performances as "mounting" and "removing" by the methods already discussed. The number of performances, however, will include a varying number of "grinds" and "measures"; and these grinds will not be interchangeable, since the more the operator removes on the first grind the less there will be left for the second, and so on. It is necessary to determine in addition to the standard grinding time the standard number of "grinds" and of "measures."

This is done by continuous time observation, recording the time for each grind in its proper progressive order and never as some other grind if it actually was, say, fifth in order. We will then be able to compute the total grinding time in each operation which will run fairly uniform. We can tabulate the number of grinds for each operation of the ten observed, and fix upon a standard number of grinds.

In accordance with the average of our observations for each successive grind, we can apportion the total grinding time standard which we have set between first grind, second grind, third grind, etc. The number of grinds will give a key to the number of times which the gage should be fitted, and having standardized a measuring time we can supply one standard measuring time for each grind we have allowed. In this way we build up the total standard for the operation.

It is well also to record in the study the time spent in dressing the grinding wheel to give a key to the tool allowance.

Very small parts are commonly held in the hand instead of being chucked for grinding. The time for picking up a group of parts in the left hand will have to be introduced into the standard through an average.

In Fig. 115 is shown the operation "turn O.D. face clutch side, bore," on part BA-37. It is a typical time study on operations of this class. The point of interest is the manner in which the cuts for several sides of the turret are isolated, and the table of cuts, which shows the detail of the cutting on each side. Note also the classified lost time below.

In the table of cuts the full detail of the set-up can be studied and the limiting cut picked out in each case. If the limiting cut is markedly below the other cuts, investigation can be made to determine if the cutting time can be reduced by transferring that particular tool to some other cut. The shapes into which all cutting tools are ground should be noted, sketched and studied in connection with the speed.

On some machines, it is necessary also to make continuous time studies of the hand feed-up time, and to set standards on that independently of the machine performance.

Since two or more of these machines are usually operated by one man, there is recurring lost time due to one machine running out while the other is being fed up. This lost time is perhaps best studied by an extended observation on time lost per hour from this cause, to arrive at a fair average. An average will have to be used because it is impossible to predict what parts will be worked on simultaneously and the lost time will of course vary with the varying relative time of the two operations in progress.

In setting rates, the following method will be found most satisfactory:

> (1) Determine how many machines the operator should normally be expected to attend.
>
> (2) Divide the basic rate per hour by this number; divide the operator's hourly rate by this number.
>
> (3) In setting the rates, use in connection with the task per hour, instead of the whole basic rate, that portion of it which has, in (2) been assigned to each machine.
>
> (4) Pay the operator at the piece rates for parts produced on each machine, up to the prescribed number of machines, and if any of the machines stand idle pay the operator the assigned fractions of his hourly rate for the idle machines concurrently with his piece rate earnings on the active machines.
>
> (5) If the operator has occasion to use more machines than the standard number, pay him at the piece rate separately on each machine used. If the standard number of machines has been properly selected, the operator cannot concurrently run more than the standard number and still keep up his production on the standard number without great extra effort for which the piece rate on the extra machines will be no more than proper compensation.

If this method be followed out, the operator will always have an incentive to keep production at a maximum, and to work as many machines as he can, economically.

An example will perhaps make the above plan clearer. Let us assume that three machines per operator is decided to be the arrangement which will give best results. (The lost time per machine in combinations of 2's, 3's, etc., will give an indication of what the standard number should be.) The operator is paid 45 cents per hour for day work, and to his reasonable piece work earnings has been assigned the basic rate of 60 cents per hour. Since he cares for three machines he may be supposed to earn 15 cents per hour from each of the three to give the total flat rate of 45 cents per hour. Since his total piece rate earning is 60 cents per hour, 20 cents per hour is the basic rate for each machine. Suppose now that the "task per hour" in parts produced by one machine, was found to be 50. At $\frac{4}{10}$ of a cent for each part, he is able to earn the basic rate of 20 cents on one machine if he produces 50 parts in an hour. Assume that he uses the one machine only and lets the other two stand idle. He would be paid for the hour's work, 20 cents on one machine and 15 cents on the other two, or 50 cents instead of 45 cents. In point of fact he would make something over 50 cents through saving of the lost time allowances; but not as much as he could earn by operating two machines at once. Nor could he earn as much on two machines as he could on three, the full standard number.

KEEPING UP PRODUCTION

This is the incentive for keeping production up. If it became expedient to work four machines, or one above the standard number, there would be the possibility of a maximum 80 cents an hour; and yet this would only be approached, with the standard number of machines properly set, if he used enough extra exertion to offset the increased lost time which would not be allowed for, and to give the regular machines the proper attention to keep their production up to standard.

Sometimes it is necessary to make the time study cycle cover two parts instead of one, as for instance when certain holes are bored with the part in a jig, and certain others with the part mounted on bars run through housings and strapped to the table. The first part may have the jig holes bored first, and then will be removed from the jig and mounted on the housings for drilling. The next part will be drilled on the housings first, since they are already in position, and then put into the jig as the second stage of the operation. The third part will begin in the jig. Obviously, the proper method of study will be to make an artificial operation out of the machining on two successive parts, to give a complete cycle.

Admittedly, these few special considerations and problems of time study do not exhaust the subject. They merely indicate the scope and methods of approach. The next article will discuss in some detail the methods of time study and rate setting needed on automatic machines, a subject to which much thought has not been given.

Some Examples of Fixtures Used on Profiling Machines

With Suitable Fixtures, the Machines May Be Used for Many Different Operations—Two or More Operations May Be Performed At One Setting

By J. M. HENRY

ON PAGE 256 of the *American Machinist*, Messrs. Dowd and Curtis very ably and entertainingly discuss the general construction of profiling machines and fixtures, with many practical suggestions as to their adaptation and use in manufacturing operations.

It is the present writer's belief that the above mentioned suggestions may be acceptably supplemented by a few "live" examples of profiling work together with illustrations showing the fixtures used and the manner of using them. To that end I have made a series of photographs of fixtures designed by the Pratt & Whitney Co. for attachment to its profiling machines.

The Scott & Williams Co., Laconia, N. H., manufacture knitting machines, and in this class of machinery, perhaps to a greater extent than in most other classes, there are used many "cams" and "fingers" of irregular shape that would be difficult if not impossible to produce by other means. In Fig. 1 may be seen a few of the parts of such machines manufactured by this company and from the picture a general idea may be gained of the nature of the work.

In some of the parts shown the entire contour is finished at one setting, thus necessitating a fixture in which the clamping devices may be loosened, reset and tightened progressively as the operation proceeds.

One of the simplest of such fixtures is shown in Fig. 2, which is designed to hold the part *A* in Fig. 1. In this case but one clamp is used at a time and the machine must be stopped while the clamps are changed. The work is located upon the block by studs or dowels, and a clamp, having its holding end machined to conform to the shape of the piece, holds it down by direct pressure. After finishing a little more than one-half of the contour, the clamp is loosened and moved out of the way while the other one is brought forward and tightened upon the work to hold it for the remainder of the operation.

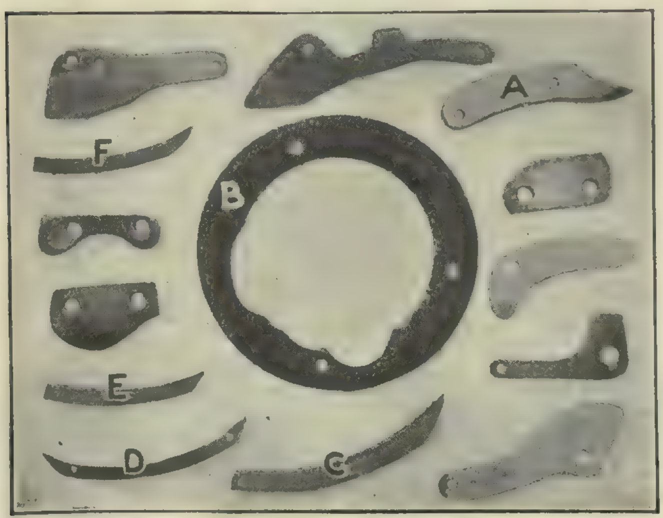


FIG. 1. KNITTING MACHINE PARTS TO BE FINISHED BY PROFILING

An internal milling operation is shown in Fig. 3 where a portion of the contour of the cam ring *B*, Fig. 1, is to be milled. In this case a single yoke-strap is used that spans the work and holds it by direct pressure. Dowels in the boss which supports the work locate the latter in correct position and prevent lateral movement.

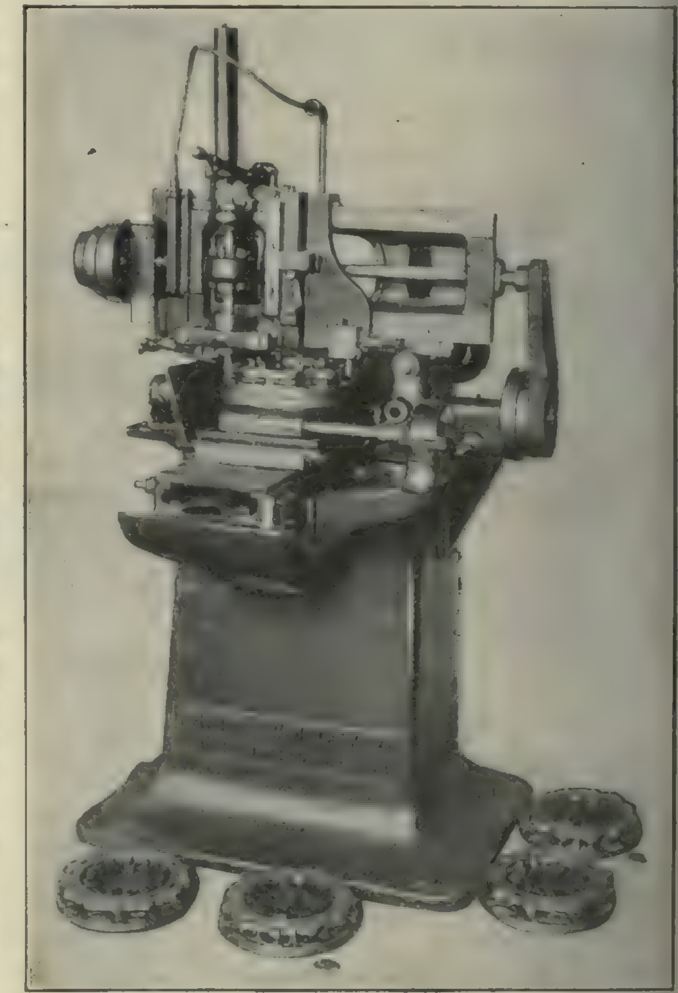


FIG. 4. MACHINE FOR CONTINUOUS MILLING UPON ROTATING TABLE

In Figs. 4 and 5 may be seen a device for continuous milling. A rotating table is driven through spur and worm gearing from the three-step cone pulley keyed to an extension of the main drive shaft of the machine; the three steps providing for varying speeds of the table to accommodate different pieces, some of which may require more time to set than others, or to make allowance for different operators who may possess varying degrees of dexterity in manipulating the work.

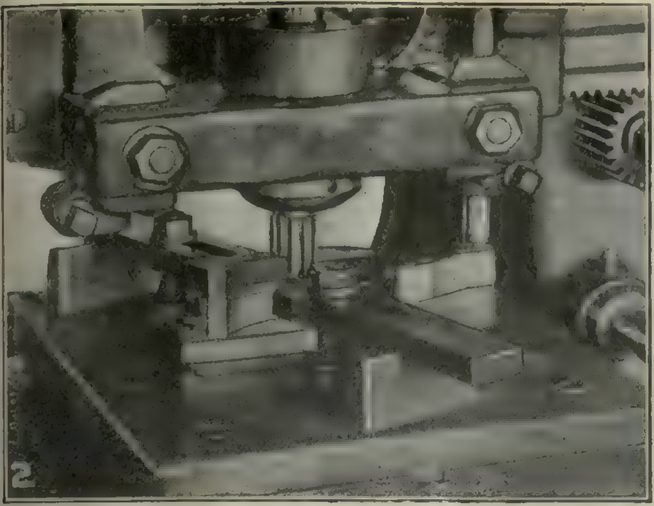
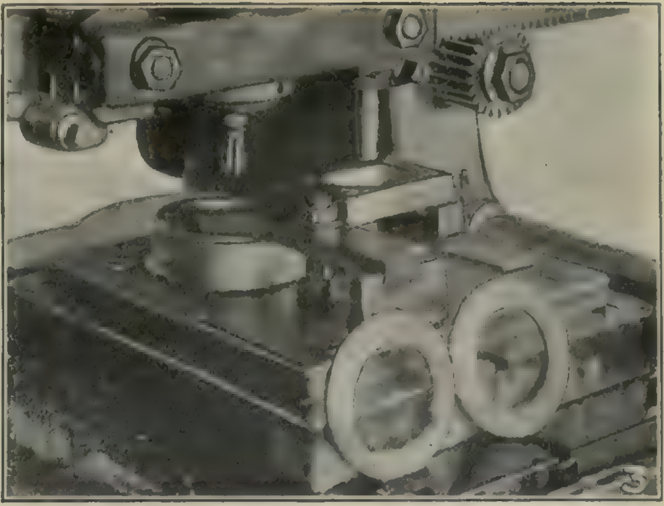
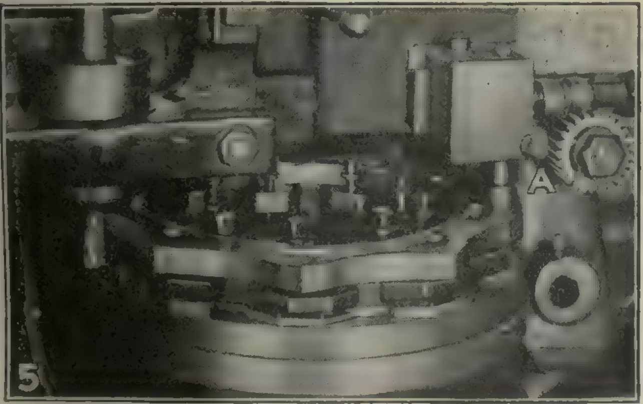



FIG. 2. HOLDING A PIECE PROGRESSIVELY FOR MILLING THE ENTIRE CONTOUR. FIG. 3. YOKE STRAP FOR HOLDING A PIECE WHILE MILLING INTERNAL CONTOUR

The baseplate of each fixture fastens to the table with suitable screws and dowels, so that it is but the work of a few moments to change from one job to another. The clamps and master plate for each fixture are permanently a part of it, so that no resetting is required when the change is made.



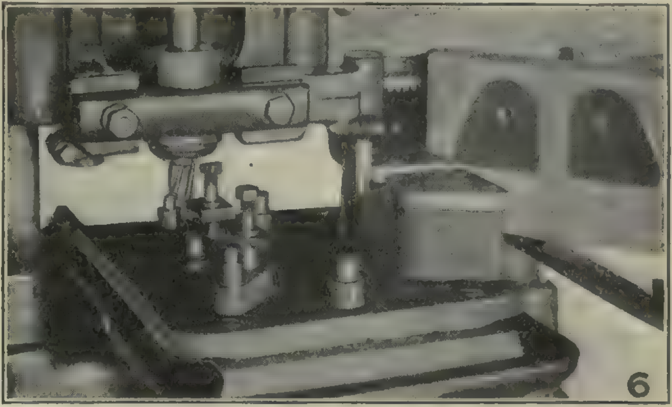


FIG. 5. A CLOSER VIEW OF THE CONTINUANCE MILLING FIXTURE. FIG. 6. PROFILING TWO PIECES AT ONE SETTING

In this device the master plate is directly above the work and revolves with it instead of being mounted upon a second table as in many forms of cam cutting machines. The guide pin, at *A* in Fig. 5, is so located that it bears upon the master plate at a point opposite to the cutter and is adjustably mounted so that small adjustments of position may be made in setting up or as the work proceeds. A micrometer screw to the right enables the operator to change the position of the pin a definite amount. Similar fixtures may be seen on the floor at the base of the machine in Fig. 4.

A reciprocating fixture is shown in Fig. 6 upon which

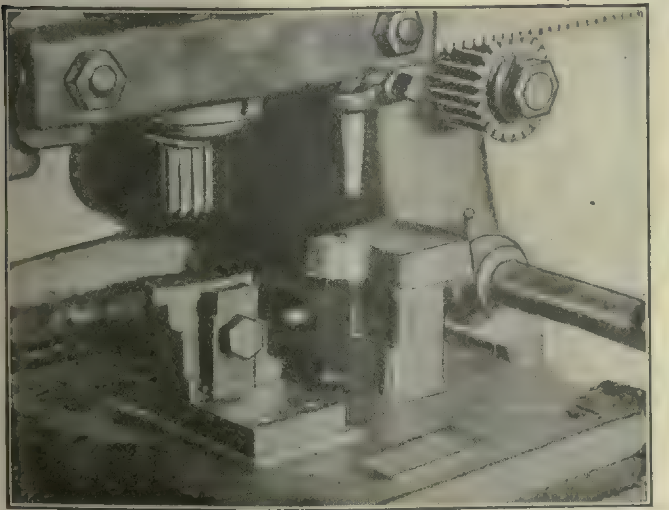
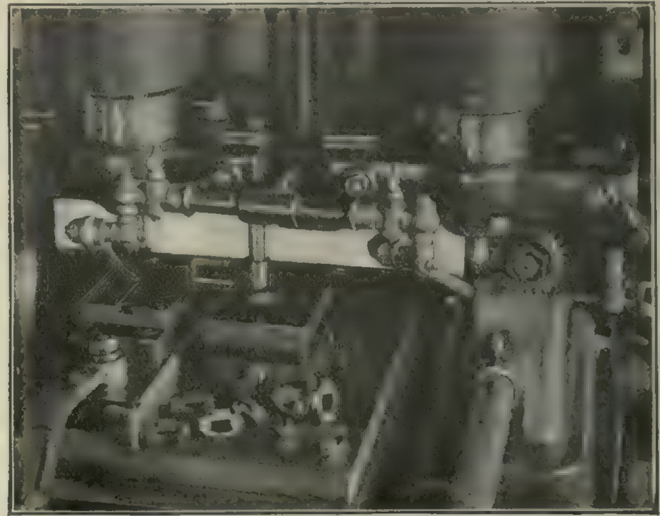



FIG. 7. A SIMPLE HOLDING DEVICE. FIG. 9. THE FIXTURE ON THE DOUBLE-SPINDLE MACHINE

work on two different pieces is carried forward at the same time. Two master plates are provided and but one guide pin and cutter are used. The pieces are right- and left-hand and slightly different in contour. Both are finished complete at one setting; thus one machine and fixture is made to serve where two would ordinarily be required.

Fig. 7 shows a simple form of clamp for holding the "cam" *C*, Fig. 1, for milling the end only. This is probably about the simplest fixture that could be made for the purpose, the block and clamp being formed to fit the contour of the piece. Parts *D*, *E* and *F* in Fig. 1 are held by similar devices.

The profiling operation has an important application in the manufacture of gun sights and some of the tools used are here considered. Much of this work involves two cuts—one for roughing and one for finishing—and this may be accomplished in either of two ways; a double-spindle machine may be used, moving the entire head over to bring into action a second cutter and guide pin, or, on the single-spindle machine, the tapered guide pin may be raised a definite amount and the slide lowered to correspond, thus allowing the same cutter to come a trifle nearer the work.

The double-spindle machine in Fig. 8 is equipped with a holding fixture, similar to a drill press vise, in which the work is clamped between a fixed and a movable jaw by a single movement of a cam lever, thus reducing the time of unloading and reloading to a minimum. False jaws to this vise provide for holding a variety of work.

It will be noted in this fixture that the master plate is not permanently located on the base, but is doweled to a block that is susceptible to movement in any direction by means of opposed screws and setscrews passing through and bearing against a projection which depends within a rectangular recess in the supporting boss. By this means the toolmaker has an easy method of securing correct relationship between the master and the work in the initial set-up. By taking a cut and checking up the work he may know the extent and direction of the error and may adjust the adapter accordingly. When the correct position is finally determined the master plate is permanently located by dowels. Fig. 9 shows this fixture in greater detail, together with some of the parts to which it is adapted.

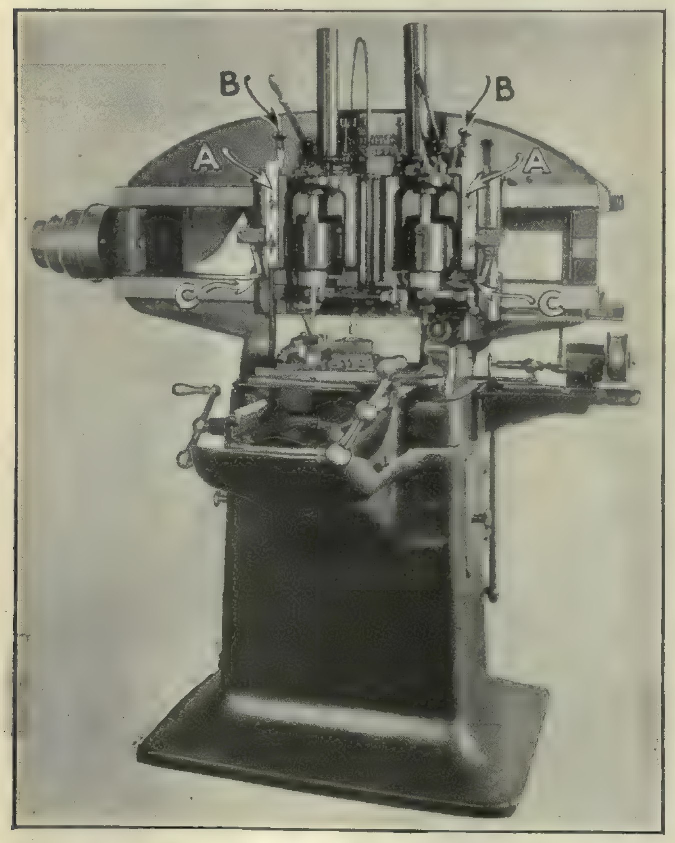


FIG. 8. DOUBLE-SPINDLE MACHINE WITH FIXTURE FOR MORE THAN ONE OPERATION

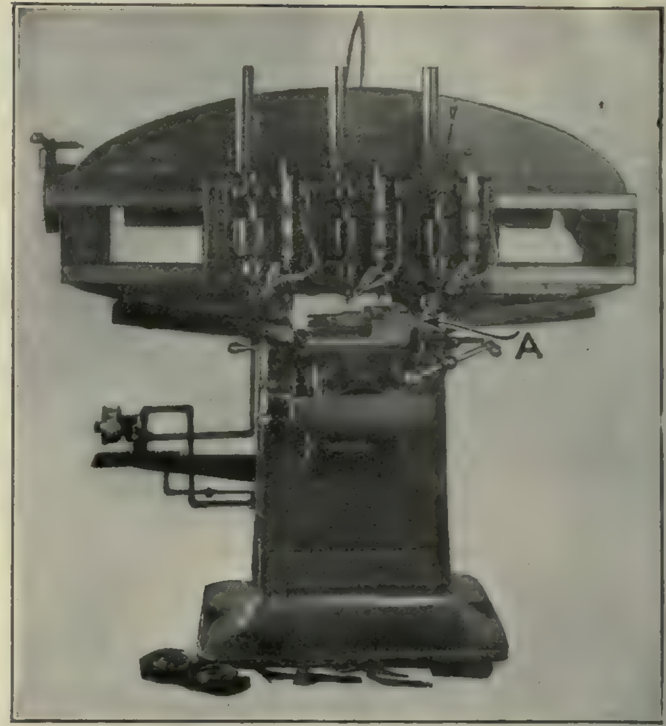


FIG. 10. PERFORMING TWO OR MORE OPERATIONS AT ONE SETTING

Upon accurate work, in which class all gun sight work may be safely included, close vertical adjustment of the profiling machine is a vital necessity because of the fact that the guide pin, and in many cases the cutter, is tapered and any variation of height immediately affects the sizes of the product.

To secure this accuracy the two stop plates *A-A*, Fig. 8, are so attached to their respective slides that by loosening the clamping screws they may be moved up or down a definite amount, the movement being gaged by means of a micrometer screw *B* in the upper end of each. A notch in the side of each stop plate engages an index pin controlled by the handles *C* and held in engagement by means of a coil spring.

By moving the respective handle to one side the index pin is withdrawn and the slide raised out of the way. When again bringing it into action it is lowered by means of its operating lever until the index pin snaps into place, assuring the operator that the position of the slide is correct.

Figs. 10 and 11 show, comprehensively and in detail, a multiple spindle machine that is set up for performing several operations at one setting and upon the same class of work—gun sights. The work is held, as in the previously described fixture, by a quick acting vise somewhat differently located.

To this fixture there are two, and may be more, master plates, doweled to a slide capable of transverse movement with respect to the base of the fixture. Its

position is determined by means of a locking bar rigidly attached to its under side, in which bar there are two or more locating notches to engage a spring controlled index pin that may be withdrawn by means of the handle *A*.

The cutters are of different shapes, and are set to different depths to perform operations of contour milling, recessing, internal grooving, etc. As each is provided with its own guide pin and master plate they are virtually independent one from another. The operator has only to see that the proper master plate is used in conjunction with its respective part.

An ingenious device for directing the flow of oil to the cutter is used in connection with this job. It consists of a metal spout (one for each cutter) a part of which is made in the form of a sphere and held between two clamping plates that are recessed to correspond. The device thus forms a ball and socket joint which can be instantly turned in any direction within its range and the adjustability of which is supplemented by making the shank of the socket in the form of a slotted yoke that can be clamped in whatever position may be required.

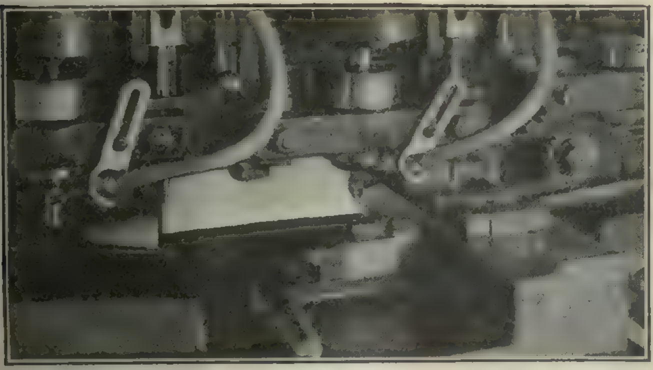


FIG. 11. CLOSER VIEW OF FIXTURE, SHOWING OIL SPOUTS

Notes on Worm-Thread Formulas

BY P. A. FREDERICKS

Most handbooks give formulas and lists of sizes for worm threads with thread dimensions measured on an axial section; that is, in a plane through the lines *AA*, Fig. 1. A few qualify this treatment by the statement, usually in a minor paragraph, that for helix angles of 15 deg. or more the thread parts should be measured at right-angles to the helix; that is, in a plane through the line *BB*. In this case the normal pitch or P_n equals *P* times the cosine of the helix angle, and becomes the basis for determining the size of the threading tool point, measuring wires, etc. Also, the thread angle must be 29 deg. as measured in the plane through *BB*. It is, of course, apparent that if the depth were not changed in accordance with the top and bottom width, then the angle would not remain 29 degrees.

This all becomes very confusing, and is really incorrect, leading to very definite errors. Assume that a 29-deg. worm thread of 1 in. pitch is to be cut on a diameter which gives a helix angle of 8 deg. As this angle is considerably below the 15-deg. limit mentioned in the handbooks, we figure our thread sizes and the size of the measuring wires from the formulas based on *P*, or read them from the tables usually accompanying the formulas.

Consider the three factors, Fig. 2, which will be of most importance in cutting the thread; namely, *W* equals the width of the threading tool at the end, *D* equals the depth and X equals the diameter of the measuring wire. We find, either by formulas or from tables, the following values for the case mentioned:

$W = 0.310$ in. $D = 0.6866$ in. $X = 0.5149$ in.

If we are going to cut the thread in a lathe, we set the threading tool square and go ahead until we get down to the proper depth, which has been given as 0.6866 in. Then we lay the wire in, expecting, of course, that it will come flush with the top of the thread, as in Fig. 3. But does it? It does not. After eliminating everything else, we finally discover that while our threading tool is square with the axis, our wire lies 8 deg. from square; and it dawns upon us that this might be the reason for our trouble. So we figure it out, and after considerable creaking of rusty mathematics find that our 29-deg. angle is only 28 deg. 42 min. where the wire rests. Due to this, our wire will extend 0.0089 in. outside of the top of the thread, instead of flush as we had expected, see Fig. 4.

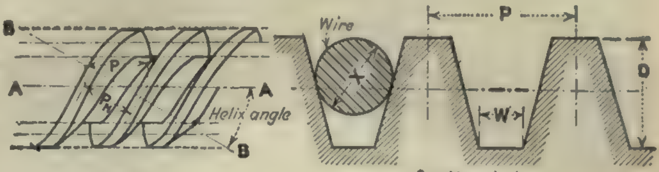


FIG.1

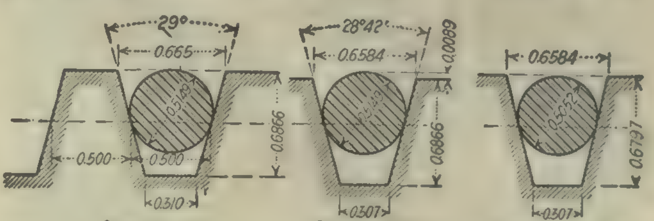
Section A-A

FIG.2

FIG. 1. WORM THREAD ELEMENTS. FIG. 2. AXIAL SECTION OF THREAD

Considering the case a trifle further, we conclude that, due to several disturbing factors, the distance 0.0089 in. isn't quite correct either. But our mathematics and our patience both being exhausted, we decide to fit the screw to the nut and let it go at that, disregarding the wire sizes and proceeding on the old method of cutting and trying.

The next time we set up the job we think that we shall profit by our last experience, and we set our threading tool tilted sidewise to the value of the helix angle, regardless of the handbook. This appears to work better; the wire comes flush as it should, and all goes well until we try the screw in the nut, when we find end play. We determine to chase things down; and eventually discover that our threading tool is cutting too wide a space, leaving the remaining thread too thin. By this time our ire is fully aroused, so we sharpen a new pencil and depart to a quiet spot with our handbooks and plenty of paper.



Section A-A
FIG.3

Section B-B
FIG.4

Section B-B
FIG.5

FIG. 3. HANDBOOK DIMENSIONS OF THREAD. FIG. 4. ACTUAL CONDITIONS OBTAINED. FIG. 5. PROPER DIMENSIONS OF THREAD

We decide to see what happens if we disregard the 15-deg. limit set by the handbooks and figure our thread dimensions normal to the thread, or in the plane previously mentioned through the line *BB*, Fig. 1, using the handbook rules applying to screws with angles of 15 deg. or more. This gives us the result shown in Fig. 5. There is nothing wrong with this layout, and we can cut this thread very nicely with the tool tilted to the side to the amount of the helix angle; but it does not match the handbook data for threads of 8-deg. helix angle, nor does the size of wire match the size given in the handbooks.

The Error in the Handbooks

Now the trouble is, of course, that the helix angle on the thread becomes troublesome at far less than the 15 deg. which the handbooks mention, so that the wire sizes which are so carefully tabulated in the handbooks are wrong for every screw, except one with a zero helix angle. The condition shown in Fig. 3, which shows the way things should come out according to the handbooks, is impossible except for a zero helix angle, giving the equivalent of a circular rack, because the measuring wire is bound to stand at an angle corresponding to the helix angle. This angle, while neglected in the handbook tables up to 15 deg., is sufficient to cause trouble when working on screws with helix angles far smaller.

Although a worm thread has been taken as an illustration, the same objection to handbook data applies to all types of threads. The data are often obsolete relics of the time when screws were mainly confined to fine leads having 2 or 3 deg. helix angle, at most. At that time, the tables were near enough, and probably closer than the work would be made.

Will the makers of quick-pitch hobs, worms and screws not take us into their confidence, and let us know what we would really get if we were to order a worm such as specified in the example just cited? Would it not be a good thing to revise the handbooks in conformity with their standards, or at least to caution the users as to the facts of the case?

Some Operations in Roller Bearing Manufacture

Various Kinds of Grinding Machines and Grinding Operations—Utilizing an Internal Grinding Machine on Outside Work

SPECIAL CORRESPONDENCE

THE manufacture of roller bearings consists for the most part of a series of grinding operations, as can be seen from the accompanying illustrations taken in the plant of the Hart Roller Bearing Co., Orange, N. J. An exception is shown in Fig. 1, where the cages are being machined on a Cleveland automatic preparatory to the grinding operations which follow hardening. This view gives a good idea of the tooling used.

One of the simpler grinding operations is shown in Fig. 2 where comparatively small roller thrust plates are being surfaced on a Blanchard machine. In Fig. 3 some of the rollers, which have previously been turned and bored on automatics, are being ground on a Sanford centerless grinding machine. The rollers are automatically fed into the machine from the magazine at *A* and after passing the grinding wheel drop into the box as shown.

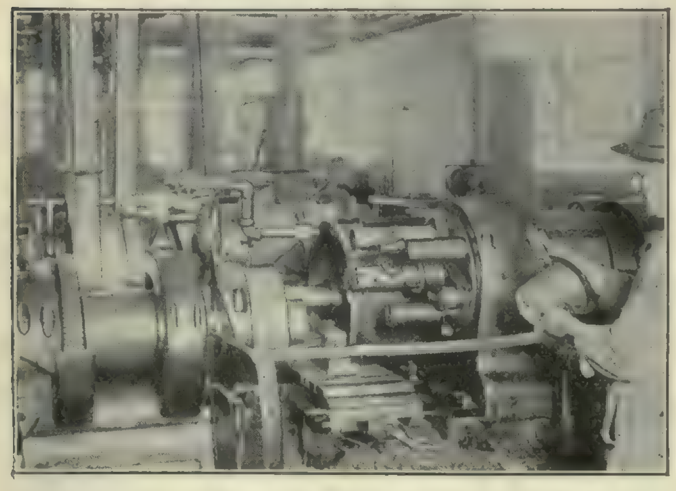


FIG. 1. MACHINING SMALL BEARING CAGES PREPARATORY TO THE GRINDING OPERATION

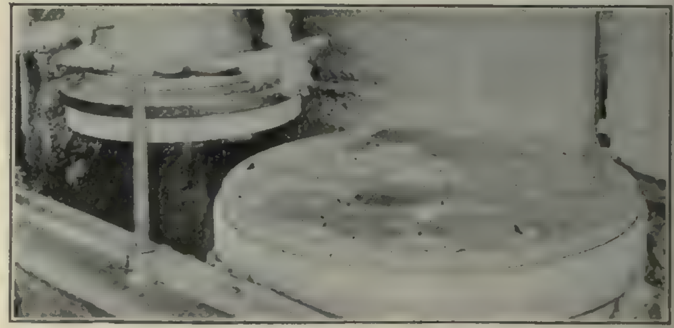


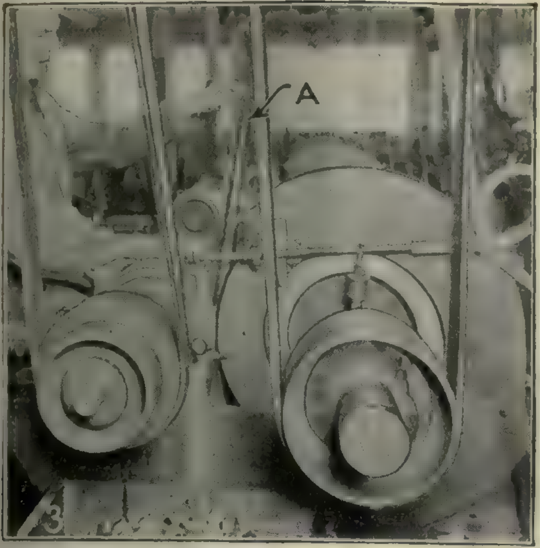
FIG. 2. GRINDING THRUST PLATES (THE WORK HELD ON A MAGNETIC CHUCK)

The internal grinding of some of the smaller races is done on the Bryant chucking grinding machine shown in Fig. 4, a number of finished races being shown on the bench. Figs. 5 and 6 show some considerably larger roller races. The first view shows the grinding of the ends on Blanchard machines while Fig. 6 is an interesting application of a Heald internal grinding machine to outside work. This arrangement is very convenient and enables a large variety of work to be handled without putting in special equipment that would be used only occasionally.

Many Sizes Manufactured

Some idea of the variety of roller bearings manufactured can be had from Figs. 7 and 8. Fig. 7 shows seven sizes of roller races nested together and indicates that micrometers of all sizes are available for their measurement.

A large completed bearing is shown in Fig. 8 together with a number of roller cages of various sizes. This illustration also shows a large Vernier caliper, both Verniers and micrometers being used for insuring accuracy on large-size bearings.



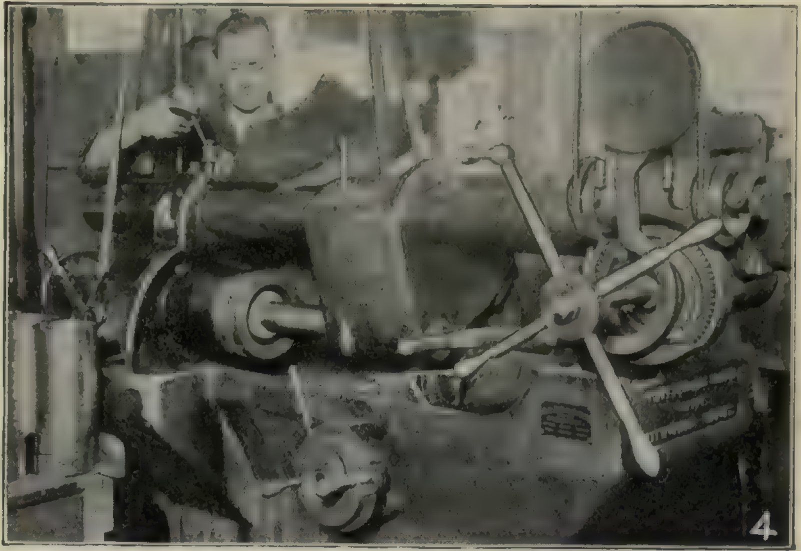
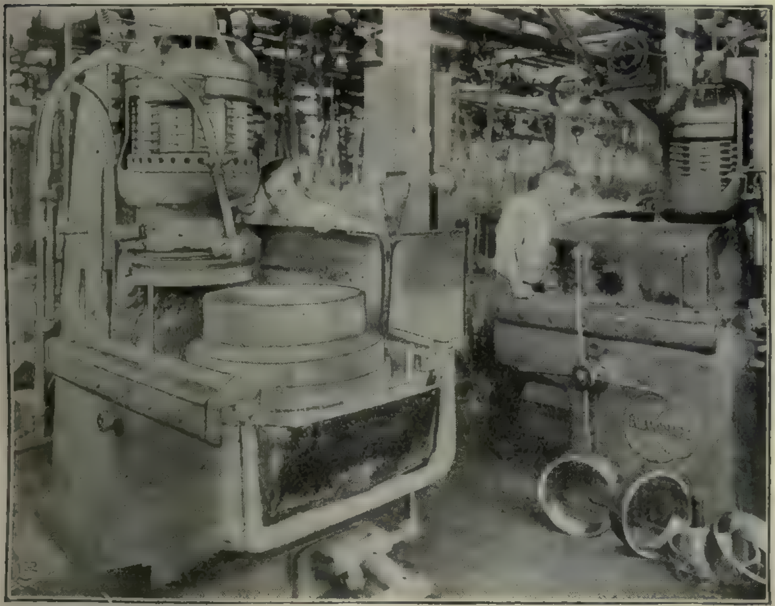


FIG. 3. GRINDING ROLLERS, USING MAGAZINE FEED. FIG. 4. INTERNAL GRINDING OF ROLLER RACES



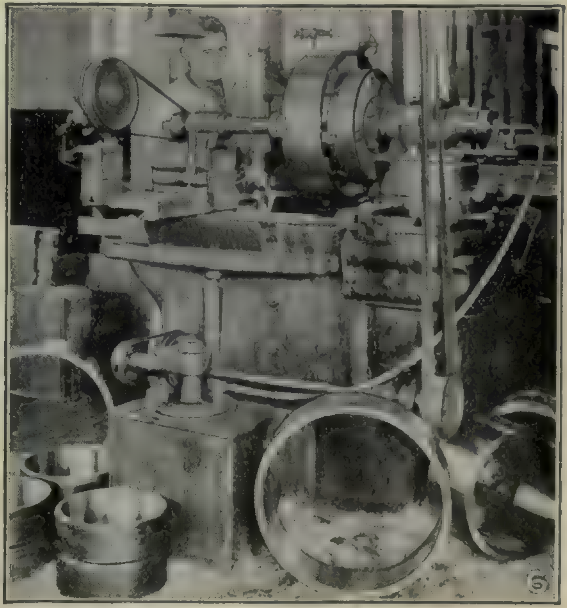
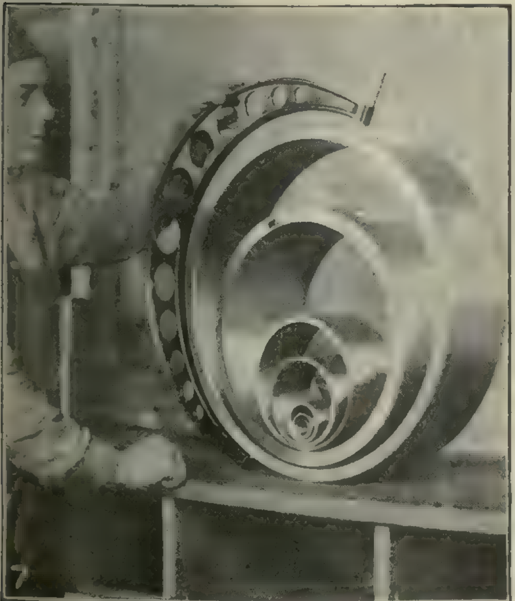


FIG. 5. GRINDING THE ENDS OF LARGE RACES. FIG. 6. UTILIZING AN INTERNAL GRINDING MACHINE



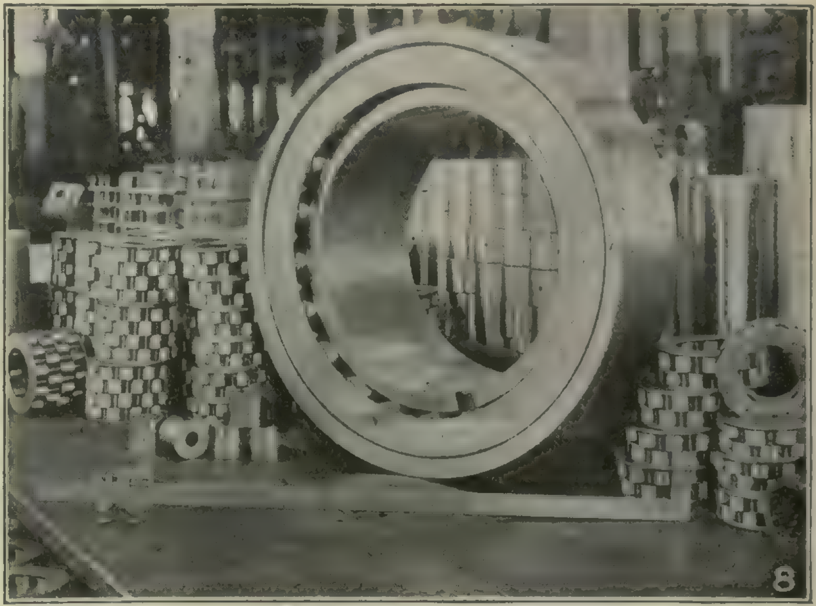


FIG. 7. SEVEN SIZES OF ROLLER RACES. FIG. 8. A LARGE ROLLER BEARING

A Good Example of Push Broaching

The Use of Shorter Broaches Which Are Easy to Make and to Harden—Details of The Broaches and How They Are Cut on a Gear Shaper

SPECIAL CORRESPONDENCE

IT IS PROBABLY safe to say that 90 per cent or more of the broaching done in manufacturing is performed with the "pull" broaching machines and long broaches. These have been developed by persistent effort to a point where broaching has become a standard operation just as has milling and grinding.

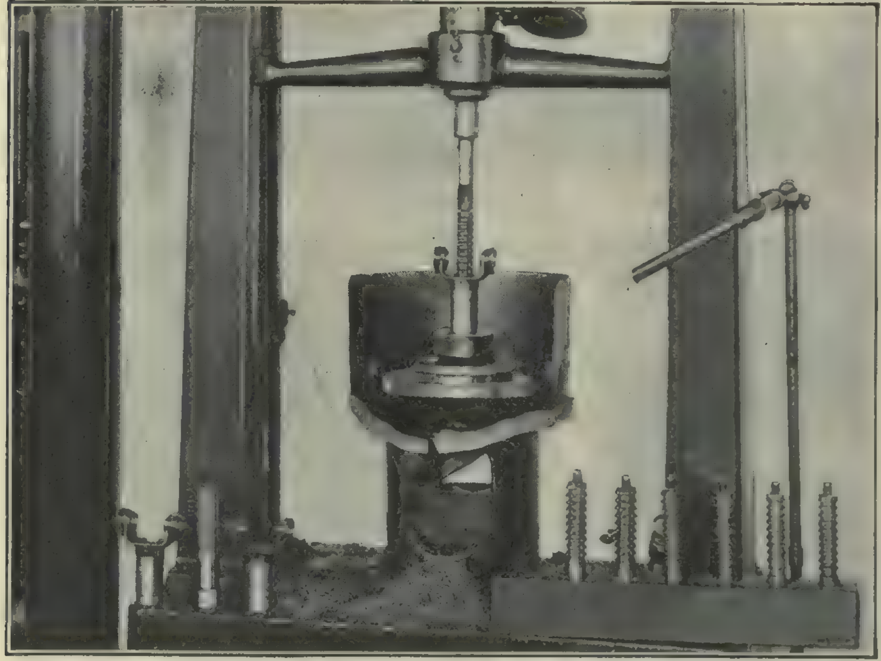


FIG. 1. BROACHING A DRIVE YOKE

But here and there we find shops which have come to believe, that for their work at least, the "push" broach has the best of the argument. Such a shop is that of the Universal Drive Shaft Co., 6200 Carnegie Ave., Cleveland, Ohio. The man responsible for the results obtained is F. W. Peters, one of the firm, and he is securing exceptionally good splined holes 5 inches long in a driving yoke, with only 35 inches of broach, divided among seven short broaches.

The illustration, Fig. 1, shows the broaches and the piece which is broached as well as the members of a coupling. The seven broaches are short, the total length being about 7 in. each. The first tooth of the series of each broach (after the first) is the same size as the preceding broach, so as to insure easy starting.

The broaches are cut on a Fellows gear shaper with special stubbed teeth of a shorter length than usual. The spline, or piece which enters the yoke, is also generated in the same way. This form of spline centers itself so that all the teeth bear evenly, which is not always the case when a straight sided tooth is used. Generating both the broach and the piece which fits the hole makes it possible to secure a remarkably good fit the entire length of the piece.

The short length of the broaches eliminate the difficulty of breaking, as they spring very little, so that it is not at all necessary to either straighten or grind the teeth. This makes it easier for a shop to make its own broaches and makes it possible to experiment with broaching possibilities at a lower cost.

It has been found that the teeth of the first two or three broaches can be given a cut of 0.004 in. per tooth,

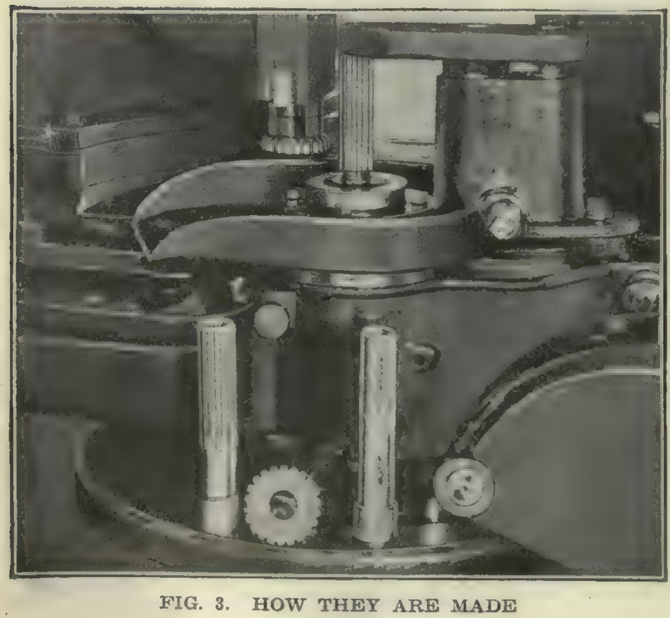


FIG. 3. HOW THEY ARE MADE

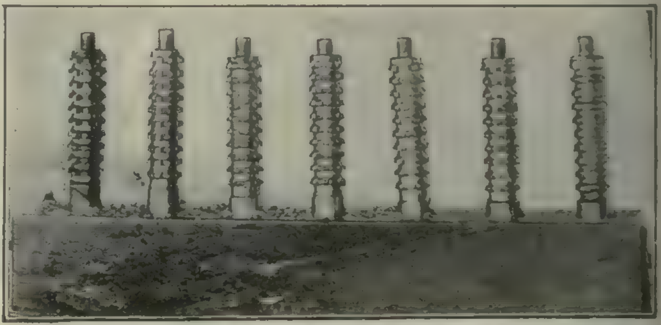
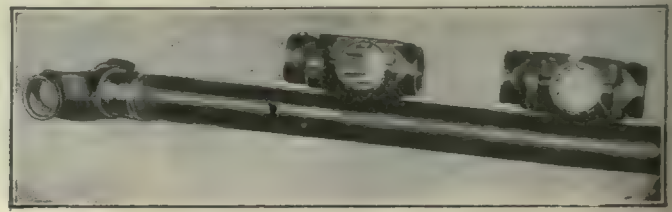


FIG. 2 (ABOVE). THE SET OF SEVEN BROACHES. FIG. 4 (BELOW). THE YOKES WHICH ARE BROACHED



but that the remaining or finishing broaches do a better job if the cut is reduced to 0.003 in. per tooth. The teeth are undercut 10 deg. and have a top or cutting rake of 3 deg. so that they roll a chip off with a clean cut. The spacing also gives ample room for chips.

The machine used is a Lucas power press which has been modified so as to give a faster power movement and a quick return. This enables an operator to finish the hole complete in two minutes, giving him ample time to handle the work and the seven broaches, one after the other. The work is remarkably smooth and uniform. This coupled with the low cost of broaches and equipment, makes it well worth careful consideration.

The broaches are shown more in detail in Fig. 2. It will be noted the lower end is plain where it enters the hole as a guide and that the upper end has a pilot which it fits into the ram of the press. The first broach is on the right and the finishing broach on the left.

Fig. 3 shows how both the broaches and the splined connections are generated. It also shows the special shape of the stub tooth used.

The splined units of the drive shaft are shown in Fig. 4.

Reminiscences of an Old-Time Machinist

By R. Thomas Huntington

In 1867 or '68 a machine shop in Philadelphia that made a specialty of coining presses received from either the Chilean or the Peruvian government an order for a number of such presses to be made from an alloy similar to that of which the howitzers on the U. S. Naval vessels were made. I suppose the officials of that far-away country had seen and admired the shining guns, and the idea of having their new mint equipped with such bright and shiny machinery appealed to them.

At any rate the government aforesaid entered into a contract with the company not only to furnish the presses but to send with the consignment six men capable of assembling the machinery and setting it running. The government undertook to pay these six men five dollars a day each, in gold coin, and bear all expenses from the day they left Philadelphia until they returned.

Though I had no hand in making these presses I was kept informed by a friend who was on the job. There was, of course, no difficulty in pouring the castings, but especial care in finishing the molds and in the pouring was necessary in order to avoid having blow holes or other imperfections that would mar the surfaces and spoil the general appearance of the otherwise highly polished machine.

Even with the utmost precaution such spots would occasionally appear, and in such cases the company adopted the expedient of cutting out a portion of the surface surrounding the bad spot (including, of course, the bad spot itself) and setting in a patch. In order to make certain that the patch would match the metal of the frame in color and appearance, numerous impressions, round, square and rectangular would be made in each mold and poured from the same batch of metal at the same time that the main casting was made; each set of patches so made being kept with the main casting from that mold and used as necessary.

To insert a patch the metal of the frame would be cut out with chisel and hammer to a depth of ¼ in. or more, depending upon the size and location of the patch, with the sides of the cavity carefully squared and the edges sharp. The patches would then be carefully fitted and held in place by countersunk head screws made without slots and with heads long enough to allow the screws to be set up tightly and then cut off flush.

The screws were, of course, of the same material, and when a patch had been properly set, the screw heads cut off, the edges hammered down all around, and the whole surface polished, it would be difficult, even for the man who put it in, to distinguish the patch from the surrounding metal.

Polishing the frames was no easy job. Practically every bit of the surface must be finished by hand with chisel, file and emery cloth, but to "get off the thickest of it" a swing frame was made, not unlike the hand grinding devices of today in principle, but much more cumbersome owing to the necessity for a belt drive. Polishing wheels made with centers of wood covered with leather were fitted to the swing frames, and these clumsy devices saved a great deal of hand work on the broad exposed surfaces but there still remained many corners inaccessible to the wheel and the finishing of a press frame was a tedious and long-lasting job at best.

Eventually the machines were completed and the consignment left Philadelphia with the six highly favored individuals, who were to accompany the shipment, on board the same vessel.

Tipperary is not located on the west coast of South America, so far as I am aware, but the destination of those presses was nevertheless a "long, long way." There was no Panama Canal to shorten the distance, and the long trip around the Horn in a "wind-jammer" was tedious and monotonous. Also there may have been no.Eighteenth Amendment to the Chilean or Peruvian constitution (whichever it was) in force at that time.

THE AFTERMATH WHERE THERE IS NO EIGHTEENTH AMENDMENT

Anyway the morning after the landing found all six of the special envoys in the calaboose, where they remained for several weeks, despite the frantic endeavors of the American Counsul and other interested parties to effect their release.

Though the government of the South American country sought to evade a portion of its contract, it was unable to do so (possibly through fear of the very guns whose brightness first attracted its attention) and in the end was not only obliged to furnish free board and lodging during the period of incarceration, but to pay the men five dollars a day in gold for staying in jail.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Device for Generating an Oval

By R. J. DePuy

We had to make a number of each of the pieces shown in Fig. 1. It was necessary to have the pieces of each kind interchangeable and one was required to be a sliding fit inside the other. We used the apparatus shown in Fig. 2 in preference to the cam method, which would have necessitated a different cam for each piece.

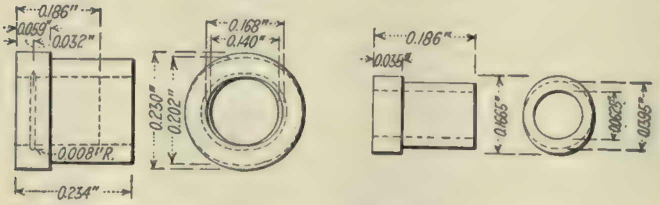


FIG. 1. OVAL PIECES TO BE PRODUCED

Referring to Fig. 2, gear *A* is forced on the body of a small chuck, which is then placed in the spindle of the lathe and the gear held tightly by two bolts through the small faceplate. Gear *B* is keyed to shaft *C*, and meshes with gear *A*, the ratio being 1:2. Shaft *C*, which is of tool steel and hardened, passes through the bracket *D*, the latter being firmly bolted to the wing of of the carriage, and has an eccentricity of 0.014 in. at *E*. A connecting rod *F* between the eccentric and a pin in the angle plate *G*, which is in turn bolted to the cross-slide, transmits a reciprocating movement to the latter. A wire rope is fastened to the under side of the cross-slide and passes over a roller to a suitable weight, to keep an even tension on all parts.

When the lathe is started, gear *A* turns gear *B*, which rotates the shaft *C*, causing the eccentric to move the cross-slide back and forth twice to each revolution of the lathe spindle, thus producing flats on opposite sides of the work. When turning the round parts the gears *A* and *B* were thrown out of mesh by moving the carriage

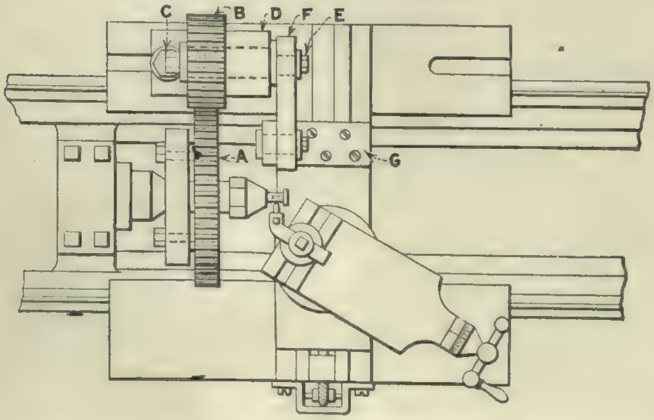


FIG. 2. THE DEVICE FOR GENERATING THE OVAL

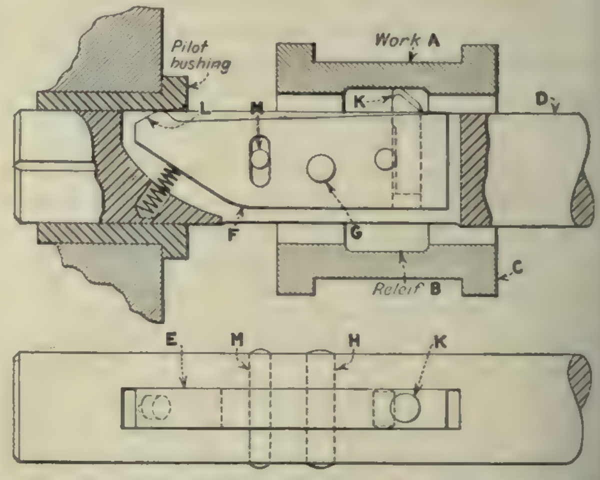
Boring Bar for Cutting an Inside Relief

By Gene Phelps

Cutting an inside relief in a piece of work generally requires considerable care and many methods have been used for producing this type of cut. The most common method used is by means of a solid tool held in a toolblock, set to the correct depth by hand and then fed through the work until the required length is obtained.

Recently the writer designed a simple relieving bar which is shown in the illustration. The bar is automatic in its operation and after setting the tool to cut to the correct depth, the work produced is uniform.

The work *A* has a relief *B* to be cut as shown, the relief being located from the face *C*. The bar *D* has a slot cut at *E* into which fits a tool holder *F*, fulcrumed at *G* by means of a pin *H*. The cutting tool *K* is held at one end as shown and on the other end the toolholder beveled at *L*. As the bar is fed through the work it enters the pilot bushing and the beveled end *L* of the holder strikes the pilot bushing, which forces the tool *K* into the work to the required depth. The length of the bushing can be the same as the length of the relief if desired, but if that is not practicable a feed stop can be used for the correct length of cut. When the bar is withdrawn from the work the spring shown throws the holder out so that the tool *K* goes inside the previously bored hole. The pin *M* governs this movement so that the holder does not project too far.

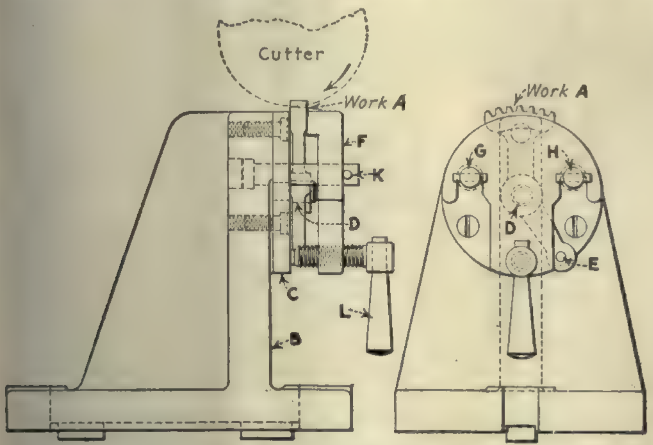


BORING BAR FOR CUTTING AN INSIDE RELIEF

Rapid Clamping Milling Fixture

By Frank Waldo

There are a number of methods of clamping used on various devices, but a milling fixture often requires something special in order that the operator's hands may not approach too closely to the cutter. An example of a clamp that can be used for milling work without endangering the operator is shown in the illustration. The work *A* is a lever at the end of which a gear sector is to be milled. The work has been previously machined on the sides and has holes drilled at *D* and *E*. The work is set up for this operation on the angle-plate fixture *B*, on which the hardened plate *C* is fastened. The work locates on studs at *D* and *E* in such a position that the portion to be cut stands vertically. The clamp *F* is made so that it rests on two studs at *G* and *H* and bears against the work very close to the point where the cutter is operating. The clamp is slotted so that it drops down over the two pins mentioned and the lever *L* operates a screw which bears against the hardened plate *C*. The result of this pressure is taken by the pins *K* which act somewhat in the nature of a hinge. In removing the clamp it is only necessary to loosen the handle by giving it a turn and pull the entire clamp off from the studs when the work will be found easily removable. Various applications to this clamp will be found useful where work is to be held in such a position that the ordinary type of clamp cannot be used.

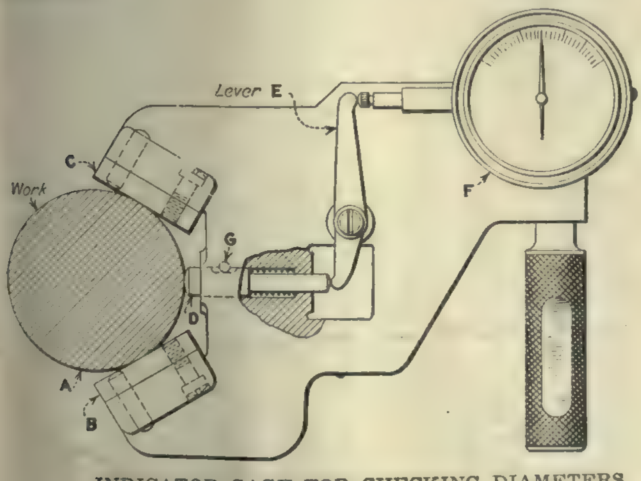


RAPID CLAMPING FIXTURE

Indicator Gage for Checking Diameters

By C. W. Frank

The quick-acting gage for checking the diameter of work shown in the illustration, can be used to advantage over a micrometer when a large amount of work is to be checked. In place of gaging the work across the diameter this gage has three points, two of which are set and the third, a plunger, which acts on the dial indicator.



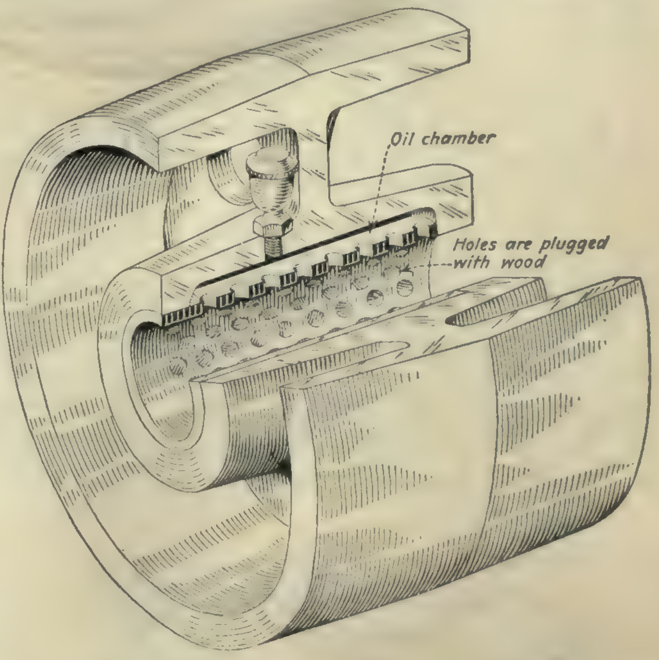
INDICATOR GAGE FOR CHECKING DIAMETERS

The blocks *B* and *C*, which strike the work *A*, are set at 30 deg. with the center line of the work. The plunger *D* strikes the work on the center line and transmits its movement through the arm *E* to the dial indicator at *F*. It will be noted that the ratio of the arm is two to one, which thus gives a one to one reading with the variation of the diameter of the work. If the blocks were to be set at different angles, the ratio of the arm would change, providing a one to one reading is required. The movement of the plunger *D* is limited by the pin *G*, which also allows the plunger to project so that it will come in contact with various diameters of the work. This gage is very easy to handle and will be found of great assistance in the inspection department.

That Loose Pulley Nuisance Again

By Ellsworth Sheldon

That the loose pulley always was, and probably always will be, a source of annoyance, cannot be gainsaid, though many shopmen have worked out solutions that have lessened, and perhaps for a time eliminated, the trouble. Each shop has its own particular kink for keeping that usually noisy adjunct more or less quiet and well behaved and each man therein will stoutly aver that the method of that shop is the best.



A NEW MATERIAL FOR AN OLD PURPOSE

However that may be, the writer has stumbled upon a new way, or rather an old way using a new material, and is herewith passing it along in the hope that someone else may be benefitted. The shop wherein it was found is located somewhat remotely from metropolitan districts and in a region where the red oak tree abounds, which may account for the selection of wood from that particular kind of tree as a cure for loose pulley ailments.

The pulleys in question were of the ordinary cast-iron variety, to be found in any machine shop, running upon a shaft that sometimes rotated and sometimes did not, thus bringing the pulley to bear upon a different part of the shaft's circumference every time the latter stopped revolving. This condition wears the shaft quickly out of round and is responsible for most of the trouble.

The pulley hubs were bored as shown in the sketch, ¾ in. larger at each end of the hub than the new shafts, and generously chambered out at the center to form an oil reservoir. A bushing of cast iron was made for each with walls ⅜ in. thick, and before the final cuts were taken the walls were drilled radially with 5/16-in. holes so spaced that about half the inner bearing surface was cut away.

Round "rods" of red oak wood, slightly more than 5/16 in. in diameter, were then produced upon the pattern-maker's dowel machine and plugs cut from these rods were driven tightly into all the holes in the bushings. Finish cuts were then taken over the bushings, inside and out; the bore being finished by hand reaming.

A suitable closed oil cup was provided for each pulley, the bushings forced into their respective hubs, and the job was completed. I have the word of the proprietor that all the pulleys that were so treated are running quietly and that some of the first of them had been up for several years.

"How often do you oil 'em"? I queried. "Oh! once in six months or so," he replied.

Use of Paper in Determining Close Measurements

By Gus Haessler

An article on the uses of paper in the shop, published on page 850, Vol. 54, of the *American Machinist*, was of more than ordinary interest. In this letter I am showing two cases where paper was effectively employed.

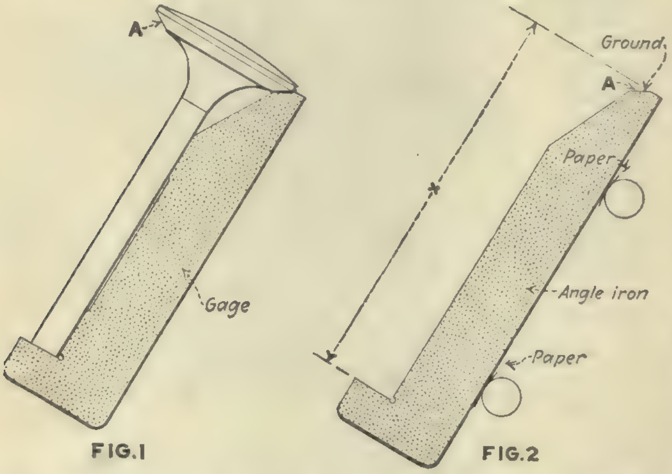


FIG.1 FIG.2

FIG. 1. THE VALVE TO BE GAGED. FIG. 2. SUPPORTING GAGE TO GRIND THE ANGLE

Fig. 1 illustrates a gage for measuring a poppet valve. The angle A on the gage is ground as is shown in Fig. 2. When the gage is clamped preparatory to grinding, it sometimes moves away from the pins and the movement passes unobserved by the operator. Strips of paper placed between the pins and the edge of the gage would indicate this at once.

In Fig. 3 this same gage is shown set up on angle iron for checking the dimension x. In checking gages of this type in any considerable numbers, it is not practical to coat the gage surfaces to be measured with Prussian blue, and paper was therefore used.

To check this dimension the height gage was first set to a few thousandths of an inch above the surface *A* and a strip of tissue paper held upon the surface of the work while the gage was adjusted to pinch the paper slightly. The reading thus obtained was then

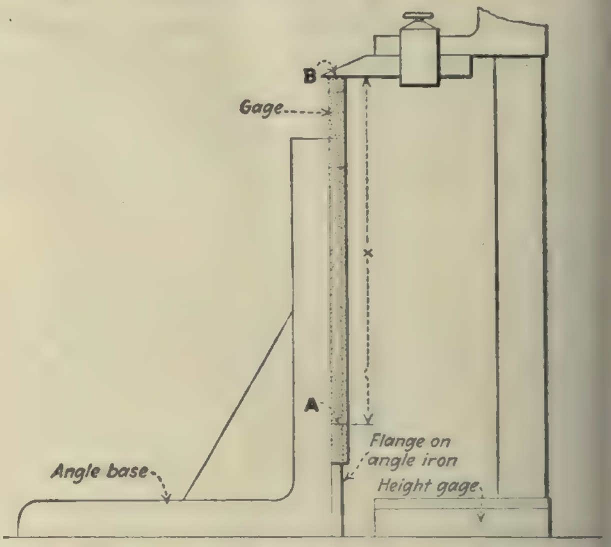


FIG. 3. TESTING BY MEANS OF STRIPS OF PAPER

added to the dimension x and the height gage set t this. If the work is ground to correct dimension th scriber should now pinch the paper slightly when passing over the surface *B*.

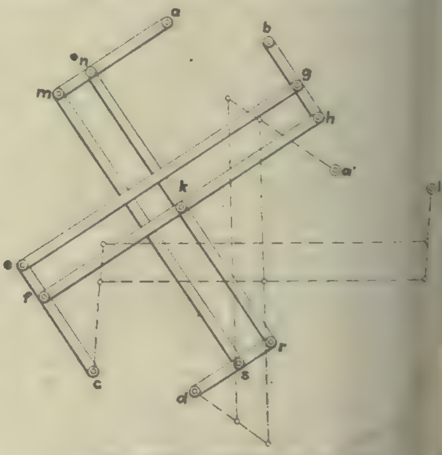
Parallel Double Tongs

By Vladimir Karapetoff

Professor of Electrical Engineering,
Cornell University

In the development of a piece of new electrica apparatus, the writer needed a kinematic device fo transmitting a given distance between two points para lel to itself. For this purpose he developed the specia tongs shown in the accompanying figure. Since the de vice may have several useful applications, apart fro the special purpose for which it was built, a descriptio of it is here given. The fixed distance is *cd*, and the con struction is such that *ab* = *cd*. The tongs may b moved in any desired position, such as is shown by th dotted lines, and the distance *a′b′* will still remain equa and parallel to *ab*.

If *cd* is varied in any arbitrary manner, both in direc tion and in magnitude, *ab*, or *a′b′*, will change auto matically, and always remain equal and parallel to c Thus, this device enables one to keep a point, such as *b*, at a desired constant or variable distance from point *a*, when the latter is moving in any arbitrary fashion in a plane. It also permits a stationary observer at *cd* to measure a



PARALLEL DOUBLE TONGS

constant or variable distance *ab* on a moving object.

If now the points *a* and *c* be kept stationary, then points *b* and *d* can be moved in any desired direction, provided that the distance *bd* remains equal and parallel to *ac*. It will be seen from the sketch that the tongs may be utilized one way or the other, depending upon the relative magnitude of the distances *ab* and *ac*.

The device consists of eight members. The four long bars are of the same length; the short bars *bh* and *dr* are of equal length, and so are the bars *ce* and *am*. The lengths *an* and *fc* must be equal, and each of them must be equal to *bh* or *dr*. The pivot joint *k* must be at the center of the two long bars which it connects. The proportions of the device are arbitrary and depend entirely upon the range of distances for which it is to be used.

Burnishing Tools for Babbitt Bearings

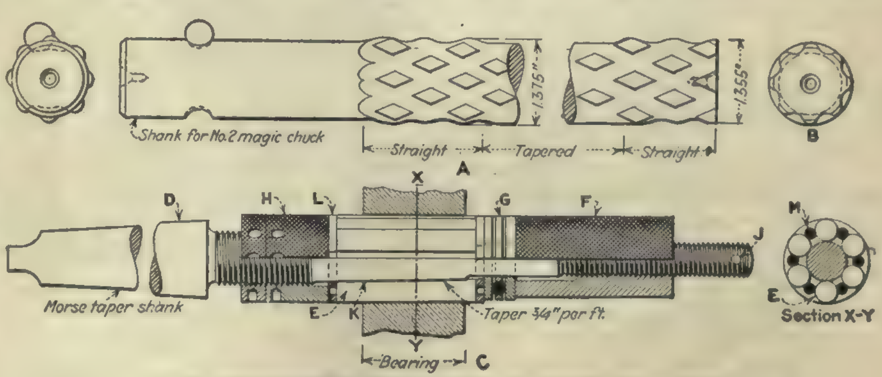
By William Owen

The two tools shown in the accompanying illustration are used for burnishing about $\frac{1}{64}$ in. out of connecting-rod and crankshaft bearings of automotive engines before line reaming. These tools press the babbitt against the wall of the bearing in the rod or crankcase, and insure a more perfect bearing and a denser babbitt metal.

The tool shown at *A* consists of a solid arbor with a number of right- and left-hand helical flutes, cut along the surface with about 6 in. lead. After the flutes are cut, the small diamond-shaped bumps that are left are rounded off, as shown by the section *B*. The tool is then glass-hardened and ground to the required sizes.

The tool shown at *C* is a little more expensive, and consists of a hardened arbor *D*, having a taper ground on it at *K*. This taper works inside a roller cage *L* composed of two flat rings and held together by six pins *M*, shown in the section *XY*. This cage carries six tapered pins or rollers *E*, which are held loosely and allowed to move in and out by means of elongated holes in the flat rings.

When inserting this tool, the feed nut *F* is back against the stop pin *J*, so as to allow the tool to slip through the bearing easily. After it has been inserted, the machine is started and the feed nut *F* is fed up against the thrust bearing *G*, which in turn pulls the tapered arbor *D* through the cage. This action expands the rollers, which press back the babbitt metal. The amount of expansion is adjusted by the stop nuts shown at *H*, and can be set to suit the conditions, so as to allow just enough metal in the bearing for line reaming.



TWO BURNISHING TOOLS FOR BABBITT BEARINGS

Squaring Up a Drawing

By H. T. Lundquist

It often becomes necessary to put a finished drawing back on the board for corrections or changes. The drawing is easily lined up when there is a long straight line to go by; but it is not so conveniently done when there is no such line, as in the case of a sheet full of small details.

The following scheme aids in squaring up a drawing quickly. When the blank sheet is first fastened down on the board, draw a short line at each end between the border line and the edge of the paper. These lines should not be allowed to run out quite to the edges of the sheet, as they may start tears at these points. When the drawing is replaced on the board, square it up by the lines.

Fixture for Pressing Small Bushings Into Connecting Rods

By Dwight Jordan

The fixture shown in the sketch was designed for the purpose of pressing bushings into the small ends of connecting rods for internal combustion engines.

Owing to the shape of the bushings, as shown in Fig. 1, difficulty was experienced in entering the tongues into their respective slots and it therefore became necessary to provide some means of locating them so that they would start right. The holding fixture and punch is shown in Fig. 2. It is quite simple and inexpensive to make, and in use was bolted to the thrust plate of an ordinary arbor press, the punch being affixed to the ram. By its use an inexperienced operator was enabled to press in the bushings much more rapidly than could have been done without it, even though plain bushings had been used.

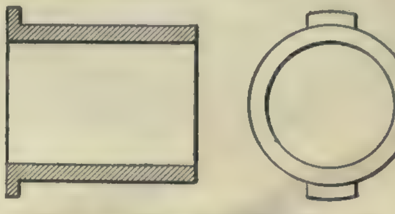


FIG. 1. THE BUSHING TO BE PRESSED IN

The drawing is quite self-explanatory and will need no description.

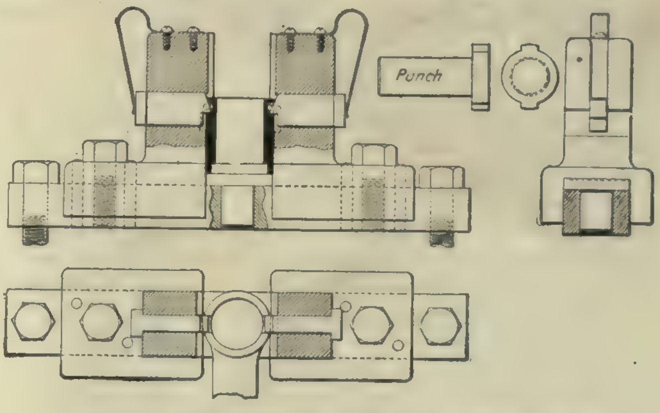
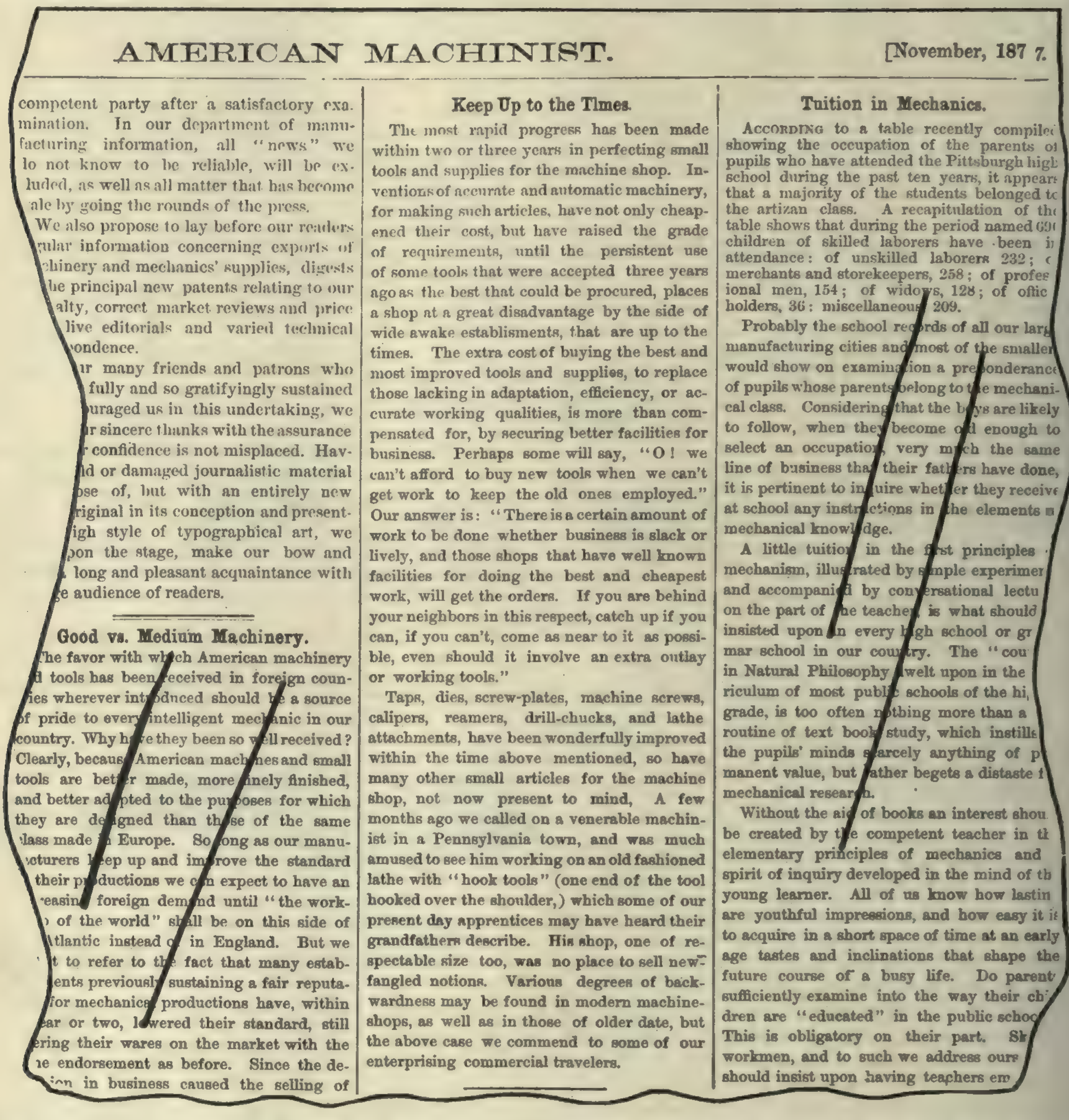


FIG. 2. THE FIXTURE USED FOR THE WORK

EDITORIALS



AMERICAN MACHINIST. [November, 187 7.

competent party after a satisfactory exa.
mination. In our department of manu-
facturing information, all "news" we
lo not know to be reliable, will be ex-
luded, as well as all matter that has become
ale by going the rounds of the press.
We also propose to lay before our readers
gular information concerning exports of
chinery and mechanics' supplies, digests
he principal new patents relating to our
alty, correct market reviews and price
live editorials and varied technical
ondence.
ur many friends and patrons who
fully and so gratifyingly sustained
uraged us in this undertaking, we
r sincere thanks with the assurance
r confidence is not misplaced. Hav-
ld or damaged journalistic material
ose of, but with an entirely new
riginal in its conception and present-
igh style of typographical art, we
pon the stage, make our bow and
long and pleasant acquaintance with
e audience of readers.

Good vs. Medium Machinery.

he favor with which American machinery
d tools has been received in foreign coun-
ies wherever introduced should be a source
f pride to every intelligent mechanic in our
country. Why have they been so well received?
Clearly, because American machines and small
tools are better made, more finely finished,
and better adapted to the purposes for which
they are designed than those of the same
lass made in Europe. So long as our manu-
cturers keep up and improve the standard
their productions we can expect to have an
easing foreign demand until "the work-
of the world" shall be on this side of
tlantic instead of in England. But we
t to refer to the fact that many estab-
ents previously sustaining a fair reputa-
for mechanical productions have, within
ar or two, lowered their standard, still
ring their wares on the market with the
e endorsement as before. Since the de-
in business caused the selling of

Keep Up to the Times.

The most rapid progress has been made within two or three years in perfecting small tools and supplies for the machine shop. Inventions of accurate and automatic machinery, for making such articles, have not only cheapened their cost, but have raised the grade of requirements, until the persistent use of some tools that were accepted three years ago as the best that could be procured, places a shop at a great disadvantage by the side of wide awake establisments, that are up to the times. The extra cost of buying the best and most improved tools and supplies, to replace those lacking in adaptation, efficiency, or accurate working qualities, is more than compensated for, by securing better facilities for business. Perhaps some will say, "O! we can't afford to buy new tools when we can't get work to keep the old ones employed." Our answer is: "There is a certain amount of work to be done whether business is slack or lively, and those shops that have well known facilities for doing the best and cheapest work, will get the orders. If you are behind your neighbors in this respect, catch up if you can, if you can't, come as near to it as possible, even should it involve an extra outlay or working tools."

Taps, dies, screw-plates, machine screws, calipers, reamers, drill-chucks, and lathe attachments, have been wonderfully improved within the time above mentioned, so have many other small articles for the machine shop, not now present to mind, A few months ago we called on a venerable machinist in a Pennsylvania town, and was much amused to see him working on an old fashioned lathe with "hook tools" (one end of the tool hooked over the shoulder,) which some of our present day apprentices may have heard their grandfathers describe. His shop, one of respectable size too, was no place to sell new-fangled notions. Various degrees of backwardness may be found in modern machine-shops, as well as in those of older date, but the above case we commend to some of our enterprising commercial travelers.

Tuition in Mechanics.

According to a table recently compile
showing the occupation of the parents o
pupils who have attended the Pittsburgh hig
school during the past ten years, it appear
that a majority of the students belonged t
the artizan class. A recapitulation of th
table shows that during the period named 69
children of skilled laborers have been i
attendance: of unskilled laborers 232; o
merchants and storekeepers, 258; of profes
ional men, 154; of widows, 128; of offic
holders, 36: miscellaneous, 209.
Probably the school records of all our larg
manufacturing cities and most of the smalle
would show on examination a preponderanc
of pupils whose parents belong to the mechani-
cal class. Considering that the boys are likely
to follow, when they become old enough to
select an occupation, very much the same
line of business that their fathers have done,
it is pertinent to inquire whether they receiv
at school any instructions in the elements
mechanical knowledge.
A little tuition in the first principles
mechanism, illustrated by simple experime
and accompanied by conversational lectu
on the part of the teacher, is what should
insisted upon in every high school or gr
mar school in our country. The "cou
in Natural Philosophy dwelt upon in the
riculum of most public schools of the hi
grade, is too often nothing more than a
routine of text book study, which instill
the pupils' minds scarcely anything of p
manent value, but rather begets a distaste
mechanical research.
Without the aid of books an interest shou
be created by the competent teacher in t
elementary principles of mechanics and
spirit of inquiry developed in the mind of t
young learner. All of us know how lastin
are youthful impressions, and how easy it i
to acquire in a short space of time at an early
age tastes and inclinations that shape the
future course of a busy life. Do parent
sufficiently examine into the way their ch
dren are "educated" in the public scho
This is obligatory on their part. Sk
workmen, and to such we address our
should insist upon having teachers em

This editorial appeared in the first issue of the *American Machinist* forty-four years ago. It might almost have been written this year for the arguments it employs apply as well to modern conditions as to those existing in 1877.

Apparently human nature changes but slowly for the first editor of the *American Machinist* found it necessary to admonish the inert and unprogressive manufacturer of 1877, just as the present editors have had to reason with his many successors during the year now happily drawing to its close. Blind conservatism maintains its grip on some of us to a surprising extent. There is a lesson here which is easy to read. In those dark ages of the machinery industry there were alert and aggressive men who believed that the best equipment was none too good for the competition ahead of them. They had the courage of their convictions and their faith was justified. Is there any reason to believe that similar business sagacity will not be equally profitable to-day?

The calamity howler is in his element now as doubtless his ancestor was in 1877. But good times came in spite of him and of his timid manufacturing brothers. They are coming again and coming soonest for those who are prepared to go out to meet them. The prosperous periods in the last forty-four years will fade into obscurity before those of the next forty-four. Let's get ready for them!

Shop Equipment News

The Bryant No. 2 Double-Head Hole-Grinding Machine

The Bryant Chucking Grinder Co., Springfield, Vt., has completed a hole-grinding machine that is a departure from standard practice in that it carries two opposed spindles and is capable of grinding a hole from both ends simultaneously. It therefore eliminates the long spindle that would otherwise be required and removes the principal cause of bell mouthing. It also cuts the grinding time practically to one-half that of a single wheel.

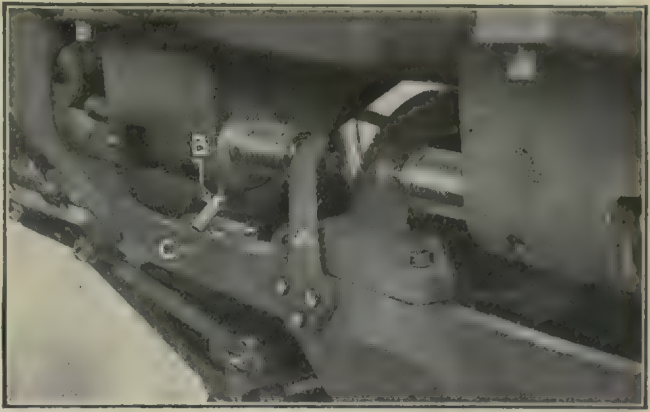


FIG. 4. BACK OF MACHINE; REDRESSING OF WHEELS

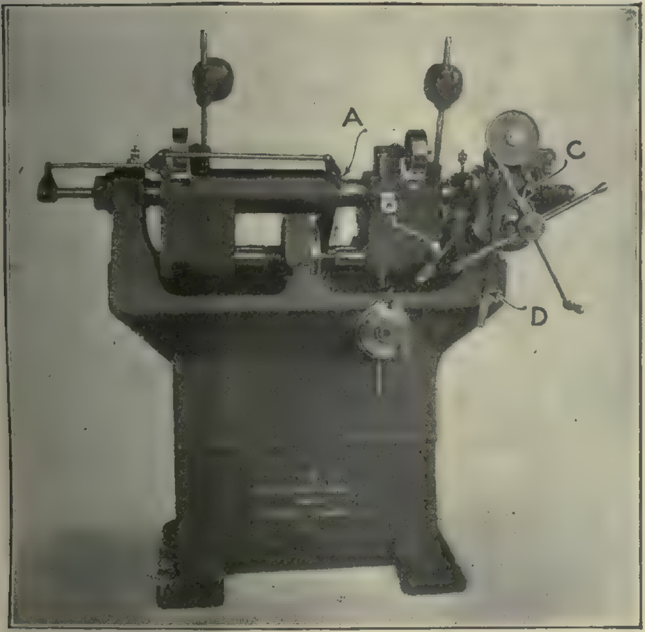


FIG. 1. BRYANT NO. 2 DOUBLE-HEAD HOLE-GRINDING MACHINE

The machine is designed primarily for the purpose of grinding the pin holes in pistons of gas engines. A front view, Fig. 1, shows the arrangement of the principal parts. A revolving chuck, driven by a small, round bolt, is located in the middle of the machine bed and two sliding and swinging heads are mounted upon the round bar above.

All the movements are controlled by the capstan wheel and traversing mechanism at the right, and this mechanism is the same in its main features as that of the standard Bryant machine. Power is applied to this mechanism through a round belt from the overhead countershaft.

In the operation of grinding, both heads are clamped to the bar and move as a unit, the distance between the grinding wheels being so adjusted that both wheels are in the cut together, one grinding one end of the hole while its mate grinds the other end. To change the work in the chuck it is, of course, necessary to separate the heads and this is accomplished by a single movement of the capstan wheel, the same movement that withdraws the grinding wheels.

On the shaft of the capstan wheel are two friction-driven pinions, one meshing with the rack on the main bar at all times, and the other meshing with a rack that is in or out of service according to the position of the operating lever. This second rack, through the medium of a long rod extending lengthwise through the center of the main bar, moves first the clamping levers of the left-hand head, and then the head itself; the direction of movement being opposite to that of the main bar.

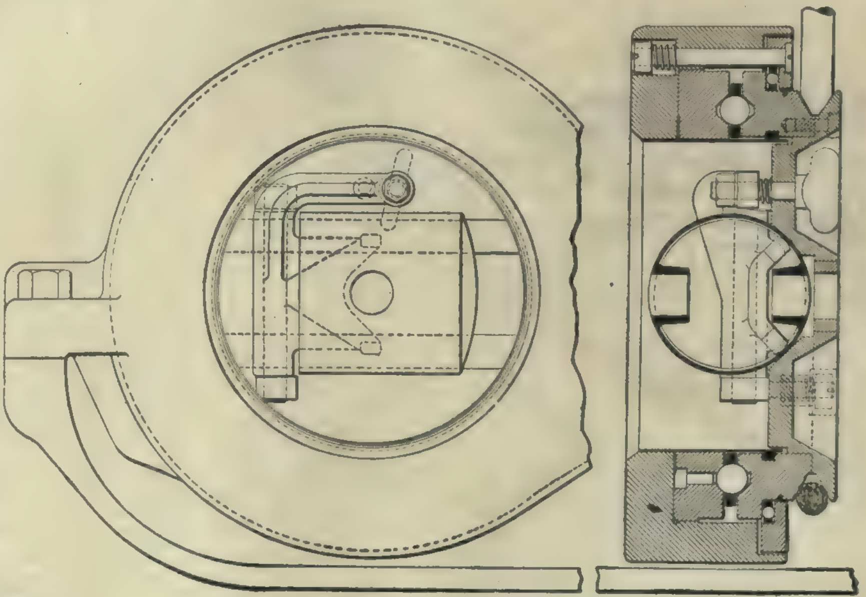


FIG. 3. DETAIL OF CHUCK

With the mechanism in the position shown, the head to the left is free to slide on the main bar, and the first movement of the capstan wheel to the left brings the

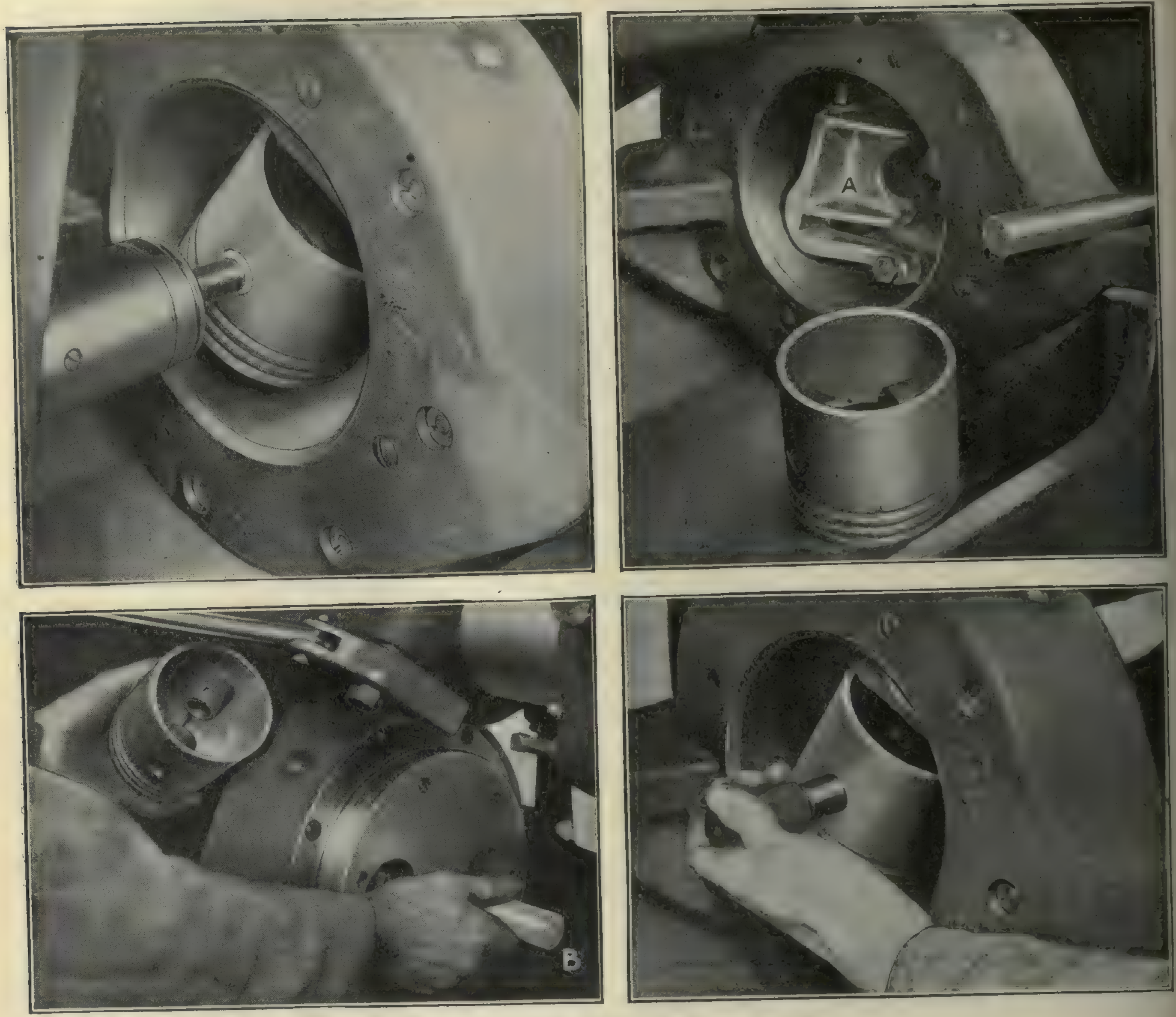


FIG. 2. POSITIONS IN LOADING THE WORK

heads together, entering the grinding wheels in the work. The toe *A* on the clamping lever strikes an adjustable stop on the opposite head as the two heads come together turning both levers to a vertical position and clamping the head to the main bar. No further movement of the capstan wheel is possible without slipping one or other of the friction pinions.

A movement of the operating lever *B* now drops the second rack out of engagement and at the same time brings the power movement into action. Both heads now move together during the grinding operation, driven by the pinion that is still in mesh with the rack of the main bar.

The length of the power traverse movement is determined by adjustable reverse dogs in the wormwheel *C*. The lever *D* is for reversing the movement by hand.

When the grinding is completed, or when the operator wishes to gage the work for size, the operating lever is disengaged and the capstan wheel turned to the right. The first movement starts the main bar in the same direction and (the second rack now being in mesh) at the same time moves the clamping levers to the left as far as they will go. Further movement continues to move the main bar, and with it the fixed head, to the right, but draws the opposite head to the left; separating the wheels to the predetermined limit. As the wheels are now clear of the work, the entire head may be swung back out of the way as in the standard Bryant grinding machine.

In the combined halftone, Fig. 2, may be seen some of the movements necessary to chucking the work, while the line drawing, Fig. 3, shows the details of the chuck itself. As may be seen in this illustration the chuck is open at all times on the left side and is closed on the right by a circular plate having at its center a hardened steel bushing to assist in positioning the work.

The piston is set over the swinging clamp shown at *A* Fig. 2. An undersized plug (fitting the bored hole in the work and having a shoulder to fit the bushing in the chuck plate) is inserted from the right as at *B*, and the clamp tightened by means of the thumbnut to be seen under the operator's right hand. Opposed to the clamp is a parallel V-block that accurately centers and aligns the work. These movements are all that are necessary to chuck a piston and are performed in a very few seconds. The grinding wheels are now brought into action as above described.

In grinding a single hole with two wheels in thi manner it is of course essential that the wheels be exactly of the same diameter and parallel. What thus appears to be a difficult proposition is accomplished in a very simple manner, as a reference to Fig. 4 will show.

A diamond is mounted in the bracket *A* at the back of the machine in such manner that when the wheels are swung to their backward position, as when changing work in the chuck and brought together to the lengthwise position occupied when grinding, they are in position for redressing. The pin *B* sliding upon the hardened plate *C*, holds the heads in position and insures a parallel traverse. The traversing is done by the same mechanism as in grinding and with the same movements, either by hand or power.

Feeding the wheels to the work in grinding, or to the diamond in redressing, is done by the handwheel on the front of the machine.

The machine uses the standard Bryant internal grinding spindles, which run upon ball bearings at a speed of approximately 20,000 r.p.m. and are entirely self contained. As they are independent of the driving pulleys and driven from them by a floating connection, they may be removed from the machine by the turning of a locking screw without disturbing the belts. The spindle driving pulleys run upon independent ball bearings, as also does the chuck or work holder.

The machine occupies a floor space of 3 x 6 ft., and the net weight is 2,300 lb., including countershaft. For independent driving a 3-hp. motor with a rotor speed of 1,720 r.p.m. is recommended. The chuck will take pistons up to 4½ in. in diameter by 4½ in. long. The equipment includes two standard internal wheel heads with an assortment of wheels, diamond and holder, countershaft, and necessary wrenches.

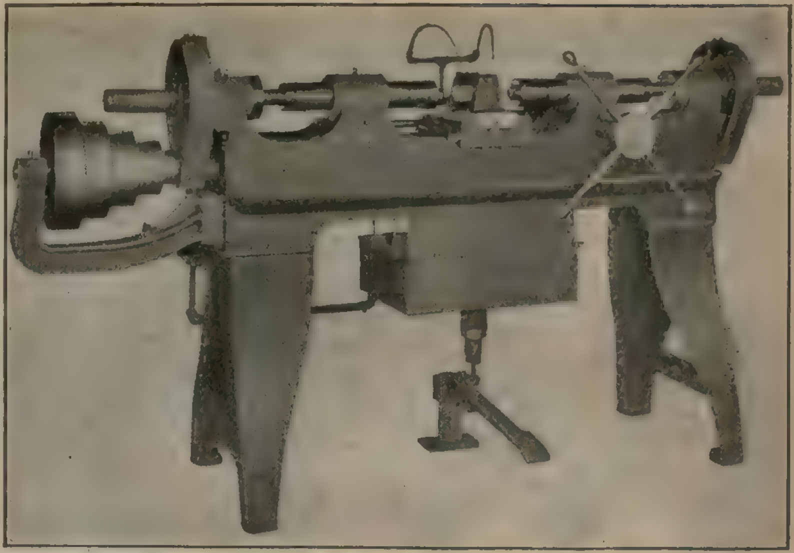


FIG. 1. MURCHEY REAMING AND CHAMFERING MACHINE

Murchey Reaming and Chamfering Machine

The machine shown in the accompanying illustrations has lately been placed on the market by the Murchey Machine and Tool Co., Detroit, Mich., and is intended for reaming and chamfering nipples. Fig. 1 is a front view of the machine, while Fig. 2 is a close up showing the simplicity of the tools and vise.

The nipple is held in a central vise which is opened by pressure on a treadle and closed automatically when the foot is raised. The spindles carrying the tools are brought to the work by the pilot wheel shown at the right of the illustration.

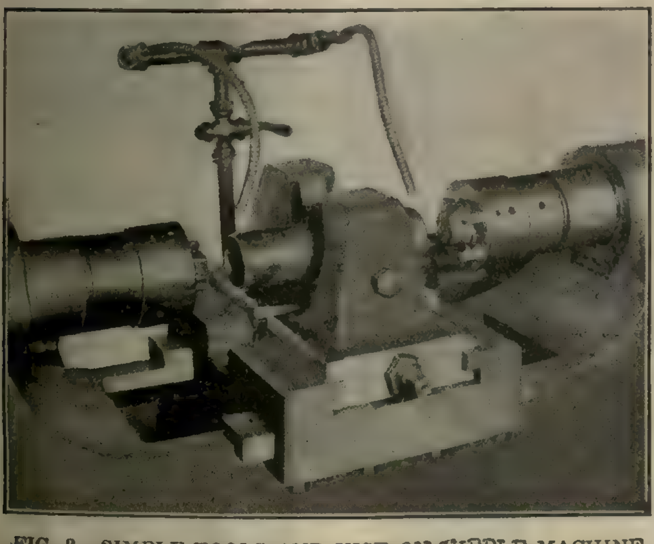


FIG. 2. SIMPLE TOOLS AND VISE ON NIPPLE MACHINE

After a nipple has been reamed and chamfered it is knocked out by the insertion of the next nipple and drops into the receptacle provided. The vise has hardened and ground jaws, slides on wide bearings and centers itself as the tools start cutting, so as to bring the work in the proper position.

The countershaft has two drive pulleys intended to be run at different speeds. This arrangement, together with a four-step cone pulley, provides for eight changes of speed. The capacity of the machine is for nipples for ½ to 2-in. pipe, and in length from close to 12 in. The output is claimed to be six hundred and fifty ¾-in. or three hundred and fifty 1½-in. nipples per hour, other sizes in proportion. Weight, approximately 1,200 lb. Floor space, 8 x 2 ft. An oil pump is included in the equipment.

While primarily designed for reaming and chamfering the machine can be equipped with dies for threading nipples from ⅛ to ¾-in. pipe size. It can also be arranged for threading tees, valves, studs and other work required to be threaded on both ends, or for performing other operations on small parts.

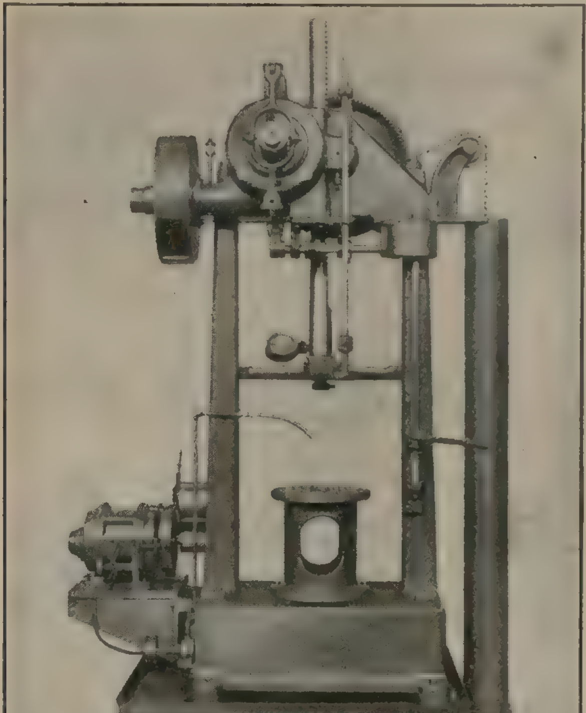
Lucas Vertical Broaching Press

The Lucas Machine Tool Co., Cleveland, Ohio, has recently added to its line the vertical broaching press shown in the accompanying illustration. The machine is intended especially for the operation of push-broaches, requiring only short broaches, allowing the work to rest in a horizontal position, permitting of easy lubrication and providing a convenient means of operation for the workman.

The machine requires small floor space and is operated by means of a belt, instead of by hydraulic pressure from an accumulater. The working elements consist principally of a ram to which motion is transmitted through gearing that is controlled by a friction engaging a wormwheel driven continuously from the pulley shaft. The lever for controlling this friction is adjustable vertically on a rod placed in front of the right-hand column. Movement of this lever to the left engages the clutch and starts the ram on the downward or pressure stroke. A dog can be set to stop the downward movement, reversing the motion until the ram reaches the top of the stroke and is stopped by means of a second dog. The friction device consists of asbestos washers between friction disks and is adjustable to give any pressure within the maximum capacity of the press. A gage is mounted on the ram, so as to register the pressure that is exerted.

The machine can be furnished with individual motor drive, as shown. The motor is of constant speed, runs at 1,200 r.p.m., and is of either 7½ or 10 h.p., depending on the size of the machine. The machine can be furnished with a pump, pan and piping for cutting lubricant, although they may be omitted when the press is used for production assembling. A circular broaching stand is provided on the base of the machine. The ram is counterweighted.

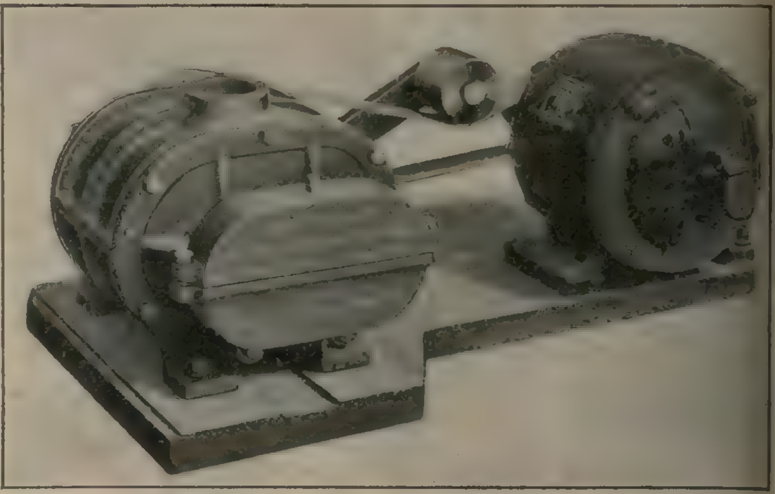
The machine is ordinarily made in two sizes, having capacities of 15 and 30 tons, respectively. The maximum distance from the base to the ram is 48 in. for both sizes, although a high-pattern type of machine may be furnished with this dimension either 60 or 72 in. The distance between the housings is 25 in. for the small machine and 30¼ in. for the large. With the driving pulley running at a speed of 500 r.p.m., the speed of the ram on the power stroke is 9 ft. per minute on the small machine and 6 ft. per minute on the large one, the speeds on the return stroke being 21 and 15 ft. per minute respectively. The net weights are respectively 2,900 and 3,800 lb., and the contents when boxed for export 125 and 150 cubic feet. The machine is adaptable to a considerable range of work, because of its capability of handling large and unwieldy parts.



LUCAS VERTICAL BROACHING PRESS

Stewart Motor-Driven Blower Unit

The Chicago Flexible Shaft Co., 5,600 Roosevelt Road, Chicago, Ill., has combined the Stewart positive-pressure blower with a motor to supply an apparatus whereby the heat-treating furnace can be maintained as a separate unit independent of the main power plant. The unit thus formed, which is shown in the illustration, is known as the Stewart motor-driven blower unit.



STEWART MOTOR-DRIVEN BLOWER UNIT

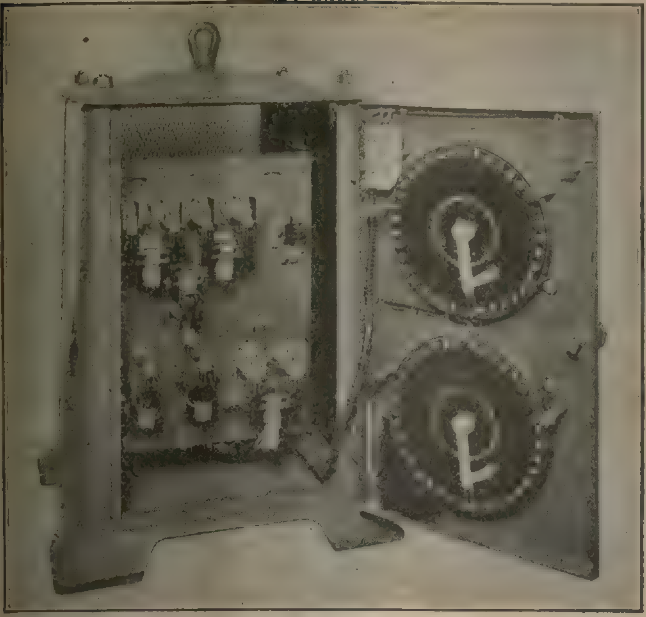
This apparatus obviates the expense of running the large plant motor when only enough power is required to operate the blower, and is particularly adaptable for small installations. It is made in four sizes accommodating blowers Nos. 3 to 6 with motors of from 1 to 2½ horsepower. Voltage and type of current should be specified when ordering.

G. E. Planer Control

The General Electric Co., Schenectady, N. Y., has recently placed on the market an apparatus for preventing the tables of electrically controlled planers from over-traveling. The apparatus employs the dynamic system of braking for stopping the table, and is said to prevent over-travel either on reversal or because of the failure of the voltage. The equipment consists of a control panel on which are mounted the necessary rheostats and contactors, as shown in the accompanying figure, resistance, master switch or push button, and a standard direct-current, reversible adjustable-speed motor. The control is furnished in two types, one with and one without a resistance-selecting contactor.

In the selective-resistance contactor, the value of the dynamic brake resistance for either direction of rotation can be adjusted independently, thus enabling the stopping of the table in the proper position at each end of its stroke. It is possible to set the braking effect at 200 instead of 100 per cent of full load, thus greatly reducing the overtravel.

The method of control is said to give dependability, as well as ease, certainty and adaptability, and also to conserve time. In case the contactor tips should become welded together because of severe service conditions, the planer table will stop, but will not overrun its set limits. Should a failure of the voltage occur, overtravel is eliminated because of the fact that the motor is always connected on the dynamic brake.

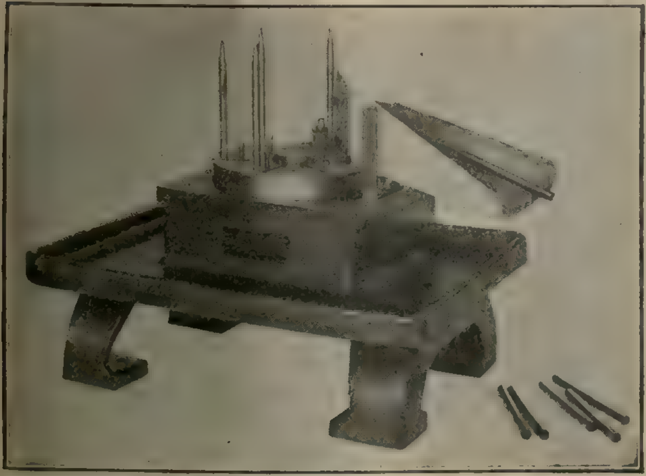


G. E. PLANER CONTROL

It is claimed that the control makes possible the performance of many operations of a difficult nature. It is possible to "jog" the table, using either a master switch or a push-button station. The selective resistance contactor enables the machine to operate on jobs allowing but small tool clearance, and also on those where the duty varies from no load to full load, and where cuts are made to the end of the travel. The time efficiency in such work is stated to be very high, because of the decreasing of the wasted or idle time of the machine.

Noble & Westbrook Marking Machine

A marking machine recently brought out by the Noble & Westbrook Manufacturing Co., Hartford, Conn., for marking names and patent marks on small tubing is illustrated herewith. The machine is power driven through a three-step cone pulley, the power being transmitted to the table of the machine through a worm-and-worm gear.



NOBLE & WESTBROOK MARKING MACHINE

The top or table of the machine revolves. It is divided into six equal parts, each having a mandrel upon which the work is fed by hand. As the table revolves, it passes the work over the die and makes the mark. Then a cam raises a small lever, ejecting the work from the machine automatically. In this way, all the operator has to do is to feed the work to the mandrels. A production of over ten thousand per day is estimated. The machine is made especially for the job and it can be furnished for marking on the end of any size tubing of short lengths. It weighs about 90 pounds..

Acme Staybolt Attachment

The attachment illustrated herewith has been brought out by The Acme Machine Tool Co., Cincinnati, Ohio, for use in connection with turret machines of its manufacture.

Two dieheads are used and when set by a master- or staybolt tap, their simultaneous cutting insures that both threaded portions on the staybolt will be the same as to lead as if a continuous thread had been cut the whole length. The die head at the rear is adjustably mounted so that any length of staybolt within range of the adjustment can be cut.

The attachment is made to fit the 2¼ x 26-in., 3¼ 36-in., and the No. 3 universal machines, and by its use staybolts can be made from forgings or from a bar.

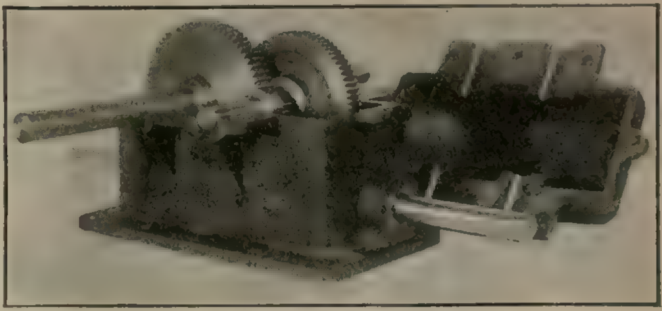
ACME STAYBOLT ATTACHMENT

Natisch Combined Worm and Spur-Gear Speed Transformer

The speed transformer shown in the accompanying illustration has been placed on the market recently by the Natisch Gear Works, 451 Hudson Ave., Brooklyn, N. Y.

By changing the ratios of the gearing the transformer can be furnished for speed reductions ranging from 75-1 to 600-1. The illustration shows a transformer for delivering ½ hp. at a speed reduction of 600-1.

The case is cast iron, oil tight and rust proof.



NATISCH SPEED TRANSFORMER

NEWS SECTION

Cincinnati Engineers Add Thirty-Three Members

F. L. Raschig, C. A. Paquette and E. K. Ruth were elected members of the board of directors of the Engineers' Club of Cincinnati (Ohio), at the annual meeting and banquet of that organization at the Business Men's Club, last week.

John L. Harrington, speaker of the evening and vice-president of the American Society of Mechanical Engineers, criticised the engineers of America, saying that members of that profession are less in public life than those of any other and as a consequence are less advertised.

Following his talk the names of thirty-three new members were read, including nineteen engineers engaged in the machine tool manufacturing business and the remainder in other lines of industry.

◆

To Study Coal Movements

Private funds in sufficient amount to make possible comprehensive study of seasonal coal movements have been placed at the disposal of the Committee on Mining of the President's conference on unemployment. This is the first of a series of surveys which are to be carried out by Edward E. Hunt, the secretary of the conference, in cooperation with the Department of Commerce.

◆

Pittsburgh Plus Case to be Heard

Elliott Cheatham, of Atlanta, counsel for the Southern Association of Rolled Steel Consumers, states that preparations have been virtually completed for the Southern hearings in the celebrated Pittsburgh Plus case, which are to begin before the federal trade commission some time during the early part of January. Mr. Cheatham was in conference at Birmingham recently with members of the Pittsburgh Plus Committee of the Birmingham Civic League, this meeting being also attended by B. R. Bane, counsel for the trade commission.

The South and West won a preliminary victory in the case last April, and prominent men of the metal trades industries of the South are confident that the January hearings will result in a final victory for southern and western interests that are affected.

It is also announced that the commission will probably have hearings at various Southern cities in addition to Pittsburgh and Chicago.

Government Air Bureau Favored by President Harding

President Harding, in a special message to Congress, forwarding the annual report of the National Advisory Committee for Aeronautics, says that America should be foremost in the development of aviation. He thinks there can be no doubt that the development of aviation will become of great importance for the purposes of commerce, as well as for national defense. After pointing out that aviation has not been extensively developed in America because of lack of wise and necessary legislation, he urges that this condition be remedied by the creation of a bureau in the Department of Commerce for the regulation and development of air navigation.

In its annual report, the National Advisory Committee for Aeronautics urges the enactment of legislation for the development of aviation and for the establishment of airways and airdromes under Federal regulation. The committee expresses the opinion that if this is done, air lines for the transportation of passengers and of goods will be rapidly established by private enterprise in all parts of the country. The committee points out, however, that the first transcontinental airways should be carefully planned to serve military as well as commercial needs. The extension of aerological service under the Weather Bureau, and the adoption of a policy to sustain and stabilize the aircraft industry, are again urged by the committee. The continuation of the Air Mail Service under the Post Office Department is recommended until, by the enactment of appropriate legislation, it will become possible for commercial air lines to operate air mail routes. The committee also recommends the development of airships and the utilization of a small amount of helium at this time, and urges conservation of the great existing resources for future use.

◆

Hoover Heads U. S. Section of High Commission

President Harding has appointed Secretary of Commerce Hoover as chairman of the United States Section of the Inter-American High Commission. The commission, established by treaty with all the South American countries, acts as an advisory body to the governments in perfecting commercial and financial practices between the countries.

Safety Engineers Confer Wit Welding Society

A joint meeting of the American ciety of Safety Engineers and American Welding Society was held the Engineering Societies' Building the evening of Dec. 20. The gene theme of the meeting was a discuss of the development of safety in o acetylene cutting and welding ope tions.

Two papers were presented. F. Napolitan, of the Davis-Bournonv Co., spoke on "Safety Engineering applied to oxy-acetylene cutting welding."

J. I. Banash, of Chicago, presented paper on the "Development of O acetylene Process." Mr. Banash vited discussion and the audience joir in some spirited arguments on the m its of the ideas put forth in the pap

◆

Chamber of Commerce Protes Capper Bill

A fair trial for the Transportat Act of 1920 has been asked of Congr by the Chamber of Commerce of United States.

Repeal, as proposed in the so-cal Capper bill, of sections which give Interstate Commerce Commission thority to correct state rates when tl discriminate unduly against interst commerce, would limit the commissio ability to maintain rates permitting free flow of interstate commerce, Emory R. Johnson, of the Univers of Pennsylvania, speaking for Chamber, told the Senate Comme Committee at a hearing on Dec. 15. the same time Dr. Johnson attacl the proposal to repeal provisions wh established the rule of rate making.

◆

Airplane Materials Sold at Auction

At a public auction held on Dec at Philadelphia, government offici sold materials, said to be enough build fifty complete airplanes, for sum of $1,000, which was the high bid. The purchaser remains a myst the bid being made by an agent s to be representing a "Mr. Brown."

The material has been held in government warehouse for over a y because of an injunction held agai its English owners for infringement Curtiss and Wright patents. The p chaser took over the responsibility the suits now pending in the matter.

Trade Conditions in Russia

By Our Latvian Correspondent

There is not in the whole world so enormous, so eager, and so empty a market as Russia. Foreign goods from needles to locomotives could be used in Russia. In Russia at present there are 130 million inhabitants; in 1912 when there were 180 millions, Russia's import was valued at 640 million dollars. During the four years that Russia was blockaded, she was unable to import anything, but the population continued to consume. In 1913 the production of the industry of Russia was valued at 1.5 billion dollars, but in the last four years the industry has become so crippled that production has fallen way below this figure. Today the starving population has no shoes, no clothing, no household fixtures or implements of trade; machinery in the factories and shops is completely broken down; pharmacies and stores are empty, and the transport system is crippled.

The natural resources of Russia are rich and should easily support a healthy import trade, the fault lies in the bad management of the Soviet government, which must be altered before Russia will be ready for international trade. By a special agreement between the Russian government and a Mr. Hodgson, the British agent in Moscow, there has been formed a Russian Import-Export Company, to do business with foreign countries on behalf of, but under the supervision of, the Soviet government.

During 1920 and 1921 the imports into Russia were rather small. The Bolsheviki had trouble with their gold; some countries refused to accept it and that there was danger that the goods which they shipped to foreign markets would be confiscated there in the favor of the various complainants. Some countries refused to recognize the trade officials of Soviet-Russia, but the chief difficulty was the lack of a sufficient gold supply. The Soviet government imported only from countries with whom she was able to make commercial treaties, or who were more or less friendly toward communistic ideas. Therefore, imports from the United States and France fell off. At present Germany and England are the leading traders in Russia, although the traffic is now occupied mostly with American relief supplies.

As the Soviet government is not able to satisfy the wants of the people because of a lack of means and private merchants are not allowed to enter foreign trade, there has developed a system of contraband—or smuggling. This is being carried on extensively especially on the boundaries of Latvia and Esthonia, which countries have food and manufactured products in abundance. The profits are royal and the frontier guards are easy to bribe. Latvia has established a system of "barter places" on the frontier. These places are fenced in; the contrabandists from the Russian side are allowed to enter and trade with the Latvian merchants under the supervision of Latvian customs officials. Duties must be paid and when the deal is closed the Russians return homeward, where they must bribe the frontier guards in order to get the goods into their own country. From he Latvian side the barter is considered lawful; from the Russian it is contrabandism. Of course, the Russian government is fully informed of this ituation, but it is impossible to keep the hungry people in check when neighbors have an abundance of worldly goods. The government of Latvia has no intention to maintain these barter places for a long time; it regards them as evil, but one cannot always choose his neighbors.

In the main the export trade of Russia is small and it cannot grow without foreign assistance. In order to collect export goods one should have real money, gold or manufactured articles to pay for them. The Russian Import-Export Company has enough British manufactures and will be able to gather considerable quantities of export goods. The Soviet government having only valueless paper money, can gather but little. This fact should be remembered by those who wish to sell to Russia. The real salvation lies in foreign credit. Russia has asked England for about 200 million pounds sterling for agricultural machinery, to be purchased in England. Perhaps a part of the sum which was recently granted to stimulate the export trade of England, will go to Russia; but it is doubtful that England will risk a very large amount until the government of Russia has been altered.

The communistic government of Russia has made important changes in its economic policy, abandoning partly the communistic doctrines and returning in a small way to capitalism. Recently, the government declared that it would pay the old foreign debts of Russia. This move was, no doubt, to gain the faith of capitalistic countries and to attempt to establish a broad international credit. Russia has much to change, much to promise and much to do before the necessary credit will be extended to her. There is but one alternative for Russia: she must starve or capitulate. The sooner the communistic regimé is changed, or entirely abolished, the better for Russia, the world and especially the labor class.

◆

French Plan Portuguese Air Service

It is reported by the Department of Commerce that the French company, Transaerienne de Tourisme et Messageries, is making overtures to the Portuguese government for valuable concessions in Portugal and the islands, and also in Portuguese Africa. American Minister Thomas H. Birch states that the company proposes a mail and passenger service for Lisbon, Paris being the starting point. Free transportation of Portuguese mail and the relinquishment of air material to Portugal in case of war are some of the inducements offered by the company.

◆

Alabama Iron Production

Pig iron production in Alabama for November was officially announced at 108,201 tons, which is some 7,000 tons less than the unofficial figures announced earlier in the month. Production, however, was almost 8,000 tons better than the previous month, and brought the total for the first eleven months of the year to 1,081,280 tons. As the iron and steel industries are improving rapidly, December production will undoubtedly be considerably in excess of November, bringing the year's total to very nearly 1,200,000 tons This, however, will make 1921 one of the lowest years of the past decade, for in recent years annual production has always been above 2,000,000 tons.

Optimism from Near East

At a dinner of the American Chamber of Commerce for the Levant, held on Dec. 20, L. I. Thomas, president of the chamber, and a director of the Standard Oil Company of New York, made a statement which should interest exporters and importers, as well as business men in general. He has just returned from an extended trip to the Near East and has visited a number of points in Jugoslavia, Bulgaria, Turkey, Greece and Rumania.

Mr. Thomas said that he was sorry to note from the press such pessimistic statements as have been made by a prominent American who has also recently visited that part of the world. There can be no doubt but that the political and economic situation leave much to be desired, but on the other hand, after talking with a great many Americans in the country, a rather deep feeling of optimism for the future is found there, from a business point of view—and this notably applies to Turkey.

◆

Industrial Exhibit in Palestine

An exhibition of American machinery and products, under the auspices of the American Palestine Co., 874 Broadway, New York City, will be held in Palestine. The exhibit will start as soon as arrangements are completed and will be a permanent institution. The company will pay the shipping and duty charges on all products sent from the United States. All products exhibited will remain the property of the manufacturer to the extent of the selling price with discount to jobbers in the United States.

◆

Changes in Canadian Tariff Law

American manufacturers who export their products to Canada should take cognizance of the new regulation which goes into effect on Dec. 31, 1921. A law was passed by the Canadian legislature in November which states: "That all goods imported into Canada which are capable of being marked, stamped, branded or labelled, without injury, shall be marked, stamped, branded or labelled in legible English or French words, in a conspicuous place that shall not be covered or obscured by any subsequent attachments or arrangements, so as to indicate the country of origin." The last words are important.

Goods coming into Canada after Dec. 31 which have not been properly branded, will be subject to an additional tax of 10 per cent ad valorem, and will not be released from the customs house until they have been marked according to the law.

◆

Exports of Oil-Well Machinery

The value of oil-well machinery exported in November is reported by the Department of Commerce to be $320,828. This is a little less than half the value of the exports of oil-well machinery in November of 1920. The value of all other mining machinery exported during November was $324,775. A year ago exports under this latter item were valued at $654,277. The exports of pumps and pumping machinery during November were valued at $343,629. This is about one-fourth of the value of pumps exported in November of 1920.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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Although the streets of the New York shopping district were made almost impassable last week by the holiday throngs, the retail merchants report that there has been no extravagance and that the demand has been chiefly for articles of utility rather than for unnecessary luxuries. This is reassuring, as thrift is essential to real prosperity, but it is disappointing to those who associate lavish expenditure with the holiday season and there is less of what might be called commercial jollity to be noticed in the shops. Reports from other large cities indicate a similar repression for economy, though salutary, does not inspire hilarity.

Perhaps it is because as the thirty-first of December approaches there is general realization of the fact that our gains for this year must be chiefly devoted to the payment of former losses, that nearly all the markets are somewhat slacker. The declines, where any have occurred, are almost negligible but the demand is a shade less eager than it was. This is particularly true of the bond market and it is entirely natural that the enormous bond sales of the last few months should be followed by a period of quiescence and digestion.

In the other markets the hesitancy shown must be attributed to extraneous influences for there is no speculative congestion in either stocks or merchandise.

Political Peace

The unfortunate ambiguity of the four power treaty whereby doubt is created as to whether the words "insular possessions and dominions" are to be construed as including the island empire of Japan itself, is probably the most important of these extraneous influences as a revision of the treaty now seems necessary to its ratification and the people are tired of this endless hairsplitting. What they want is peace and by peace is meant not only freedom from war but an end of the political and legislative uncertainty that is so disturbing to business.

The delay of the Irish Dail in ratifying the treaty agreed to in London is another disconcerting factor that is felt here as well as abroad.

Still another is Germany's insistence that she can only pay 200,000,000 gold marks on the reparation installment of 500,000,000 marks due in January and nothing at all on account of the 275,000,000 marks due in February. Almost concurrently the Reichsbank reports that 103 billion paper marks were outstanding Dec. 15 against which there was held a reserve of less than 1 per cent in gold. Meantime Professor Irving Fisher of Yale University, now in Germany, is quoted as saying that a German chemist has succeeded in making synthetic gold, and while the authenticity of this statement is doubted, it has brought into bolder relief the economic chaos in which "Mittel Europa" and Russia are involved.

One curious effect of all this financial disorganization is that the liquid capital of Teutonic Europe is seeking sanctuary in Switzerland and that American dollars are selling at a discount there while short time money is lending at 2½ per cent.

To try and bring order out of all this confusion Lloyd George is arranging to call an economic conference to be held in London or Paris where it is hoped remedial measures that are practicable can be agreed upon. Meantime foreign exchange remains remarkably steady and even marks continue salable in New York at from 50 to 60 cents a hundred. It is only when we contrast the enthusiasm that followed the opening of the disarmament congress with the "let down" now felt that we realize the intrinsic soundness of business conditions in this country. Our distributive trade seems fully up to normal.

The supply of credit is ample and while as a result of the holiday demand for currency the weekly statement of the Federal Reserve Banks shows increases of $54,000,000 in circulation and $100,000,000 in loans that are reflected by a 2 per cent decline in the reserve ratio it is probable that after the New Year the reserves will rise again. It is to be noted, however, that for the first time in many weeks the gain in gold is less than $2,000,000 and there are indications that it will be less rapid hereafter.

The developments in the commodity markets call for but little comment. Cotton is steady but the advancing tendency has been checked. By way of an antidote for its increased estimate of the American crop the Department of Agriculture has published a statement in which the world's cotton production for the current season is put at 15,593,000 bales, as compared with 20,650,000 bales last year. The Russian crop for this year is estimated at only 50,000 bales against 1,309,000 bales in 1914.

Sugar is attracting a good deal of attention. The Cuban Sugar Finance Commission which has controlled the sale of the Cuban crop for some time past has been abolished by Presidential decree as of Jan. 1, after which date the market will be free. Sugar futures are selling at or near two cents a pound for raw sugar landed in New York. This price does not include the present duty, which on Cuban sugar is 1.6 cents per pound.

As raw sugar has not for many years sold at less than 1⅝ cents per pound landed in New York, some patient speculators are now buying it upon the theory that a great staple is generally a good investment when it can be bought at approximately the lowest price on record. They may be right but they will probably have to be patient as the surplus supply is large.

The soft coal production for the year is estimated at 410,000,000 tons as compared with 535,000,000 tons in 1920. The industry has been and still is seriously hampered by labor unrest and the high cost of production and transportation has recently made it possible to sell Welsh coal in our Atlantic and Pacific seaports at less than the price of the American article. This Welsh coal is brought out as ballast in English steamers coming hither for cargo. Considerable quantities are on the way to Portland, Seattle and San Francisco.

High Rail Rates Prohibitive

The steel industry is quieter and it is stated that many orders are being withheld in the hope of lower rail freights after New Year's. This is the case in not a few lines of trade for the expectation of lower freight rates is very general and is adroitly encouraged by the railroad managers who seem to realize that the present high cost of transportation is restricting business in many directions. It is also holding the market for railway shares in check for would-be buyers of what would usually be considered bargains are deterred by the uncertainty. Thus far, however, there is no indication that the Interstate Commerce Commission is likely to order a reduction until the railroads themselves apply for it and Henry Ford's second application for permission to reduce rates on his road has been again denied.

The sensation created in Canada last week when the Bank of Montreal took over the Merchants Bank has apparently subsided and people there have been reassured by the confidence with which Sir Vincent Meredith and Sir Frederick Williams-Taylor, of the Bank of Montreal, expressed themselves at the annual meeting of their shareholders.

A decision of the Supreme Court at Washington in which an "open price" association was declared to be in restraint of trade, and therefore illegal under the Sherman law, has attracted wide attention. There are many such associations in this country that may have to be abandoned or reformed. No serious disturbance to business is, however, indicated and there is every prospect that after the American people have eaten their Christmas dinners and made up their balance sheets for the year 1921, they will return to their accustomed pursuits with the earnestness that their unique position justifies. At Christmas Eve it is especially satisfactory to report that Congress has appropriated $20,000,000 for the relief of the starving Russians and that the food that this money will buy will soon be on the way to these unfortunates.

India as a Steel Producer

India expects to be able to produce steel cheaper than any country in the world, according to the British press. The United Steel Corporation of India is perfecting arrangements for the construction of large works. While the exact site of the proposed plant is not mentioned, it will be at a strategic point between the coal and iron-ore deposits in Bihar and Orissa.

Plans for Washington Meeting of Engineering Council

Plans for the development of the work of the Federated American Engineering Societies were under discussion at a series of conferences and meetings held in New York last week. President Mortimer E. Cooley and executive secretary L. W. Wallace met with the American Engineering Council's committee on procedure on Dec. 16 and 17 at the Engineers Club, with the secretaries of the national societies. At these meetings questions of finance, publication and closer relations with member societies came up. General agreement was expressed on major questions of policy.

Subsequent to the meeting of the committee on procedure, chairman Calvert Townley announced further details of the Washington meeting of the council. On Jan. 4 the events of the meeting will get under way with a session of the executive board at the Cosmos Club, where the sessions of the council will also be held. On Jan. 5 the Council will convene for an all day session at which Dean Cooley will preside. The business of the council will include the election of three new officers, two vice-presidents and a treasurer.

Hoover to Speak

On the evening of Jan. 5 the council will give an informal dinner at the University Club to which the engineers of Washington will be among those invited. Herbert Hoover has been asked to attend and he has accepted, provisionally. Secretary Hoover is to spend the holidays in California and his presence is contingent upon his ability to arrange for his return to the capitol by this day. In addition to Secretary Hoover, other prominent speakers are expected to deliver addresses.

On Jan. 6 the council will again meet in business session and there will also be a meeting of the executive board, the new members of which will be elected by the delegates from the national organizations and the regional areas. Each region will choose one member of the board. Representation of the national societies will be determined by membership, the A.S.M.E. for example electing five.

The Unemployment Phase

At the Washington meeting the work of the past year will be reviewed and plans for the ensuing year discussed. Among the important reports to be received will be that of the special committee on unemployment. Other leading topics will be industrial waste. National Department of Public Works. Patent Office conditions and licensing. Proposed constitutional changes will also be acted upon.

The committeemen expressed the opinion that marked progress had been made during the past year and that, though many difficulties were ahead, the outlook was encouraging. The federation, it was felt, had made such progress as amply to justify its existence. Its purposes were becoming better known to the engineer and the public and it unquestionably is gaining ground as an effective instrument of coalescing and registering the viewpoint of the engineer in national government and administration.

What is characterized by Dean Cooley as one of the most instructive meetings he has yet called, was that which the secretaries attended. Dean Cooley made it plain that throughout his administration their assistance and co-operation would be consistently and earnestly sought. Questions of policy fundamental to the progress of the F.A.E.S. were frankly threshed out, the result being, according to Dean Cooley, a clarifying of procedure and aims. The secretaries of the founder societies presented their point of view very fully and clearly, particularly in regard to the publication efforts of the federation and the most effective methods of interlinking the member societies into a coherent unit which in order to function must be kept fully informed.

Export Statistics

A new schedule governing the classification of exports of domestic commodities will be put into effect on Jan. 1 by the Bureau of Foreign and Domestic Commerce. In order that the new regulations in regard to statistical returns of exports may be carried into effect, J. Hohn, chief of the bureau's Division of Statistics, points out that the co-operation of exporters is essential. It is absolutely necessary to the accuracy of the statistics that the shipper fill out his export declaration in accordance with the new classification.

S. A. E. to Standardize Auto Body Frames

Representatives of passenger-car frame manufacturers recently held a meeting and determined to undertake the standardization of passenger-car frames, as it is felt that such standardization would be of material assistance to passenger-car designers and to frame manufacturers. Information in reference to present frame practice is to be obtained as a basis for the standardization involved, a questionnaire requesting this information having been sent out to all manufacturers.

The standardization of frames will be of special assistance to many frame manufacturers, because passenger-car manufacturers are often willing to use a frame for which the frame manufacturer has the necessary tool equipment in case the design conforms fairly close to requirements. The adoption of definite frame standards will result in an increase in the number of such orders to the mutual advantage of both frame and passenger-car manufacturers.

The division has definitely recommended a standard for passengar-car running-board brackets which will be acted upon at the meeting of the committee on Jan. 10. The standard specified but three sizes of brackets, but they are designed so that these three sizes will furnish a suitable range for all requirements by slightly shifting the position of the rivet holes in the frame. The width of the brackets can be changed to fit the running board.

How Van Norman Company Sells Machine Tools

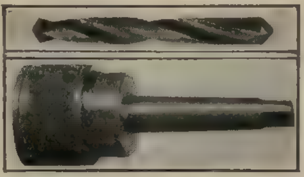
The growing tendency of machine tool salesmen to take the machines right to the prospective customer has resulted in the rigging as shown in the accompanying photograph. The machine mounted on the rear of the automobile is a Van Norman "Relio" grinder. It fits snugly on the back of the salesman's Dodge roadster and can be demonstrated to a customer at any place at a minute's notice.

The machine is fitted with electric motor drive, which can be connected with an ordinary lighting circuit from a lamp socket. All the necessary fixtures and tools are carried in the car. This method has brought more than ordinary success to the enterprising salesman who took this means of promoting his sales in places where the customer "had to be shown."

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Chuck, Broken Twist Drill
Wayne Tool Mfg. Co., Waynesboro, Pa.
"American Machinist," June 30, 1921



The chuck is for holding twist drills which have been broken at the shank. It is said to be very simple and composed of only the shank, casing, two pawls, two screws and a casing plate. The drill, shown at the top of the illustration, is ground to a 60-deg. point at the broken, or right-hand end. This allows the drill to automatically center itself on a 60-deg. recess in the shank; and on turning the casing the drill is locked in place by the two pawls, gripping it in the grooves. No wrench is required to tighten or release the chuck. Since the chuck enables the use of broken drills which would otherwise be discarded, it is suitable especially to shops where twist drills are used in large quantities on production work.

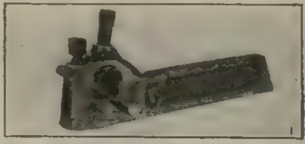
Grinding Machine, Twist Drill
Oliver Instrument Co., Adrian, Mich.
"American Machinist," June 30, 1921

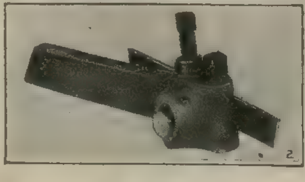
The machine is said to involve a number of radial features in handling its class of work. It will handle the work automatically after the drill has been placed in position, thus avoiding variations of grinding due to the personaity of the operator. The grinding wheel is mounted on an arbor supported by an arm arranged to give it an oscillating motion. The drill is held in a spindle mounted on a bracket on the arm at the right of the machine, and is arranged so that a rotating motion is imparted to it at the proper time. The grinding wheel arbor revolves in ball bearings, and is mounted on an oscillating cradle. The machine will grind two-, three-, or four-lip drills. No adjustment is required for grinding various sizes of drills. The drill point is in full view of the operator. The motions of the machine are all obtained by a simple mechanism contained in an oil-tight case. Net weight, 550 lb.

Bench, Work, Combination, No. 1
Myers Machine Tool Corporation, Columbus, Pa.
"American Machinist," July 7, 1921

The outfit is intended for use where a small machine equipment is required. All of the units are mounted on a table 39 in. wide by 78 in. long by 33 in. high. Two drawers are provided for holding small tools. The motive power is furnished by an a.c. electric motor, delivering ½ hp. when running at 1,750 r. p. m. The motor is belted to a countershaft, which permits the use of the machines either individually or simultaneously. The machine equipment consists of the company's No. 2 geared automatic hacksaw having a capacity of 6 x 6 in.; a 10-in. sensitive drilling machine having a ⅜-in. chuck; and a grinding head equipped with one abrasive wheel and one muslin polishing wheel. A 4-in. machinist's vise having hardened steel jaws is also mounted on the table. Weight, crated, 750 lb.

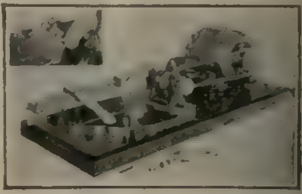
Toolholder, Universal, Rapid, "Uniheart"
Rapid Universal Toolholder Corporation, 199 Franklin St., New York, N. Y.
"American Machinist," July 7, 1921





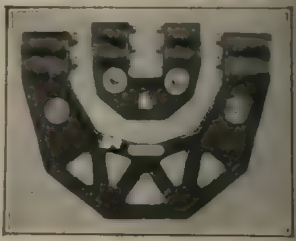
The toolholder is intended for general use in a lathe, boring mill or shaper, and adapted to the holding of tool stock, boring tools, drills and such articles. As shown in Fig. 1, there is a square hole broached through at the front end of the shank, for the holding of square-section tool bits, both screws being tightened on it. Round, square or hexagon bars up to ¾ in. can be held traversely to the shank by passing them through the hole. For small bars the V-block shown is placed in the rounded bottom of the hole. For the holding of a parting or cutting-off tool, a special clamping device is provided, a conical-shaped piece, seen projecting from the hole in Fig. 2, holding the tool stock. The holder is made in two sizes.

Grinding Machine, Gear-Cutter, Small
Anderson Die Machine Co., Iranistan Ave. and Admiral St., Bridgeport, Conn.
"American Machinist," June 30, 1921



The machine is for grinding the teeth of small gear cutters, such as those used in automatic pinion-cutting machines for clock work. The chief feature of the machine is the fact that the indexing for each tooth is done with reference to the form of the tooth, rather than by equal spacing. It is claimed that errors due to hardening may thus be corrected in grinding, so that each tooth does the same amount of work. The machine is mounted on a base, together with a motor and switch. In the view of the complete machine the diamond is shown mounted for dressing the wheel, while the proportional view at the top shows the manner of mounting a cutter for grinding. For the purpose of positioning the grinding wheel so that the face of the tooth will always be radial, the gage in front of the machine is used.

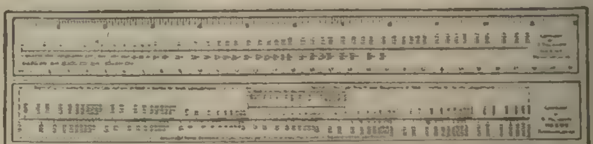
Gage, Snap, Adjustable-Limit
Pratt & Whitney Co., Hartford, Conn.
"American Machinist," June 30, 1921



The frame of the gage is made in the form of a truss. The gaging anvils are of tool steel, glass hard. The anvils are adjustable, and the "go" and "no go" anvils may be set to any amount of tolerance desired. Each anvil is held in position by two opposed set screws. The gage, when set, may be sealed, so that the adjustment may not be disturbed without leaving evidence. The anvils are made with large heads to allow the gage to be used close to a shoulder. Two separate buttons of brass, the parts of which are held together and to the frame by a single small screw, are furnished with each gage for stamping sizes, tolerances, and shop numbers, thus enabling the user to put a permanent marking upon his gage without striking it. The gage is made in fifteen sizes, to gage from 0 to 12 in., the possible adjustment of each gage overlapping the next size in either direction.

Chuck, Drill, Cushion, Safety, Universal
Karge-Baker Corporation, Phoenix, N. Y.
"American Machinist," July 7, 1921

The chuck is intended for the holding of drills, dies, taps and similar tools. It is provided with a "cushioning" feature which permits a moderate relative rotation between the shank and the socket ends of the chuck. A helical steel spring having a square section transmits the driving torque. It is claimed that the use of the chuck largely eliminates the breakage of drills and taps, and that it acts as a chip breaker. The shanks and sockets can be furnished in the size and style desired, and different styles are interchangeable on the chuck. The thrust is taken on double ball bearings, and an adjustment is provided to compensate for wear. The chuck is capbale of operation in any position. It is made in five sizes to carry drills from ½ to 4 in. in diameter, taps from ¼ to 7 in., or die heads from ¾ to 9 in. in size.



Rule, Calculating, Machine Shop, "Universal"
R. Poliakoff, 709 Sixth Ave., New York, N. Y.
"American Machinist," July 7, 1921

The purpose of the rule is to enable the quick and accurate solution, without making any calculations, of problems relating to the speed of cutting work in a lathe or grinding it in a grinding machine. It is intended for solving problems showing the relation between the diameter of the bar, the cutting or grinding speed and the number of revolutions; and those involving the length of bar, feed, number of revolutions per minute and the time required to turn or grind the bar. The charts on the rule were previously described in the **American Machinist.** The inch and millimeter divisions have been added to permit the use of the rule for measuring. The rule is made of celluloid, but can be made of steel. It is 12 in. long.

Europe Making Progress with Economic and Political Problems

Secretary of Commerce Herbert Hoover has issued a most interesting statement on the condition of Europe today, tracing developments back to the end of the war in an effort to show that the countries of the continent are slowly recovering their stability and have made considerable progress toward a prosperous era.

The economic recovery of Europe is necessarily slow and difficult. It contains great dangers, but it is not at all as gloomy as some statements would make it appear.

Year by year since the Armistice, the combatant states (except Russia) show steady gains in social and political stability; they show great progress in recovery of agriculture, industry, foreign trade and communications. The one field of continuous degeneration is that of governmental finance—that is the unbalanced budgets, the consequent currency inflation, etc., of certain countries with its train of credit destruction. The commerce of the whole world obviously suffers grievously from this failure in fiscal finance and the apprehension that flows from it, and unless remedies are found the great recuperation in the five great fields of social, political, industrial, agricultural and commercial life of the past three years are endangered. Its effects spread constantly outside the borders of those states predominately concerned and substantially check our recovery also.

The most eminent and most dangerous of these unbalanced inflation situations is Germany. Her case depends upon the method and volume of reparation payments. As the United States does not participate either in its control or its receipts we have no voice or right to interfere. In any event this is peculiarly a European matter and must be adjusted by the parties at interest. It is earnestly to be hoped that the present negotiations upon reparation may succeed in finding a sound basis that will secure permanent economic and political stability to Germany and certainty of regular payment to the Allies. With this effected the way is open for constructive consideration of the situations in other states. The American people have never been and will not be remiss in participation in these further measures, but our people cannot successfully enter until those who have control of the reparations have settled this major issue upon so sound an economic basis that we can look upon the future of Europe with confidence.

Outside of the government finance of a limited number of states, the outlook is very encouraging. Any general survey of the social situation in Europe will show that the danger of Bolshevism is passed, partly through improved standards of life and partly through the salutary lesson of Russia. Democratic institutions are gaining strength among the 150,000,000 people formerly supporting autocracies. In Russia itself extreme communism is slowly boiling to death in a caldron of starvation and its leaders freely acknowledge its failure.

In the field of international political relations, aside from conflict in Turkey, war has ceased and treaties of peace are effective throughout the world. Russia no longer threatens any serious military offensive. The warring states have settled for a time their major territorial issues and while there are remote forces of instability such as irredentism, yet the new boundary alignment is securing acceptance and the agencies for allaying international friction are proving themselves steadily more effective. There are bright prospects of limitation in naval armament. Agreed limitations in land armament are not very hopeful but the economic pressure of taxes and unbalanced budgets is slowly disarming Europe and it will disarm more of them yet. The number of men under arms has decreased by fully a million in the past twelve months.

In the field of economic life, the progress of agricultural and industrial production year by year since the war is very marked. Famine has disappeared from Europe except in Russia. Except in countries where credit machinery is checked by danger fiscal bankruptcy such as is the case of Austria, their food, fuel and clothing supplies are sufficient albeit at a low standard of living in some places, but in even these countries the standards are much higher than the low point after the Armistice, and are thus not such a factor of discontent as would otherwise be the case. Populations have fairly settled to work and industrial efficiency and productivity is being steadily restored. The private credit institutions of the world are demonstrating their ability to handle the international trade and credits except for those regions excessively disabled by the currency demoralization. Transportation and communications have been reconstructed. There are some useless hindrances to freedom of healing processes of commerce through artificial barriers between the new nations but by and large the processes of healing are going on.

Generally, there is progress and the problems yet to be solved are being steadily narrowed and their solutions better understood.

Naval Ordnance Board Helps Army Technical Staff

Referring to the work of the special board on Naval Ordnance, Rear Admiral C. B. McVay, Chief of the Bureau of Ordnance, in a report to the Secretary of the Navy says:

"Examination and report has been made on the numerous inventions relating to guns, mines, fuses, torpedoes, and other ordnance material submitted to the bureau. But few of these have been found to be of new design or adaptable to service use or not containing ideas already covered by patent. However, encouragement has been given to their presentation for research and experiment.

"The meetings of the ordnance committee of the Army technical staff have been regularly attended and by this association touch has been kept with the progress and work of Army ordnance.

"In the development of ordnance material, the board took up the general question of aircraft offense and defense against aircraft attack and the improvements of material accessory to both, including airplane sights, bombs and fuses, and anti-aircraft guns. The improvement in illuminating shell has been given consideration.

"This board is of assistance to the department since it affords an opportunity to study ideas presented and to select those having promise. It is also of great value to persons presenting ideas, since a prompt opinion on the merits of the idea saves expenditure of time and money by the patentee."

Distribution of Tools

The 2,408 machine tools that were sold by the War Department to educational institutions throughout the country are classified as follows: engine lathes, 70 per cent; milling machines, 10 per cent; grinders, 10 per cent; shapers, 5 per cent; planers, 2 per cent and miscellaneous, 3 per cent.

Exports of Metal-Working Machinery in November

There was no appreciable change in the volume of exports of metal-working machinery in November, as compared with those of October. The value of all metal-working machinery exported during November is given by the Bureau of Foreign and Domestic Commerce as having been $672,810. This is some $7,000 less than the total in October. While the exports for the month show a heavy decline from November of 1920, there was an increase over October in the value of goods sent to France, United Kingdom, Canada, Argentina and Japan. The detailed figures which have just become available are as follows:

	Nov. 1920	Nov. 1921
Metal working machinery:	589,444	67,911
Lathes	1,131,461	270,923
Other machine tools	237,395	61,962
Sharpening and grinding machines	1,373,323	272,014
All other	3,331,623	672,810
Total metal-working machinery		
Exported to:	245,759	2,880
Belgium	359,975	135,669
France	44,939	240
Italy	7,871	362
Norway	74,365	17,274
Spain	25,836	3,614
Sweden	951,541	93,530
United Kingdom	214,225	60,696
Canada	31,203	27,291
Mexico	232,826	10,137
Cuba	72,389	45,419
Brazil	22,882	10,866
Chile	68,742	7,272
China	79,869	97,265
British India	300,503	65,551
Japan	101,197	10,858
Australia	......	3,322
Netherlands	......	44,053
Argentina		......
Dutch East Indies	497,501	36,711
Other countries		

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

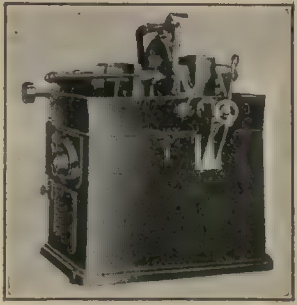
Reamer, Cylinder, Expansion, Pilot-Blade
New Britain Tool and Mfg. Co., New Britain, Conn.
"American Machinist," July 21, 1921.

The reamers are designed to be used in pairs, a roughing and a finishing reamer for each oversize of gas-engine cylinder. The pilot portion of the roughing reamer is ground to fit the normal bore of the cylinder with which it is to be used, while the cutting portion of the blades is so made as to remove about 0.030 in. of stock. Similarly, the pilot of the finishing reamer follows the bore left by the roughing reamer, and the blades remove about 0.005 in. of metal. The device is said to provide a very simple means of reboring worn or scored gas engine cylinders. The tools are made in the form of shell reamers, and shanks can be furnished with either Nos. 3 or 4 Morse tapers.

Truck, Industrial, Electric, Elevating Platform
Cowan Truck Company, Holyoke, Mass.
"American Machinist," July 28, 1921.

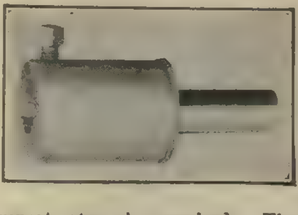
In design the truck is said to have been greatly improved over the former machines of the same type made by the concern. It has three speeds in either direction and steers upon all four wheels, so as to give a turning radius for the extreme outside point of the truck of 7 ft. 5½ in. The platform lifts vertically, having a capacity of 5,000 lb., and requires but five seconds to rise to its full height. It may be stopped at any point and reversed, if desired, no matter in which direction it is traveling. All of the controls are conveniently centralized, so that the operator may face in any direction that he desires. The lifting mechanism is operated by a separate series-wound motor.

Grinding Machine, Poppet Valve Seat
Fitchburg Grinding Machine Co., 76 Winter St., Fitchburg, Mass.
"American Machinist," July 28, 1921.



The valve being ground is held in a collet chuck, which can be swung to any angle. The head carrying the chuck has automatic reciprocating movement parallel to the wheel spindle, so as to feed the work across the wheel. The wheelhead has a cross movement and is operated by the vertical lever directly in front of it. The machine is self-contained, and is operated by a 3-hp. motor in the base. The weight, including the motor, is approximately, 2,500 lb. Besides grinding valves, the machine can be adapted to a large variety of small parts.

Holder, Tap and Die, Clutch
Warner & Swasey Co., Cleveland, Ohio.
"American Machinist," July 28, 1921.

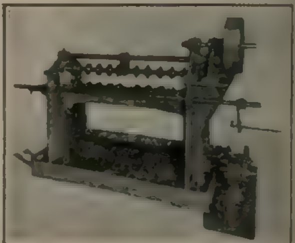


The tool differs from the old model of holder made by the same concern in the fact that it is greatly simplified, only eight parts being used, while twenty-three were used in the old model. The tool is capable of holding either right- or left-hand dies or taps, the difference when used for right- or left-hand work being in the position of the pawl. When threading is being done, the pawl holds the tool rigid by a metal-to-metal contact, until the turret stop is reached. The head of the holder then moves forward on the work and pulls the cam over the pawl, thus releasing the head and allowing it to revolve freely. A spring is used to cushion the pawl.

Shaper, Gear, Multiple, Vertical
Stevenson Gear Co., Indianapolis, Ind.
"American Machinist," July 28, 1921.

The machine cuts all or a large proportion of the teeth in a gear, or similar product at one operation. The tool-head is stationary and carries a number of tools spaced radially. The work is reciprocated vertically, being carried on a ram in the cylindrical portion of the frame. The work is indexed automatically between each stroke, so that each tool cuts in each tooth space. The tools are fed in as the cutting occurs, a stop being provided to limit the depth. A reverse feeding movement relieves the tools on the back stroke of the ram. The machine is made in sizes, the one shown handling gears up to 12 in. in diameter, 6-in. face and 4 diametral pitch.

Cutting-off Machine, Tube, Multiple
Nathan F. Fretter, 9113 Columbia Ave., Cleveland, O.
"American Machinist," July 28, 1921.

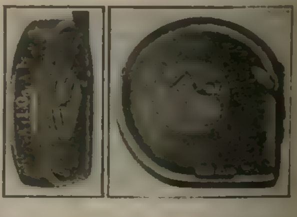


The machine is intended for cutting long pieces of pipe or tubing into a number of short pieces at one operation. A number of rotary cutters are mounted on a shaft, which is driven through back gearing and a driving pulley. The table has a dovetail groove, in which slide roller tube rests or holders, each adjustable to correspond with the positions of the cutters. The table is raised to feed the work, by means of cams operated by a treadle. The machine has a large capacity, according to the number of cutters used, and will cut tubes 2½ in. outside diameter having a wall 1/16 in. thick.

Burning-in and Running-in Machine, Universal
Theodore W. Jansen Machine Co., 739 Twenty-First St., Des Moines, Ia.
"American Machinist," July 28, 1921.

The machine is designated as No. 560, Type J, and is compact, low and heavy in construction. It is driven by means of a belt on a 16-in. wide-faced pulley, a lever-operated friction clutch being incorporated in the drive. Back gears running in oil are provided, thus giving two speeds, the ratios of reduction being 3¾:1 and 1½:1. It is stated that the machine will hold all types of motors without special blocking or fixtures. The work is mounted on the stand by securing it at each end to pivoted holders, so that the motor can be rotated about its shaft and held in any position desired. Eight to 15 hp. is said to be sufficient to operate the machine.

Tape, Steel, "One Man"
Union Tool Co., Orange, Mass.
"American Machinist," July 28, 1921.



The tape has several distinctive features, which include a hook on the end of the tape, a heel on the case, and a locking device which holds the reel in position after a measurement has been taken. The features contribute to the ready applicability of the tool, by enabling one man to make measurements ordinarily requiring two men. A measurement is taken by hooking either the free end of the tape or the heel of the case over the edge of the object to be measured, running out the tape to the length required, and then reading the measurements through the window in the top of the case.

Clip, paste on 3 x 5-in. cards and file as desired

Business Items

The Anchor Machinery and Supply Co., has been incorporated at Brooklyn, N. Y., with a capital stock of $20,000. Directors are J. M. McNamara, T. P. Mackey, and J. A. Male.

The Porcelized Metal Corporation has been organized at Buffalo, N. Y., to manufacture license plates and other metal products. August Ebke is president of the corporation which has a capital of $150,000.

The Andrews Iron and Steel Corporation, capitalized at $75,000, has been organized at Utica, N. Y., Directors are S. W. Andrews, of Whitesboro, N. Y., and O. J. McKeown and C. A. Schmidt, of Utica.

The Frank Held Tractor Co., has leased a factory building at 609 N. Fourth St., Columbus, Ohio, and as soon as machinery is installed will begin the production of tractors and parts.

With the approval of the stockholders, the Pullman Company has purchased the property and assets of the Haskell & Barker Car Co., Inc., of Chicago, Ill. The Pullman Company will assume all debts and obligations, and will increase the capital stock of the H. & B. Company to $135,000,000. Three new directors in the Pullman Company are E. F. Carry, J. R. Morrow and A. O. Choate. Mr. Carry was the president of the H. & B. Company.

Reorganization of Walden-Worcester, Inc., manufacturers of wrenches, has been completed. The company will resume manufacturing operations at its factory in Worcester, Mass. J. V. Critchley was elected president; W. S. and L. E. Bellows will assume the management.

It is expected that the new machine shop of the American Car and Foundry Co., at Terre Haute, Ind., will be completed and in operation by Feb. 1. The old shop was destroyed by fire several months ago. The new shop is of modern steel construction and is equipped with several new machines.

As a preliminary to the sale of the Harley Company plant in Springfield, Mass., attachments amounting to $1,046,700 have been discharged, the major portion of which had been put on by the Hendee Manufacturing Co., which has had a controlling interest. New York and Philadelphia capital has been interested in the works, and it is anticipated that the sale and reorganization of the property will bring a revival and expansion of operations for the manufacture of drop forgings, brass, bronze, aluminum and copper castings, steel and brass casket hardware.

The Bass Foundry and Machine Co., Fort Wayne, Ind., has increased its capital stock from $1,700,000 to $2,100,000.

The Auto Metal Body Corporation, of Springfield, Mass., has enlarged its force and is operating its plant at full capacity.

The General Electric Co.'s plant at Pittsfield, Mass., is now operating at from 10 to 15 per cent above the lowest point, according to a statement by C. C. Chesney, general manager. About 50 per cent of the business is said to be on foreign orders.

Personals

E. D. BATCHELOR, district sales manager in St. Louis for the Jones & Laughlin Steel Co., has been appointed sales manager of the wire department and will assume this duty at the Pittsburgh headquarters on Jan. 1. Mr. Batchelor has been with the company for thirty-two years.

PHILIP A. RHINEHART has been appointed superintendent of production at the Anderson Foundry and Machine Works, Anderson, Ind. He was formerly with the Hill Pump Co.

J. ELMER ANDERSON has severed his connection with the Hendee Manufacturing Co. of Springfield, Mass., and is now in the engineering department of the Hart & Hegeman Manufacturing Co. of Hartford, Conn.

H. B. MACFARLAND, consulting engineer, of Chicago, formerly engineer of tests for Atchison, Topeka and Santa Fe Railway Co., has recently returned from England. During the past year he installed and tested the Lewis draft appliance to the latest type of large Mogul engine on the London, Brighton & South Coast Railway.

C. F. MEYER, assistant secretary of the Landis Machine Co., Waynesboro, Pa., manufacturers of bolt and pipe threading machines, has returned from a year's trip around the world. Mr. Meyer's itinerary included India, Java, China, Japan and the Hawaiian Islands.

GARFIELD HOOD, has been appointed sales manager of the Ontario Steel Products Co., with headquarters at Gananoque, Canada.

P. D. REID, president of the Reid-Newfoundland Co., of Canada, has returned from a three-months visit to England. He reports that development work to cost $7,000,000 is to be done at Humber Bay, the Armstrong-Whitworth Company having been awarded the contracts.

V. E. HILLMAN, metallurgist at the Crompton & Knowles Loom Works, Worcester, Mass., addressed the Springfield (Mass.) chapter of the American Society for Steel Treating on Dec. 16. His subject was "The Efficiency of Different Mixtures for Cyanide Hardening," and the lecture was illustrated.

W. W. MACCLEARY, for many years associated with the Whitaker-Glessnes Co., at Portsmouth, Ohio, and during the war in charge of the raw material purchases of the War Department ordnance bureau, has been made district manager at New York for the Warren Iron and Steel Works, Warren, Ohio.

LAWRENCE J. STODDARD, who had resigned as sales manager for the small tools department of the Greenfield Tap and Die Corporation, will assume the position of sales manager of the Lakeside Forge Co., Erie, Pa., on Jan. 1.

H. O. PETERSON has joined the Chicago branch office of the general sales department of the Gilbert & Barker Manufacturing Co., of West Springfield, Mass.

W. E. HILL has recently joined the general sales department of the Gilbert & Barker Manufacturing Co., West Springfield, Mass. Mr. Hill will be the representative of the company in Grand Rapids, Mich.

Obituary

CHARLES H. BARRETT, president of the Meadville Wrench Co., and director in the Barrett Machine Tool Co., died recently.

JOHN MCCLARY, president and founder of the McClary Manufacturing Co., London, Ontario, Canada, died suddenly last week. He was ninty-three years old.

THOMAS B. DOWSLEY, inventor of the Downsley spring, and president of the Dowsley Spring and Axle Co., Chatham, Ontario, Canada, died recently at Owen Sound, Ontario.

JOHN BINDLEY, chairman of the board of directors of the Pittsburgh Steel Co., died at his winter home in Florida on Dec. 20. He was seventy-five years old.

Trade Catalogs

Lead Screw Variator. Precision and Thread Grinder Manufacturing Co., Philadelphia, Pa. Circular describing a machine for obtaining precision lead from a lathe lead screw. Another device described in a similar circular is the multi-graduated precision grinder.

Special Ingersoll Milling Machine. Ingersoll Milling Machine Co., Rockford, Ill. Circular illustrating and describing a new special, heavy, adjustable housing, milling machine, 27 ft. long and 31 ft. 10 in. wide overall. It weighs 150,000 lb.

Pneumatic Products. Chicago Pneumatic Tool Co., Chicago, Ill. Special publication No. 674, describing a line of pneumatic tools, including riveting, chipping and calking hammers; air drills and grinders; geared hoists, winches and motors.

Sullivan Pumps. Sullivan Machinery Co., Chicago, Ill. Catalog 70-W, 71-F and 71-G, describing a line of air lift pumps, displacement pneumatic pumps and rotator hammer drills.

Boring, Drilling and Milling Machine. Pawling & Harnischfeger Co., Milwaukee, Wis. Bulletin No. 4-F illustrating and describing a horizontal, floor type boring, drilling and milling machine, with standard equipment.

Clark Band Saw. Clark Tool Works, Inc., Belmont, N. Y. A well prepared catalog illustrating and describing the Clark compound metal cutting band saw. Specifications, performance tests and other data are included.

Hydraulic Power Transmissions. The Oilgear Co., Milwaukee, Wis. Bulletin No. 2 describing a line of variable speed oil-pressure power transmission machinery using the Oilgear feed control system.

Forthcoming Meetings

American Engineering Council: Annual meeting Jan. 5 and 6, Washington, D. C. L. W. Wallace is secretary.

Society of Automotive Engineers: Annual meeting Jan. 11 to 13, Engineering Societies Building, New York City. C. F. Clarkson, secretary.

American Society of Civil Engineers: Annual meeting Jan. 18 and 19, Engineering Societies Building, New York City. Charles W. Hunt, secretary.

United Engineering Societies: Annual meeting Jan. 26, Engineering Societies Building, New York City. A. D. Flinn, secretary.

American Institute of Electrical Engineers: Mid-winter meeting Feb. 15, 16 and 17. Engineering Societies Building, New York City, F. L. Hutchinson, secretary.

American Institute of Mining and Metallurgical Engineers: Annual meeting Feb. 20 to 24, Engineering Societies Building, New York City. B. Staughton, secretary.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Chuck, Drill, Slip-Collet, "Rapid"

American Equipment Co., 5928 Second Blvd., Detroit, Mich.
"American Machinist," July 28, 1921.

Drills, reamers, counterbores and taps may be held in the collets, which can be put in or taken out of the chuck by one hand while the spindle is running, it being necessary only to raise the outer sleeve. There are no projections from the chuck, the exterior being smooth. The main feature of the device is the use of two driving keys. The illustration shows the chuck in both the released and the driving positions. The chuck is made in five sizes, having outside diameters from 1½ to 3⅝ in. Either blind-head or slotted collets can be furnished, to enable the removal of the drill.

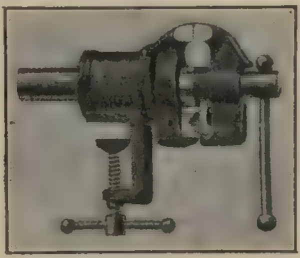
Clamps, Parallel, Toolmakers'

Union Tool Co., Orange, Mass.
"American Machinist," July 28, 1921.

On each clamp the outer screw, which has a step bearing in the lower jaw, is held to that jaw by two steel pins that enter a groove in the end of the screw, thus preventing the latter from slipping out of its bearing and allowing the upper jaw to swing around. One of the clamps is arranged to have both screws project from the same side, so that the lower jaw may be used as a parallel strip. This arrangement enables the toolmaker to set up his work on a pair of parallels and clamp it in place without necessitating the use of extra bolts and straps. All parts are hardened and the straps are ground accurately square and parallel.

Vise, Combination, Special, F & R

Boker Cutlery and Hardware Co., Inc., 101 Duane St., New York, N. Y.
"American Machinist," July 28, 1921



The vise is fitted with two sets of jaws, one being placed on each side of the operating screw. The jaws can be swung about the axis of the screw, so that either set may be at the top or at any angle desired, a locking device holding them in place. The No. 3-S vise has jaws 3 in. wide and capable of opening 3½ in., while the pipe jaws can hold pipe up to 1 in. in size and round stock up to 1⅜ in. in diameter. A shear blade is placed back of the moving pipe jaw, so that bars up to ¼ in. in diameter can be placed under it and cut by turning the tightening screw. The clamp is suitable for holding the vise on a bench from ¾ to 3 in. in thickness.

Grinding Machine, Tool, Ball Bearing

The Wheeler Co., Railroad, Pa.
"American Machinist," July 28, 1921.

The machine is similar in construction to the polishing machine made by the same concern, its chief feature being the fact that ball bearings are employed for all the running parts; that is, for the spindle, the countershaft and the loose pulley. The machine is made in units, each complete in itself. The head alone can be used on a bench or mounted on the pedestal. The countershaft assembly is mounted at the rear of the pedestal, and is fitted with a shifter operated by means of a pedal at the front of the machine. The head is built in two sizes, one for wheels 10 in. in diameter and 1½ in. thick and the other for wheels from 12 to 14 in. in diameter and up to 2 in. in thickness.

Clips, Card, One-Piece

Detroit Stamping Co., 3445 West Fort St., Detroit, Mich.
"American Machinist," July 28, 1921.

The clips are especially adapted for use where cards have to be changed frequently, as is the case of time cards, stock-bin records, bulletin boards and scheduling boards. They are fastened in place by two screws or tacks and can be used in any position. The holders are ordinarily made of untempered sheet steel. The holding points or lobes are spherically shaped, so that the cards may be easily inserted under them. The style E clip, shown at the top, has but one lobe and is 2 in. in length, while the style C, shown at the bottom and having two lobes or contact points, is 3 in. long.

Hacksaw, Adjustable

Union Tool Co., Orange, Mass.
"American Machinist," July 28, 1921.

The frame is made of cold-rolled steel of heavy section and the minor parts are steel stampings. The channel which forms the back of the frame is truss-shaped, to withstand the bending strain imposed by too great tension on the blade. The position of the blade enables the operator to secure a firm grip and protects the hand against injury when the piece is cut off. The frame will tak

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Extractor, Bushing

Conant & Donelson, Conway, Mass.
"American Machinist," July 28, 1921.

The tool is for extracting the soft bushings used in automobile work. It is made of carbon steel and is hardened. A 16-pitch "saw tooth' thread is cut over the entire length of the tapered portion. For extracting a refractory bushing, the extractor is screwed into the bushing a turn or two, and the bushing driven out by tapping on the small end of the extractor with a mallet or soft hammer. The tool can be used to extract bushings from ½ to 1 in. in diameter.

Gage, Thickness, Feeler

Union Tool Company, Orange, Mass.
"American Machinist," July 28, 1921.

This thickness or "feeler" gage is intended especially for the use of garage repair men. The tool is compactly arranged and is held together by a ring, by which it may be conveniently attached to a key chain, thus enabling the user to carry it in his pocket. There are seven leaves, the thicknesses of which are calculated to provide combinations to any number of thousandths up to 0.043 in. Many half-thousandths combinations may be obtained. The thickness of each leaf is etched upon it in conspicuous figures, so that measurements may be made in comparatively dark places.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Pa., Hamburg—Hamburg Boiler Wks.—one radial drill.

Pa., Mifflinburg — The Mifflinburg Body Co., manufacturer of auto bodies—presses and other equipment for stamping bodies.

Pa., Philadelphia — Fanning & Schuette Mfg. Co., 502 Ruscomb St.—equipment for machine shop now under construction.

Pa., Philadelphia—The Penn Motor Corp., 1719 North Broad St., H. W. Sofield, Pres. —lathes, boring machines, drill presses, etc.

Pa., Philadelphia—The Sobel Multiplying Bookkeeping Machine Co., 880 North 48th St.—one 14 to 18 in. shaper; one 20 in. lathe; surface grinder; power hack saw and electric tool post grinder.

Fla., Ft. Pierce—The Riverside Garage, E. O. Dennison, Mgr.—one shaper, miller, and burning in machine. Estimated cost, $5,000.

La., New Orleans—The Ideal Auto Co., 641 Baronne St., O. Melancon, Prop.—small or medium sized grinder to grind pistons and valves, valve tappets and transmission shaft (used if in good condition).

Ill., Sibley—The twp. High School Bd. Educ., Dist. 48, W. R. Preston, Clk.—manual training and domestic science equipment.

O., Cincinnati—The Economy Mach. Co., 428 East Pearl St.—one 6 ft. boring mill.

O., Cincinnati—C. Vandevalle, West 6th St. and Mt. Echo Rd., manufacturer of machinery and motor boats—Hill cylinder grinder (used).

Wis., Madison — The Ellwood Tractor Mfg. Co., c/o W. S. Heddler, Assn. of Commerce, Cantwell Bldg.—special machinery for proposed tractor factory.

Wis., Milwaukee — Johns-Manville Co., Inc., 201-31 Clybourn St., G. A. Lindhill, Purch. Agt.—one 30 in. engine lathe, with 16 ft. bed, gear box with 3 in. raising blocks to increase swing to 36 in. and an attachment arm to cut and thread pipe up to 20 in. diameter, one 14 in. lathe with 8 ft. bed, gear box, feed, one No. 2 plain milling machine with gear box, equipped for single pulley, one 4 ft. radial drill with speed box, one 20 in. back geared drill, one No. 2 Universal cutter and tool grinder, one 9 x 9 in., or 8 x 8 in. high speed hack saw, one pipe threading and cutting off machine, capacity 2½-8 in., one pipe threading and cutting off machine, capacity 4-12 in., one 20 in. back geared shaper with gear box, one 26 in. x 26 in. x 12 ft. open sided planer, one 60 in. automatic knife grinder, one No. 2 Universal milling machine with gear box equipped for single pulley, all foregoing to be belt driven; one 14 in. sensitive floor drill with cone pulleys, one No. 3 emery grinder, for wheels 10 x 1½ in., one No. 5 emery grinder for wheels 16 in. x 2½ in.

Wis., Orfordville—O. A. Roen—special machinery for proposed machine shop.

Wis., Peshtigo—Parlow Bros. Co.—machinery and equipment for auto repair shop.

Mo., Joplin—W. LaBarr, 626 Byers Ave. —machine shop tools, including lathes, wrenches, and an air compressor.

Okla., Okmulgee—The Okmulgee Machine Shop, 2nd and Alabama Sts.—one 30 in. lathe with not less than 12 ft. bed, also foundry equipment to handle oil field work.

Cal., San Diego—The City, E. D. Williams, City Hall, Purch. Agt.—one 12 in. independent lathe chuck; one key seating drill for lathe; one Ford coil testing machine; 2 sets ½ in. to 1 in. stocks and dies; one portable electric drill.

Cal., San Diego—The Independent Electrical Co., 828 7th St., F. L. Edwards, Mgr. —armature winding machine and screw cutting lathe.

Cal., San Diego—The San Diego Machine Co., 743 4th St.—one 2 in. turret lathe to handle 2 in. bar stock, cylinder grinder, crank shaft grinder and piston grinder.

Cal., San Diego—Young & Chamberlain, 1130 Front St.—drill press and air compressor.

La., New Orleans—The Mooney Sheet Metal Wks., 728 Girod St.—small boring machine complete, large size hand groover, shears No. 8 (used if in good condition).

Conn., Bridgeport—Botwinik Bros., 28-42 Drouve St., —$2,500 worth of used woodworking equipment, including planers, jointers, circular saws, band saws, etc., also 5 ton good used belting.

Conn., New Haven — F. L. McDermott Iron Wks., 217 Lafayette St., F. L. McDermott, Purch. Agt.—two 1½ ton chain hoist blocks.

Pa., Philadelphia — The Thull Furniture Co., Trenton Ave. and Dauphin St.—additional machinery including sanders, gang drills and mortiser.

Pa., Pittsburgh — The Pittsburgh Valve Fdry. & Constr. Co., 26th St., along tracks of Allegheny Valley R.R.—one large face grinder.

W. Va.—Huntington — C. A. Love Co., 1145½ 4th Ave—complete circular saw mill.

W. Va., Lowsville—R. Talbott Coal Co.—loading, conveying and other equipment for coal plant.

O., Dayton — The Advance Fdry. Co., Parnell St.—one 24 in. tumbler (used if in good condition).

Wis., Chippewa Falls — The Chippewa Wood Mfg. Co.—wood working machinery.

Wis., Green Bay—Ford Howard Paper Co., South State St.—paper machine and beater.

Wis., Kenosha—The Nash Motor Co., W. A. Gross, Kenosha, Engr.—equipment for private gas plant.

Wis., Oshkosh—F. E. Zuelke, 238 Waugoo St.—ice cream machinery and other refrigerating machinery.

Wis., Milwaukee—The Milwaukee Goodwill Industries, 407 Grove St., O. A. Friedman, Purch. Agt.—automatic fly shuttle rag-rug loom.

Wis., Sheboygan—The Leverenz Shoe Co., 830 Alabama Ave.—special machinery for cutting leather, etc.

Ia., Monticello—The Monticello Tire & Rubber Co.—equipment for the manufacture of tires.

Cal., San Diego—The Coast In Garage, 302 B St., J. E. and M. V. Knapp, Mgrs. —air compressor, motor driven.

Ont., Forest—T. H. Cooke—equipment for ham and bacon curing plant.

Que., Montreal—The Mount Royal Arena, Mount Royal Ave. W., T. J. Duggan, Purch. Agt.—equipment for artificial ice plant.

Metal Working Shops

NEW ENGLAND STATES

Conn., Bridgeport—Union Specialty Co., 138 Hurd Ave., is having plans prepared for the construction of a 2 story, 50 x 125 ft., factory for the manufacture of small metal articles, etc., on Hurd Ave. Estimated cost, $50,000. Private plans.

MIDDLE ATLANTIC STATES

N. J., West Hoboken — J. Keavy, 357 Palisade Ave., has had plans prepared for the construction of a 1 story, 75 x 100 ft. garage on Malone St. Estimated cost, $42,000. McDermott & Binda, 582 Bergenline Ave., Archts.

Pa., Johnstown — The Wharton Motors Co. plans to construct a 3 story motor factory. Estimated cost, $100,000. W. H. Lamborne, Mgr. Architect not selected.

Pa., Sharon—The Wilton Tool Co., 2121 Grand River Ave., Detroit Mich., plans to construct a 100 x 150 ft. plant here for the manufacture of gage blocks, measuring and precision tools.

MIDDLE WEST STATES

Ind., Indianapolis — The Alena Steam Products Co., 208 Hume Mansur Bldg., is having plans prepared for the construction of a 1 story, 60 x 260 ft. truck and tractor factory on Denny Ave. Estimated cost, $45,000. F. Hamilton, 208 Hume Mansur Bldg., Engr.

Ind., Indianapolis—F. R. Chandler, 3817 North Pennsylvania St., is having plans prepared for the construction of a 5 story, 60 x 202 ft. garage at 30-32 West Vermont St. Estimated cost, $250,000. Vonnegut, Bohn & Mueller, 610 Ind. Trust Bldg., Archts.

O., Cleveland — The Cleveland Refrigerator Co., 2996 East 72nd St., has awarded the contract for the construction of a 1 story, 60 x 180 ft. factory and warehouse, at 600 Sideway Ave. Estimated cost, $50,000. Noted Dec. 22.

O., Lakewood — (Cleveland P. O.) — H. Kaplan, 2016 Marlowe Ave., plans to construct a 1 story garage on Madison Ave. near Marlow Ave. Estimated cost, $40,000. Private plans.

Wis., Green Bay — Ford Howard Paper Co., South State St., has awarded the contract for the construction of a 3 story, 100 x 120 ft. machine shop on South State St. Estimated cost, $200,000.

Wis., Madison—The Ellwood Tractor Mfg. Co., c/o W. S. Heddler, Assn. of Commerce, Cantwell Bldg., is having plans prepared for the construction of a 2 story, 60 x 150 ft. tractor factory. Estimated cost, $50,000. Private plans.

Wis., Orfordville—O. A. Roen plans to construct a 1 story, 50 x 90 ft. machine shop. Estimated cost, $45,000. Architect not selected.

WEST OF MISSISSIPPI

Mo., Joplin—W. LaBarr, 626 Byers Ave., is having plans prepared for the construction of a 1 story, 30 x 45 ft. machine shop on 4th St. and Schifferdecker Ave. Estimated cost, $8,000. C. Sudhoelter, 715 Joplin St., Archt.

The Weekly Price Guide

This Week's Market

Pittsburgh mill price of $1.50 on structural steel shapes, plates and bars continues to apply on lots of 100 tons or more; smaller tonnages, $1.60 per 100 lb. Mill shipments, New York, of steel shapes are quoted at $1.88@$1.98; plates at $1.83@$1.98 and soft steel bars at $1.88 per 100 lb. A reduction of $4 per ton is quoted on wire rods and plain steel wire has dropped 35c. per 100 lb. during the week.

Openhearth spring steel is quoted in New York warehouses at 4½c. as against 5c. and light spring steel (base) at 7c. as compared with last week's price of 8c. per lb.

Aluminum ingots, 98 to 99 per cent, are quoted at 19.2c. as against 25.2c. per lb. in less than 15 ton lots.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$22.50
Northern Basic	22.02
Southern Ohio No. 2	23.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	28.50
BIRMINGHAM	
No. 2 Foundry	18.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	23.26
Virginia No. 2	28.74
Basic	20.75
Grey Forge	22.50
CHICAGO	
No. 2 Foundry local	21.70
No. 2 Foundry, Southern, sil 2.25@2.75	24.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	22.46
Basic	20.96
Bessemer	21.96

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.25	3.28	3.10	3.38
No. 12	2.30	3.33	3.15	3.43
No. 14	2.35	3.38	3.20	3.48
No. 16	2.55	3.48	3.30	3.58
Black				
Nos. 17 and 21.	2.85	3.80	3.55	3.95
Nos. 22 and 24.	2.90	3.85	3.60	4.00
Nos. 25 and 26.	2.95	3.90	3.65	4.05
No. 28	3.00	4.00	3.75	4.15
Galvanized				
Nos. 10 and 11.	3.00	4.00	3.75	4.15
Nos. 12 and 14.	3.10	4.10	3.85	4.25
Nos. 17 and 21.	3.40	4.40	4.15	4.55
Nos. 22 and 24.	3.55	4.55	4.30	4.70
No. 26	3.70	4.70	4.55	4.85
No. 28	4.00	5.00	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel			BUTT WELD	Iron	
Inches	Black	Galv.	Inches	Black	Galv.
1 to 3	71	58½	¾ to 1½	44½	29½
		LAP WELD			
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	29½
9 to 12	64	50½	7 to 12	40½	27½
		BUTT WELD, EXTRA STRONG, PLAIN ENDS			
1 to 1½	69	57½	1 to 1½	44½	30½
2 to 3	70	58½			
		LAP WELD, EXTRA STRONG, PLAIN ENDS			
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded.	66%	53%	60½%	47½%	60%	46%
2½ to 6 in. steel lap welded.	61%	47%	58½%	44½%	57%	43%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.28
Spring steel (light) (base)	6.00	6.00	3.68
Coppered Bessemer rods (base)	7.00	8.00	6.03
Hoop steel	3.53	3.14	3.28
Cold rolled strip steel	6.25	8.25	6.75
Floor plates	4.85	2.64@2.80	5.23
Cold finished shafting or screw	3.55	3.50	3.55
Cold finished flats, squares	4.05	4.00	4.05
Structural shapes (base)	2.78	2.64	2.88
Soft steel bars (base)	2.68	2.54	2.78
Soft steel bar shapes (base)	2.68	2.54	2.78
Soft steel bands (base)	3.28	....	3.48
Tank plates (base)	2.78	2.92½	2.88
Bar iron (2.00@2.10 at mill)	2.68	3.52	2.78
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
$\frac{3}{32}$	8.50		12@13
$\frac{1}{8}$	7.15		11@12
$\frac{5}{32}$ to $\frac{1}{4}$	6.75		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.37½
Tin, 5-ton lots, New York	34.00
Lead (up to carlots), St. Louis, 4.60; New York	5.00
Zinc (up to carlots), St. Louis, 4.97½; New York	5.62½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	18.00
Antimony (Chinese), ton spot	5.50	6.50	6.75
Copper sheets, base	21.25	22.00	23.00
Copper wire (carlots)	16.50	17.00	16.25
Copper bars (ton lots)	19.75	24.00	19.50
Copper tubing (100-lb. lots)	21.25	24.00	23.00
Brass sheets (100-lb. lots)	16.75	17.00	18.75
Brass tubing (100-lb. lots)	18.50	19.50	20.50
Brass rods (1,000-lb. lots)	14.75	16.00	15.75
Zinc sheets (casks), (8% dis. carlots)	10.50	10.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ½), (case lots)	21.00	21.50@23.50	19.25
Babbitt metal (best grade)	24.62½	43.75	36.00
Babbitt metal (commercial)	9.87½	13.50	9.00

—Shop Materials and Supplies

MONEL METAL—Base price in cents per lb., f.o.b. Bayonne, N.J.:

Shot	35.00	Hot rolled machined rods (base)	53.00
Blocks	35.00	Hot rolled rods (base)	42.00
Ingots	38.00	Cold drawn rods (base)	56.00
Sheet bars	40.00	Hot rolled sheets (base)	55.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grades "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

OLD METALS--Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	11.25	11.50	11.00
Copper, heavy, and wire	11.00	11.00	10.00
Copper, light, and bottoms	9.50	9.00	8.75
Lead, heavy	4.00	3.75	3.50
Lead, tea	3.00	2.75	3.00
Brass, heavy	7.00	6.50	8.50
Brass, light	5.00	4.50	5.00
No. 1 yellow brass turnings	5.75	5.50	5.75
Zinc	3.00	2.50	2.75

TIN PLATES—American Charcoal Plates—Bright—Cents per lb

	New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:			
IC, 20x28, 112 sheets	20.00	19.00	18.50
IX, 20x28, 112 sheets	22.50	21.50	20.90
"A" Charcoal Allaways Grade:			
IC, 20x28, 112 sheets	17.00	16.75	17.00
IX, 20x28, 112 sheets	20.00	19.50	19.60
Coke Plates, Bright			
Prime, 20x28 in.:			
100-lb., 112 sheets	12.50	12.00	14.50
IC, 112 sheets	12.80	12.30	14.80
Terne Plate			
mall lots, 8-lb. Coating:			
100-lb., 14x20	7.00	5.60	7.25
IC, 14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb	$\$0.07\frac{1}{2}$@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb	.055@.09	.09	.10
Wiping cloths per M., $13\frac{1}{4}$x$13\frac{1}{4}$	....	50.00	55.00
Wiping cloths per M., $13\frac{1}{4}$x$20\frac{1}{2}$	....	55.00	65.00
Sal soda, 100 lbs	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb	2.55	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.72	.77	.74
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 75 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville........per ton			$2.75
Coke, prompt foundry, Connellsville.......per ton			3.75

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in	—50%	—60%	60-10-10%
$1\frac{1}{8}$ and $1\frac{1}{4}$x3 in. up to 12 in	—40%	-60-10-10%	-60-10%
With cold punched sq. nuts	—30%	....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	—40%	.....	$4.00 off
Button head bolts, with hex. nuts	—20%	$3.90 net	.....
Hex. head and hex. nut bolts	—20%	....	-65-5%
Lag screws, coach screws	—50–10%	....	—60%
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	—50-10-10%	50–5%
Bolt ends, with hot pressed nuts	—50%	....	—55%
Tap bolts, hex. heads	—20%	....	.....
Semi-finished nuts all sizes	—70%	—75%	—80%
Case-hardened nuts	—60%	....	.....
Washers, cast iron, $\frac{1}{2}$ in., per 100 lb Off list	$5.00	$5.50	$3.50 net
Washers, cast iron, $\frac{5}{8}$ in. per 100 lb. Off list	4.25	3.75	3.50 net
Washers, round plate, per 100 lb. Off list	3.00	....	3.50 net
Nuts, hot pressed, sq., per 100 lb Off list	2.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	2.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.50	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.50	3.00	4.00
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	—50-10%	60-10-10%	-65-5%
Rivets, tinned	—50-10%	60-10-10%	$4\frac{1}{2}$c. net
Button heads $\frac{3}{4}$-in., $\frac{7}{8}$-in., 1x2 in. to 5 in., per 100 lb (net)	$3.50	3.50	3 43
Cone heads, ditto (net)	3.60	3.60	3.53
$1\frac{1}{8}$ to $1\frac{7}{8}$-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
$\frac{7}{8}$ in. diameter *EXTRA*	0.15	....	0.15
$\frac{1}{2}$ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in *EXTRA*	0.25	....	0.25
Less than 200 lb *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$4.03 base
Copper rivets	—60-5%	—40-10%	—50-10%
Copper burs	—40%	—15%	—10%

	New York	Cleveland	Chicago
Lard oil, pure, (50 gal. bbl.) per gal	$0.90	$0.85	$0.90
Lard cutting oil (50 gal. bbl.) per gal.	0.60	0.50	0.55
Machine oil, lubricating, per gal.	0.45	0.35	.....
Belting—Present discounts from list in fair quantities ($\frac{1}{2}$ doz. rolls)			
Leather:			
Light grade	50–5%	50–5%	50–5%
Medium grade	45%	40–10–$2\frac{1}{2}$%	.....
Heavy grade	40%	40%	.....
Rubber and duck:			
First grade	50–10%	50–10%	.....
Second grade	60–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	List $9.00 less 20-10-5%	50–10–5%'	–20-10%
Emery paper	List 11.00 less 20%	$11.00 net	–20%
Emery cloth	List 32.75 less 10%	32.75 net	–10%
Flint cloth, regular weight, width $3\frac{1}{2}$ in., No. 1 grade, per 50 yd. roll	$4.50 net	....	list+10%
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	List $1.65 less 20%	.....	–10%
Cloth	List $3.55 less 10%	.....	–10%

Mo., St. Louis—C. Ulman, 4550 Lindell Ave., is having plans prepared for the construction of a 1 story garage at 221 York Ave. Estimated cost, $40,000. P. J. Bradshaw, International Life Bldg., Archt.

Mo., St. Louis—Haynes & Langenberg Mfg. Co., 4045 Forest Park Blvd., has awarded the contract for the construction of a factory for the manufacture of furnaces. Estimated cost, $125,000. Noted Nov. 24.

CANADA

Ont., Brockville—J. R. Baxter Co., Engrs., 102 St. Antoine St., Montreal Que., will soon receive bids for the construction of a factory for the manufacture of electric goods, for E. F. Phillips Electrical Wks., Ltd. Estimated cost, $40,000. Noted Nov. 3.

General Manufacturing

NEW ENGLAND STATES

Conn., Bridgeport—The Nichols Underwear Corp., Inc., 23 Benham Ave., has awarded the contract for the construction of a 2-story, 50 x 100 ft. addition to its factory. Noted June 16.

Conn., South Norwalk—The Norwalk Box Co., North Main and Ann Sts., is having plans prepared for the construction of a 4 story, 60 x 180 ft. box factory on North Main St. Estimated cost, $100,000. Fletcher Thompson, Inc., 542 Fairfield Ave., Bridgeport, Archts. and Engrs.

Mass., Webster—Stevens Linen Wks. has awarded the contract for the construction of a 2 story, 70 x 80 ft. addition to its spinning mill. Estimated cost $50,000.

R. I., Pawtucket—The Providence Braid Co., Lowden St., has awarded the contract for the construction of a 2-story, 100 x 105 ft. addition to its braid plant. Estimated cost, $50,000.

MIDDLE ATLANTIC STATES

N. J., West New York—P. L. Shultz, Archt., 400 Lewis St., Union Hill, will receive bids until Dec. 31 for the construction of a 1 story, 100 x 150 ft. factory for the manufacture of mirrors, on 13th St. and Park Ave., for S. Denier & Son, 15 Crosby St. Estimated cost, $50,000.

N. Y., Long Island City—The Natl. Printing & Engraving Co., 136 West 52nd St., New York City, plans to construct a 4-story printing plant on Washington Ave., from 6th to 7th Sts. Estimated cost, $400,000. Architect not selected.

N. Y., Utica—A. Scala & Son, 710 Bleeker St., have purchased a site and plan to build a packing plant. Cost between $100,000 to $150,000. Architect not selected.

Pa., Brackenridge—The Atlantic Bottle Co., c/o G. Gander, has awarded the contract for the construction of a 2-story, 100 x 250 ft. bottle manufacturing plant. Estimated cost, $30,000.

Pa., Philadelphia—The Thull Furniture Co., Trenton Ave. and Dauphin St., has awarded the contract for the construction of a 3 story, 18 x 48 ft. furniture factory. Estimated cost, $7,000.

Pa., Turtle Creek—The Wilkinsburg Ice Co., 208 Centre Ave., has awarded the contract for the construction of a 1-story, 85 x 106 ft. ice plant on Monroeville Rd. Estimated cost, $125,000. Noted Dec. 15.

SOUTHERN STATES

W. Va., Wheeling—The White Swan Laundry 30 10th St. will build a 2-story, 50 x 82 ft. and 100 x 200 ft. laundry. Estimated cost, $65,000.

Fla., Osceola (Sanford P. O.)—The Osceola Cypress Co. plans to rebuild its saw mill which was destroyed by fire. Estimated cost, $100,000.

MIDDLE WEST STATES

Ill., Chicago—The Nemo Dye Wks., c/o P. Gerhardt, Archt., 64 West Randolph St., has awarded the contract for the construction of a 1-story, 103 x 115 ft. factory at 4203-07 Grand Ave. Estimated cost, $125,000.

Ill., Henry—The Henry Artificial Ice Co. is having plans prepared for the construction of a 1-story artificial ice plant. Estimated cost, $30,000. C. N. Lucas, Pres. B. L. Hulsebus, 1232 Jefferson Bldg., Peoria, Engr.

Ill., Rockford—Hess & Hopkins Leather Co. will build a 1 story, 60 x 115 ft. tannery. Estimated cost, $40,000. F. L. Morgan, Secy. Noted Dec. 22.

Ill., Rockford—The Nelson Knitting Co., 660 South Wyman St., plans to construct a 3-story knitting factory on Kent St., near Church St. Estimated cost, $75.000. Architect not selected.

Ill., Sterling—The Sterling Canning Co. plans to construct a 2 story cannery. Estimated cost, $45,000. C. M. Sauers, Pres. Architect not selected.

Ill., West Chicago—Reid, Murdock & Co., Clark St. Bridge, has awarded the contract for the construction of a 1-story warehouse and condensing plant. Estimated cost, $40,000. Noted Dec. 1

Ill., Zeigler—The Zeigler Ice & Bottling Co. will build an ice plant. Estimated cost, $50,000. Noted Dec 1.

Ind., Frankfort—Royal Cleaners, 12 South Main St., plans to construct a cleaning establishment on West Washington St. Estimated cost, $25,000. R. Leonard, Peoples Life Bldg., Archt.

Ind., Jonesboro—The Indiana Rubber Co. is having plans prepared for the construction of a 3-story, 60 x 125 ft. factory for the manufacture of rubber products. Estimated cost, $50,000. Private plans.

Ind., New Castle—The Indiana Village of Epileptics will receive bids until Jan. 17 for the construction of 14 buildings, including a 1 story, 64 x 100 ft. laundry. Total cost about $400,000. H. Foltz, 843 Lemcke Annex, Indianapolis, Archt.

O., Cleveland—The Whitman-Jackson Sash & Door Co., 1996 West 3rd St., has had plans prepared for the construction of a 1 story, 70 x 128 ft. addition to its factory. Estimated cost, $40,000. H. M. Morse & Co., Plymouth Bldg., Archts.

Wis., Antigo—C. W. Fish Lumber Co., Elcho, is having plans prepared for the construction of a 1-story, 60 x 75 ft. planing mill, here. Estimated cost, $45,000. Private plans.

Wis., Chippewa Falls — The Chippewa Wood Mfg. Co. is having plans prepared for the construction of a 2 story, 50 x 95 ft. factory. Estimated cost, $65,000. Private plans.

Wis., Chippewa Falls—F. Sterzik, Pres. of the Natl. Toy & Tinsel Co., 16th and Hamilton Sts., Manitowoc, is having plans prepared for the construction of a 2-story, 52 x 76 ft. furniture factory here. Estimated cost, $50,000. Private plans.

Wis., Dundas—The Calûmet Packing Co., c/o P. H. Peacock, Secy., 309 Michigan Ave., Sheboygan, is having plans prepared for the construction of a 3-story, 50 x 50 ft. canning plant here. Estimated cost, $45,000. W. C. Weeks, 720 Ontario Ave., Sheboygan, Archt. Noted Dec. 1.

Wis., Fond-du-Lac—The Eastern Wisconsin Electric Co., 15 North Main St., has awarded the contract for the construction of a 1-story gas plant. Estimated cost $25,000.

Wis., Fond-du-Lac—The Northern Wisconsin Oil Co., De Pere St., Menasha, has had plans prepared for the construction of a 1 story, 30 x 40 ft. warehouse and a 60 x 60 ft. filling station, on Main and Arndt Sts. Estimated cost, $40,000. Private plans.

Wis., Green Bay—The Fort Howard Paper Co. has awarded the contract for the construction of a 3-story, 100 x 120 ft. paper mill and power house. Estimated cost, $105,000. A. Cofrin, Mgr.

Wis., Green Bay—The Green Bay Investment Corp., 113 West Walnut St., has awarded the contract for the construction of a 3 story, 82 x 240 ft. cold storage plant on North Bway. Esimated cost, $250,000. Noted Dec. 22.

Wis., Green Bay—The Investment Corp. of Green Bay, 113 West Walnut St., will open bids about Jan. 10 for the construction of a 3-story, 80 x 240 ft. cold storage plant on North Bway. Estimated cost, $250,000. L. M. Hansen, Pres. Private plans.

Wis., Kenosha — The Nash Motor Co. plans to construct a private gas plant. Estimated cost, $100,000. Architect not selected.

Wis., Milwaukee—Lockwood Green & Co., Archts., 38 South Dearborn St., Chicago, Ill., is receiving bids for the construction of a 3-story, 260 x 315 ft. tannery at 658 Commerce St., here, for the Amer. Hide & Leather Co., 1320 Elston St., Chicago. Estimated cost, $500,000. G. A. Riker, local mgr. Noted Nov. 3.

Wis., Neenah—The Jersild Knitting Co., 331 North Commercial St., plans to construct a 2-story, 60 x 120 ft. knitting factory. Estimated cost, $100,000. Architect not selected.

Wis., Oshkosh—F. E. Zuelke, 238 Waugoo St., is having plans prepared for the construction of a 2 story, 50 x 54 ft. ice cream factory on Main St. Estimated cost, $40,000. Auler & Jensen, F. R. A. Bldg., Archts.

Wis., Rhinelander—The S. Miller Fruit Co. is having plans prepared for the construction of a 3-story, 50 x 126 ft. warehouse and cold storage plant. Estimated cost, $150,000. Private plans. Noted Nov 10.

Wis., Sheboygan—The Leverenz Shoe Co 830 Alabama Ave., has awarded the contra for the construction of a 1 story, 50 x 6 ft. shoe factory on Alabama Ave. Estimated cost, $45,000.

Wis., Sheboygan—The Wisconsin Mirror Plate Co., 20th and Maryland Sts., has awarded the contract for the construction of a 2-story, 60 x 118 ft. factory on Indiana St. Estimated cost, $150,000.

Wis., Wausau—T. G. Kons Co., recently incorporated, plans to construct a 2-story, 50 x 95 ft. factory for the manufacture of chimney cleaners. Estimated cost, $25,000. Architect not selected.

Wis., Wauwatosa—The Modern Builders Inc., Spring Ave. and Vliet St., will build a 1 and 2 story, 40 x 100 ft. wood working factory. Estimated cost, $50,000.

WEST OF MISSISSIPPI

Ia., Dubuque—The Globe Portland Ce ment Co. has awarded the contract for th construction of a cement plant, includin seven or eight 1- and 2-story buildings, etc Estimated cost, $2 000,000.

Ia., Monticello—The Monticello Tire & Rubber Co. is building a 60 x 160 ft. tir mill. Estimated cost, $20,000.

Mo., Cape Girardeau—The Internationa Shoe Co., 15th and Washington Sts., St Louis, is having plans prepared for the con struction of a 3-story shoe factory, here Estimated cost, $100,000. A. Hume, c/ owner, Engr.

Mo., Carterville—The Carterville Frui & Tomato Cannery, c/o F L. Gass, Secy plans to construct a 1-story cannery or Main St. Estimated cost, $5,000. Architec not selected.

Mo., Joplin—The Thomas Fruit Co., 7t and Virginia Sts., is having plans prepare for the construction of a 3-story ice plan on East 7th St. Estimated cost, $75,000 A. Thomas, Pres. C. A. Moore, 646 Ply mouth Bldg., Minneapolis, Minn., Archt.

Mo., Monett—W. Frederick is havin plans prepared for the construction of a 2 story, 30 x 40 ft. cigar factory. Estimate cost, $10,000. B. Robbins, Monett, Archt.

Mo., Monett—The Hammond Dehydratio Co. is having plans prepared for the con struction of a 2 story dehydration plant o Bway. Estimated cost, $50,000. Hicken lively & Marks, Landers Bldg., Springfiel Archts.

Mo., St. Louis—J. H. Belz Provision Co 2035 Gravois Ave., is having plans prepare for the construction of a 4-story, 36 x 46 f cooler building at 3601 South Bway. Estimated cost, $40,000. Tait & Nordmeye Eng. Co., 1107 Clark St., Engrs.

Mo., Sweet Springs—The Internationa Shoe Co., 15th and Washington Sts., S Louis, plans to build a 2-story factory her Estimated cost, $75,000. Architect no selected.

S. D., Watertown—Kampeska Materia Co. plans to construct a sand, gravel, wash ing and screening plant. Estimated cos $40,000. D. O. Noonan, Pres.

WESTERN STATES

Cal., Calwa—The Pacific Fruit Expres Co., 65 Market St., San Francisco, ha awarded the contract for the constructio of an ice plant. Estimated cost, $52,050.

Cal., Sacramento—A. B. Atkinson, 32 5th Ave., will build a 1-story, 80 x 160 f ice plant on South East 13th and S St Estimated cost, $75,000.

Cal., San Jose—Santa Clara Co. is ha ing plans prepared for the construction a 3 story addition to its service buildin to contain laundry, engine room, cold sto age plant, X-ray rooms, laboratories, et on County hospital grounds. Estimat costs, $60,000. Binder & Curtis, 225½ Sou 1st St., archts.

CANADA

Ont., Acton—A. Mason has purchased old electric power plant and will remod and equip same as wollen mills. Plans build an additional story next year. Estimated cost, $35,000.

Ont., Norwich—W. W. Avey plans to co struct a planing mill. Estimated co $25,000.

Ont., Penetang—Gropp Bros. plan to r build their saw mill which was destroy by fire. Estimated cost, $20,000.

Ont., Petrolea—The Peninsular Sugar C has had plans prepared for the constru tion of a 2- and 4-story sugar refinery, 6 ton capacity. Estimated cost, $1,500,00 F. H. Hubbard, Genl. Mgr.

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High Efficiency Roller and Silent Type

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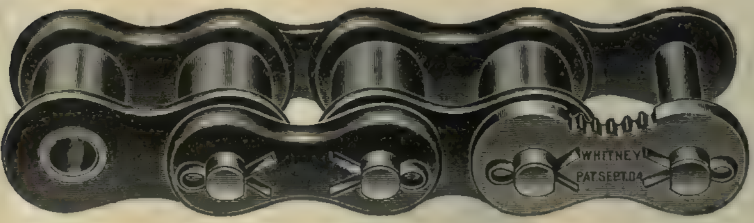

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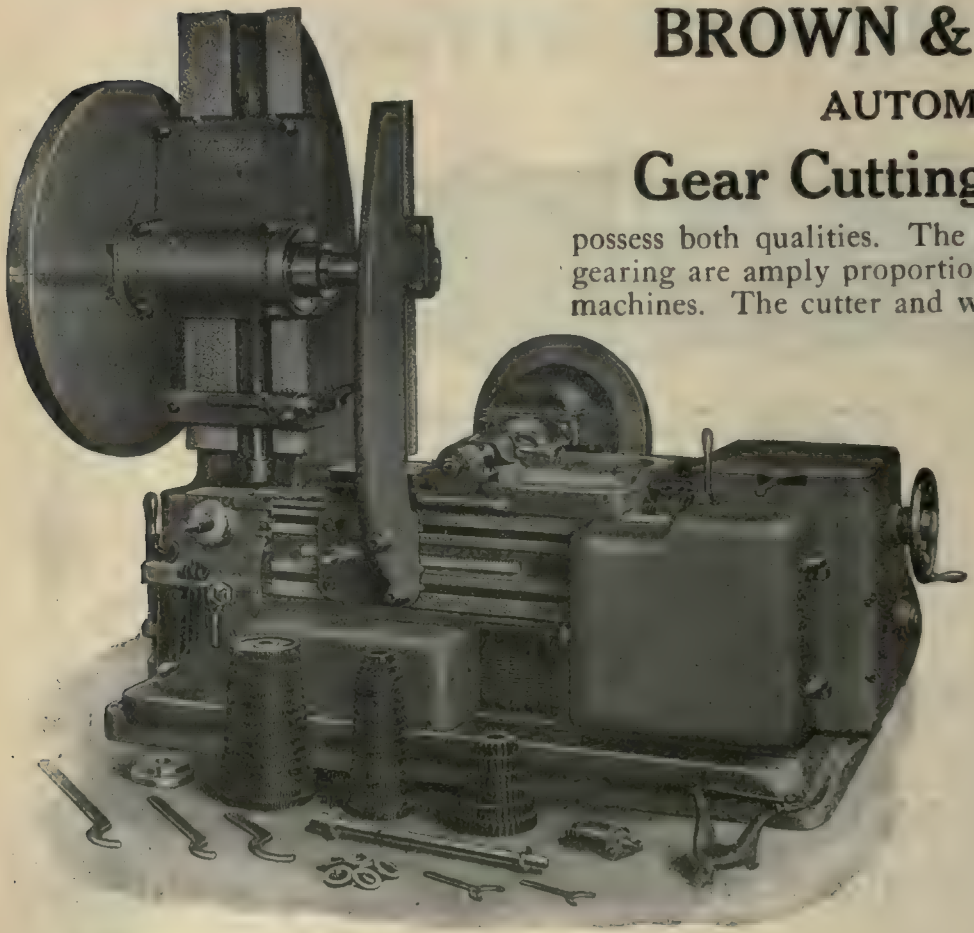

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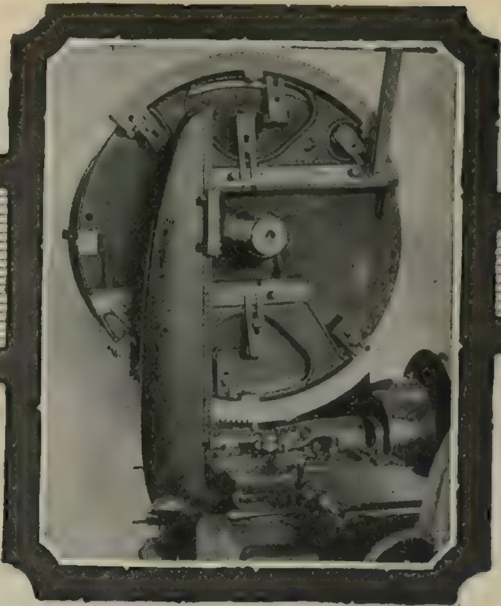
possess both qualities. The driving belt and ratio of gearing are amply proportioned to the capacity of the machines. The cutter and work spindle are of exceptionally large diameter and the heavy balance wheel on the cutter spindle prevents chattering and maintains uniform cutting action.

Capacity No. 6 Machine Spur Gears to 72 in. diameter; 13 in. face, cast iron, 1¾ diametral pitch; steel, 2 diametral pitch.

BROWN & SHARPE MFG. CO.

SHARPE
CUTTING MACHINES



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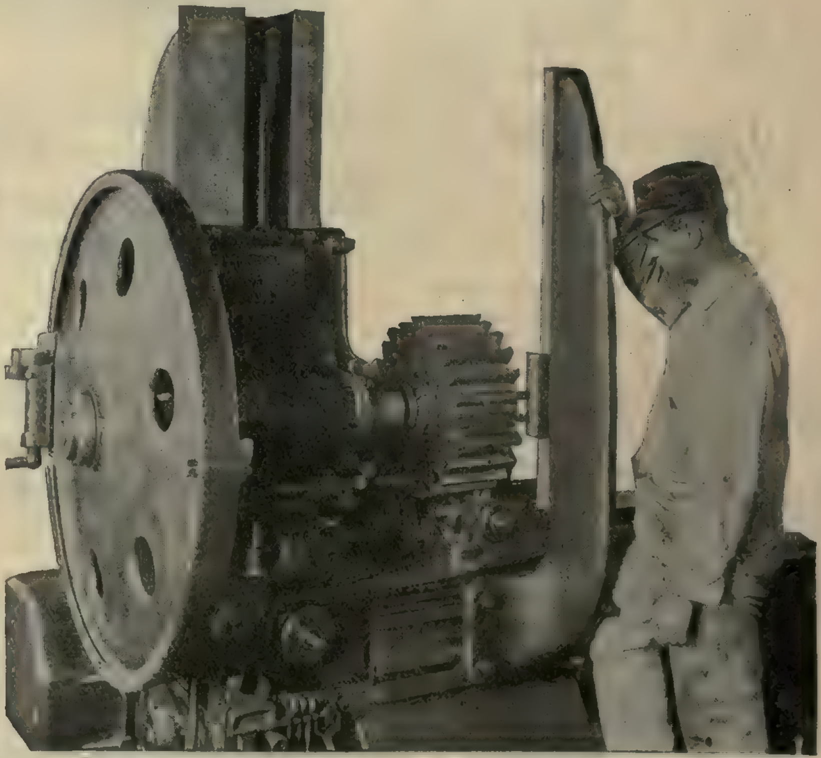
The accuracy with which these machines function is due primarily to their sturdy construction features. The substantial base and the one piece bed and upright, with heavy internal ribbing, furnish a rugged support and prevent vibrations that would impair the accuracy of the finished product. This rigid construction eliminates destructive chatter and permits utilizing fast feeds and high speeds.

The indexing mechanism starts and stops without shock and is locked positively for each tooth space. In addition, the index wheel is of large diameter and keyed to the work spindle, which further reduces the possibility of any inaccuracy in spacing.



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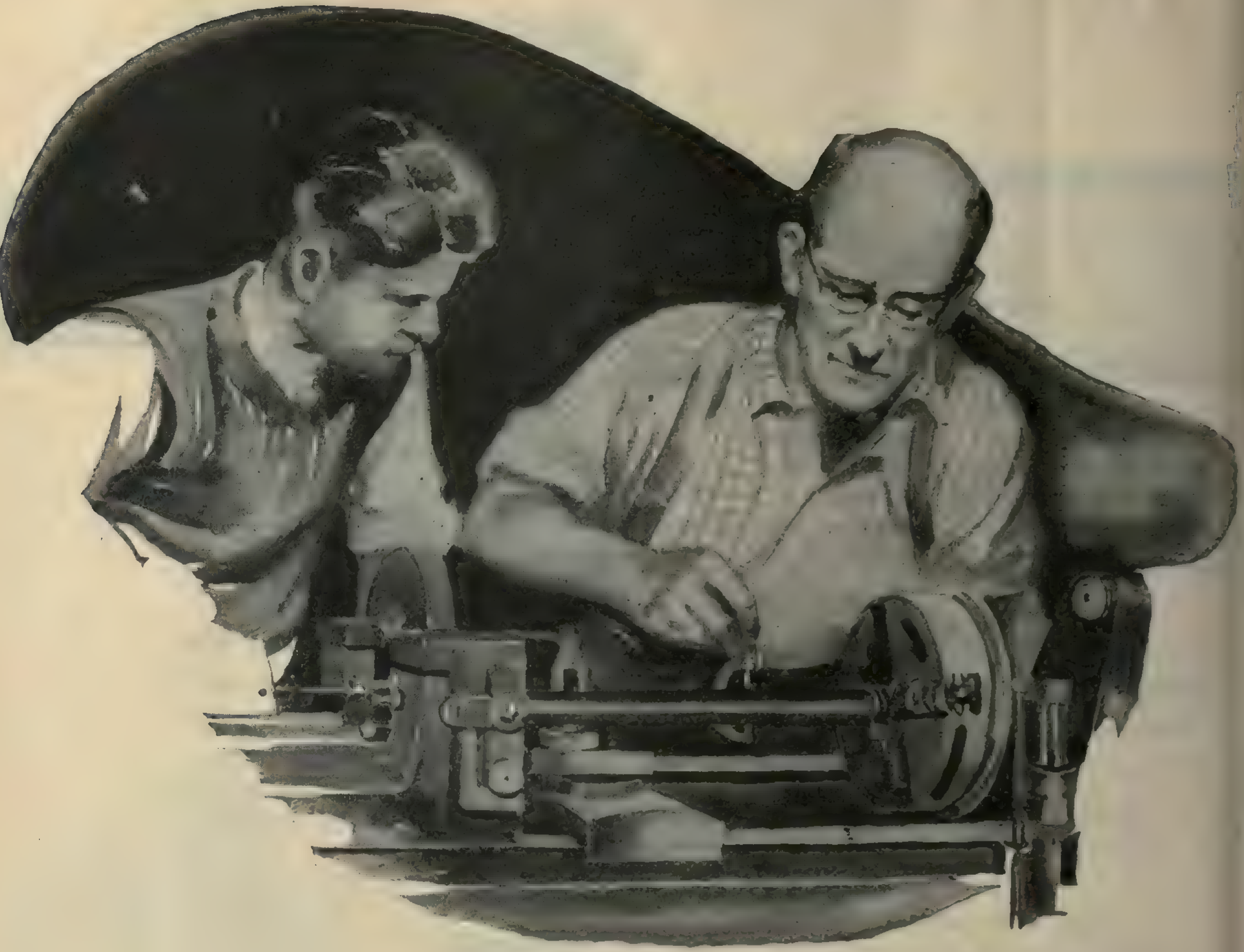

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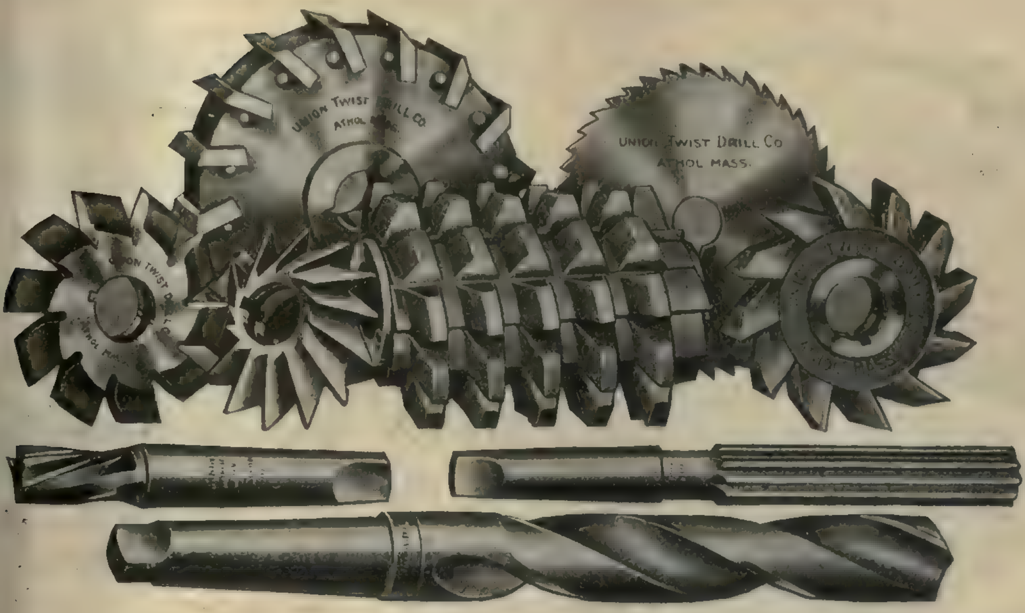
Starrett Tools


UNION TWIST DRILL CO ATHOL MASS.
UNION TWIST DRILL CO ATHOL MASS.
UNION TWIST DRILL CO ATHOL MASS.

Industrial Conditions Clearly Suggest the Use of Union Tools

The necessity for cost-reduction is arousing tool users to the necessity for careful buying. Experience has shown that high grade tools are the most economical. Union Tools are KNOWN to belong to this class.

Are you still resisting this drift to Union? Perhaps you haven't realized before that there is a type for every purpose.

UNION TWIST DRILL CO.
DRILL AND CUTTER MAKERS
ATHOL MASS. USA
NEW YORK **CHICAGO**

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Ledrite Brass Rod A Bridgeport Product — It's Tested

Ledrite Brass Rod is made of carefully selected materials, by exclusive processes that make it possible to test the free-cutting qualities of the metal while the "heat" is still in the molten state.

Ledrite Brass Rod A Bridgeport Product — It's Tested

Ledrite Brass Rod therefore offers the advantages of—

less tool wear,
greater production
and less rejections
of finished parts.

Ask for Brass Rod Book No. 1432.

Bridgeport Brass Company
Bridgeport Connecticut

"Bridgeport" BRASS CO. U.S.A. TRADE MARK

Ledrite Brass Rod A Bridgeport Product — It's Tested

Will Stay 'til the Bench Splits

THE positive lock on this Athol Swivel Base and Swivel Jaw Vise will hold it exactly where you wish it, under strains that will wreck your bench.

This is a mighty desirable type of vise for all-around bench use and readily accommodates itself to a wide variety of work.

The usual "hold-fast" qualities are found in the jaws and speedy swiveling is a feature.

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Athol Vises

Athol Machine & Foundry Co.
Athol, Mass.

The Machine for the Automobile Repair Shop

The NORTON AUTOPART REGRINDING MACHINE need not stand idle in the automobile repair shop—it will do all the cylindrical grinding, the crankshaft, pistons, piston pins and valves. It is a convenient machine for any odd cylindrical grinding job. It was especially designed for the repair shop and is made to the same high standards as are the thousands of Norton machines in use in automobile factories.

This Autopart Regrinding Machine constitutes a large part of the equipment necessary for a regrinding shop.

Thousands of worn automobile engines are being renewed by regrinding.

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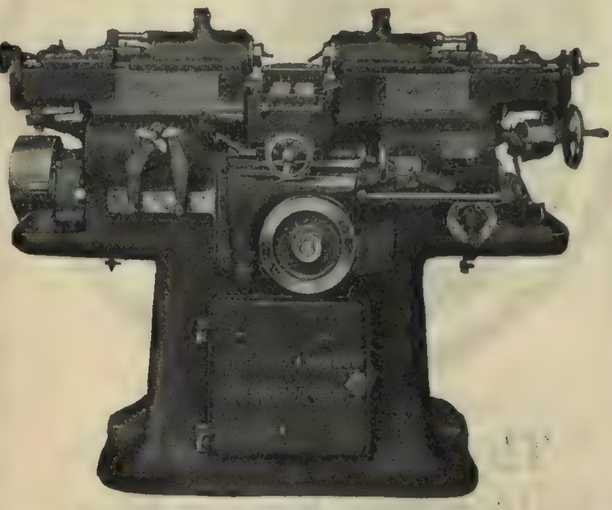
A 2-3

Spline Milling Machine

For splines with closed ends, keyways, through slots, circular, spiral and irregular grooves.

A machine having many new and valuable features described in the circular.



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The Taylor & Fenn Company
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KNIGHT

Milling and Drilling Machine

This is one of the most versatile machines of its kind on the market. It will handle a larger variety of general shop and toolroom work than any other single machine, to our knowledge.

The Table Tilts

The table of the Knight can be swung to practically any angle in the entire circle, and work can be milled, drilled, reamed, bored, etc., at the same setting.

It is exceptionally simple of construction and operation. Any intelligent man or boy can easily be taught to run it, and turn out the best grade of work.

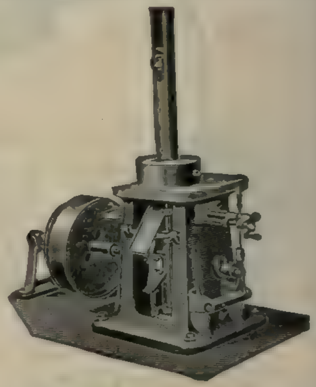
Economical Maintenance

All parts of the Knight are interchangeable. There is nothing superfluous or over-elaborate. Its power consumption, operating costs, and initial investments are nominal. Literature on request.

W. B. Knight Machinery Company
3920 West Pine Boulevard, St. Louis, Mo.

Better Keyseats for Less Money
on the

GIANT

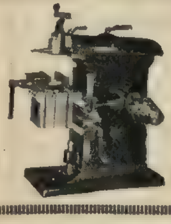


The design of the GIANT Keyseating Machine assures precision. Set-Ups are a matter of seconds as no clamps are required to hold the work to the table. The "pull down" of the cutter bar prevents slipping and chatter. Speed is a big factor.

Your work will not prove difficult for the GIANT.

Let us show you.

MITTS & MERRILL, Saginaw, Mich.



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12-14-16-Single Geared
16-20-Back Geared
26-in. Combined Open Side Crank Planer and Shaper
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Builders of High Grade Planers for 33 years. Accurate to the highest degree and Rugged to stand up to the hardest work.

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THE NATIONAL MACHINERY CO
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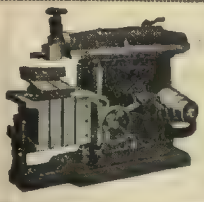

Increased Production Thru

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5-Spindle
AUTOMATIC
Screw Machine

No Special Cams Needed. Uniform feed. For jobbing as well as long runs.

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Boring, Drilling and Milling Machines

Pawling & Harnischfeger Company
Milwaukee, Wisconsin

WE are manufacturers of Lincoln Type Milling Machines, Bench Milling Machines, Hand Milling Machines, and a line of reliable Screw and Lever Vises.

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THE CARTER & HAKES MACHINE CO.
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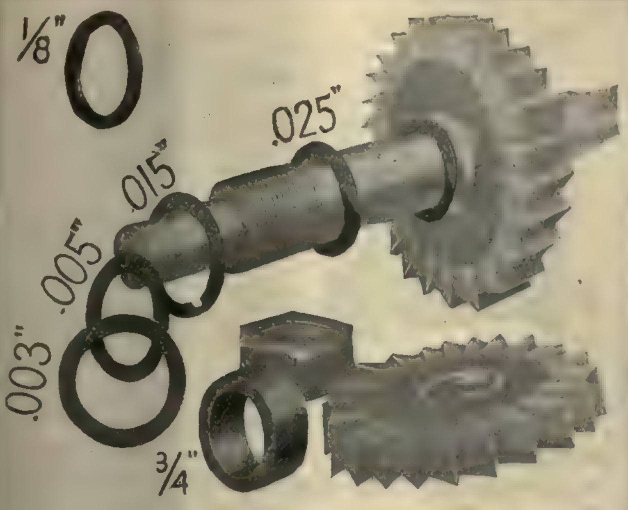

Spacers for Milling Machines Arbors, etc.

For arbors of the following diameters, ½, ⅝, ¾, ⅞, 1, 1⅛, 1¼, 1⅜, 1½, 1⅝, 1¾ 1⅞, 2, 2¼, 2½ and 3½ inches.
.003, .005, .015 and .025 inch thicknesses in stock.
.0015 to 3.000 inch thicknesses made to order.

Prices and Samples on Request.

Detroit Stamping Company
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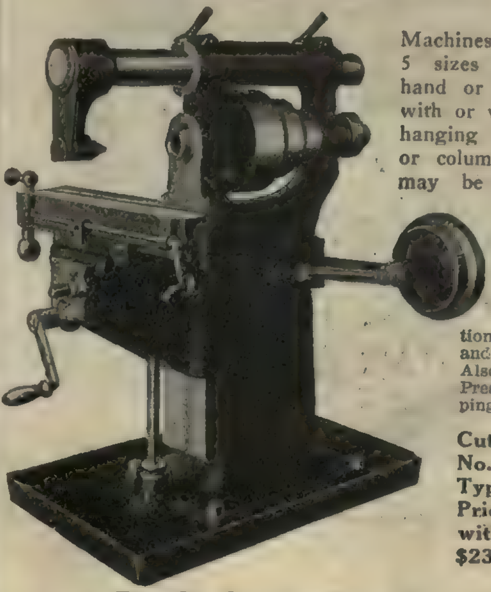
BURKE
Bench Milling Machines
For Accuracy, Convenience, Power, Rigidity, Economy
And the ability to handle any work within the range of the machine.



Machines are built in 5 sizes with either hand or power feed, with or without overhanging arm, bench or column type, and may be fitted with complete set of attachments.

Catalogue gives complete description of machines and attachments. Also Burke Drill Presses and Tapping Machines.

Cut shows the No. 4 Bench Type Machine, Price $220, with Column $236.

The Burke Machine Tool Co.
520 Sandusky St., Conneaut, Ohio, U. S. A.
Dealers in all foreign countries—Write for addresses

Vertical Boring and Turning Mills

handle a wide variety of work not expedient or possible on other machines—particularly the unusual, the irregular.

BICKFORD Vertical Boring and Turning Mill

is a finely developed example. Complete within itself; no costly and seldom-used attachments, therefore moderately priced. 4 ft. to 8 ft. Single or double heads. Rapid power traverse. Motor or belt driven. Get the full catalog description.

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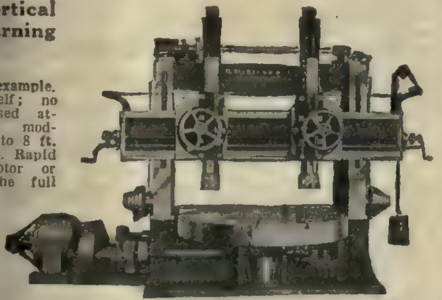
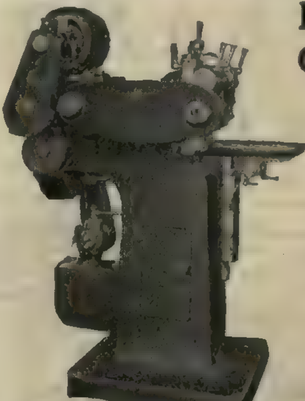




Economical Output Is the Cry

The Standard Milling Machine will handle your small and medium Slotting, Slabbing, Straddle Milling, Profiling, Cam Cutting, Hobbing and Spline Milling operations in a highly economical manner.

It performs many of the operations you ordinarily put on the large, expensive machines.

Get the Bulletin and note its range.

The Standard Engineering Works
Pawtucket, R. I., U. S. A.

Enlarge Your Working Capacity the "Davenport" Way

The wide range of screw machine jobs and the large output made possible on the Davenport Multiple Spindle Automatic Screw Machine, enlarges the working capacity of any shop having this kind of work to do.

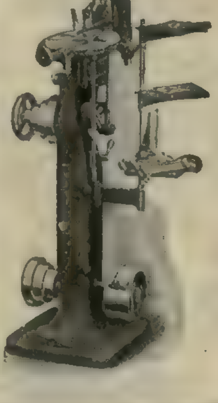
There's no sacrifice in accuracy or finish to get the "Davenport" output.

Many users say that they have taken on business which could never be touched under old production costs.

Let us send you our Catalog. Now

Davenport Machine Tool Co., Rochester, N. Y.

THE AUTOMATIC MACHINE COMPANY
Bridgeport, Conn.
Makers of
Automatic Threading Lathes
Automatic Hob Thread Millers
Coulter Multiple Spindle Profilers
Coulter Shaping Planers Special Machine Tools



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Floor and Bench
Belt and Motor Drive

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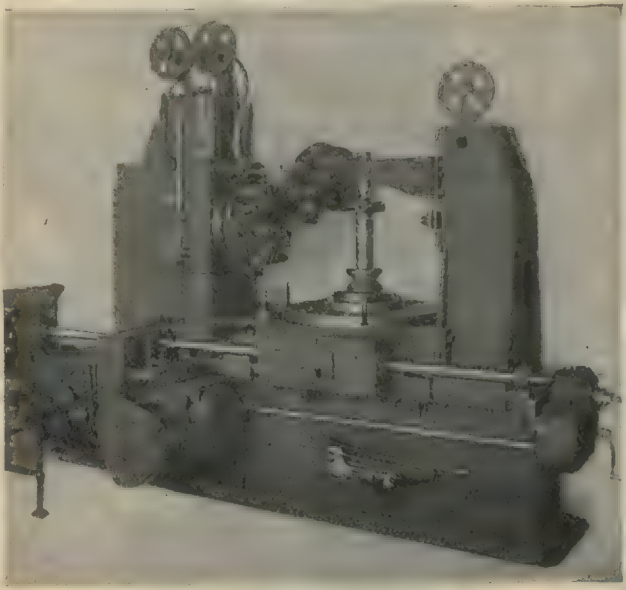
Cochrane-Bly Co.
Rochester, N. Y.

NEWARK GEAR



Newark Hobbing Machine

The growing use of herringbone-gears demands that they be cut on the proper machine.

The NEWARK Hobbing Machine is designed just for such work as herringbone and helical gears. It saves time in setting up and in cutting; and time represents money. The gears are cut with the greatest accuracy.

Newark Gear Cutting Machine Co.
Henry E. Eberhardt, President
65 Prospect St., Newark, N. J.

CLEVELAND
—OPEN-SIDE—
PLANERS

THE CLEVELAND PLANER COMPANY, CLEVELAND, OHIO

For screw machine economy, accuracy and big output

4 Sizes—Get Catalog

Cone Automatic Machine Co., Windsor, Vermont
Mr. J. C. Austerberry, 684 Congress St., Detroit, Mich.

CONE AUTOMATICS

A New Way to Mill Threads

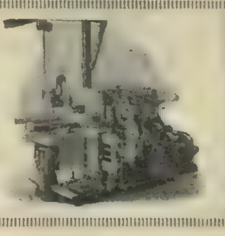
Hall Planetary Thread Millers

Reduces threading cost 50% on some classes of work. Cuts all style threads internal or external.

Write for particulars.

THE HALL PLANETARY THREAD MILLING MACHINE CO.,
Bridesburg, Philadelphia, Pa.

Morton 36-Inch Draw Cut Shaper



A somewhat wider range can be covered, and a heavier grade of work can be done on this machine than on our 30-in. stroke model.

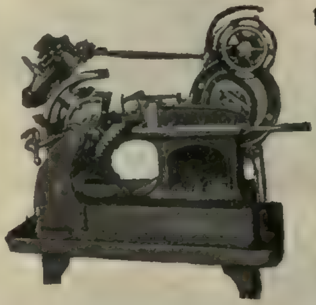
The main difference lies in the fact that the cross-rail is adjusted by two screws instead of one. Also, it can be furnished with extended crossrail and larger table, which adapts the machine to work of a larger size.

We will gladly discuss the applicability of this machine to any work you may have.

Ask for Bulletin No. C-3.

Morton Mfg. Co., Muskegon Heights, Mich.

No Machine Can Be More Accurate than its Bevel Gears



Gears cut on the **Bilgram Bevel Gear Generator** prevent all lost motion and thus enhance the precision of machines of the better grade.

Whether you cut your own or we cut them for you, **Bilgram Gears** will prove more efficient.

We have special facilities for cutting Spur, Worm, Helical, Miter, Internal and Elliptical Gear Wheels. Let us quote on the gears you use.

The Bilgram Machine Works
1233 Spring Garden St., Philadelphia, Pa.

Gear Cutters—Gear Hobbers

For Spur and Spiral Gears

A complete line of automatic machines for automotive and industrial requirements.

The Cincinnati Gear Cutting Machine Co.
(Subsidiary of The Cincinnati Shaper Co.) Cincinnati, Ohio

FOR RAPID AND ECONOMICAL PRODUCTION OF ACCURATE GEARS—INSTALL A

Farwell Gear Hobber

Write for Catalog No. 809

THE ADAMS COMPANY
1910 Bridge Street Dubuque, Iowa, U. S. A.

CINCINNATI SHAPERS

Strokes from 16 to 32 inches

Also Crank Planers and Traverse Head Shapers

The Cincinnati Shaper Co., Cincinnati, Ohio

COOK'S WOOD-SCREW MACHINES

for making

Iron and Brass Wood-Screws

EASY TO OPERATE RAPID OUTPUT ALL SIZES

Modern plant equipment furnished for starting Wood-Screw factories

SEND FOR CATALOG 6-H

The Asa S. Cook Co., Hartford, Conn., U. S. A.

High Duty Shapers and Automatic Gear Cutting Machinery

GOULD & EBERHARDT
"HIGH DUTY" SHAPERS
AUTOMATIC GEAR AND RACK CUTTING MACHINERY
ESTABLISHED 1833 NEWARK, N.J. U.S.A. CHANCELLOR AVE.

KELLY SHAPERS

Have the advantage of being the sole machine tool product of an organization of specialists. They possess correct design. unusual accuracy and are easy to operate. Three sizes, single geared; four sizes, back geared. **Write for a Catalog.**

THE R. A. KELLY COMPANY Makers of shapers only for 25 years.
P. O. BOX 488 XENIA, OHIO, U. S. A.

TIREX
(ALL RUBBER)
Portable Cord

Tirex Cords are extremely flexible. They may be bent, twisted and tied in knots repeatedly without damage. It is impossible to kink them and they always lie flat on the floor leaving no dangerous loops to trip over. Because they never kink their maximum length is always available without delay or annoyance.

SIMPLEX WIRE & CABLE Co
MANUFACTURERS
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You don't have to favor the "Willey"

Portable drill demands are usually severe and it takes a rugged machine to stand up to day-in-day-out service.

Mechanically correct design and smooth, powerful, action gives long service life to "Willey" Portable Electric Drills. They are designed and built for *Service* and prove efficient under all working conditions. "Willeys" have stood the test for over 25 years and will prove economical in your shop.

The Catalog gives details that prove "Willey" superiority. Send for your copy.

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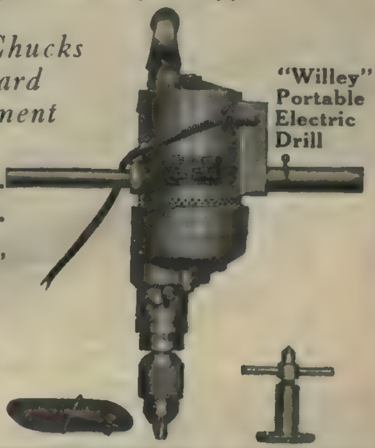
Standard
Equipment


"Willey"
Portable
Electric
Drill

James Clark, Jr.
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521 W. Main Street,
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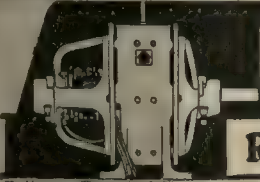
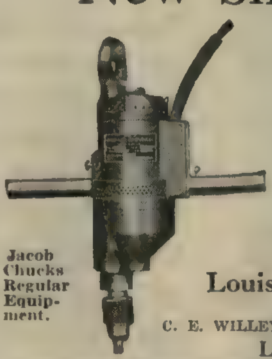


We specialize in motors, ½ to 150 hp. constant and adjustable speed D.C.; squirrel cage and slip ring A.C.

RELIANCE MOTORS

Reliance Electric & Engineering Co., 1044 Ivanhoe Rd., Cleveland, O.

New Single Speed
Pioneer
Electric Drill

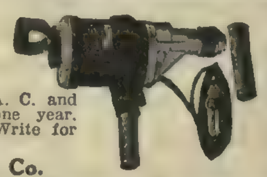

Jacob
Chucks
Regular
Equipment.

"It Will Do the Work"

The Pioneer line of high grade Electrical tools is complete. A size and style for every purpose. Write for prices and description.

Louisville Electric Mfg. Co.
Incorporated
C. E. WILLEY, Pres. J. B. McFERRAN, Sec'y-Treas.
Louisville, Ky., U. S. A.
New York Representative: 150 Nassau St., New York City.

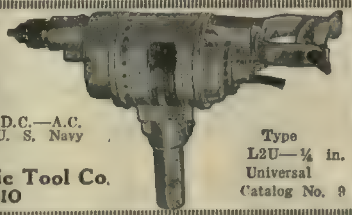
STANDARD PORTABLE
ELECTRIC DRILLS
AND GRINDERS



Manufactured in all sizes for both A. C. and D.C. Every tool guaranteed for one year, both electrically and mechanically. Write for Catalog and Price List.

The Standard Electric Tool Co.
Cincinnati, Ohio

Portable Electric
Drills and Grinders


Type
L2U—¼ in.
Universal
Catalog No. 9

Complete line of sizes suitable for D.C.—A.C. and Universal current tested to U. S. Navy requirements.

The Neil & Smith Electric Tool Co.
CINCINNATI, OHIO

BURKE ELECTRIC CO.
ERIE, PA.

$^{A.C.}_{D.C.}$ MOTORS $^{A.C.}_{D.C.}$ GENERATORS
MOTOR GENERATORS, ARC WELDING EQUIPMENT

Sales Offices: Buffalo, Cleveland, Detroit, Erie, New York, Philadelphia, Pittsburgh
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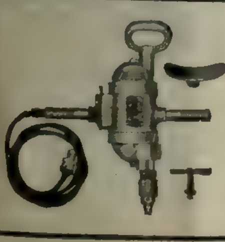

Expensive Equipment Is Not Always Necessary

Take U. S. Electric Tools to the work and save four-fifths of the time usually required on each job. Every kind of portable drill, grinder and buffer ready for prompt delivery. Write for Catalog.

THE UNITED STATES ELECTRICAL TOOL CO., Cincinnati, Ohio

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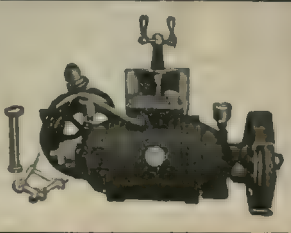
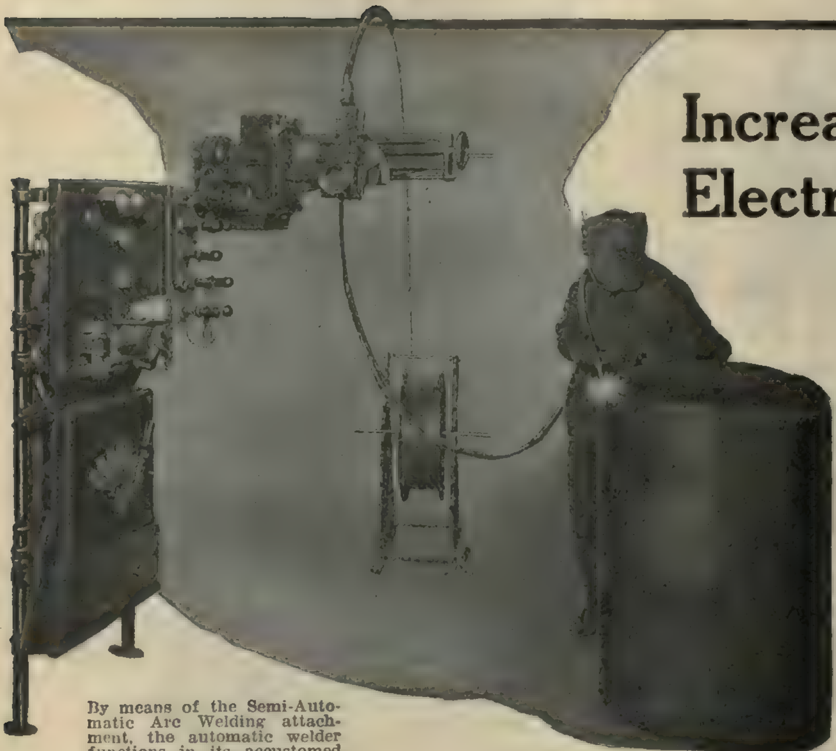




By means of the Semi-Automatic Arc Welding attachment, the automatic welder functions in its accustomed manner tending to hold the arc length constant, and the operator merely directs the arc as required by the particular job.

Increase Your Use of Electric Arc Welding

Advantages

Saves time ordinarily lost in changing electrodes.

Saves 10% to 25% in electrode material ordinarily thrown away as waste ends.

Operators learn to use it quickly, as they do not require the muscular training for hand welding.

Continuous operation results in few interruptions in the welding, eliminating a source of defective welds.

Automatic electrode feed—hand work

The G-E Semi-Automatic Arc Welding Lead is a device to be attached to the G-E Standard Automatic Arc Welder which obtains the continuous welding features of the automatic welder, and permits the operator to direct the arc as required by the conditions of the work.

This new device consists of a welding tool to be held by the operator, which acts as a guide for the electrode wire. In the handle of the welding tool there is provided a switch for operating the control on the panel of the Automatic Welder. Attached to the welding tool is a 10-ft. length of flexible steel tubing (called the flexible wire guide) with an adapter at the other end for attaching it to the automatic welding lead.

By means of this attachment the operator can work on products where the seam to be welded is of very irregular contour, or on large work where the clamping and travel mechanism for full automatic welding would be complicated and costly.

This new G-E device can be attached to any G-E Automatic Arc Welding head in such a manner that the electrode wire passes from the feed rolls into the flexible tubing and thence to the arc through a guide nozzle in the welding tool.

General Electric Company

General Office
Schenectady, N.Y.

Sales Offices in
all large cities

43B-630

Westinghouse

Illustrations of the Houston, Stanwood & Gamble lathe on which a Westinghouse 35 horsepower motor successfully operated at 80 horse power.

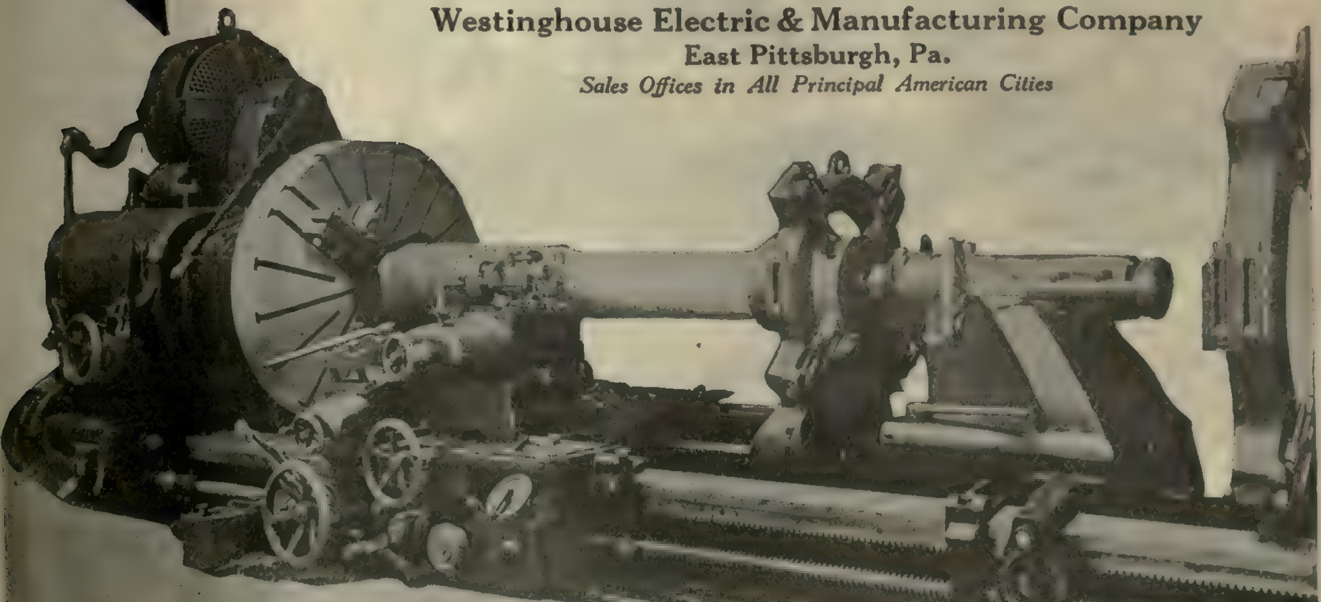
Back of the Tool—POWER

In a test run to determine the power of a lathe and its component parts, a Westinghouse 35 horsepower motor successfully operated at 80 horsepower. An extract from an official report of the test read:

"The chips which we sent you represent a 3$\frac{3}{4}$-in. reduction in diameter at 15 feet per minute at $\frac{1}{4}$-in. feed, which shows that we took a 1$\frac{7}{8}$-in. depth of cut. The ampere reading during this time registered from 250 to 275 and at 220 volts indicates that we were using about 75 or 80 electrical horsepower. After running this test for 10 to 15 revolutions of the forging, we decided to stop and take a photograph of the actual chip coming from the tool, although the lathe gave no evidence that it could not continue on this cut for hours."

This test proved that the Westinghouse motor as "the power back of the tool" was fully capable of meeting exceptional requirements.

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.
Sales Offices in All Principal American Cities



Air Compressors

Efficiency at Full and Partial Loads

The volume of air required will vary with your production and it is hardly possible to predict what this will be at all times. The question, therefore, comes down to the installation of an air compressor which not only meets your maximum requirements, but also operates efficiently at partial loads.

Class "PRE" direct-connected electric motor driven compressors are regulated by the 5-step Clearance Control which causes the compressor to operate at any one of the *five different load points*, depending upon the demand for air.

With this Control, the Class "PRE" Compressor will deliver **full, three-quarter, one-half, one quarter, or none of its capacity,** and the horsepower required will be practically in proportion to the air output.

The Clearance Control is entirely automatic being governed by a predetermined variation in air receiver pressure.

We will be glad to tell you more about Class "PRE" Compressors. Meanwhile request Bulletin 3126, which describes these machines in detail.

INGERSOLL-RAND COMPANY
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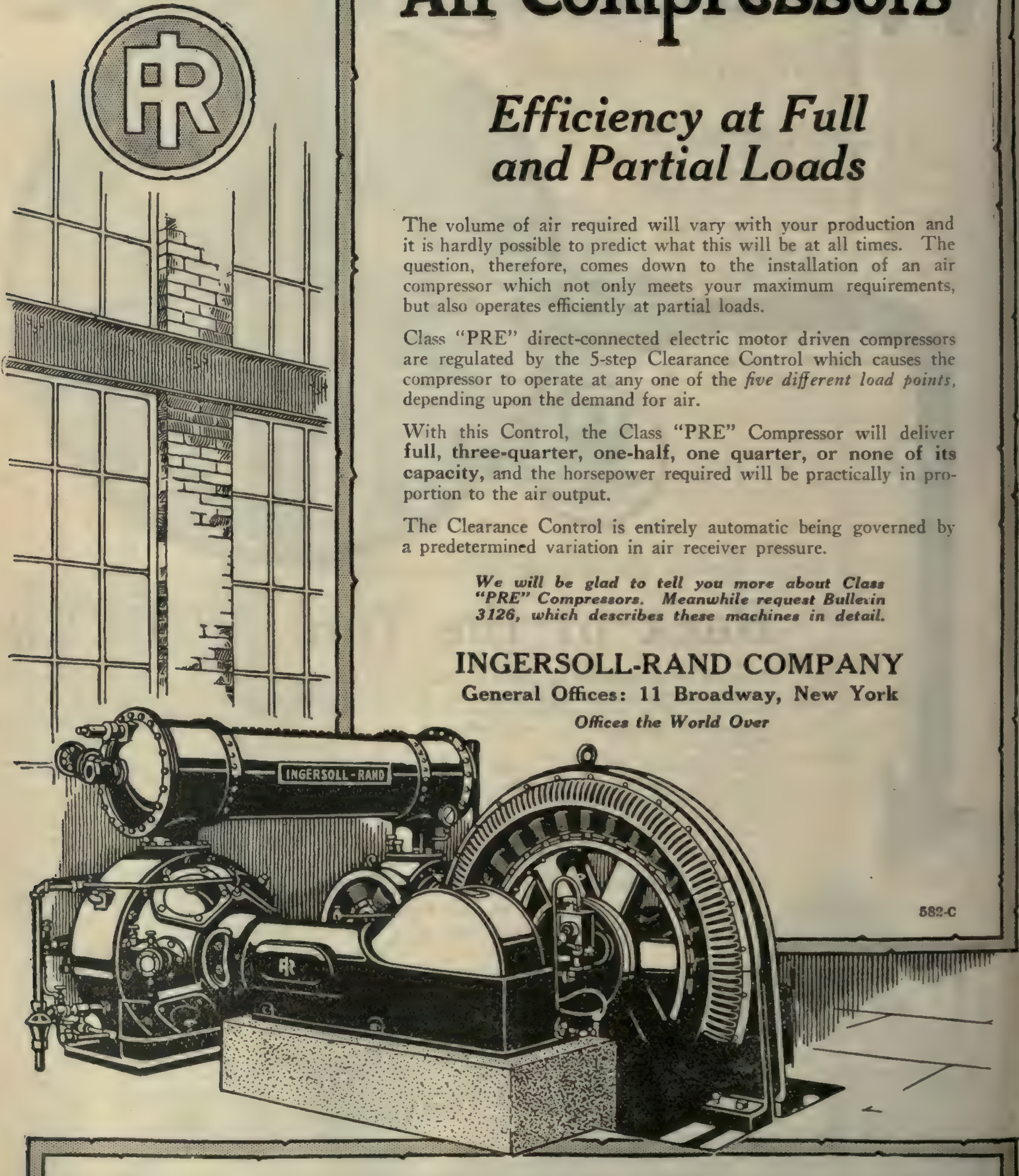

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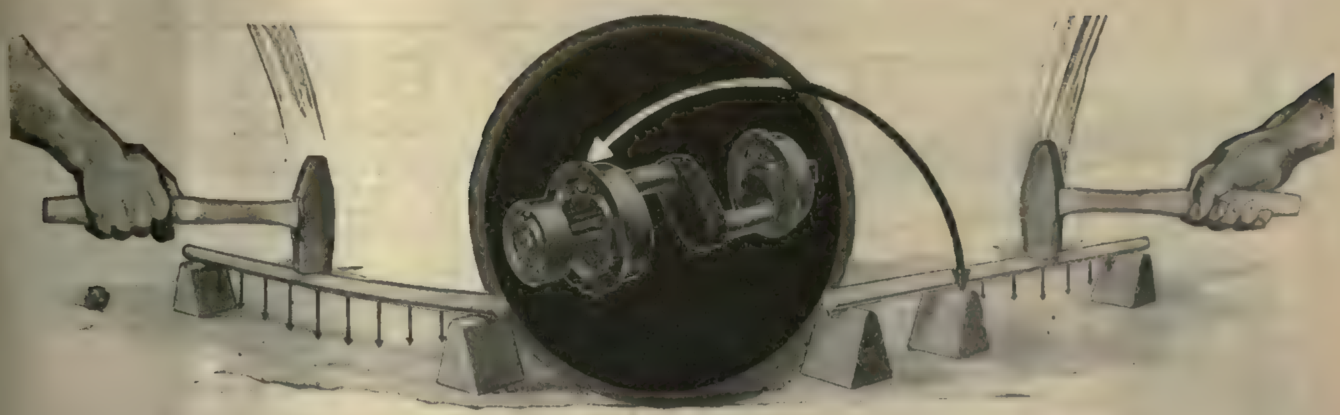

Permanent crankshaft alignment has a vital relation to economical air drill operation

WHEN a hundred-odd pounds of air pressure shoots against the pistons of an air drill, the crankshaft which shoulders the load must be properly aligned and rigidly supported, or every moving part is subjected to unusual strains.

Such support is not only desirable but necessary in permanently securing proper crankshaft alignment, which is possible only by placing supports on *both* sides of the main driving gear. If either the outer or inner bearing is omitted at the driving end, improper crankshaft alignment often results, throwing severe strains on the crank pins, connecting rods and crankshaft.

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With the three-point ball-bearing crankshaft suspension, exclusively embodied in Little Giant Air Drills, crankshaft alignment is *maintained.* Air drill designers can eliminate this extra *third* bearing, but they cannot eliminate its *job!*

Three-point crankshaft suspension is but *one* of the distinctive features of Little Giant Air Drills. Balanced piston valves which resist wear and remain leak-proof indefinitely, and three-unit housing construction which lessens upkeep expenses and provides easy accessibility, are other advanced features making Little Giants the most *economical,* most *productive* air drills built. Prompt deliveries from Branch stocks. Ask for Bulletin 598.

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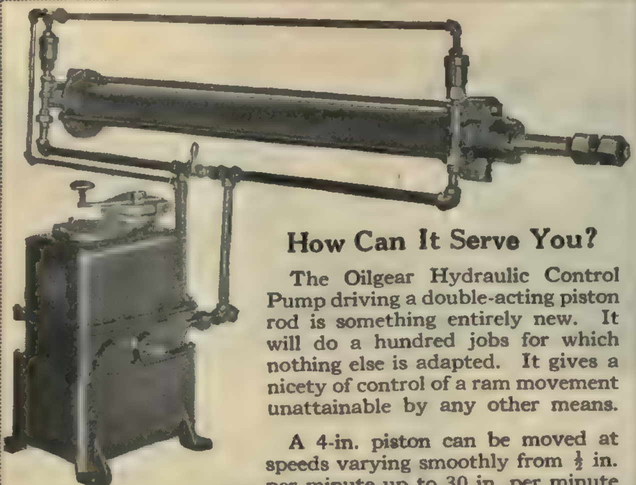

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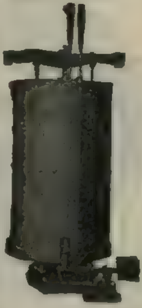

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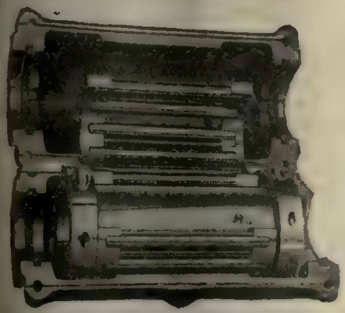

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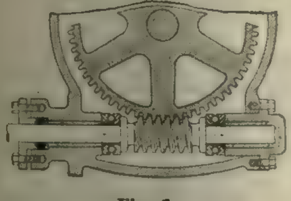
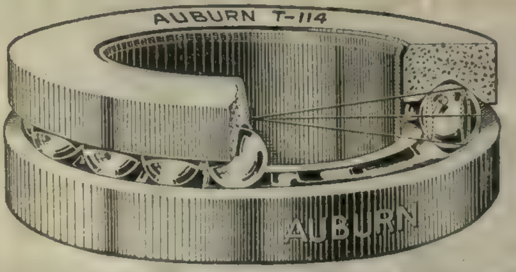


Fig. 1.



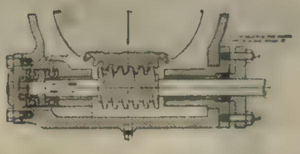


Fig. 4.

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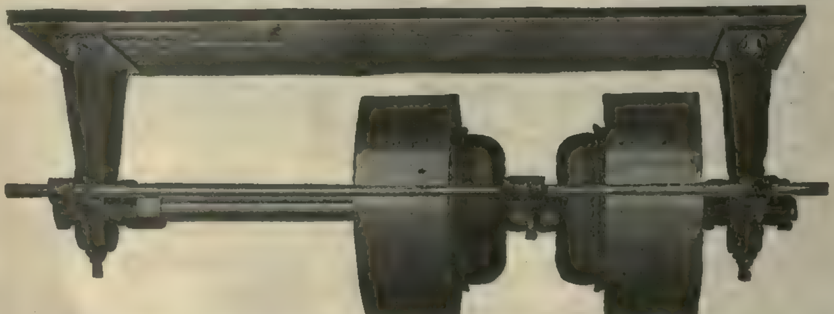

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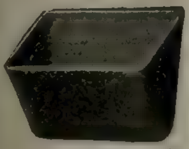

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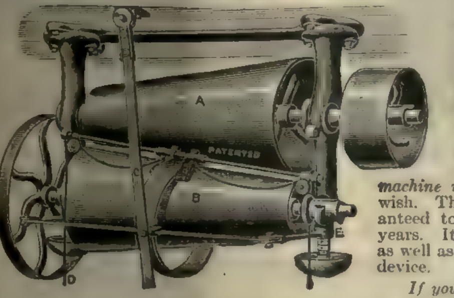

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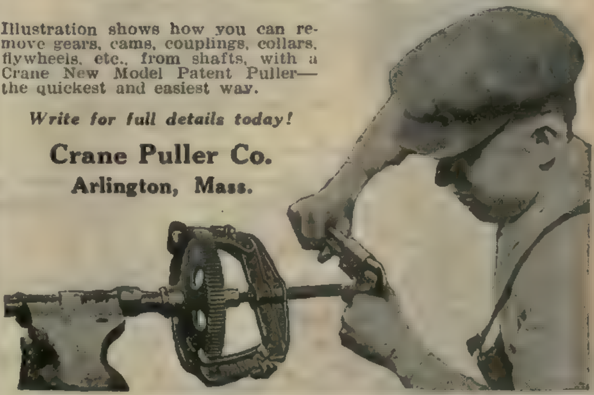

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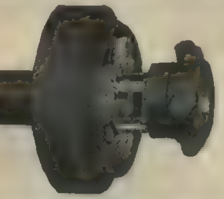

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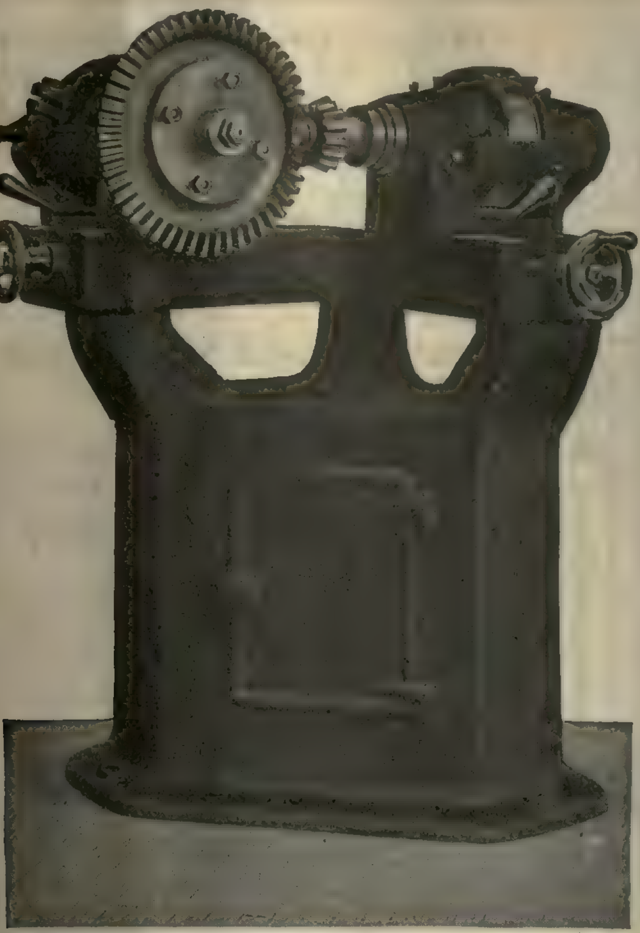

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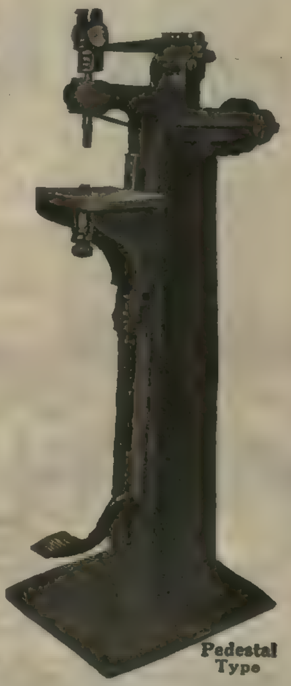

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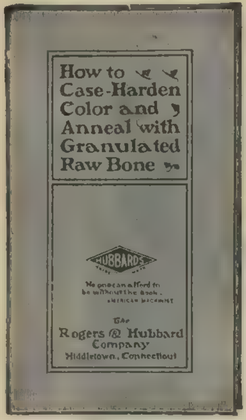
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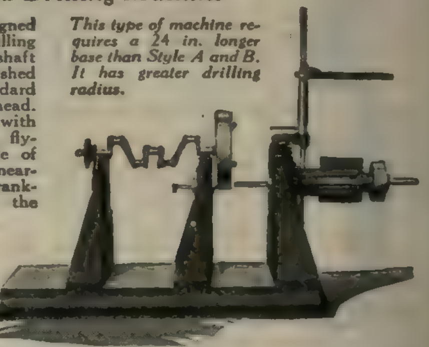

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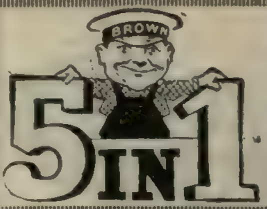

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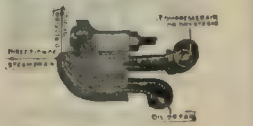

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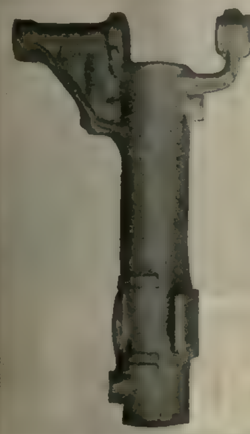

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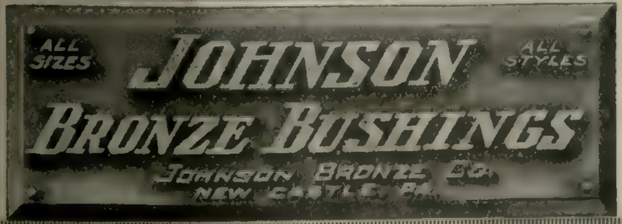

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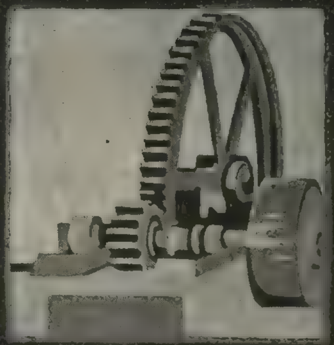

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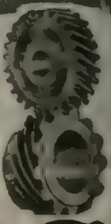

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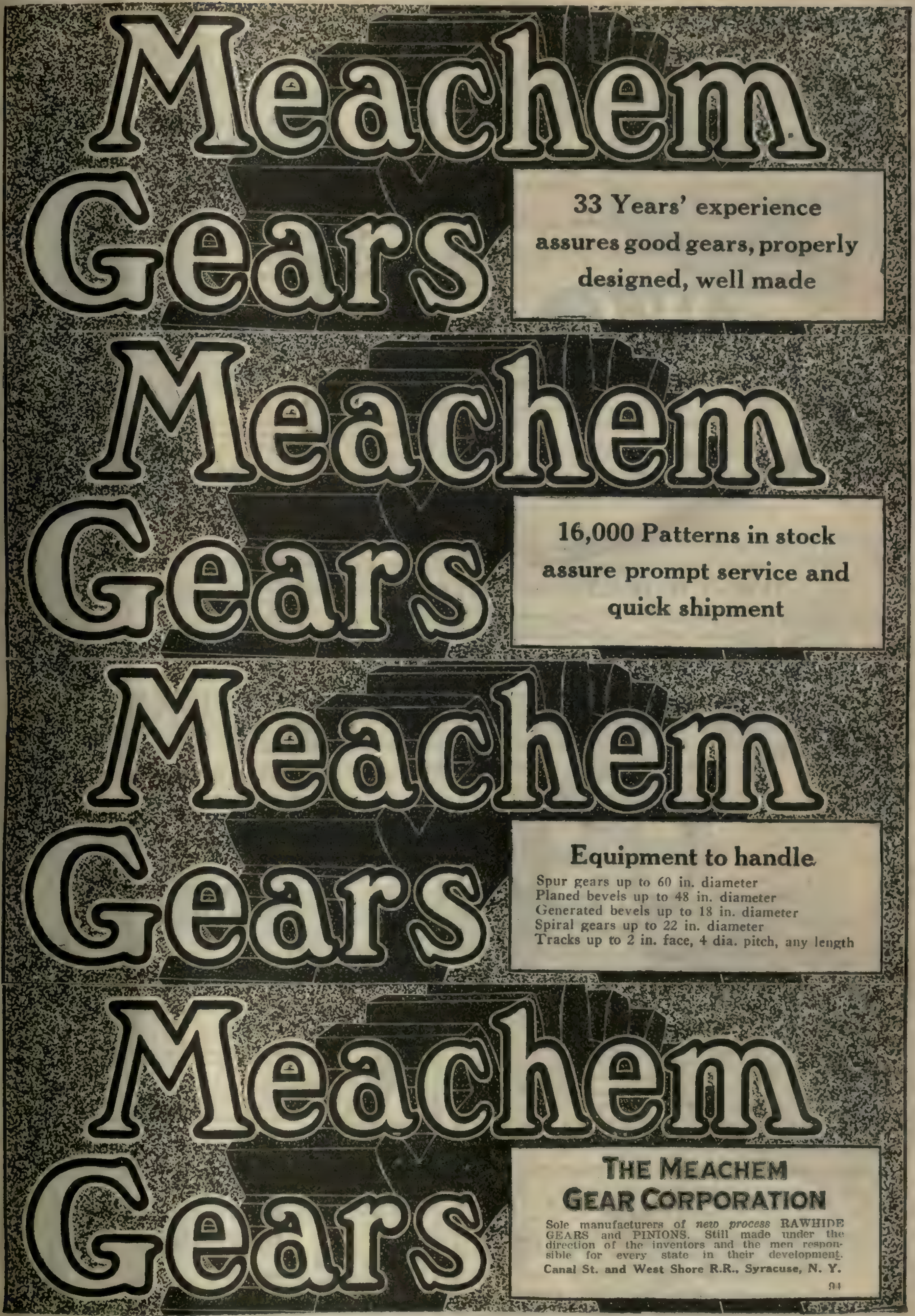

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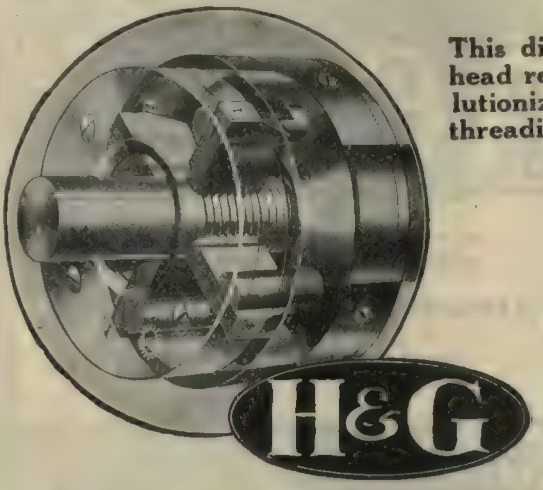

This die head revolutionized threading

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H & G Die Heads will increase your production, give you better threads, reduce rejections to a minimum, and enable you to meet competition.

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Plain, Ice-cooled and both Ice and Ice-water cooled.

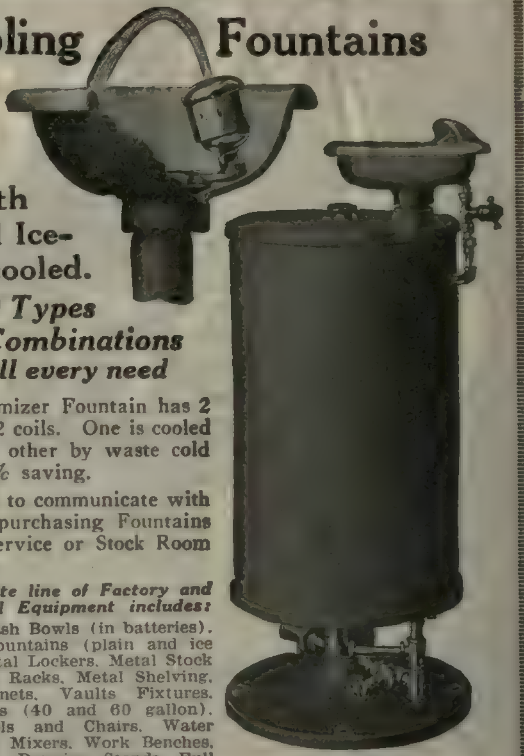

Fig. 627

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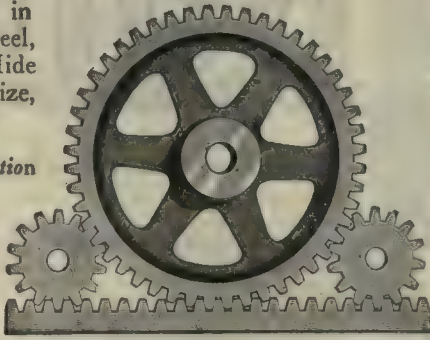

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They are accurately cut.
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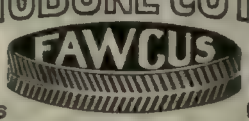

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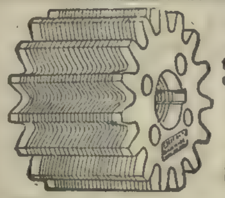

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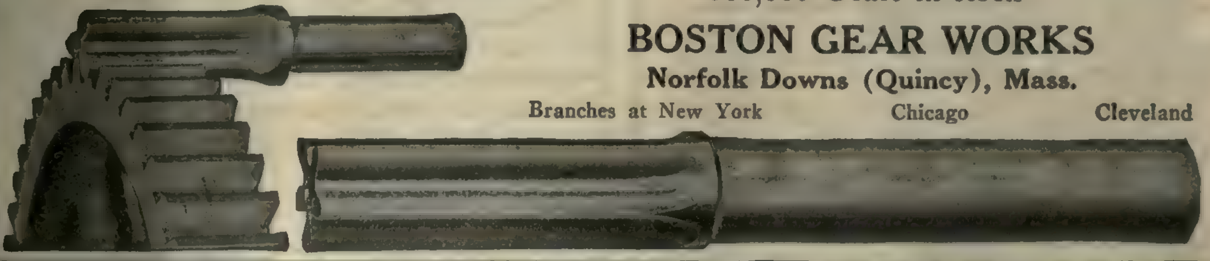

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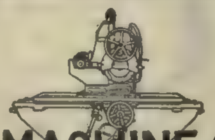

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Can Grind a Drill to Perfection in Thirty Seconds

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ROUND FILE BLANKS—8 in. and 10 in. long, removing .018 in. in one cut grinding both straight and taper in one operation at a speed of 1 in. per second, or 60 in. per minute.

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PRECISION CENTERLESS CYLINDRICAL GRINDER

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Built in 3 sizes

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Speed can be changed in two seconds.
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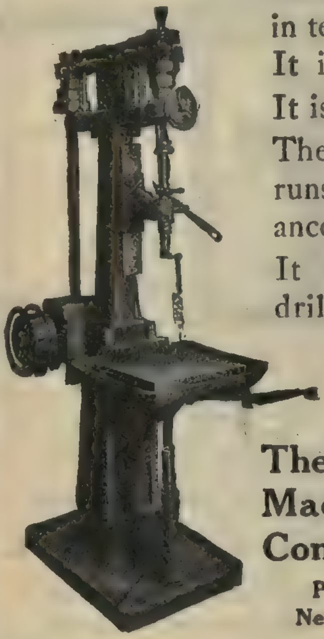
You get highest belt efficiency.



Belts can be changed in ten seconds.
It is extremely rigid.
It is very sensitive.
The spindle always runs in perfect balance.
It is a Safety First drill.

Let us tell you more about it

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For Wet Grinding

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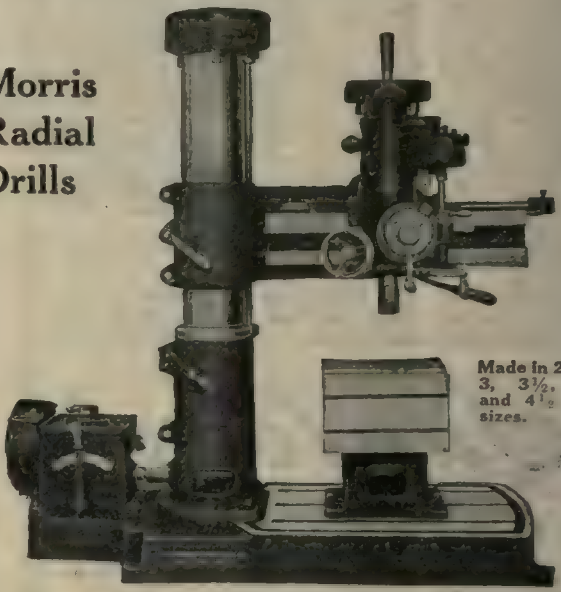

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Highest Efficiency—Utmost Economy

"Hole Hog" Multiple Drillers and Borers increase the output and reduce production costs. Save in every direction. Increase the capacity of your plant by using "Hole Hogs" instead of building an addition. Tell us your needs.

MOLINE TOOL COMPANY, Moline, Illinois

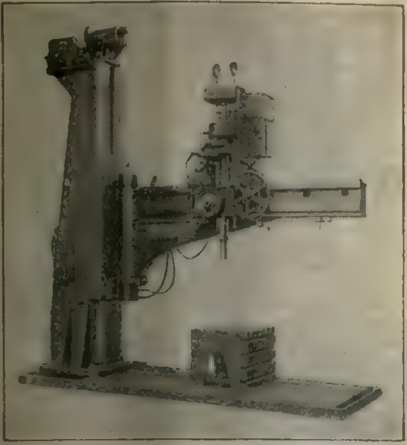
Fits Any Spindle—Drills Any Pattern

3 to 12 HOLES. Built for fast Production.

Nelson Blanck Mfg. Co.
Detroit, Mich.

The Buhr DRILL HEAD

N. Y. Office:
Grand Central Palace



William Sellers & Co., Incorp.

Philadelphia, Pa.

Radial Drill—Direct Geared Head

Driving motor carried on back of head and connected to spindle through spur gearing. No belts, bevels or sliding gears. Motor counter-balances head. Head traversed by large hand wheel. Adjustable rollers bearing on top of arm insure easy movement. Spindle 3¼-in. diameter, 15-in. stroke. Arm raised and lowered by motor at top of upright. Pneumatic locking device for arm. Power pump and circulating system for lubricant. Means for controlling various movements within easy reach of operator from working position.

SHAFTING—LABOR SAVING MACHINE TOOLS—INJECTORS

Volume Production
Is a Habit

Write for Catalog "A"

These finished parts are accurately drilled, bored, reamed, faced and tapped on this HeavyDuty, Self-Oiled, ALL GEARED Drill. Every demand of service is successfully met.

No cone or inherent belts. 8 Geared Speed changes. 8 Geared Feed Changes, all under instant control without stopping spindle.

Our line of first-class, high powered ALL GEARED and Self-Oiled Drills and Tappers is a complete one. Machines that will help to cut down your production costs.

Exclusive Manufacturers

Barnes Drill Company

830 Chestnut St. **Inc. 1907** **Rockford, Ill., U. S. A.**

AGENTS FOR GREAT BRITAIN: Burton, Griffiths & Co., Ltd., London, E. C. FRANCE: R. S. Stokvis & Fils, Paris. JAPAN: Roku Roku Shoten, Tokyo. ITALY: Alfred Herbert, Ltd., Milan. NEW SOUTH WALES: R. L. Scrutton & Co., Sydney. BELGIUM: G. & F. Limbourg, Freres, Brussels. Spain and Portugal: American Machinery Corporation, S. A. E. Madrid. Sindicato de Maquinaria Americana, Bilbao.

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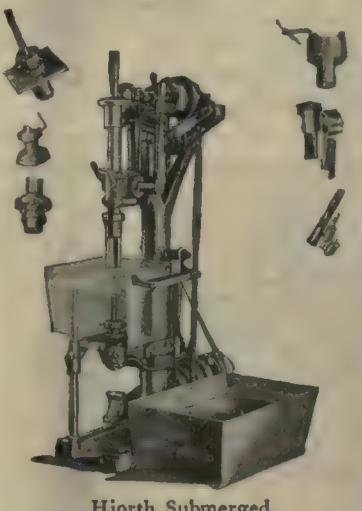
Every manufacturer is interested in better methods, of doing certain manufacturing operations, that result in greater output and lower production costs.

Here is the Hjorth Submerged Drilling Attachment that can easily be applied to any upright drill. With this attachment the drill is held stationary, and the work is chucked to the spindle. There are many advantages in drilling this way, for instance — work does not become heated; drill is constantly submerged in lubricant which results in higher cutting efficiency and less regrinding; chips are kept from sticking to the drill and stock by the continuous circulation of the lubricant; revolving of the stock keeps it perfectly centered and assures accurate drilling.

There is no time like the present to try out this submerged drilling. Let us send you the complete details.

Write today.



Hjorth Submerged
Drilling Attachment

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Office: Boston, Mass. **Works: Woburn, Mass.**

TURNER TURRET

It is adaptable to a wide range of work. Each spindle carries a different tool. All register in the same position. Simple and easy to operate. Increases output, reduces cost, insures quality. In use all over the civilized world.

Ask for Bulletin

We also manufacture the Quint Turret

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Danbury, Conn.

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Showing Geared Motor Drive.

A Super-Drill
20 and 25-in. sizes

For 65 years "Silver" products have led the field for reliability, economy and service. The 20-in.

"Silver" Upright

which showed up splendidly during the war against every conceivable difficulty, has been made larger, stronger and better.

For the repair man, the tool room, the garage man, or for general production, this sturdy, handy "Silver" is in a class by itself.

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The Silver Mfg. Co.

Box 360, Salem, O.

Established 1854

The operator's ideal for handy, instant control—unlimited power—rigid precision.

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Gears cannot be shifted under load. Feed rod and lead screw cannot be engaged simultaneously. The few speed and feed controlling handles are placed where the operator *instinctively* reaches for them. No electric brake or electric control of any kind is necessary.

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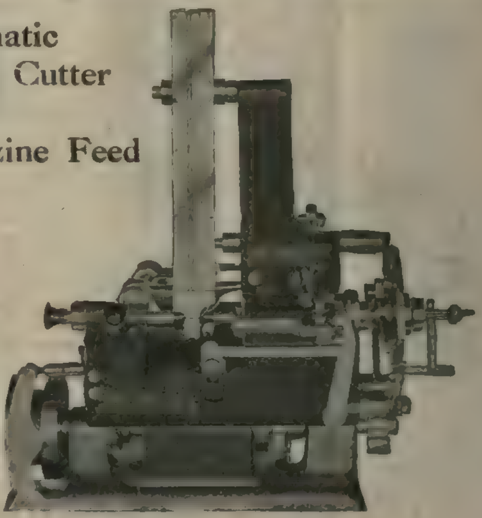
Get Bulletin No. 25 Today

The Bradford Machine Tool Co.
Cincinnati, Ohio, U. S. A.

Automatic Pinion Cutter With Magazine Feed



Rapid production on small pinions up to ½ in. diameter. The only hand function is keeping the magazine loaded—Pinions are cut automatically and accurately.

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The G-K Heavy Duty Lathe Carriage is extra heavy, with full length bearing on each "V" and on a wide, flat bearing inside the front "V." This gives a substantial support directly under the tool rest, and shortens the bridge of the carriage. The carriage is locked by an eccentric clamp conveniently operated.

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G.K.

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THE JOHNSTON LATHE

"The most economical investment"

$185.00 Complete with Countershaft

The lathe designed for machine shops, garages, Manual Training Schools, and the home. Actual swing 9½ in., between centers 17½ in., hole in spindle ¾ in. Send for more information.

JOHNSTON MFG. CO., Arlington, N. J., U. S. A.

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Cut Down Cost
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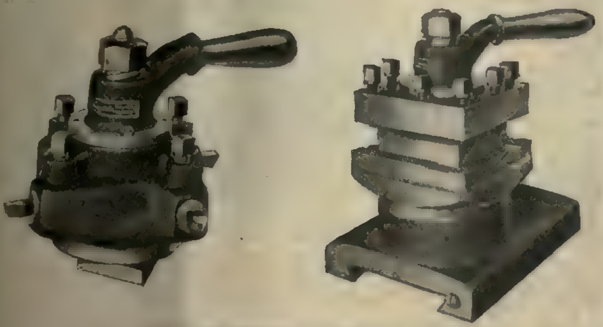

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Have been made standard engine lathe equipment in hundreds of plants and shops because they can secure turret lathe production for a nominal investment. There is a cost-cutting McCrosky Turret for your job. McCrosky Catalogue No. 8 will show you.

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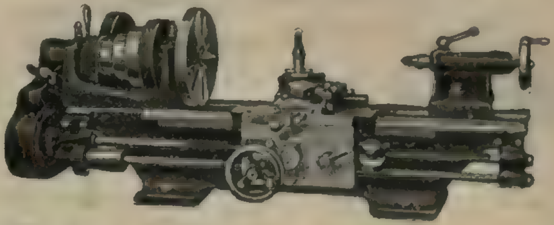
Type B-6
"The Small Lathe for the Big Job"



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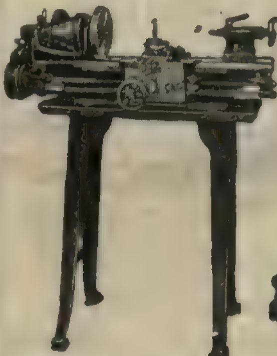
Bench Type



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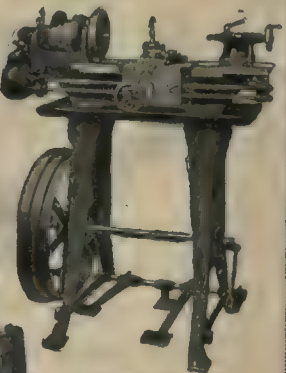

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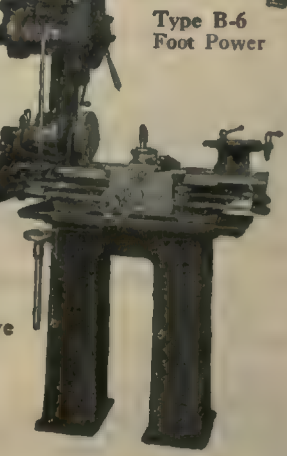

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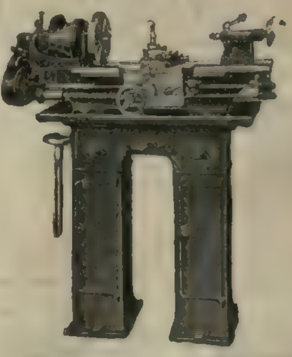

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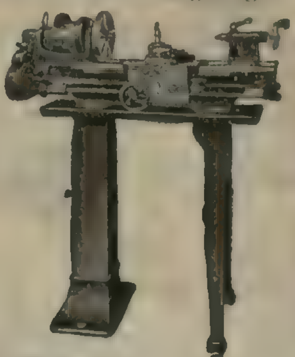

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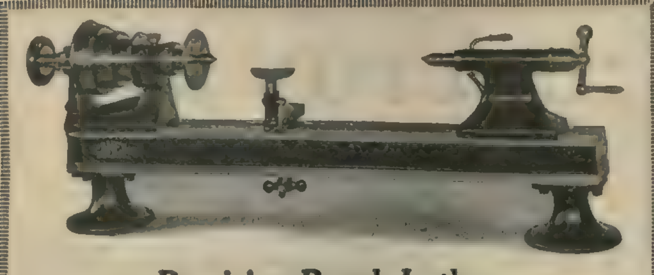

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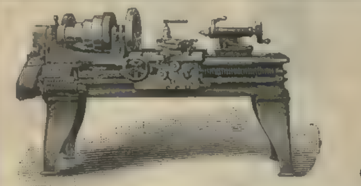

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QUALITY
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LATHES

13-15-17-19 in. Swing

Champion Tool Works
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Bench Millers

STARK TOOL CO., Waltham, Mass.
Originators of the American Bench Lathe ***Established 1862***

STEINLE TURRET LATHES

A modern high power, high duty production turret Lathe for bar or chucking work. Designed and built sufficiently powerful and rigid to enable use of greatest number of multiple cutters and thus insure rapid, accurate and economical work. Why not write us for full particulars.

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The kneading, squeezing, hammering action of the Dayton Swaging Machine toughens and strengthens the metal. Up to 6,000 forming blows per minute can be obtained. For tapering, pointing and graduating it has no equal.

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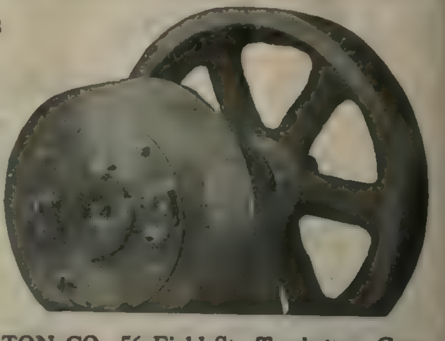

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Regular Line. Quick Change Engine Lathes, 10 in. to 30 in. swing.

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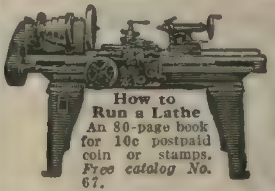

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9 in. x 3 ft. Lathe	$176.00	$216.00
11 in. x 4 ft. Lathe	228.00	273.00
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also 18 in., 21 in. and 24 in. swing.

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TURRET LATHES AND SCREW MACHINES

MODERN DESIGN—
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Lathes sold with advice. Particulars on request.

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IMPROVED THREAD TOOL
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will save an unsightly patch, and a few drops of oil will prevent a burned bearing. Oil holes alone are not efficient bearing insurance. Dust and grit works in and soon plays havoc with running parts. See that your machines are provided with oil holes and then fit the holes with **Tucker Oil Hole Covers.** There's a style and size for every journal in your plant.

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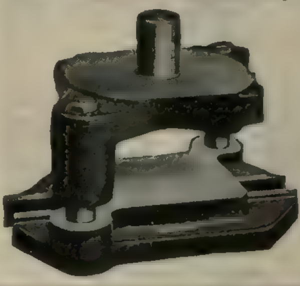

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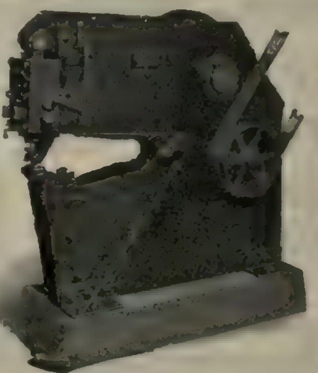

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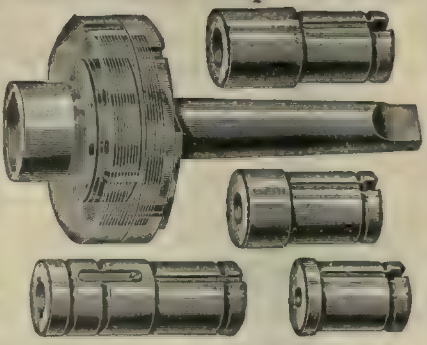

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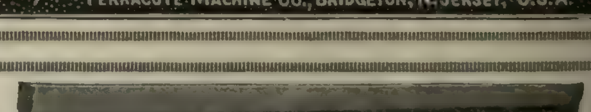

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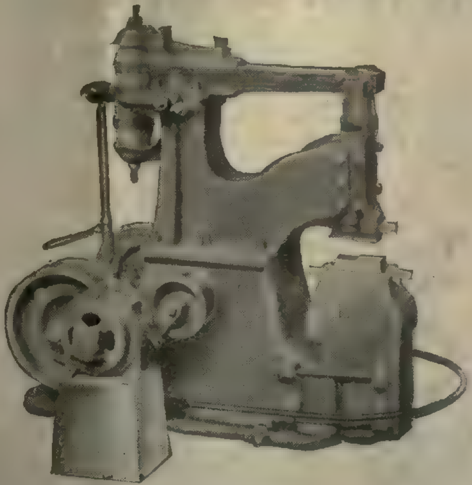

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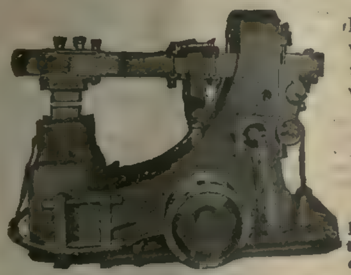

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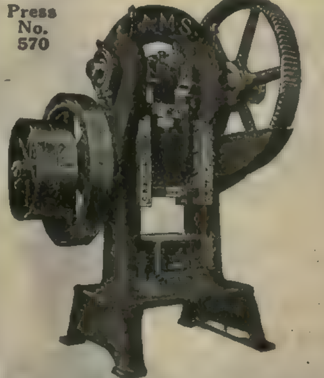

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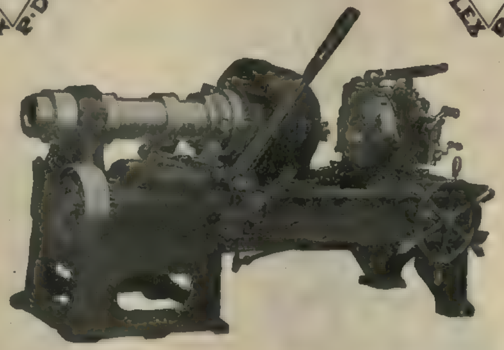

Rapid and Accurate Pipe Threading

Is the kind done by B & K Pipe Threading Machines. They work with remarkable rapidity and ease of operation. Every thread is clean and accurate. Every machine is equipped with the Peerless Die Head. Made in nine sizes, each size having a capacity of 8 to 10 sizes of pipe.

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Dies Set to Exact Size At Will of Operator

The micrometer adjustment of the Standard Bolt Cutter is so sensitive that bolts may be cut over or under size, and dies set to again cut exact size at the will of the operator while machine is running. A graduated index eliminates errors. Dies open and close without affecting adjustment.

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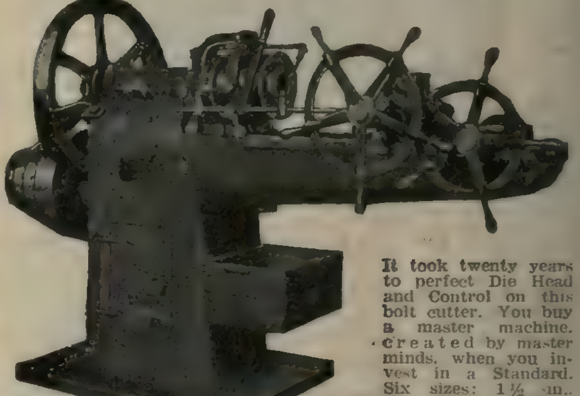

It took twenty years to perfect Die Head and Control on this bolt cutter. You buy a master machine, created by master minds, when you invest in a Standard. Six sizes: 1½-in., 2-in., 2½-in., 3-in., 3½-in., and 4-in.

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for every kind of precision measurements on duplicate parts. Quickly and easily applied. Unsurpassed in simplicity and durability.

Calibrated in thousandths of an inch or metric scale. Ideal for the rapid, accurate inspection of large quantities of work. No modern shop should be without them.

Write us today.

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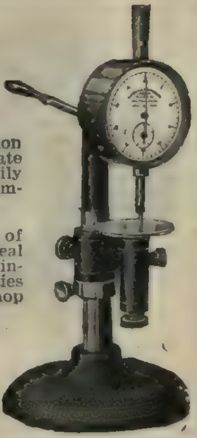

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Put a bar of stock in this machine, start it going, and forget about it. The "Marvel" No. 5 will cut off piece after piece, at the proper dimensions, and stop when the bar is used up.

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All Sizes ⅛ to 18 in. inclusive

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SHOP superintendents are beginning to realize that using poor hack saw blades quickly runs into real money—even though the cost of the blades themselves amounts to but little.

We believe that the more you know about hack sawing costs, the firmer you will put your faith in Star Saws.

That is why we welcome every opportunity to compare Star blades with other makes, by actual test. Write and let us tell you more about how to conduct a comparative test.

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Middletown, N. Y.
Canadian Office and Warehouse
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You Will Use Them a Hundred Times a Day

Plain Shears Nos. 3 and 4.

If you use wire screen, fibre board, rubber or other sheet materials no tougher than iron or mild steel in your product, you'll not only find *Hercules Shears* handy—you'll appreciate their economy.

Capacities: No. 3—¼ in. and under. No. 4—$\frac{5}{16}$ in. and under.

Also made as a combination Shears and Rod Cutter. Shear Catalog tells all. Write for it.

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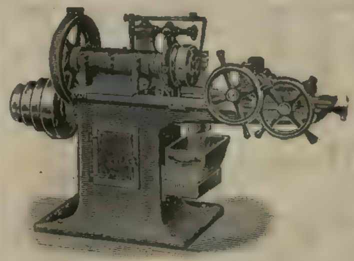

help to give Acme Bolt and Nut Machines their undoubted superiority as immediate cost reducers on all work in their capacity.

They turn out work faster than others and perfect accuracy can be depended upon. Write us for description of our entire line. Catalog?

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PIPE MACHINES
Treadwell Engineering Company
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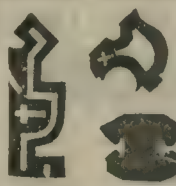

Gray's Sheet Metal Cutter Cuts Shapes Like These

Made in four sizes for cutting shapes from ⅛, $\frac{3}{16}$, ⅜ and ⅝-inch plate.

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Made of the finest tungsten steel by specialists of many years' experience. Specify "QUALITY" on your next order and settle your Hack Saw Problem.

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hang on till the job is finished

Chucks for Every Purpose

The Hoggson & Pettis Co.
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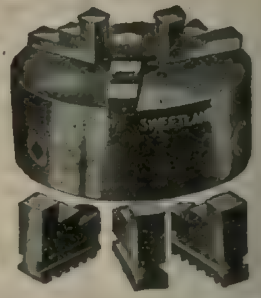

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All Types of Circular Saws for Cutting Metal

Inserted tooth saws, solid tooth milling saws made of chrome alloy, semi-high and high-speed steels, hot saws, friction discs. Saw sharpening machines.

Have you tried our "Beskut" semi-high speed milling saws? They will cut costs on hard jobs.

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For Butt or Straddle milling of a square or hexagon nature.

Will clamp in either a horizontal or vertical position.

Made in two sizes:
1 in. size, ½ to 1 in. cap.
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Spring and Varick Sts. 50 Years in NEW YORK CITY

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Cold Metal Saw

Catalog will be sent on application to

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Drives Straight and True
Cannot Injure the Collet

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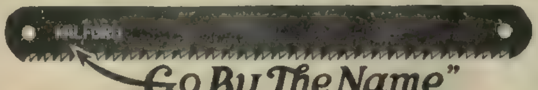
"MILFORD" HACK SAW BLADES



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The Lavoie Air Chucks are very simple in construction and are easy to operate. The grip is absolutely certain, as is the release. Made in seven types with six styles of jaws.

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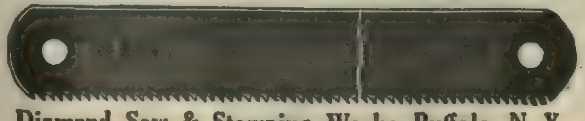

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LATHE—DRILL—PLANER—CHUCKS

THE SKINNER CHUCK COMPANY
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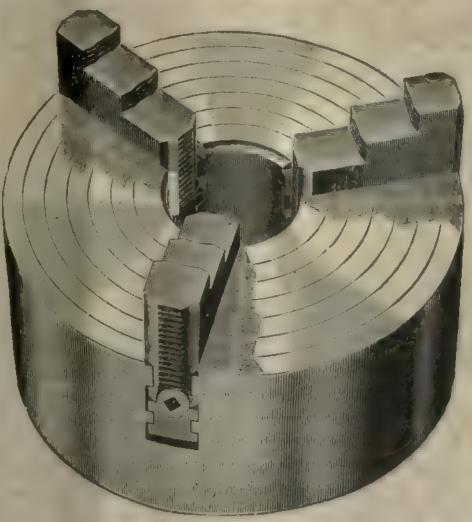

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The body of a *Whiton Chuck* is made in one solid piece and thus cannot spring under stress. The jaws are sturdy and have bearing their entire length. For fine finishing or heavy roughing cuts, the *Whiton* has no peer.

Let us tell you something about *Whiton* range.

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"Whiton" Chucks are sold and kept in stock by principal dealers all over Europe.

Errington Auto Reverse Friction Tapper

Style C.

Tapping Blind Holes in Air Cooled Automobile Cylinder

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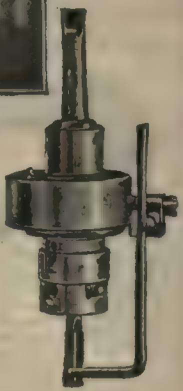

The breakage of a single tap on this job would cause an intolerable blemish in the appearance of the piece and result in heavy loss in time and money. The **Errington Sensitive Adjustment and Quick Reverse** insure perfect results. Regulate the power of the machine to **just** drive and remove all danger of **breaking the tool or injuring the work** Fool proof, fits any drill press, and taps steel as safely as cast iron. Seven sizes, ⅜″ to 2″.

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Hand-Operated Self-Tightening Drill Chucks

Instant release by hand even after most severe driving strain. Drives high speed drills without slipping.

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Improved Body Design
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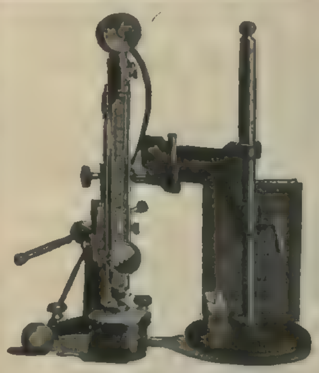

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The Shore Scleroscope

is now used in hundreds of plants for its accuracy in hardness testing. It is direct reading and can readily be operated by anyone. Ranges from softest metals to hardest steels without adjustment. It is invaluable in ordering materials to specifications. The free booklet will interest you.

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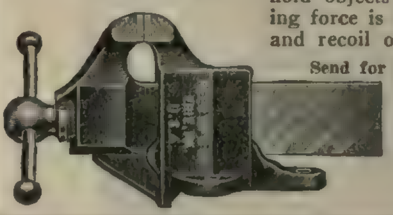

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Send for proof of superiority.

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30% Extra Strength over broached hollow screws—the only other kind made. By a patented process we increase the density of the steel around the socket-holes, so that even the smaller sizes will stand all the strain the best made wrench can apply. The Allen process makes deep, perfectly-formed socket-holes—no chips in the bottom. The entire length of the ALLEN is utilized either for solid metal at the point, or depth of socket for the wrench. All sizes in stock from ¼ in.; to 1½ in.; any length, point or thread. Also Pipe Plugs Socket-Head Cap Screws. Tap Extensions and Tire Wrenches—Allen process. Complete descriptive catalogue on request.

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Taps and Dies that cut clean and accurate.
All sizes and pitches furnished promptly
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will give you your accurate production. Tested 20,000 per hour.

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COWLES TOOL COMPANY
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Contain exclusive features giving Strength, Service, Durability, Satisfaction.

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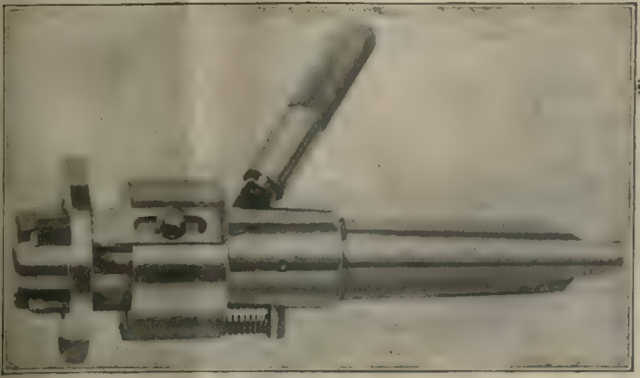
High Speed Drills, Reamers and Special Tools

FASTFEED DRILL AND TOOL CORPORATION
TOLEDO, OHIO

We Recommend This Tap for Cutting Thread in Steel Flanges and Similar Jobs



VICTOR Cam Style Collapsible Tap

This tap not only saves power, but gives you clean, perfect threads in less time.

We make the famous Victor Collapsible, Adjustable Taps and Hand Collapsible Taps which save the time formerly required in backing out. Also, Solid Adjustable Hand Taps with which you get years of service. You should have the catalog that describes the complete VICTOR Thread-cutting line.

Have you been using ordinary taps on this kind of work? Then you know the power they take and the trouble they make!

You'll appreciate the fact that the chasers on this tap are short and straight, instead of tapered. Chasers recede as they enter the work and a cam moving along the correct angle gives them the proper taper in forming the thread. Pressure against the trip collar gives the tap its action.

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Why Waste Time Grinding Lathe Centers *when the*

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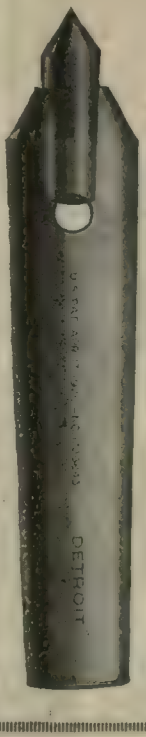

requires only ten seconds to change a point which can be done without removing the sleeve from the machine?

The Detroit Center consists of only two parts—a high speed steel center or point and a sleeve of hardened steel. The sleeve is not subject to wear, is permanent and takes up all wear insuring perfect alignment and rigidity. Both hole and center are ground to a Morse taper.

Requires less attention—is more dependable—wears much longer than ordinary steel.

Order a few for test on your machines.

Dimensional chart and price list on request.

Detroit Twist Drill Company
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Canadian Detroit Twist Drill Co., Limited, Walkerville, Ontario.

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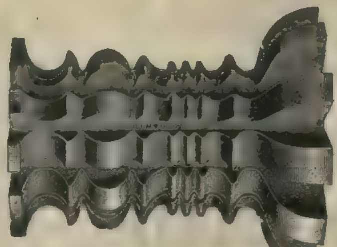

Morse Cutters

Do the work for which they are designed.

What more about them do you need to know?

Morse Twist Drill & Machine Co.
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Are you interested in an extra long featherweight wrench, drop forged from Chrome Nickel Steel heat treated and oil tempered? Light, stiff and tough.

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"The Tool Holder People"
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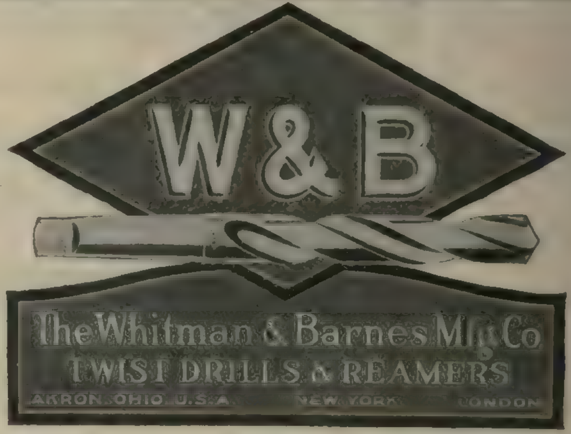

W & B
The Whitman & Barnes Mfg Co
TWIST DRILLS & REAMERS
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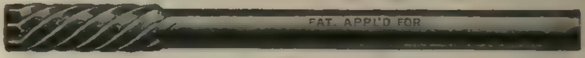

They do better work and do it faster. There's a reason. Note the design. It combines a fast cutting end with a smooth cutting body. Chatter is eliminated and perfect work results. Let us tell you more about them. What size do you want price on?

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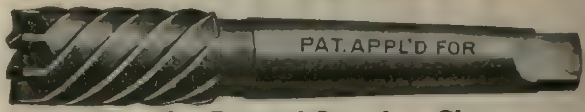

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Latrobe Drills are Highest Quality in material and workmanship—they are rugged drills—built for speed, accuracy, long life. **Latrobe** Drills are made from hot rolled special section high speed steel [as shown above] hot twisted and the grooves are milled—therefore **Latrobe** drills have all the strength of a forged drill plus the accuracy of a milled drill.

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Manufacturers: LATROBE, PA.

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AND SPECIAL TOOLS

NATIONAL
TWIST DRILL & TOOL CO.
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CASLER Offset Boring Head

Use it on your milling machine. It is particularly handy on jig and fixture work. Has micrometer adjustment to limits of .001 inch. Write for Catalog "H."

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Butterfield Taps are the biggest buy you can make in the tapping field. They cut cleaner and last longer, due to scientific temper and correct design. You may get a tap at a shorter cost, but you can't get one with a longer record for good tapping.

We have used up the best part of two-score years to make **Butterfield Taps** better and opinions of users prove that our efforts have not been in vain.

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No Tap Breakage When Tapping Blind

You can tap a close pattern of holes with the APEX SAFETY TAP HOLDER, and its safety factors are an assurance against tap breakage when tapping blind.

THE

APEX
Safety Tap Holder

because of its design, is applicable to both single and multi-spindle drilling machines.

In these days of strict economy, it is consoling to know that expensive machine taps are not required with the "APEX." This is an item in cost lowering worth thinking about—*seriously.*

Go ahead of your competitor or he will go ahead of you. *Write for further details now.*

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Safety Tap Holders and Universal Joints

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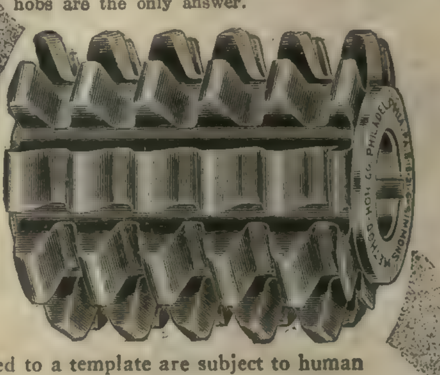
Every Hob can be Generated

Don't pin your chances of exact duplication on Hobs formed to a template. When a worn out hob must be replaced, you can't be sure the new hob is a mechanical duplicate unless all chances for error in making the hob are eliminated. Generated hobs are the only answer.



We are now prepared to hob gears up to 18 in. diameter

Ask for Prices

Hobs formed to a template are subject to human error—but

SIMMONS
METHOD-HOBS

are mechanically accurate and uniform—just as generated gears are mechanically accurate.

Learn about them—write to

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The best file buyer is the one who buys the most service, and best service per dollar!

If a STAR & CROSS file costs 5% or 10% more on the dozen, and actually gives 50% longer service than ordinary files sold on a price basis, there's no question as to which is the better buy!

Mechanics who have tried them have no doubts about the superiority of AMERICAN SWISS FILES. They equal the famous foreign-made files in cutting edge—and surpass them in uniformity of temper and spacing!

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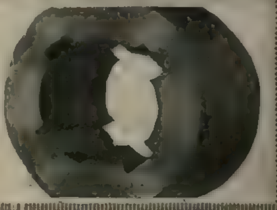
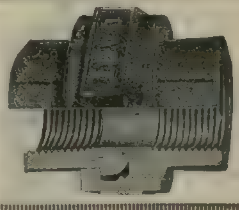
Broaching cuts cost on keyways, splines, oil grooves, gear teeth, and countless regular or irregular shaped holes. Send your problems to the originators of commercial Broaching

Remember—"Lapointe of Hudson"

Lapointe Machine Tool Co.
Hudson, Mass.





Absolutely Tight

non-corrosive bronze seats accurately ground together make Dart Unions non-leaking. A free sample on request. Write for catalog and price list No. 20.

E. M. Dart Mfg. Co. Providence R. I.

The Fairbanks Co., Sales Agents
Canadian Factory, Dart Union Co., Ltd.,
Toronto.

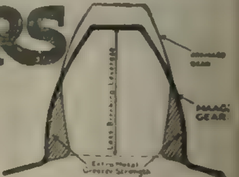
Ask your dealer for prices

MAAG GEARS

Strongest at the Base
Where Others are Weakest

Catalogue No. 265

Niles-Bement-Pond Co.
111 Broadway, New York



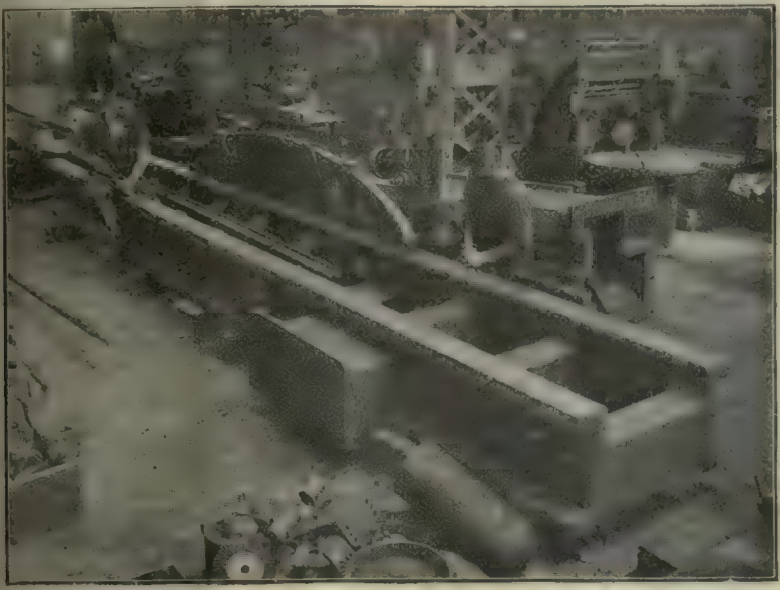
"Opportunity" Advertising:

Think *"SEARCHLIGHT"* First!

0096

ReMANUFACTURED -(ORIGINATED BY US)- MACHINE TOOLS

Reg. U. S. Pat. Office



Hand Scraping the ways of a planer—a step in the ReManufacturing Process.

The four fundamentals of a good machine tool, which are emphasized in the ReManufacturing Process, are Accuracy, Alignment, Construction, and Performance.

Lacking any one of these qualities, a tool could not merit this guarantee.

If, for any reason whatsoever, you decide not to retain your ReManufactured Tool, return it to us within 30 days from date of purchase (freight prepaid) and we will buy it back at the original price.

The Green List*

*of Guaranteed ReManufactured Machine Tools

LATHES

30—14 in. x 6 ft. Reed Ext. Hvy. Pl. Turning.
1—14 in. x 6 ft. Flather, Q.C.G.
1—16 in. x 6 ft. Flather, Q.C.G.
6—16 in. x 6 ft. Reed.
8—17 in. x 6 ft. Le Blond Mfg. Auto.
22—18 in. x 8 ft. Boye & Emmes, Q.C.G.
20—19 in. x 8 ft. Le Blond Hvy., Q.C.G.
13—20 in. x 8 ft. Le Blond, Q.C.G.
89—20 in. x 8 ft. American Q.C.G.
3—20 in. x 10 ft. Lodge & Shipley, Q.C.G.
26—21 in. x 10 ft. Le Blond Hvy. Q.C.G.
19—22 in. x 8 ft. Davenport.
8—25 in. x 10 ft. Le Blond Hvy. Q.C.G.
28—26 in. x 10 ft. Niles, Bement, Pond.
1—26 in. x 11 ft. Wickes.
13—26 in. x 9 ft. Bridgeford, Q.C.G.
70—26 in. x 10 ft. Bridgeford, Q.C.G.
22—26 in. x 12 ft. Bridgeford, Q.C.G.
1—26 in. x 18 ft. Bridgeford, Q.C.G.
1—26 in. x 20 ft. Bridgeford, Q.C.G.
[illegible]—30 in. x 11 ft. American Gd. Hd.
1—30 in. x 20 ft. American Gd. Hd.
19—32 in. x 12 ft. Pittsburgh, Q.C.G.
2—36 in. x 14 ft. Johnson Trip. Gd.
1—36 in. x 19 ft. Johnson Trip. Gd.
15—36 in. x 30 ft. Pittsburgh Gd. Hd.
4—36 in. x 37 ft. Niles, Bement, Pond Trip. Gd.
4—40 in. x 12 ft. Fifield Trip. Gd.
1—40 in. x 18 ft. Fifield Trip. Gd.
2—45 in. x 24 ft. Pond Trip. Gd.

SHAPERS AND PLANERS

3—16 in. Walcott, Cone Drive.
1—16 in. Walcott, S.P.D.
1—20 in. Walcott.
1—24 in. Walcott, Cone Drive.
2—24 in. Walcott, S.P.D.
6—26 in. Niles, Bement, Pond.
1—34 in. x 26 in. x 8 ft. American Planer.
2—36 in. x 13 in. x 14 ft. Niles, Bement, Pond Frog & Switch.
1—56 in. x 56 in. x 10 ft. Gray, 2 hds.
1—72 in. x 72 in. x 14 ft. Niles Planer, 4 hds.
1—96 in. x 72 in. x 20 ft. Bement, Miles, 4 hds.

MILLERS

49—No. 6 Whitney Hand.
60—Garragus Hand.
22—Van Norman Hand.
60—No. 3½ Fox P. F.
1—No. 0 Brown & Sharpe.
1—No. 2 Rockford, Plain.
1—No. 2-A Milwaukee, Plain.
1—No. 2-B Milwaukee, Plain.
1—No. 20 Ohio, Plain.
1—No. 2 Ohio, Plain.
1—No. 24 Ohio, Universal.
1—No. 2 Cincinnati, Plain.
1—No. 1 Dow.
32—12 in. Cincinnati Mfg.
2—No. 4 Cincinnati Pl. S.P.D.
2—No. 4 Becker Vertical.
105—No. 4 Hendy Lincoln.
25—No. 4 Loew-Victor Lincoln.
11—No. 12 Pratt-Whitney Lincoln.
50—No. 7-H Becker Lincoln.
2—Type B-34 in. Briggs.
2—18 in. Cincinnati Automatic.
7—Putnam Semi-Automatic.
1—17 in. x 10 Newton, 3 hds.
1—No. 1½ Newton Duplex.
1—24 x 6 Ingersoll, 3 hds.
1—48 in. x 10 Newton Slab.

TURRET & SCREW MACHINES

8—⅝ in. Pratt & Whitney Screw.
1—1 in. Pratt & Whitney Screw.
8—1 in. Warner & Swasey, No. 2.
5—1 in. Foster, No. 2.
5—1¼ in. Foster, No. 3.
3—1½ in. Warner & Swasey, No. 4.
4—No. 4 Warner & Swasey Universal.
15—1½ in. Wood, No. 4.
1—1½ in. Southworth, No. 4.
1—2 in. Brown & Sharpe, wire feed, No. 6.
2—2 in. Pratt & Whitney Screw.
1—2 in. Wood, No. 6.
2—3 x 36 Jones & Lamson.
1—3 x 36 Acme.
4—14 in. Warner & Swasey Turret.
2—20 in. Pratt & Whitney Chuck.
2—No. 3-A Warner & Swasey.
25—24 in. Steinle.
4—No. 75 4-spdl. National Acme.

GRINDERS

12—American Drill.
1—No. 2 Garvin Hole.
2—No. 70 Heald Int.
1—12 in. x 96 in. Landis Pl.
1—No. 2 Bath Surface.
1—8 in. x 48 in. Thompson Surface.
2—12 in. x 36 in. Landis Plain.
1—12 in. x 36 in. Modern Plain.
1—20 in. x 96 in. Landis Plain.
1—12 in. x 36 in. Cincinnati Univ. No. 2.
3—6 in. x 32 in. Norton, Plain.
1—No. 2 Oesterlein, Cutter.
2—No. 3 Oesterlein, Universal.

UPRIGHT DRILLS AND RADIALS

1—2-spl. Henry & Wright.
1—3-spdl. Allen.
[illegible]—6-spdl. Allen.
3—No. 6-B Henry & Wright Sens.
1—20 in. Silver.
1—25 in. Silver Sliding Hd.
3—3 ft. American Sens. Radial.
1—6-spdl. Barnes, gang.
1—3 ft. Western Radial S.P.D.
1—3½ ft. Western Radial S.P.D.
1—4 ft. Western Radial S.P.D.
1—5 ft. Western Radial S.P.D.
1—6 ft. Western Radial S.P.D.

BORING MILLS

1—30 in. Gisholt.
1—34 in. Colburn.
1—10 ft. Niles Vertical.
1—4 in. Bar Niles Hor.
1—Beaman & Smith Hor., 2 hds.
1—2-spdl. Espen-Lucas, 2 hds.

MISCELLANEOUS

2—No. 4-B Cochran-Bly Auto. Cold Saws.
18—Pilton Slotters.
6—4 in. Pratt & Whitney Thd. Millers.

If the tools you want are not listed here, write and ask us.

HILL, CLARKE & CO
OF CHICAGO
649 Washington Boulevard

Genuine Bargains

Here is a list of equipment, just purchased from a manufacturing plant, that we are offering at prices that will move them quickly.

Some of them are *Brand New*. *All* are late type tools and in *first class* working condition.

LATHES

13 in. x 6 ’t. HENDEY, taper attach. and draw bar	$475
14 in. x 6 ft. SIDNEY (NEW)	475
16 in. x 6 ft. SIDNEY (NEW)	490
20 in. x 8 ft. WALCOTT (95% NEW)	725
22 in. x 10 ft. REED (90% NEW)	490
13 in. x 6 ft. REED-PRENTICE, taper attach	325
No. 5½ SLOAN & CHACE bench lathe, grinding attach.	125

MILLERS

No. 2 CINCINNATI HI.-POWER UNIVERSAL, VERTICAL MILLING ATTACH. (90% NEW)	1300
No. 2 CINCINNATI UNIVERSAL, cone driven	900
No. 2 ROCKFORD UNIVERSAL, vertical milling attach. (90% NEW)	1150
No. 1 GARVIN UNIVERSAL	575
No. 2A BROWN & SHARPE UNIVERSAL (90% NEW)	950
No. 2 BROWN & SHARPE PLAIN, with dividing heads	400
No. 1-½B BROWN & SHARPE PLAIN (90% NEW)	500
No. 3 BROWN & SHARPE PLAIN	250
No. 2 BROWN & SHARPE VERTICAL with circular milling attach.	500
No. 1-½ AMERICAN PLAIN with dividing heads	375
No. 3-½ FOX PLAIN	135
CINCINNATI 12 in. PLAIN	175
TYPE “A” BRIGGS	175

PLANERS—SHAPERS
BORING MILLS

20 in. GOULD & EBERHARDT, back geared	650
7 in. RHODES (90% NEW)	175
20 in. AMERICAN—MOTOR DRIVEN	650
16 in. WHIPP (NEW)	500
24 in. x 24 in. x 6 ft. GRAY—2 HEADS	750
34 in. COLBURN VERTICAL BORING MILL	750
32 in. KING VERTICAL BORING MILL (90% NEW)	950

DRILLS

14 in. WASHBURN HIGH SPEED SENSITIVE (NEW)	90
14 in. MYERS SENSITIVE	62
No. 11 NATCO MULTIPLE DRILL—8 Spindles	385
FOX MULTIPLE DRILL—12 Spindles	350
AVEY SENSITIVE, single spindle	125
20 in. CHAMPION (NEW)	115
HENRY & WRIGHT SENSITIVE 3 spindle Class L	215
4 SPINDLE ADJUSTABLE spindles and adjustable table	125
HAMMOND RADIAL (NEW)	390
QUINT 6 Hole turret drill	65

GRINDERS

No. 1 BROWN & SHARPE UNIVERSAL	425
3 in. x 18 in. NORTON PLAIN	475
14 in. PRATT & WHITNEY VERTICAL SURFACE	675
No. 1-½ CINCINNATI CUTTER (95% NEW)	275
BROWN & SHARPE TYPE SURFACE, with magnetic chuck	250
No. 1-½ DIAMOND BENCH POLISHING JACKS	17

SCREW MACHINES

5A POTTER & JOHNSTON AUTOMATIC	370
No. 10 FOSTER geared head, power feeds, (90% NEW)	650
No. 4 FOSTER geared head	350
No. 3 FOSTER plain head, (90% NEW)	375

WOODWORKING

No. 55 CRESCENT UNIVERSAL WOODWORKER	450
6 in. AMERICAN BENCH JOINTER	75
PEERLESS VERTICAL SANDER (90% NEW)	225
PEERLESS HORIZONTAL SANDER (90% NEW)	175
24 in. x 8 ft. FAMOUS PLANER (NEW)	375

MISCELLANEOUS

No. 7B JARECKI PIPE MACHINE	300
No. 3 LAPOINTE BROACHER, single spindle	375
40 LB. BRADLEY HELVE HAMMER	300
25 LB. BRADLEY HELVE HAMMER	275
THURSTON DIE MILLER (NEW)	125
No. 2B COCHRANE & BLY COLD SAW	115
No. 11 COCHRANE & BLY SAW SHARPENER (90% NEW)	135
No. 2 BAIRD FOOT PRESS	18
RICKERT SHAEFFER HORIZONTAL TAPPER (90% NEW)	75

All machines for immediate delivery and all are offered subject to prior sale.

Standard Machinery Company, 453 Chapel St., New Haven, Conn.

PRE-WAR PRICES!

USED TOOLS

PARTIAL LIST

5—Ona-spindle Allen Drill Presses.
2—Three-spindle H. & W. Drill Presses.
1—Three-spindle Sipp Drill Press.
1—Five-spindle T. & F. Drill Press.
1—Dow No. 1 Knee Type Plain B. G. Miller.
[illegible]—No. 1 Hendey Knee Type Plain Millers.
1—No. 12 P. & W. Lincoln Miller.
1—No. 32 Kempsmith Lincoln Miller.
1—Briggs Standard Type “A” Miller.
4—Briggs 58-in. Table Type “A” Millers.
3—No. 6 Whitney Hand Millers; two-step cone.
3—Stark No. 3½ Bench Lathes.
4—Bryant No. 6 Chucking Grinders.
3—Rivett No. 103 Internal Grinders.
3—No. 0 B. & S. Bench Tool Grinders.
1—No. 2 B. & S. Universal Grinder.
3—No. 2 B. & S. Surface Grinders.
1—6 in. x 30 in. Morse Plain Cyl. Grinder.
1—No. 10 Foster Turret Lathe.
8—No. 1-A Standard Foot Presses (new).
1—Waterbury Farrel (not inclinable). Standard Open Back Press, about size No. 18 Bliss.
25—No. 1 Baird Bench Presses.
1—B. & S. Die Trimmer.
1—No. 2 B. & S. Hand Screw Machine.

PURINTON & SMITH
31-41 Edward St., Hartford, Conn.

Special Bargains in Grinders

2—No. 16 Blanchard High Power Vertical Surface, direct motor drive, 26-in. magnetic chuck, condition as good as new, extremely accurate.
[illegible]—14-in. Pratt & Whitney Vertical Surface Grinders, motor driven with 15-hp. motors, rotary plain table, one with mag. chuck; used a short time; accurate on production to .0005.
6—Person-Arter 8-in. Rotary Surface, with mag. chucks; accurate to .00025 and in A-1 condition.
20—No. 3T Van Norman Auto Ball Race Grinders for radial or thrust bearings or any mechanical perfect groove or radius; accurate to .0005 and A-1 condition.

Lot of other Grinders and good new and used equipment.

IDEAL MACHINERY CO.
Plainville, Conn., U. S. A.

FRANK TOOMEY, INC.

127-129-131 N. Third St., Philadelphia, Pa.

MACHINE TOOLS IN STOCK

LATHES	New Sidney, all sizes, 10 in. to 36 in., any length. New Carroll-Jamieson, 13 in., 15 in., 16 in., any length bed. New Johnston Bench Hi-duty, 9 in. x 36 in. Used 42 in. Pond car wheel Lathe. WRITE FOR USED LATHE LIST.
TURRETS	Used 2¼ in. Gridley, No. 4 and 6 Warner & Swasey. Used No. 1, No. 6 Bardons & Oliver, No. 21 Gisholt. MANY OTHER USED TURRETS.
DRILL PRESSES	Full Line Superior Drills. Full Line Champion Drills. Full Line Buffalo Drills. Full Line Excelsior Drills. Full Line Sensitive Drills. 42 in. New Standard Plain Radial. ALSO USED DRILLS AND RADIALS.
BORING MILLS	Used 42 in. Bullard Boring and Turning. Used 3 in Binsse Horizontal Mill.
SHAPERS	Full Line Steptoe Shapers. 7 in. Rhodes Shaper.
PLANERS	Used 36 in. x 36 in. x 10 ft. Cincinnati, 3 Hds. Motor. Used 24 in. x 24 in. x 6 ft. Pease, 1 Head. Used 24 in. x 24 in. x 8 ft. Hendey, 1 Head. Used 48 in. x 48 in. x 16 ft. Flather, 4 Heads. Used 16 in. x 16 in. x 42 in. Walter, 1 Head.
MILLERS	Various Sizes, New and Used. Brown & Sharpe, Garvin, American, Dow, Burke, Steptoe.
PUNCHES	Line of Buffalo Forge Armor Plate.
SHEARS	Line of Royersford Foundry & Mch. Co.
PRESSES	Line Hendley-Whittemore, Beloit. Line Max-Ams. Line of Ferracute. VARIOUS USED MACHINES.

Write for further list of Hack Saws, Hammers, Bolt Cutters, Pipe Machines, Slotters, Keyseaters, Grinders, Etc.

FRANK TOOMEY, Inc., 127-129-131 N. Third St., Philadelphia, Pa.

SLOTTERS

10-in. Newton.
16-in. Betts.

For sale by

CYRIL J. BATH & COMPANY
Machinery Merchants
1607 St. Clair Ave., N.E., Cleveland, Ohio

FOR SALE

Drawings, Patterns, Jigs and Fixtures, and completed parts of iron planers from 24 in. to 42 in. wide. For further details write this office.

MORLEY MACHINERY CORPORATION
215-217 North Water Street
Rochester, New York

SECOND-HAND MACHINE TOOLS

DRILLS

1 spdl. Avey ball bearing.
2 spdl. Avey ball bearing.
3 spdl. Henry & Wright ball bearing.
3 spdl. Taylor & Fenn.
4 spdl. Francis Reed.
20 in. Prentice Bros. stationary head.
20 in. Prentice Bros. sliding hd., B.G., P.F.
23 in. Rockford sliding hd., B.G., P.F., Tapping att.
24 in. Cincinnati-Bickford sliding hd., B.G., P.F.
28 in. Sibley sliding hd., B.G., P.F.
42 in. Cincinnati-Bickford sliding hd., B.G., Tapping att.
No. 12 Natco multiple spdl. tapping att.
No. 13 Natco multiple spindle drill.
No. 14 Natco multiple spdl.
No. 30 Bausch multiple spdl.
3 ft. Cincinnati-Bickford radial, tapping att.
4 ft. Dreses radial, tapping att.
5 ft. Cincinnati-Bickford full universal radial.
4 ft. Western (Full universal) radial, tapping att.
Baker Bros. & Colburn manufacturing type drills.

LATHES

No. 5 Rivett Precision, with slide rest.
12 in. x 6 ft. Prentice Bros. Tool Room, taper att.
14 in. x 6 ft. Flather Tool Room, taper att.
16 in. x 6 ft. Lodge & Shipley Tool Room, taper att.
16 in. x 8 ft. Lodge & Shipley Tool Room, taper att., geared hd., M.D.
24 in. x 10 ft. Lodge & Shipley, C.R., P.C.F. taper att.
26 in. x 12 ft. Putnam, C.R., P.C.F.
32 in. x 14 ft. Boye-Emmes, C.R., P.C.F.
32 in. x 14 ft. Hamilton, C.R., P.C.F., triple geared.
38 in. x 20 ft. New Haven, C.R., P.C.F.
50 in. x 22 ft. Fifield, C.R., P.C.F., triple geared.

BORING MACHINES

3 in. dia. bar, Lucas hor., table type.
4 in. dia. bar, Detrick & Harvey, hor., floor type.
34 in. Colburn turret head, vertical.
38 in. Niles, 2 reg. heads.

SCREW MACHINES AND TURRET LATHES

⅜ in. capacity Brown & Sharpe, wire feed.
1 in. capacity Acme, wire feed.
1¼ in. capacity Acme, wire feed.
1½ in. capacity Acme, wire feed.
2¼ in. capacity Acme, wire feed.
16 in. and 18 in. Acme Universal, Fox type.
No. 3 Acme Universal 3½ in. capacity flat turret.
2¼ in. and 3¼ in. Jones & Lamson bar or chucking.

MILLERS

No. 2, 3 and 4 Cincinnati, plain.
No. 2A, 5 and 9 Kempsmith, plain.
No. 3 and 4 Cincinnati, vertical.
No. 2A, 4B and 5 Becker, vertical.
No. 2 B. & S. Universal.
No. 1 Cincinnati Type M, Universal.
No. 6 Whitney, hand.
36 in. x 10 ft. Newton, face slab type.

GRINDERS

3 in., 6 in., 10 in., 18 in. Swing Norton, pl. mfg. type.
10 in. x 30 in. Landis, pl. mfg. type.
12 in. x 120 in. Landis, pl. mfg. type.
12 in. x 36 in. and 48 in. Cincinnati, pl. mfg. type.
No. 2 Cincinnati 12 in. x 36 in., universal.
No. 3 Cincinnati 12 in. x 48 in., universal.
No. 1 Cincinnati cutter and reamer grinder.
No. 1 LeBlond cutter and reamer grinder.
No. 1 Norton cutter and reamer grinder, pwr. feed table.
No. 34 Van Norman, internal.
No. 6 Rivett, internal.
No. 60 Heald, cylinder (very good).
No. 11 Rivett Ball Race, with power, oscillating att.
Saxon face grinder.
10 in. Garrigus rotary, with magnetic chuck.
1—24 in. x 12 in. Surface (No. 1 Diamond).
No. 16 Blanchard grinders.
18 in. and 20 in. disc. grinders.

SHAPERS AND PLANERS

14 in. Pratt & Whitney crank shaper.
14 in. Springfield crank shaper.
16 in. Ohio plain crank shaper.
16 in. and 20 in. Gould & Eberhardt crank shapers, back geared.
24 in. Stockbridge crank shaper, back geared.
15 in. and 24 in. Hendey friction shapers.
24 in. x 24 in. x 6 ft. Flather planer, 1 hd.
26 in. x 24 in. x 7 ft. Gray planer, 1 hd.
36 in. x 36 in. x 8 ft. Pond planer, 2 hds.
36 in. x 36 in. x 12 ft. Pond planer, 2 hds.
36 in. x 30 in. x 14 ft. Cincinnati planer, 3 hds.
36 in. x 36 in. x 12 in. Cincinnati planer, 4 hds.
40 in. x 30 in. x 12 ft. Cincinnati planer, 2 hds.
42 in. x 42 in. x 12 ft. Cincinnati planer, 3 hds.
48 in. x 36 in. x 12 ft. Cincinnati planer, 3 hds.
48 in. x 48 in. x 15 ft. Sellers planer, 3 hds.
66 in. x 60 in. x 30 ft. Bement planer, 3 hds.

MISCELLANEOUS

No. 00 S. & S. Hobbing, gear cutter.
No. 000 S. & S. Hobbing, gear cutter.
36 in. B. & S. gear cutter.
36 in. Cincinnati gear cutter.
No. 3 Lapointe broaching machine.
3 in. P. & W. centering machine.
No. 72 Ferracute.
8 in. x 8 in. air compressor.
½ in. and 1 in. 6 spdl. Acme nut tappers.
12 and 13 PPP. & W. profilers.
No. 6A National butt welder.
4 in. Baker Bros. tapping machine.

We have a number of machines not mentioned in this list. Send us your inquiries.

HENRY PRENTISS & COMPANY, Inc.
NEW YORK, N. Y., Warehouse, Jersey City
BOSTON BUFFALO HARTFORD SYRACUSE ROCHESTER

"SIMMONS"

LATHES

1—16 in. x 6 ft. Pratt-Whitney Precision Tool Room, taper and draw-in.
1—22 in. x 12 ft. Niles Lathe, complete.
7—24-in. x 10-ft. American High Duty Geared Head.
1—24-in. x 18-ft. LeBlonde Heavy Duty Engine Lathe.
8—27-in. x 18-ft. LeBlonde Heavy Duty, QCG, with motor.
7—27-in. x 24-ft. LeBlonde Heavy Duty, DBG, QCG, (NEW)
4—30-in. x 12-ft. High Duty American Geared Head, motor drive with motor.
1—33-in. x 14-ft. Putnam All Geared Head Lathe.
1—36-in. x 18-ft. Putnam Heavy Duty Triple Geared Lathe.
6—36-in. x 34-ft. Bridgeford Geared Head, QCG, (NEW).
1—42-in. x 20-ft. Niles-Bement-Pond Heavy Duty Triple Geared.
8—48-in. x 29-ft.-56-ft. Niles-Bement-Pond Motor Drive (NEW).
3—60-in. x 29-ft.-56-ft. Niles-Bement-Pond Motor Drive (NEW).

PLANERS

1—60-in. x 60-in. x 20-ft. Woodward-Powell, 4 heads, 35 hp. Motor Rev.
1—48 in. x 48-in. x 20-ft. Ridgeway, high duty, four heads.
1—48-in. x 48-in. x 28-ft. Cincinnati, two heads (NEW).
1—42-in. x 42-in. x 12-ft. Openside Simmons Planer, two heads (NEW).
1—36-in. x 36-in. x 20-ft. Woodward-Powell Planer, four heads.
1—30-in. x 30-in. x 18-ft. Cincinnati, two heads.
1—30 in. x 30 in. x 8 ft. Cincinnati one head.
24 in. x 24 in. x 12 ft. American two heads.

MILLERS

1—No. 1½ Milwaukee Universal Miller, latest type.
8—No. 3-S Cincinnati Geared Head Universal.
5—No. 3 Cincinnati Heavy Duty Geared Head Vertical.
1—No. 4 Cincinnati High Duty Vertical.
1—Pratt-Whitney Heavy Duty Slab Miller.
1—Type-B Gooley-Edlund High Duty "Briggs" Miller.

BORING MILLS

1—12-ft. Bement Extra Heavy Boring-Turning Mill, two swivel heads.
1—10 ft. Betts Vertical Mill, 15 hp. var. speed motor.
1—34-in. Bertram Vertical Turret Head Boring Mill.
1—No. 31 Lucas Precision Horizontal Mill.
1—36-in. Bullard New Era Type Vertical, Cutting Lub. System.
1—24-in. Bullard New Era Type Turret Lathe.

RADIALS

2—6-ft. Reed-Prentice Plain Radial Drill, one with tapping attachment.
1—5-ft. Fosdick Full Universal Radial.
1—4 ft. Prentice Plain.
1—4 ft. Gang Plain Radial.
1—31 in. Rockford Sliding Head Drill Tapping Attachment.
3—No. 310 Baker Heavy Duty Drills, 2½ in. Cap. in steel.
1—28 in. Cincinnati Upright Vertical, tapping attachment.
1—36 in. Aurora Sliding Head Drill.
No. 13 Natco Multiple Spindle Drill.

MISCELLANEOUS

1—48 in. Ohl's Gang Punch.
1—New 5-Ton Pawling & Harnischfeger Crane, 38 ft. span.
1—250 ton Southwark Hydraulic Press.
1—72 in. Niagara Squaring Shear.
1—No. 6 Leffler Inclinable Power Press.
1—14-in. x 96-in. Norton Plain Grinder (NEW).
1—15-18 in. Dill Slotter.
8—32 in. Cincinnati High Duty Shapers (NEW).
2—36 in. Fellows Gear Shapers.
3—Pratt-Whitney No. 12 Two Spindle Profilers.
1—26 in. x 10 ft. Bullard Turret Lathe.
1—Brown-Sharpe Planer Type Surface Grinder.
1—Gould & Eberhardt Spur and Bevel Automatic Gear Cutter.

Write for Photographic Stock Book
WE BUY COMPLETE PLANTS

SIMMONS MACHINE CO., Albany, N. Y.

BRANCH OFFICES:
801 Singer Bldg., New York, N. Y.
86-88 Exchange St., Buffalo, N. Y.

EXCEPTIONAL VALUES

New and Used Machine Tools of the Better Kind

MILLING MACHINES

1—No. 5 Cincinnati Universal; rectangular arm; latest type.
1—No. 5 Cincinnati Plain; rectangular arm; latest type.
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1—Whitcomb 24 in. x 24 in. x 6 ft. **Planer.**
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3—Baird 24 in. x 20 in. **Tilting Tumbling Barrels**
2—Globe **Tilting Tumbling Barrels.**
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Lathe, Reed Prentice, 14 in. x 10 ft.
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Lathe, Turret, W. & S. No. 2 Hollow Hexagon
Miller, Universal, No. 1 Kempsmith
Miller, Plain, No. 25 Becker
Motors, ½ to 50 H.P., G.E., 3 phase
Oil Separator, Springfield
Planer, Gray, 24 in. x 24 in. x 6 ft.
Planer, Pond, 36 in. x 36 in. x 18 ft.
Planer, Putnam, 84 in. x 84 in. x 32 ft., 4 Hd.
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Punch and Shear, ½ in. x ½ in., 12 in. throat
Shear, 5 ft. for 10 gauge metal

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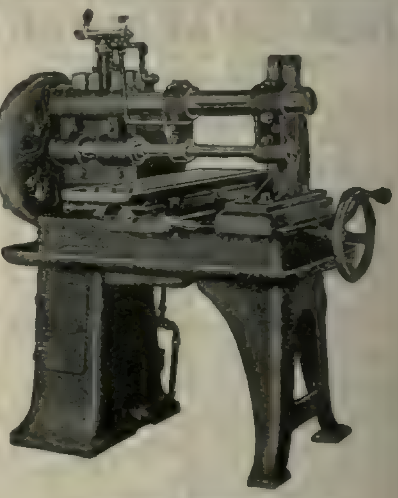

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2¼ in. to 2½ in. Warner & Swasey type

HAND TURRET LATHE

20 in. and 24 in. quick-change, heavy duty

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taking 5 ft. 6 in. to 6 ft. 6 in. between centers. Give full specifications in reply.

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16-in. Gould & Eberhard Shaper; B. G.; good condition	525
1,000-lb. Merrill Bros. Automatic Drop Hammer; board lift, excellent condition	800

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TURRET LATHE

2¼ in. to 2½ in. Warner & Swasey type hand

ENGINE LATHE

20 in. and 24 in. quick-change heavy duty

taking 5 ft. 6 in. to 6 ft. 6 in. between centers.

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Designers and Builders
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Especially Spur Gears up to 10" diam.

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Quality quaranteed. Ask us for estimates.

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Anything up to 3½-in. in diameter.

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For Alphabetical Index See Last Page

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Carborundum Co., Niagara Falls
Gardner Mch. Co., Beloit

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Sullivan Machinery Co., Chicago.

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Cushman Chuck Co., Hartford.
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National Twist D. & T. Co., Detroit
Nicholson & Co., W. H., Wilkes-Barre
Standard Eng. Works, Pawtucket
Union Mfg. Co., New Britain.
Union Twist Drill Co., Athol
Whitney Mfg. Co., Hartford.

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Bearings Co. of America, Lancaster

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Abbott Ball Co., Hartford.
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SKF Industries, N. Y.

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Gisholt Mch. Co., Madison
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American Bronze Corp., Berwyn, Pa.
Bunting Brass & Bronze Co., Toledo.

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Auburn Ball Bearing Co., Rochester.
Bearings Co. of America, Lancaster
Boston Gear Works, Quincy
Fafnir Bearing Co., New Britain.
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Norma Co., of America, N. Y.
Schatz Mfg. Co., Poughkeepsie.
S K F Industries, N. Y.

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Doehler Die Casting Co., Brooklyn.

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Franklin Die Cast. Corp., Syracuse.
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Bearings, Roller
Gwilliam Co., N. Y.
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Schieren Co., Chas. A., N. Y.

Belt Clamps
Hoggson & Pettis Mfg. Co., New Haven

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Schieren Co., Chas. A., N. Y.
Texas Co., N. Y.
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Bristol Co., Waterbury, Conn.

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Link-Belt Co., Chicago, Philadelphia.
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Skinner & Co., R. D., N. Y.

Belting, Leather
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Brown & Sharpe Mfg. Co., Providence.
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Benches, Work
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Niles-Bement-Pond Co., N. Y.

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Gisholt Mch. Co., Madison
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Driver-Harris Co., Harrison

Boxes, Tote (See Furniture, Machine Shop)

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Bridgeport Brass Co., Bridgeport

Broaches
Hurlbut-Rogers Broach Co., Hudson
Lapointe Co., J. N., New London
Lapointe Mach. Tool Co., Hudson.

Broaching Machines
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Bronze, Phospor
Bunting Brass & Bronze Co., Toledo.

Bucket Carriers, Pivoted
Link-Belt Co., Chicago: Philadelphia

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Johnson Gas Appliance Co., Cedar Rapids.

Bushings
American Bronze Corp., Berwyn
Bunting Brass & Bronze Co., Toledo.
Columbus Brass Co., Columbus.
Johnson Bronze Co., New Castle
Sterling Specialty Co., Newcomerstown.
Tate, Jones & Co., Pittsburgh

Cabinets, Tool
Armstrong Bros. Tool Co., Chicago.

Calipers
Athol Machine & Foundry Co., Athol
Brown & Sharpe Mfg. Co., Providence.
Randall & Stickney, Waltham
Starrett Co., L. S., Athol, Mass.

Cam Cutting Machines
Cochrane-Bly Co., Rochester
Garvin Mach. Co., N. Y.
Rowbottom Mach. Co., Waterbury.

Cams
Rowbottom Machine Co., Waterbury

Can-Making Machinery (See Sheet Metal Working Machinery)

Castings, Aluminum
Bunting Brass & Bronze Co., Toledo.
Doehler Die Casting Co., Brooklyn.
Grey Mfg. Co., C. M. E. Orange
Light Mfg. & Fdry. Co., Pottstown.

Castings, Brass and Bronze
Accurate Brass Cast Co., Brooklyn
American Bronze Corp., Berwyn
Bunting Brass & Bronze Co., Toledo.
Columbus Brass Co., Columbus.
Doehler Die Casting Co., Brooklyn.
Imperial Brass Mfg. Co., Chicago.
Light Mfg. & Fdry. Co., Pottstown.
Pangborn Corp., Hagerstown

Castings, Carbonizing
Driver-Harris Co., Harrison

Castings, Die Molded
Doehler Die Casting Co., Brooklyn.
Franklin Die Cast. Corp., Syracuse.
Light Mfg. & Fdry. Co., Pottstown.
Castings, Electric, Steel
Treadwell Eng Co., Easton

Castings, Iron
Athol Machine & Foundry Co., Athol
Brown & Sharpe Mfg. Co., Providence.
Franklin Mach. Co., Providence.
Munson, E. G., Utica
Springfield Mch. T. Co., Springfield, O.
Treadwell Eng. Co., Easton
Whitcomb-Blaisdell Mach. Tool Co., Worcester.

Castings, Malleable Iron
Link Belt Co., Chicago, Philadelphia

Castings, Nichrome
Driver-Harris Co., Harrison

Castings, Semi-Steel
Pangborn Corp., Hagerstown
Springfield Mch. T. Co., Springfield, O.

Centering Machines
Hendey Mach. Co., Torrington
Niles-Bement-Pond Co., N. Y.
Pawling & Harnischfeger Co., Milwaukee
Standard Engrg. Wks., Pawtucket.
Whiton Mach. Co., D. E., New London

Centers, Planer
Cincinnati Planer Co., Cincinnati.
Woodward & Powell Planer Co., Worcester.

Chains (See Sprockets and Chains)

Chains, Driving
Baldwin Chain & Mfg. Co., Worcester.
Link-Belt Co., Philadelphia: Chicago
Morse Chain Co., Ithaca, N. Y.
Whitney Mfg. Co., Hartford.

Chucking Machines
Brown & Sharpe Mfg. Co., Providence.
Bullard Mach. Tool Co., Bridgeport.
Cleveland Auto Mach. Co., Cleveland
Gisholt Mch. Co., Madison
Jones & Lamson Mach. Co., Springfield, Vt.
Potter & Johnson Mch. Co., Pawtucket.

Chucks, Air
Frontier Chuck & Tool Co., Buffalo
Manufacturing Equip. & Eng. Co., Framingham

Chucks, Centering
Cushman Chuck Co., Hartford.

Chucks, Drill and Tap
Almond Mfg. Co., T. R., Ashburnham
American Equip. Co., Detroit
Clemson Bros., Inc., Middletown
Cushman Chuck Co., Hartford.
Horton & Son Co., E., Windsor Locks
Marvin & Casler Co., Canastota
Modern Tool Co., Erie, Pa.
Morse Twist D. & M. Co., New Bedford
National Twist D. & T. Co., Detroit
S K F Industries, N. Y.
Skinner Chuck Co., New Britain.
Union Mfg. Co., New Britain
Victor Tool Co., Waynesboro
Whitney Mfg. Co., Hartford
Whiton Mach. Co., D. E., New London

Chucks, Lathe
Almond Mfg. Co., T. R., Ashburnham
Bullard Mach. Tool Co., Bridgeport.
Clemson Bros., Inc., Middletown
Cushman Chuck Co., Hartford.
Gisholt Mch. Co., Madison
Hoggson & Pettis Mfg. Co., New Haven
Horton & Son Co., E., Windsor Locks
Ryerson & Son, Joseph T., Chicago
Simplex Tool Co., Woonsocket
Skinner Chuck Co., New Britain.
Terkelsen Mch. Co., Boston
Union Mfg. Co., New Britain.
Whiton Mch. Co., D. E., New London

Chucks, Magnetic
Heald Machine Co., Worcester.

Chucks, Planer
Cincinnati Planer Co., Cincinnati.
Hoggson & Pettis Mfg. Co., New Haven

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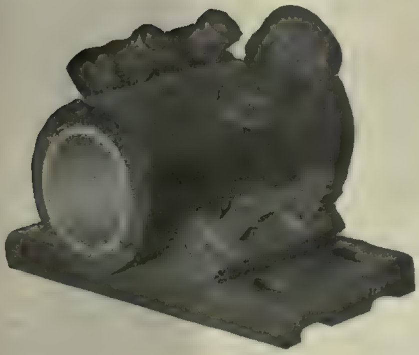

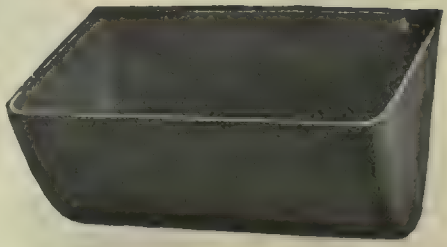

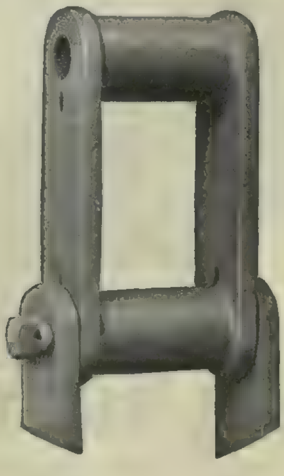

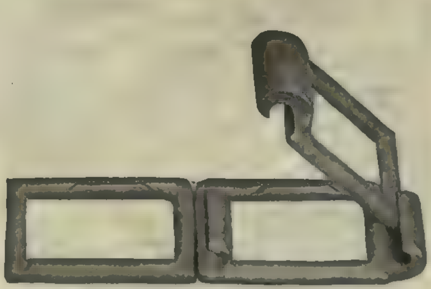

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Horton & Son Co., E., Windsor Locks
Skinner Chuck Co., New Britain.
Union Mfg. Co., New Britain.

Chucks, Split
Ames Co., B. C., Waltham. Mass.
Rivett Lathe & Grinder Co., Boston.
Seneca Falls Mfg. Co., Seneca Falls.
Stark T. Co., Waltham
Wade-American T. Co., Waltham

Chucks, Vertical Boring Mill
Bullard Mach. Tool Co., Bridgeport.
Gisholt Mch. Co., Madison

Clamps, Machinists'
Armstrong Bros. Tool Co., Chicago.
Reed Mfg. Co., Erie. Pa.
Starrett Co., L. S., Athol, Mass.
Williams & Co., J. H., Brooklyn.

Cleaners, Metal, Waste General
Oakley Chemical Co., N. Y.

Clocks, Time
Gisholt Mch. Co., Madison

Clutches, Friction
Brown Co., A. & F., N. Y.
Brown Engrg. Co., Reading, Pa.
Edgemont Mch. Co., Dayton
Hilliard Clutch & Mchy. Co., Elmira
Johnson Mach. Co., Carlyle, Manchester.
Link-Belt Co., Chicago, Philadelphia
Moore & White Co., Philadelphia.

Coal and Ash Handling Machinery
Link-Belt Co., Chicago, Phila.
Shepard Elec. C. & H. Co., Montour Falls.

Coal-Storage Systems
Link-Belt Co., Chicago, Philadelphia

Coils, Electric
General Elect. Co., Schenectady

Collars, Shaft & Set
Royersford Fdry. & Mch. Co., Royersford

Collars, Spacing
Detroit Stamp. Co., Detroit.

Collets
Brown & Sharpe Mfg. Co., Providence.
Geometric Tool Co., New Haven
McCrosky Tool Corp., Meadville
Modern Tool Co., Erie. Pa.
Rivett Lathe & Grinder Co., Boston.
Standard Eng. Wks., Pawtucket.
Union Twist Drill Co., Athol, Mass.
Whitney Mfg. Co., Hartford.

Compounds, Carburizing, Casehardening and Tempering
Rogers & Hubbard Co., Middletown
Shore Instrument & Mfg. Co., N. Y.

Compounds, Cleaning
Oakley Chemical Co., N. Y.

Compounds, Cutting, Drawing, Drilling, Grinding and Screw Cutting
Oakley Chemical Co., N. Y.
Sun Co., Philadelphia
Texas Co., N. Y.
White & Bagley Co., Worcester.

Compressors, Air and Gas
Bury Compressor Co., Erie.
Chicago Pneumatic Tool Co., N. Y.
Curtis Pneu. Mchy. Co., St. Louis
General Elect. Co., Schenectady
Ingersoll-Rand Co., N. Y.
Sullivan Machinery Co., Chicago.

Conduits, Interior
General Elec. Co., Schenectady

Containers, Heat Treating
Driver-Harris Co., Harirson

Contract Work
Acklin Stamping Co., Toledo.
American Mch. & Fdry Co., B'klyn.
American Tool Co., Pawtucket
American Tool & Mfg. Co., Urbana.
Ames Co., B. C., Waltham
Barth Stamp & Mch. Wks. Cleveland
Becker Milling Mch. Co., Hyde Park
Bettcher Stamp & Mfg. Co., Cleveland
Betts Mach. Co., Rochester.
Binghamton Mch. Wks., Binghamton
Brock T. & Mfg. Wks., Arthur, Phila.
Brown & Sharpe Mfg. Co., Providence
Buffalo Pitts Co., Buffalo.
Columbus Die T. & M. Co., Columbus
Conradson Mch. T. Co., Green Bay
Davis-Bournonville Co., Jersey City.
Detroit Stamping Co., Detroit
Earle Gear & Mch. Co., Philadelphia.
Emery, A. H., Glenbrook, Conn.
Franklin Mach. Co., Providence.
Garvin Mach. Co., N. Y.
General Mach. Wks. York.
General Rlwy. Signal Co., Rochester
Gisholt Mch. Co., Madison
Grant Mfg. & Mach. Co., Bridgeport
Hartford Special Mchy. Co., Hartford
Keller Mech. Eng., Brooklyn.
Kempsmith Mfg. Co., Milwaukee
Lamb Co., Jos. T., Detroit
Lambert & Todd Mach. Co., Camden.
Lincoln Mach. Co., Pawtucket.
Long and Allstatter Co., Hamilton
Lux Clock Mfg. Co., Waterbury
Mehl Mach. Tool & Die Co., Roselle.
Meisel Press Mfg. Co., Boston.
New London Ship & Eng. Co., Groton
Robbins Mch. Wks., Worcester
Root Co., B. M., York
Rowbottom Mach. Co., Waterbury
Sexton Mch. Co., Hartford
Shepard Eng. Co., Williamsport
Simplex Tool Co., Woonsocket
Starrett Co., L. S., Athol
Steel Prod. Eng. Co., Springfield
Sterling Specialty Co., Newcomerstown
Terkelsen Mch. Co., Boston
Toledo Mch. & Tool Co., Toledo
Underwood Corp., H. B., Phila.
Wade-American T. Co., Waltham
Waltham Mach. Wks., Waltham

Controllers & Starters
General Elect. Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Converters
General Elect. Co., Schenectady

Conveyors and Elevators (See Elevators)

Cotter Pins
Williams & Co., J. H., Brooklyn

Counterbores
Detroit Twist Drill Co., Detroit
National Tool Co., Cleveland
National Twist D. & T. Co., Detroit

Countershafts
Brown & Sharpe Mfg. Co., Providence.
Diamond Mach. Co., Providence.
Evans Fric. Cone Co., Newton Highlands.
Garvin Mach. Co., N. Y.

Counters, Revolution
Bristol Co., Waterbury.

Counting Machines
Hart Mfg. Co., R. A., Battle Creek.

Counting and Printing Wheels
Doehler Die Casting Co., Brooklyn.
Franklin Die Cast. Corp., Syracuse.

Couplings, Flexible
Brown Eng. Co., Reading
Smith and Serrell, Newark.

Coupling Hose, Universal
Chicago Pneu. Tool Co., N. Y.

Couplings, Rigid
Smith & Serrell, N. Y.

Couplings, Shaft
Almond. T. R., Mfg. Co., Ashburnham
Edgemont Mch. Co., Dayton
Johnson Mach. Co., Carlyle, Manchester.
Nicholson & Co., W. H., Wilkes-Barre
Royersford Fdry. & Mach. Co., Royersford
Smith and Serrell, Newark, N. J.
Standard Gauge Steel Co., Beaver Falls

Cranes, Electric (See Hoists & Cranes, Electric)

Cranes, Hand (See Hoists, Hand)

Cranes, Locomotive
Link-Belt Co., Chicago, Philadelphia

Cranes, Traveling
Canton Fdry. & Mach. Co., Canton.
Curtis Pneu. Mchy. Co., St. Louis
Harrington, Son & Co., Ed., Phila.
Link-Belt Co., Chicago, Philadelphia
Niles-Bement-Pond Co., N. Y.
Northern Engrg. Wks., Detroit.
Pawling & Harnischfeger, Milwaukee
Shepard Elec. C. & H. Co., Montour Falls.
Toledo Crane Co., Bucyrus

Crank Pin Turning Machines
Niles-Bement-Pond Co., N. Y.
Underwood Corp., H. B., Phila.

Cut-outs, Electrical
General Elect. Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Cutters, Gear
Barber-Colman Co., Rockford. Ill.
Brown & Sharpe Mfg. Co., Providence.
National Tool Co., Cleveland
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol, Mass.

Cutters, Milling
Barber-Colman Co., Rockford, Ill.
Becker Milling Mach. Co., Hyde Park
Brown & Sharpe Mfg. Co., Providence.
Cowles Tool Co., Cleveland.
Detroit Twist Drill Co., Detroit
Geometric Tool Co., New Haven.
Ingersoll Milling Mch. Co., Rockford
Morse Twist D. & M. Co., New Bedford
National Tool Co., Cleveland.
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol. Mass.
Whitney Mfg. Co., Hartford.

Cutters, Thread.
Rivett Lathe & Grinder Co., Boston.
Universal Mch. Co., Bowling Green

Cutting-Off Machines
Armstrong-Blum Mfg. Co., Chicago.
Armstrong Bros. Tool Co., Chicago.
Automatic Mach. Co., Bridgeport.
Brown & Sharpe Mfg. Co., Providence.
Cochrane-Bly Co., Rochester
Earle Gear & Mach. Co., Phila.
Garvin Mach. Co., N. Y.
Gorton Mach. Co., Geo., Racine.
Hurlbut-Rogers Mchy. Co., So Sudbury
Newton Mach. Tool Wks., Phila.
Vandyck Churchill Co., N. Y.
Williams & Co., J. H., Brooklyn

Cutting-Off Machines, Pipe (See Pipe-Cutting and Threading Machines)

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago.

Cutting Oil Filters (See Oil Filtering Systems)

Cutting, Oxy-Acetylene
Davis-Bournonville Co., Jersey City.

Dealers, Machinery (See Searchlight Section)
Asher Mchy. Co., Newark
Bath Co., Cyril J., Cleveland
Botwinik Bros., New Haven
Brownell Mchy. Co., Providence.
Essley, E. L., Mchy. Co., Chicago
Garvin Mach. Co., N. Y.
Gelb & Co., J., N. Y.
Hill, Clarke & Co. of Chicago.
Hyman & Sons, Jas., Philadelphia
Ideal Mchy. Co., Plainsville
Industrial Plants Corp., N. Y.
Lamberg & Co., A., N. Y.
McMullen Mchy. Co., Grand Rapids
Metzler, Robt. J., Newark
Morey & Co., N. Y.
N. J. Mchy. Exch., Newark
Niles & Co., F. H., N. Y.
Niles-Bement-Pond Co., N. Y.
Osborne Sexton Mchy. Co., Columbus
Prentiss & Co., Henry, N. Y.
Purinton & Smith, Hartford
Russell Mch. Co., Pittsburgh
Ryerson & Son, Joseph T., Chicago
Seyfert's Sons, L. F., Philadelphia
Sherritt & Stoer Co., Philadelphia
Simmons Mach. Co., N. Y.
Standard Machy. Co., New Haven
Stokvis & Sons, R. S., N. Y.
Toomey, Frank, Philadelphia
Vandyck Churchill Co., N. Y.
Wayne Mchy. Co., Ft. Wayne.
Winterer, H. L., Philadelphia.

Diamond Tools
Crafts & Co., Arthur A., Boston.
Dickinson, Thomas L., N. Y.
Wheel Trueing Tool Co., Detroit.

Die Making Machines
Cochrane-Bly Co., Rochester
Keller Mech. Engraving Co., Bklyn.

Dies, Forging
Keller Mech. Engraving Co., Bklyn.
Steel Prod. Eng. Co., Springfield

Dies, Self-Opening Adjustable
Eastern Mach. S. Corp., New Haven.
Geometric Tool Co., New Haven
Jones & Lamson Mach. Co., Springfield, Vt.
Murchey Mch. & T. C., Detroit
Victor Tool Co., Waynesboro

Dies, Sheet Metal and Sub-Press (See Tool Work)

Dies, Threading-Opening
Eastern Mach. S. Corp., New Haven.
Errington Mechanical Laboratory, N. Y.
Geometric Tool Co., New Haven.
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Mach. Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Mch. & T. C., Detroit
National Acme Co., Cleveland.
National Mchy. Co., Tiffin, Ohio.
Steel Prod. Eng. Co., Springfield
Victor Tool Co., Waynesboro

Dividing Heads
Knight Mchy. Co., W. B., St. Louis

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago.

Drafting Boards and Tables
Pease Co., C. F., Chicago

Drafting Materials
Pease Co., C. F., Chicago

Dressers, Grinding Wheel
Bay State Stamping Co., Worcester.
Clemson Bros., Inc., Middletown
Crafts & Co., Arthur A., Boston.
Norton Co., Worcester

Drill Holders
Armstrong Bros. Tool Co., Chicago.

Drill Speeders
Graham Mfg. Co., Providence.
Turner Mach. Co., Danbury.

Drilling Attachments
Hjorth Lathe & T. Co., Boston.

Drilling Machine Heads
Baush Mch. T. Co., Springfield, Mass.
Hoefer Mfg. Co., Freeport
Langelier Mfg. Co., Arlington
Nelson-Blanck Mfg. Co., Detroit.

Drilling Machines, Automatic
Avey Drilling Mach. Co., Cincinnati.
Baker Bros., Toledo. O.
Baush Mch. T. Co., Springfield, Mass.
Langelier Mfg. Co., Arlington
Nat'l Automatic Tool Co., Richmond

Drilling Machines, Bench
Ames Co., B. C., Waltham. Mass.
Avey Drill. Mach. Co., Cincinnati.
Barnes Co., W. F. & John, Rockford.
Clark Elect. Co., Jas., Louisville.
Clemson Bros., Inc., Middletown
Henry & Wright Mfg. Co., Hartford
Hoefer Mfg. Co., Freeport
Langelier Mfg. Co., Arlington
Silver Mfg. Co., Salem
Standard Elect. T. Co., Cincinnati
Taylor & Fenn Co., Hartford.
U. S. Elec. Tool Co., Cincinnati

Drilling Machines, Duplex
Knight Mchy. Co., W. B., St. Louis

Drilling Machines, Electric and Pneumatic
Chicago Pneumatic Tool Co., N. Y.
Clark Elect. Co., Jas., Louisville.
Ingersoll-Rand Co., N. Y.
Louisville Elect. Mfg. Co., Louisville
Neil & Smith Elec. T. Co., Cincinnati
Silver Mfg. Co., Salem
Standard Elect. T. Co., Cincinnati
U. S. Elec. Tool Co., Cincinnati.

Drilling Machines, Gang
Baker Bros., Toledo.
Barnes Drill Co., Rockford. Ill.
Cincinnati (O.) Bickford Tool Co.
Colburn Mach. Tool Co., Cleveland
Dreses Mch. T. Co., Cincinnati
Foote-Burt Co., Cleveland
Fosdick Mch. T. Co., Cincinnati
Henry & Wright Mfg. Co., Hartford
Langelier Mfg. Co., Arlington
Moline Tool Co., Moline. Ill.
Silver Mfg. Co., Salem
Sipp Mach. Co., Paterson.
Taylor & Fenn Co., Hartford.

Drilling Machines, Heavy Duty
Baker Bros., Toledo.
Betts Mach. Co., Rochester.
Colburn Mach. Tool Co., Cleveland
Foote-Burt Co., Cleveland
Fosdick Mch. T. Co., Cincinnati
Hoefer M'fg. Co., Freeport
Minster Mch. Co., Minster
Niles-Bement-Pond Co., N. Y.
Ryerson & Son, Joseph T., Chicago

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)

Drilling Machines, Multiple Spindle
Baush Mch. T. Co., Springfield, Mass.
Foote-Burt Co., Cleveland
Fox Machine Co., Jackson, Mich.
Harrington Son & Co., Ed., Phila.
Langelier Mfg. Co., Arlington
National Acme Co., Cleveland
Nat'l Automatic Tool Co., Richmond
Newton Mach. Tool Wks., Phila.
Sellers & Co., Wm., Philadelphia.
Turner Machine Co., Danbury.

Drilling Machines, Radial
American Tool Wks. Co., Cincinnati
Baush Mch. T. Co., Springfield, Mass.
Betts Mach. Co., Rochester.
Cincinnati (O.) Bickford Tool Co.
Fosdick Mach. Tool Co., Cincinnati.
Harrington Son & Co., Ed., Phila.
Henry & Wright Mfg. Co., Hartford
Lynd-Farquhar Co., Boston.
Morris Mach. Tool Co., Cincinnati.
Mueller Mach. Tool Co., Cincinnati.
Newton Mach. Tool Wks., Phila.
Niles-Bement-Pond Co., N. Y.
Reed-Prentice Co., Worcester.
Ryerson & Son, Joseph T., Chicago
Sellers & Co., Wm., Philadelphia.

Drilling Machines, Sensitive
Avey Drill. Mach. Co., Cincinnati.
Henry & Wright Mfg. Co., Hartford
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Royersford Fdry. & Mach. Co., Royersford
Sipp Mach. Co.. Paterson.
Taylor & Fenn Co., Hartford.

Drilling Machines, Turret
Nat'l Automatic Tool Co.. Richmond
Turner Mach. Co., Danbury.

Drilling Machines, Vertical
Avey Drill. Mach. Co., Cincinnati.
Baker Bros., Toledo.
Barnes Co.. W. F. & John. Rockford.
Barnes Drill Co., Rockford. Ill.
Baush Mch. T. Co.. Springfield. Mass.
Betts Mach. Co., Rochester.
Cincinnati (O.) Bickford Tool Co.
Colburn Mach. Tool Co.. Cleveland
Foote-Burt Co., Cleveland
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Harrington Son & Co.. Ed.. Phila.
Henry & Wright Mfg. Co.. Hartford
Hoefer Mfg. Co., Freeport
Knight Mchy. Co. W. B.. St. Louis.
Langelier Mfg. Co.. Arlington
Leland-Gifford Co.. Worcester.
Niles-Bement-Pond Co.. N. Y.
Reed-Prentice Co., Worcester.
Royersford Fdry. & Mach. Co.. Royersford
Silver Mfg. Co., Salem
Taylor & Fenn Co.. Hartford.
Turner Mach. Co., Danbury.

Drills, Center
Detroit Twist Drill Co.. Detroit
Morse Twist D. & M. Co., New Bedford.
National Twist D. & T. Co.. Detroit
Union Twist Drill Co., Athol. Mass.

Drills, Ratchet
Armstrong Bros. Tool Co.. Chicago
Detroit Twist Drill Co.. Detroit
National Twist D. & T. Co.. Detroit
Union Twist Drill Co., Athol. Mass.

Drills, Twist and Flat
Buckeye Twist Drill Co.. Alliance.
Detroit Twist Drill Co.. Detroit
Fast-Feed Drill & T. Corp., Toledo
Latrobe Tool Co.. Latrobe.
Morse Twist D. & M. Co., New Bedford
National Twist D. & T. Co., Detroit
Union Twist Drill Co.. Athol. Mass.
Whitman & Barnes Mfg. Co., Akron

Dynamometers
General Elect. Co., Schenectady

Electrical Instruments
General Elect. Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Electrical Supplies
General Elect. Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Elevating Trucks (See Trucks)
Elevators and Conveyors
Caldwell & Son Co., H. W.. Chicago
Link-Belt Co.. Chicago. Philadelphia

Emery Wheels (See Grinding Wheels)

Engines, Oil, Gas and Steam
Chicago Pneu. Tool Co., N. Y.

Engineers, Industrial & Mechanical
Hartford Special Mchy. Co., Hartford
Underwood Corp., H. B., Phila.

Engraving Machinery
Gorton Mach. Co.. Geo.. Racine.
Keller Mech. Engraving Co., Bklyn.

Expanders, Tube
Watson-Stillman Co., N. Y.

Eyeglasses, Safety (See Goggles, Safety)

Fans, Electric
General Elect. Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Fans, Exhaust
General Elect. Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Fans Ventilating
General Elect. Co., Schenectady

File Handles
Nicholson File Co.. Providence.

Files and Rasps
American Swiss F. & T. Co., N. Y.
Barnett Co., G. & H.. Philadelphia.
Nicholson File Co., Providence.

Filing Machines
Ames Co.. B. C., Waltham. Mass.
Cochrane-Bly Co., Rochester
Noble & Westbrook Mfg. Co., Hartford.
Oliver Instrument Co., Adrian.

Filler, Iron (See Cements, Iron)

Fittings, Hydraulic
Burroughs Composition Mchy. Corp., Newark.
Elmes Eng. Wks., Chas. F., Chicago.
Watson-Stillman Co., N. Y.

Flexible Shafts
Chicago Flexible Shaft Co.. Chicago
Errington Mechanical Laboratory, N. Y.
Strand & Co., N. A., Chicago.

Forgings, Drop
Bearings Co. of America. Lancaster
Universal Mch. Co., Bowling Green
Williams Co., J. H., Brooklyn

Forging Machinery
Acme Mchy. Co.. Cleveland.
Bradley & Son. C. C., Syracuse.
National Mchy. Co., Tiffin.

Foundry Equipment
Adams Co., Dubuque. Ia.

Fuel Oil Buring System
Advance Furnace & Eng. Co., Springfield, Mass.

Furnaces, Forging
Bellevue Industrial Furnace Co., Detroit.
Chicago Flexible Shaft Co., Chicago.

Furnaces, Heat-Treating, Coal
American Industrial Furnace Corp., Boston

Furnaces, Heat Treating, Oil and Gas
Advance Furnace & Eng. Co., Springfield, Mass.
American Gas Furnace Co.. N. Y.
American Industrial Furnace Corp., Boston
Bellevue Industrial Furnace Co., Detroit.
Brown & Sharpe Mfg. Co.. Providence
Chicago Flexible Shaft Co., Chicago
Johnson Gas Appliance Co.. Cedar Rapids

Furnaces and Ovens, Electric
Englehard. Charles. N. Y.
General Elect. Co., Schenectady

Furnaces, Tempering and Annealing
Advance Furnace & Eng. Co., Springfield, Mass.
Bennett Co.. W. R.. Elmwood. Ct.
Brown & Sharpe Mfg. Co., Providence
Chicago Flexible Shaft Co.. Chicago
General Elect. Co., Schenectady
Johnson Gas Appliance Co., Cedar Rapids

Furniture, Machine Shop
Brown Eng. Co., Reading
Manufacturing Equip. & Eng. Co., Framingham.

Gages, Comparator
Jones & Lamson Mch. Co., Springfield, Vt.

Gages, Dial
Ames Co., B. C., Waltham. Mass.
Brown & Sharpe Mfg. Co.. Providence
Niles-Bement-Pond Co., N. Y.
Randall & Stickney, Waltham
Starrett Co., L. S., Athol, Mass.

Gages. Recording
Bristol Co., Waterbury

Gages, Snap, Thread and Cylindrical
Brown & Sharpe Mfg. Co., Providence

Gages, Standard
Brown & Sharpe Mfg. Co., Providence
Hartford Special Mchy. Co., Hartford

Gas, Compressed
Davis-Bournonville Co., Jersey City

Gear Cutting Machines
Adams Co., Dubuque.
Barber-Coleman Co., Rockford. Ill.
Becker Milling Mch. Co., Hyde Park.
Bilgram Machine Works, Phila.
Brown & Sharpe Mfg. Co.. Providence
Cincinnati (O) Gear Cutting Mch. Co
Fellows Gear Shaper Co., Springfield. Vt.
Flather & Co., Nashua
Garvin Mach. Co., N. Y.
Gleason Works. Rochester
Gould & Eberhardt, Newark
Harrington Son & Co., Ed.. Phila.
Newark Gear Cutting M. Co., Newark
Newton Mach. Tool Works. Phila.
Waltham Mach. Wks., Waltham
Whiton Mch. Co., D. E., New London

Gear Tempering Machinery
Gleason Works. Rochester

Gear Testing Machinery
Adams Co., Dubuque
Brown & Sharpe Mfg. Co., Providence
Gisholt Mch. Co., Madison
Gleason Works. Rochester
Newark Gear Cut Mch. Co., Newark

Gears, Cast
Brown & Sharpe Mfg. Co., Providence
Brown Co.. A. & F., N. Y.
Caldwell & Son Co., H. W., Chicago
Franklin Die Cast Corp., Syracuse
Grant Gear Works, Boston
Horsburgh & Scott Co.. Cleveland.
Link-Belt Co.. Chicago. Philadelphia
Meisel Press Mfg. Co., Boston
Philadelphia Gear Works, Phila.

Gears, Cut
Adams Co., Dubuque
Albaugh-Dover Co.. Chicago
Baush Mch. T. Co., Springfield. Mass.
Bilgram Machine Works. Phila.
Boston Gear Wks.. Quincy, Mass.
Brown & Sharpe Mfg. Co.. Providence
Brown Co.. A. & F.. N. Y.
Chicago Rawhide Mfg. Co.. Chicago
Cincinnati Gear Co.. Cincinnati
Connecticut Gears. Inc., Waterbury
Diefendorf Gear Corp., Syracuse.
Earle Gear & Mch. Co., Philadelphia
Fawcus Machine Co., Pittsburgh.
Fellows Gear Shaper Co.. Springfield. Vt.
Flather & Co., Nashua
Foote Bros. Gear & M. Co., Chicago.
Garvin Mach. Co.. N. Y
General Elect. Co., Schenectady
Gleason Works. Rochester
Grant Gear Works. Boston.
Horsburgh & Scott Co.. Cleveland
Link-Belt Co.. Chicago. Philadelphia
M-C Mfg. Co., Newark
Meacham Gear Corp., Syracuse
Meisel Press Mfg. Co., Boston
Newark Gear Cutting Mach. Co., Newark.
Niles-Bement-Pond Co., N. Y.
Philadelphia Gear Works. Phila.
Simonds Mfg. Co., Pittsburgh

Gears, Forged
Philadelphia Gear Wks., Philadelphia

Generators, Electric
General Electric Co., Schenectady
Reliance Elect. & Eng. Co.. Cleveland
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Grab Buckets
Link-Belt Co.. Chicago. Philadelphia
Toledo Crane Co., Bucyrus

Greases, Lubricating
Royersford Fdry. & Mach. Co.. Royersford
Sun Co.. Philadelphia
Texas Co., N. Y.
White & Bagley Co.. Worcester

Grinding Machines, Ball Bearing Race (See Grinding Machines, Radial)

Grinding Machines, Bench
Athol Mch. & Fdry. Co., Athol
Blount Co.. J. G., Everett. Mass.
Brown & Sharpe Mfg. Co., Providence
Clark Elec. Co.. Jas., Louisville.
Diamond Mach. Co.. Providence
Louisville Elect. Mfg. Co., Louisville
Norton Co.. Worcester
Ransom Mfg. Co., Oshkosh
Safety Emery Wheel Co., Springfield, O.
Standard Elect. T. Co., Cincinnati
Union Twist Drill Co.. Athol
U. S. Electrical Tool Co., Cincinnati

Grinding Machines. Center
Louisville Elect. Mfg. Co., Louisville
Standard Elect. T. Co., Cincinnati
U. S. Electrical Tool Co., Cincinnati

Grinding Machines, Chaser
Geometric Tool Co., New Haven
National Acme Co., Cleveland

Grinding Machines, Chucking
Blanchard Mach. Co.. Cambridge
Bryant Chuck Grinder Co., Springfield, Vt.
Heald Machine Co., Worcester
Landis Tool Co.. Waynesboro
Rivett Lathe & Grinder Co., Boston
Van Norman Mach. Tool Co., Springfield, Mass.

Grinding Machines, Cutter and Reamer
Armstrong Bros. Tool Co.. Chicago
Barnes Co., W. F. & John, Rockford.
Blount Co., J. G., Everett
Brown & Sharpe Mfg. Co.. Providence
Cincinnati (O) Gear Cut. Mch. Co.
Cincinnati (O.) Milling Mach. Co.
Diamond Mach. Co., Providence
Garvin Mach. Co.. N. Y.
Gisholt Mch. Co., Madison
Heald Mach. Co., Worcester
Landis Tool Co., Waynesboro
LeBlond Mach. Tool Co.. R. K., Cincinnati
Modern Tool Co.. Erie. Pa.
Noble & Westbrook Mfg. Co.. Hartford
Norton Co., Worcester
Safety Emery Wheel Co.. Springfield. O.
Sellers & Co.. Wm.. Philadelphia
Sterling Grind. Wheel Co.. Tiffin
Taylor & Fenn Co.. Hartford
Union Twist Drill Co.. Athol
U. S. Electrical Tool Co., Cincinnati
Wilmarth & Morman Co., Grand Rapids

Grinding Machines. Cylindrical
Brown & Sharpe Mfg. Co.. Providence
Bryant Chuck Grinder Co., Springfield, Vt.
Detroit Mch. Tool Co., Detroit
Heald Machine Co., Worcester
Landis Tool Co., Waynesboro. Pa.
Modern Tool Co., Erie. Pa.
Norton Co., Worcester
Rivett Lathe & Grinder Co.. Boston
Sanford Mfg. Co., F. C., Bridgeport
Van Norman Mch. Tool Co.. Springfield, Mass.
Whitney & Son. Baxter D.. Winchendon.
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Die
Bignall & Keeler Mach. Co., Edwardsville.
Blanchard Mach. Co.. Cambridge
Diamond Mach. Co.. Providence
Geometric Tool Co.. New Haven
Heald Machine Co.. Worcester
Murchey Mch. & T. Co.. Detroit
National Acme Co., Cleveland.
National Machinery Co., Tiffin
Newton Mach. Tool Wks., Phila.
Noble & Westbrook Mfg. Co., Hartford
Wilmarth & Morman Co., Grand Rapids.

Grinding Machines, Disc
Badger Tool Co.. Beloit
Besly & Co., Chas. H., Chicago
Diamond Mach. Co.. Providence
Gardner Mch. Co., Beloit
Graham Mfg. Co., Providence
Rowbottom Mach. Co., Waterbury

Grinding Machines. Drill
Bellevue Industrial Furnace Co., Detroit
Louisville Elect. Mfg. Co., Louisville
Safety Emery Wheel Co.. Springfield. O.
Sellers & Co.. Wm.. Philadelphia
Sterling Grind. Wheel Co., Tiffin. O.
U. S. Electrical Tool Co.. Cincinnati
Wilmarth & Morman Co., Grand Rapids

Grinding Machines. Face
Blanchard Mach. Co.. Cambridge
Detroit Mch. Tool Co.. Detroit
Diamond Mach. Co.. Providence
Graham Mfg. Co., Providence

Grinding Machines, Floor
Blount Co.. J. G.. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence
Detroit Mch. Tool Co., Detroit
Diamond Mach. Co., Providence
Forbes & Myers. Worcester
Louisville Elect. Mfg. Co., Louisville
Noble & Westbrook Mfg. Co., Hartford
Norton Co.. Worcester
Ransom Mfg. Co., Oshkosh
Royersford Fdry. & Mach. Co.. Royersford
Safety Emery Wheel Co.. Springfield. O.
Sterling Grind. Wheel Co., Tiffin, O.
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Gage
Landis Tool Co., Waynesboro. Pa.
Rivett Lathe & Grinder Co. Boston
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Internal
Bryant Chuck Grinder Co., Springfield, Vt.
Garvin Mach. Co., N. Y.
Heald Mach. Co.. Worcester
Landis Tool Co. Waynesboro
Rivett Lathe & Grinder Co., Boston
Van Norman Mch. Tool Co., Springfield. Mass.
Whitney & Son. Baxter D., Winchendon
Wilmarth & Morman Co., Grand Rapids

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Armstrong-Blum Mfg. Co., Chicago
Chicago Pneumatic Tool Co., N. Y.
Clark Elec. Co., Jas., Louisville.

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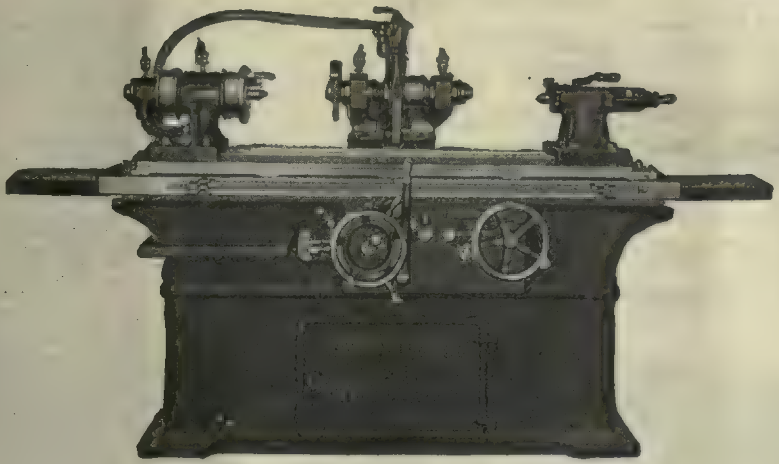

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Forbes & Myers, Worcester
Louisville Elect. Mfg. Co., Louisville
Neil & Smith Elec. T. Co., Cincinnati
Stroud, Arva, N. Y.
U. S. Electrical Tool Co., Cincinnati

Grinding Machines, Radial
Landis Tool Co., Waynesboro
Rivett Lathe & Grinder Co., Boston
Van Norman Mach. Tool Co., Springfield, Mass.

Grinding Machines, Ring Wheel
Badger Tool Co., Beloit
Besly & Co., Chas. H., Chicago
Diamond Mach. Co., Providence
Gardner Mch. Co., Beloit

Grinding Machines, Snagging
Blount Co., J. G., Everett
Diamond Mach. Co., Providence
Ransom Mfg. Co., Oshkosh

Grinding Machines, Surface
Blanchard Mach. Co., Cambridge
Brown & Sharpe Mfg. Co., Providence
Detroit Mch. Tool Co., Detroit
Diamond Mach. Co., Providence
Graham Mfg. Co., Providence
Heald Mach. Co. Worcester
Newton Mach. Tool Wks., Phila.
Noble & Westbrook Mfg. Co., Hartford
Norton Co., Worcester
Rowbottom Mach. Co., Waterbury
Safety Emery Wheel Co., Springfield, O.
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Brown & Sharpe Mfg. Co., Providence
Chicago Pneumatic Tool Co., N. Y.
Gisholt Mch. Co., Madison
Landis. Tool Co.. Waynesboro
Norton Co., Worcester
Wilmarth & Morman Co., Grand Rapids

Grinding Wheels
Carborundum Co., Niagara Falls.
Dickinson, Thomas L., N. Y.
Norton Co., Worcester
Safety Emery Wheel Co., Springfield, O.
Sterling Grind. Wheel Co., Tiffin.
Vitrified Wheel Co., Westfield

Guides, Elevator
Standard Gauge Steel Co., Beaver Falls

Gun-Barrel Machinery
Baush Mch. T. Co. ,Springfield, Mass.

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Bradley & Son, C. C., Syracuse.
Niles-Bement-Pond Co., N. Y.

Hammers, Forging
Nazel Eng. & Mch. Wks., Philadelphia

Hammers, Pneumatic
Chicago Pneu. Tool Co., N. Y.
Ingersoll Rand Co., N. Y.

Hammers, Power
Bliss Co., E. W., Brooklyn.
Bradley & Son, C. C. Syracuse.
Nazel Eng. & Mach. Wks., Phila.
Niles-Bement-Pond Co., N. Y.
Ryerson & Son, Joseph T., Chicago
West Tire Setter Co., Rochester.

Handles, Machine
Rockwood Sprinkler Co., Worcester

Hangers, Shafting
Armstrong Bros. Tool Co., Chicago.
Brown & Sharpe Mfg. Co., Providence.
Royersford Fdry. & Mach. Co., Royersford
S K F Industries, N. Y.

Hardening, Casehardening and Tempering
General Machine Works, York, Pa.

Hardness Testing Apparatus
Shore Instrument & Mfg. Co., N. Y.

Hobbing Machines
Adams Co., Dubuque.
Barber-Colman Co., Rockford, Ill.
Cincinnati (O) Gear Cut. Mch. Co.
Gould & Eberhardt, Newark
M-C Mfg. Co., Newark, N. J.
Newark Gear Cut Mch. Co., Newark

Hobs
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence.
National Tool Co., Cleveland.
Newark Gear Cut Mch. Co., Newark
Simmons Method-Hob Co., Phila.
Union Twist Drill Co., Athol.

Hoists & Cranes, Electric
Link-Belt Co., Chicago, Philadelphia
Niles-Bement-Pond Co., N. Y.
Northern Eng. Works. Detroit.
Pawling & Harnischfeger Co., Milwaukee
Shepard Elec. C. & H. Co., Montour Falls.
Toledo Crane Co., Bucyrus
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Hoists, Hand
Canton F. & M. Co., Canton.
Ford Chain Block & Mfg. Co., Phila.
Harrington Son & Co., Ed., Phila.

Hoists, Pneumatic
Chicago Pneumatic Tool Co., N. Y.
Curtis Pneu. Mchy. Co., St. Louis
Ingersoll-Rand Co., N. Y.
Sullivan Mchy Co., Chicago

Holders-On, Pneumatic
Chicago Pneumatic Tool Co., N. Y.

Hydraulic Leather
Schieren Co., Chas A., N. Y.

Hydraulic Machinery
Oilgear Co., Milwaukee
Watson-Stillman Co., N. Y.

Igniters, Gas Engine
Doehler Die Casting Co., Brooklyn.

Indicators, Speed and Test
Brown & Sharpe Mfg. Co., Providence.
Marvin & Casler Co., Canastota
Starrett Co., L. S., Athol.

Jacks, Hydraulic
Watson-Stillman Co., N. Y.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago.

Jigs and Fixtures (See Contract Work)

Kettles, Soda
Brown & Sharpe Mfg. Co., Providence.
Gray & Prior Mach. Co., Hartford.
Manufacturing Equip. & Eng. Co., Farmingham.

Keyseating Machines
Baker Bros., Toledo
Lapointe Co., J. N., New London
Lapointe Mach. Tool Co., Hudson.
Mitts & Merrill, Saginaw.
Morton Mfg. Co., Muskegon Heights.
Newton Mach. Tool Wks., Phila.
Niles-Bement-Pond Co., N. Y.

Keys, Machine
Moltrup Steel Products Co,. Beaver Falls
Morton Mfg. Co., Muskegon Heights.
Whitney Mfg. Co., Hartford.

Knurl Holders
Williams & Co., J. H., Brooklyn.

Lamp Brackets, Adjustable
McCrosky Tool Corp., Meadville

Lamps, Electric
General Elect. Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Lathe Attachments
Ames Co., B. C., Waltham, Mass.
Dalton Mfg. Corp., N. Y.
Flather & Co., Nashua
Rivett Lathe & Grinder Co., Boston

Lathe Tools
Armstrong Bros. Tool Co:, Chicago
Gisholt Mch. Co., Madison
Williams & Co., J. H., Brooklyn

Lathes, Automatic and Semi-Automatic
Gisholt Mch. Co., Madison
Jones & Lamson Mach. Co., Springfield, Vt.
National Acme Co., Windsor, Vt.
Potter & Johnston Mach. Co., Pawtucket.
Reed-Prentice Co., Worcester
Steinle Turret Mach. Co., Madison.

Lathes, Bench
Ames Co., B. C., Waltham, Mass.
Blount Co., J. G., Everett, Mass.
Dalton Mfg. Co., N. Y.
Diamond Machine Co., Providence
Hjorth Lathe & T. Co.. Boston.
Johnston Mfg. Co., Arlingon
Potter Tool & Mch. Wks., N. Y.
Rivett Lathe & Grinder Co., Boston
Seneca Falls Mfg. Co., Seneca Falls,
South Bend Lathe Wks., South Bend.
Stark Tool Co., Waltham
Van Norman Mach. Tool Co., Springfield, Mass.
Wade-American T. Co., Waltham

Lathes, Boring
Gisholt Mch. Co., Madison
Niles-Bement-Pond Co., N. Y.
Potter & Johnston Mach. Co., Pawtucket.

Lathes, Chucking (See Lathes, Horizontal Turret)

Lathes, Engine
American Tool Wks. Co., Cincinnati.
Barnes Co., W. F. & John, Rockford
Barnes Drill Co., Rockford
Blount Co., J. G., Everett, Mass.
Bradford Mach. Tool Co., Cincinnati
Champion Tool Wks. Co., Cincinnati.
Dalton Mfg. Corp., N. Y.
Fitchburg Mach. Wks., Fitchburg
Flather & Co., Nashua
Gisholt Mch. Co., Madison
Greaves, Klusman T. Co., Cincinnati
Hamilton Mch. Tool Co., Hamilton
Hendey Mach. Co., Torrington
LeBlond Mach. Tool Co., R. K., Cincinnati
Lodge & Shipley Mach. Tool Co., Cincinnati
Monarch Mach. Tool Co., Sidney, O.
Morris Mach. Tool Co., Cincinnati
Mueller Mach. Tool Co., Cincinnati
Niles-Bement-Pond Co., N. Y.
Reed-Prentice Co., Worcester
Robbins Mch. Wks., Worcester
Rockford (Ill.) Tool Co.
Ryerson & Son, Joseph T., Chicago
Seneca Falls Mfg. Co., Seneca Falls
Sidney Mch. Tool Co., Sidney
South Bend Lathe Wks., South Bend
Springfield Mch. T. Co., Springfield, O.
Whitcomb-Blaisdell M. T. Co., Worcester
Wickes Bros., Saginaw

Lathes, Extension and Gap
American Tool Wks. Co., Cincinnati
Barnes Drill Co., Rockford, Ill.
Harrington Son & Co., Ed., Phila.
Niles-Bement-Pond Co., N. Y.
Ryerson & Son, Joseph T., Chicago

Lathes, Foot Power
Barnes Co., W. F. & John, Rockford.
Dalton Mfg. Corp., N. Y.
Seneca Falls Mfg. Co., Seneca Falls

Lathes, Horizontal Turret
Acme Mach. Tool Co., Cincinnati
Foster Mach. Co., Elkhart
Gisholt Mch. Co., Madison
International Mach. Tool Co., Indianapolis
Jones & Lamson Mach. Co., Springfield, Vt.
Millholland Mch. Co., Indianapolis
Reed-Prentice Co., Worcester
Steinle Turret Mach. Co., Madison

Lathes, Polishing (See Polishing and Buffing)

Lathes, Speed and Hand
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Diamond Machine Co., Providence
Flather Mfg. Co., Nashua
Garvin Mach. Co., N. Y.
Seneca Falls Mfg. Co., Seneca Falls

Lathes, Threading
Automatic Mach. Co., Bridgeport
Flather Mfg. Co., Nashua
Rivett Lathe & Grinder Co., Boston

Lathes, Vertical Turret
Bullard Mach. Tool Co., Bridgeport

Lathes, Wood Turning
Barnes Co., W. F. & John, Rockford.
Blount Co., J. B., Everett.
Seneca Falls Mfg. Co., Seneca Falls

Letters and Figures
Brown & Sharpe Mfg. Co., Providence
Hoggson & Pettis Mfg. Co., New Haven
Pannier Bros. Stamp Co., Pittsburgh

Lighting Fixtures
General Elect. Co., Schenectady
McCrosky Tool Corp., Meadville

Lockers, Clothes
Manufacturers Equip. & Eng. Co., Framingham.

Lubricants
Oakley Chemical Co., N. Y.
Royersford Fdry. & Mach. Co., Royersford
Sun Co., Philadelphia
Texas Co., N. Y.
White & Bagley Co., Worcester

Machinists' Small Tools
Armstrong Bros. Tool Co., Chicago.
Athol Mch. & Fdry. Co., Athol
Browne & Sharpe Mfg. Co., Providence
Randall & Stickney, Waltham
Simplex Tool Co., Woonsocket
Starrett Co., L. S., Athol.
Williams & Co., J. H., Brooklyn

Mandrels, Expanding
Brown & Sharpe Mfg. Co., Providence.
Cochrane-Bly Co., Rochester
Nicholson & Co., W. H., Wilkes-Barre

Mandrels, Solid
Brown & Sharpe Mfg. Co., Providence.
Nicholson & Co., W. H., Wilkes-Barre
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol

Marking Machines
Noble & Westbrook Mfg Co., Hartford.

Marking Devices (See Stamps, Steel)

Metal Cleaning Equipment
Pangborn Corp., Hagerstown, Md.

Meters, Steam Flow
General Elect. Co., Schenectady
Norma Co. of America, N. Y.

Micrometer Callipers
Almond Mfg. Co., T. R., Ashburnham
Brown & Sharpe Mfg. Co., Providence.
Randall & Stickney, Waltham
Starrett Co., L. S., Athol.

Milling Attachments
Adams Co., Dubuque.
Becker Milling Mch. Co., Hype Park.
Brown & Sharpe Mfg. Co., Providence.
Cincinnati, (O.) Milling Mach. Co.
Garvin Mach. Co., N. Y.
Hendey Mach. Co., Torrington
Ingersoll Milling Mach. Co., Rockford
Kearney & Trecker Co., Milwaukee
Kempsmith Mfg. Co., Milwaukee.
LeBlond Mach. Tool Co., R. K., Cincinnati.
Potter & Johnston Mach. Co., Pawtucket
Standard Eng. Wks., Pawtucket.

Milling Machines, Automatic
Brown & Sharpe Mfg. Co., Providence.
Cincinnati (O.) Milling Mach. Co.
Ingersoll Mill Mch. Co., Rockford

Milling Machines Bench
Ames Co., B. C., Waltham.
Burke Mch. T. Co., Conneaut
Carter & Hakes Mach. Co., Winsted
Stark Tool Co., Waltham
Van Norman Mach. Tool Co., Springfield, Mass.

Milling Machines, Continuous
Ingersoll Mill Mch. Co., Rockford
Newton Mach. Tool Wks., Phila.
Potter & Johnston Mch. Co., Pawtucket

Milling Machines, Duplex
Cincinnati (O.) Milling Mach. Co.
Knight Mchy. Co., W. B., St. Louis.
Newton Mach. Tool Wks., Phila.

Milling Machines, Hand
Becker Milling Mch. Co., Hyde Park.
Brown & Sharpe Mfg. Co., Providence
Burke Mch. T. Co., Conneaut
Carter & Hakes Mach. Co:, Winsted,
Cincinnati (O.) Milling Mach. Co.
Fox Machine Co., Jackson, Mich.
Garvin Mach. Co., N. Y.
Standard Eng. Wks., Pawtucket.
Van Norman Mach. Tool Co., Springfield, Mass.
Whitney Mfg. Co., Hartford.

Milling Machines, Horizontal and Planer Type
Beaman & Smith Co., Providence
Betts Mach. Co., Rochester.
Ingersoll Milling Mch. Co., Rockford
Newton Mach. Tool Wks., Phila.
Niles-Bement-Pond Co., N. Y.

Milling Machines, Plain
Becker Milling Mch. Co., Hyde Park.
Betts Mach. Co., Rochester
Browne & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Cochrane-Bly Co., Rochester
Fox Machine Co., Jackson, Mich.
Garvin Mach. Co., N. Y.
Hendey Mach. Co., Torrington
Ingersoll Milling Mch. Co., Rockford
Kearney & Trecker Co., Milwaukee
Kempsmith Mfg. Co., Milwaukee
LeBlond Mach. Tool Co., R. K., Cincinnati
Newton Mach. Tool Wks., Phila.
Potter & Johnston Mach. Co., Pawtucket
Ryerson & Son, Joseph T., Chicago
Standard Eng. Wks., Pawtucket
Van Norman Mch. Tool Co., Springfield, Mass.

Milling Machines, Portable
Ingersoll Mill Mch. Co., Rockford
Newton Mach. Tool Wks., Phila.
Underwood Corp., H. B., Phila.

Milling Machines, Thread
Automatic Mach. Co., Bridgeport
Foster Mach. Co., Elkhart
Gisholt Mch. Co., Madison
Hall Planetary Thread Milling Mch. Co., Philadelphia
Harrington Son & Co., Ed., Phila.
Newton Mach. Tool Wks., Phila.
Waltham Mach. Wks., Waltham

Stewart Vertical Muffle Furnace for High Speed Steel

Furnaces of this type are intended for use where it is necessary that the products of combustion be prevented from coming in contact with the work. Unusually efficient in heat treatment of long pieces apt to be distorted when laid on floor of oven furnace. Especially recommended for hardening reamers, hobs, cutters, drills and similar articles.

Furnace is circular—gas or oil fired. Carbofrax muffle in center, with small openings around bottom to admit reducing gases preventing scaling of work. Pieces are suspended in rectangular opening at top—do not touch each other or walls of muffle.

Three Standard Sizes

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When a manufacturer selects Stewart Furnaces for his heat treating operations, he is assured of heat treating economy.

Stewart Furnaces are installed in many of the largest and most progressive manufacturing plants in the country for just that reason.

They cut costs by turning out maximum production accurately and uniformly, with minimum time and fuel consumption.

In automobile, truck, tractor, tool and gear manufacturing plants, Stewart Furnaces, by their steady, reliable operation, have established remarkable cost reductions and production increases.

Stewart Furnaces are built to master the most intricate heat treating jobs in your plant. They are designed and built by men who know the heat treating requirements of modern industry.

The wide experience of our Service Department in planning heat treating equipment for varied industries should prove helpful in solving your difficulties. This service is freely extended.

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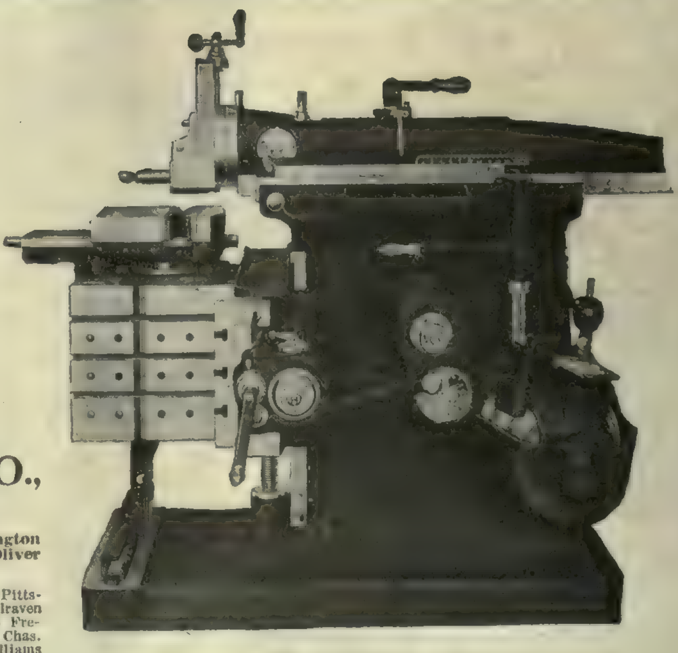

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Milling Machines, Universal
Becker Milling Mch. Co., Hyde Park.
Betts Mach. Co., Rochester.
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Cochrane-Bly Co., Rochester
Fox Machine Co., Jackson, Mich.
Garvin Mach. Co., N. Y.
Hendey Mach. Co., Torrington
Ingersoll Mill Mch. Co., Rockford
Kearney & Trecker Co., Milwaukee
Kempsmith Mfg. Co., Milwaukee
LeBlond Mach. T. Co., R. K., Cincinnati
Potter & Johnston Mach. Co., Pawtucket
Ryerson & Son, Joseph T., Chicago
Van Norman Mach. Tool Co., Springfield, Mass.

Milling Machines, Vertical
Becker Milling Mch. Co., Hyde Park.
Betts Mach. Co., Rochester
Brown & Sharpe Mfg. Co., Providence
Burke Mch. T. Co., Conneaut
Cincinnati (O.) Milling Mach. Co.
Garvin Mach. Co., N. Y.
Ingersoll Milling Mach. Co., Rockford
Kearney & Trecker Co., Milwaukee.
Knight Mchy. Co., W. B., St. Louis
LeBlond Mach. Tool Co., R. K., Cincinnati
Newton Mach. Tool Wks., Phila.
Niles-Bement-Pond Co., N. Y.
Potter & Johnston Mach. Co., Pawtucket
Van Norman Mach. T. Co., Springfield, Mass.

Milling Machines, Worm
Cleveland Auto Mach. Co., Cleveland
Newton Mach. Tool Wks., Phila.
Waltham Mach. Wks., Waltham

Milling Tools, Adjustable, Hollow
Geometric Tool Co., New Haven

Monel Metal
Driver-Harris Co., Harrison

Monel Metal Castings
Driver-Harris Co., Walkerville, Ont., Canada

Motors, Electric
Burke Elect. Co., Erie
General Elect. Co., Schenectady
Reliance Elect. & Eng. Co., Cleveland
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Nickel Sheets
Driver-Harris Co., Harrison

Nut Tappers (See Bolt and Nut Machinery)

Oil and Grease Cups
Bay State Stamp Co., Worcester
Bowen Products Corp., Auburn,
Gits Bros. Mfg. Co., Chicago
Tucker, W. A. & C. F., Hartford

Oil Stones
Norton Co., Worcester

Oils
Sun Co., Philadelphia
Texas Co., N. Y.
White & Bagley Co., Worcester

Oxygen
Davis-Bournonville Co., Jersey City

Packing, Hydraulic
Chicago Rawhide Mfg. Co., Chicago
Schieren Co., Chas. A., N. Y.

Pattern Shop Machinery (See Woodworking Machinery)

Patterns, Wood and Metal
Everett Pattern Wks., Everett
Mehl Mach. Tool & Die Co., Roselle

Pipe Bending Machines
Harrington Son & Co., Edwin, Phila.
Underwood Corp., H. B., Phila.

Pipe Cutting and Threading Machines
Bignall & Keeler Mach. Wks., Edwardsville.
Fox Machine Co., Jackson, Mich.
Harrington Son & Co., Edwin, Phila.
Landis Mach. Co., Waynesboro
Merrell Mfg. Co., Toledo
Murchey Mch. & T. Co., Detroit
Saunders Sons, D., Yonkers
Treadwell Eng. Co., Easton

Pipe Fitters' Tools
Butterfield & Co., Derby Line, Vt.
Saunders Sons, D., Yonkers
Williams & Co., J. H., Brooklyn

Piston-Ring Machines
National Acme Co., Windsor, Vt.
Potter & Johnston Mach. Co., Pawtucket

Planing Machines
American Tool Wks. Co., Cincinnati
Betts Machine Co., Rochester
Cincinnati Planer Co., Cincinnati
Cleveland Planer Co., Cleveland
Hamilton Mch. Tool Co., Hamilton
Liberty Mch. Tool Co., Hamilton
Newton Mach. Tool Wks., Phila.
Niles-Bement-Pond Co., N. Y.
Ryerson & Son, Joseph T., Chicago
Sellers & Co., Wm., Philadelphia
Whitcomb-Blaisdell Mch. Tool Co., Worcester

Planing Machines, Rotary
Newton Mch. Tool Wks., Phila.
Niles-Bement-Pond Co., N. Y.
Underwood Corp., H. B., Phila.

Plate Rolls
Niles-Bement-Pond Co., N. Y.

Pneumatic Tools
Anderson Bros. Mfg. Co., Rockford
Chicago Pneu. Tool Co., N. Y.
Ingersoll-Rand Co., N. Y.

Polishing and Buffing Machines
Barnes Co., W. F. & John, Rockford
Blanchard Mach. Co., Cambridge
Blount Co., J. G., Everett
Brown & Sharpe Mfg. Co., Providence
Bryant Church Grinder Co., Springfield, Vt.
Diamond Mach. Co., Providence
Gardner Mch. Co., Beloit
Heald Mach. Co., Worcester
Landis Tool Co., Waynesboro
Newton Mach. Tool Wks., Phila.
Noble & Westbrook Mfg. Co., Hartford
Potter Tool & Mach. Wks., N. Y.
Rivett Lathe & Grinder Co., Boston
Rowbottom Mach. Co., Waterbury
Royersford Fdry. & Mach. Co., Royersford
Safety Emery Wheel Co., Springfield, O.
Union Twist Drill Co., Athol
U. S. Elect. Tool Co., Cincinnati.
Van Norman Mch. T. Co., Springfield, Mass.

Pressed Steel Parts
Acklin Stamp. Co., Toledo
Worcester Pressed S. Co., Worcester

Presses, Arbor
Atlas Press Co., Kalamazoo
Barnes Co., W. F. & John, Rockford
Crane Puller Co., Arlington
Nicholson & Co., W. H., Wilkes-Barre

Presses, Broaching
Atlas Press Co., Kalamazoo

Presses, Drop and Forging
Ams Mach. Co., Max N. Y.
Bliss Co., E. W., Brooklyn
Elmes Eng. Wks., Chas. F., Chicago
Niles-Bement-Pond Co., N. Y.
Toledo Mach. & Tool Co., Toledo
U. S. Tool Co., Newark

Presses, Foot and Hand
Atlas Press Co., Kalamazoo
Bliss Co., E. W., Brooklyn
Ferracute Mach. Co., Bridgeton
Shuster Co., F. B., New Haven
Taylor & Fenn Co., Hartford

Presses, Forcing
Ams Mach. Co., Max N. Y.
Atlas Press Co., Kalamazoo
Barnes Co., W. F. & John, Rockford
Hydraulic Press Mfg. Co., Mt. Gilead
Lucas Mach. Tool Co., Cleveland

Presses, Hydraulic
Burroughs Composition Mchy Corp., Newark
Elmes Eng. Wks., Chas. F., Chicago
Hydraulic Press Mfg. Co., Mt. Gilead
Niles-Bement-Pond Co., N. Y.
Oilgear Co., Milwaukee
Watson-Stillman Co., N. Y.

Presses, Power
Ams Mach. Co., Max N. Y.
Barnes Co., W. F. & John, Rockford
Bliss Co., E. W., Brooklyn
Ferracute Mach. Co., Bridgeton
Henry & Wright Mfg. Co., Hartford
Rowbottom Mach. Co., Waterbury
Stoll Co., D. H., Buffalo
Toledo Mach. & Tool Co., Toledo
V. & O. Press Co., Glendale, N. Y.

Presses, Screw
Barnes Co., W. F. & John, Rockford
Bliss Co., E. W., Brooklyn

Profiling Machines
Becker Milling Mch. Co., Hyde Park.
Cochrane-Bly Co., Rochester
Garvin Mach. Co., N. Y.
Newton Mach. Tool Wks., Phila.
Stark Tool Co., Waltham
Wade-American T. Co., Waltham

Pullers, Wheel
Crane Puller Co., Arlington

Pulley Turning and Boring Machines
American Tool Wks. Co., Cincinnati
Niles-Bement-Pond Co., N. Y.

Pulleys, Cork Insert
American Pulley Co., Philadelphia

Pulleys Metal
American Pulley Co., Philadelphia
Brown Co., A. & F., N. Y.
Brown & Sharpe Mfg. Co., Providence
Caldwell & Son Co., H. W., Chicago
Johnson Mach. Co., Carlyle, Manchester.

Pumps, Hydraulic
Burroughs Composition Mchy Corp., Newark
Elmes Eng. Wks., Chas F., Chicago
Hydraulic Press Mfg. Co., Mt. Gilead

Pumps, Lubricant and Oil
Brown & Sharpe Mfg. Co., Providence
Oilgear Co., Milwaukee

Pumps, Power
Ingersoll-Rand Co., N. Y.
Sullivan Mchy. Co., Chicago

Punches, Center
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol.

Punches, Hand
Armstrong-Blum Mfg. Co., Chicago.

Punches, Power
Ferracute Mach. Co., Bridgeton
Mitts & Merrill, Saginaw
Royersford Fdry. & Mach. Co., Royersford
Ryerson & Sons, Joseph T., Chicago
Watson-Stillman Co., N. Y.

Pyrometers, Electric
Bristol Co., Waterbury.
Engelhard Chas., N. Y.

Rack Cutting Machines
Gould & Eberhardt, Newark
Newark Gear Cut Mch. Co., Newark

Rack Machine
Standard Gauge Steel Co., Beaver Falls

Racks, Cut
Moltrup Steel Products Co., Beaver Falls

Racks, Storage (See Furniture, Machine Shop)

Radiators, Japanning Oven
American Gas Furnace Co., N. Y.
Chicago Flexible Shaft Co., Chicago.

Rammers, Foundry
Brown & Sharpe Mfg. Co., Providence.
Chicago Pneumatic Tool Co., N. Y.
Ingersoll-Rand Co., N. Y.

Rawhide, Rope
Schieren Co., Chas. A., N. Y.

Reamer, Holders
Gisholt Mch. Co., Madison
Victor Tool Co., Waynesboro

Reamers, Expanding
Brubaker & Bros. Co., W. L., N. Y.
Detroit Twist Drill Co., Detroit
Gisholt Mch. Co., Madison
McCrosky Tool Corp., Meadville

Reamers, Solid
Brubaker & Bros. Co., W. L., N. Y.
Buckeye Twist Drill Co., Alliance.
Butterfield & Co., Derby Line, Vt.
Detroit Twist Drill Co., Detroit
Gammon Holman Co., Manchester
Morse Twist D. & M. Co., New Bedford
National Tool Co., Cleveland.
National Twist D. & T. Co., Detroit
Reed Mfg. Co., Erie.
Union Twist Drill Co., Athol.
Whitman & Barnes Mfg. Co., Akron

Reamers, Taper
Brown & Sharpe Mfg. Co. Providence.
Gammon-Holman Co., Manchester
Union Twist Drill Co., Athol

Recorders, Pressure
Bristol Co., Waterbury.

Recorders, Temperature
Bristol Co., Waterbury.

Recorders, Time
Gisholt Mch. Co., Madison

Resistance Materials
Driver-Harris Co., Harrison, N. J.

Rheostats
General Elect. Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Rivet Making Machinery
Cook Co., Asa S., Hartford.
National Machinery Co., Tiffin.

Rivet Sets
Chicago Pneu. Tool Co., N. Y.

Riveting Machines
Chicago Pneumatic Tool Co., N. Y.
Grant Mfg. & Mach. Co., Bridgeport
Ingersoll-Rand Co., N. Y.
Shuster Co., F. B., New Haven
Townsend Mfg. Co., H. P., Hartford.

Rod Cutters
Tucker, W. A. & C. F., Hartford

Rules, Steel
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol.

Rust Preventatives
Oakley Chemical Co., N. Y.

Sand-Blast Apparatus
Pangborn Corp., Hagerstown, Md.

Sand Rammers, Pneumatic
Chicago Pneumatic Tool Co., N. Y.

Saw Frames and Blades, Hack
Clemson Bros., Inc., Middletown
Diamond S. & Stamp Wks., Buffalo
Hunter Saw & Mch. Co., Pittsburgh
Napier Saw Wks., Springfield, Mass
Starrett Co., L. S., Athol.
Thompson & Son Co., Hy. G., New Haven.

Saw Sharpening Machines
Cochrane-Bly Co., Rochester

Saw Tables, Universal
Baker Bros., Toledo.
Silver Mfg. Co., Salem

Sawing Machines, Metal
Armstrong-Blum Mfg. Co., Chicago.
Cochrane-Bly Co., Rochester
Diamond S. & Stamp Wks., Buffalo
Earle Gear & Machine Co., Phila.
Napier Saw Wks., Springfield, Mass.
Newton Mach. Tool Wks., Phila.
Vandyck Churchill Co., N. Y.

Sawing Machines, Power Hack
Armstrong-Blum Mfg. Co., Chicago.
Clemson Bros., Inc., Middletown
Diamond S. & Stamp Wks., Buffalo
Napier Saw Wks., Springfield, Mass.
Thompson & Son Co., Hy. G., New Haven.
Victor Saw Wks., Middletown

Saws, Circular Metal
Barber-Colman Co., Rockford, Ill.
Cochrane-Bly Co., Rochester
Hunter Saw & Mch. Co., Pittsburgh
Napier Saw Wks., Springfield, Mass.
Union Twist Drill Co., Athol.

Saws, Metal Band
Hunter Saw & Mch. Co., Pittsburgh
Silver Mfg. Co., Salem

Saws, Metal Cutting
Brown & Sharpe Mfg. Co., Providence
Cochrane-Bly Co., Rochester
Hunter Saw & Mch. Co., Pittsburgh

Saws, Milling
Brown & Sharpe Mfg. Co., Providence.
National Tool Co., Cleveland
Union Twist Drill Co., Athol

Saws, Screw Slotting
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol.
Union Twist Drill Co., Athol.

Scales
Brown & Sharpe Mfg. Co., Providence.

Screw-Machine Work
Acme Mch. T. Co., Cincinnati
Automatic Products Co., L. I. City
Cincinnati (O.) Automatic Mach. Co.
Eastern Mch. Screw Corp., New Haven
Link-Belt Co., Chicago, Phila.
Meisel Press Mfg. Co., Boston
National Acme, Cleveland.
Poorman, J. E., Philadelphia
Simplex Tool Co., Woonsocket

Screw Machinery, Wood and Lag
Cook Co., Asa., S., Hartford.
Townsend Mfg. Co., H. P., Hartford.

Screw Machines, Automatic
Acme Mch. T. Co., Cincinnati
Brown & Sharpe Mfg. Co., Providence.
Cincinnati (O.) Automatic Mach. Co.
Cleveland (O.) Auto. Mach. Co.
Cone Auto. Mch. Co., Windsor
Davenport Mch. T. Co., Rochester
National Acme Co., Cleveland.

Screw Machines, Plain or Hand
Acme Machine Tool Co., Cincinnati.
Brown & Sharpe Mfg. Co., Providence
Cleveland (O). Auto Mch. Co.
Foster Mach. Co., Elkhart.
Garvin Mach. Co., N. Y.
Jones & Lamson Mach. Co., Springfield, Vt.
Millholland Mch. Co., Indianapolis.

Screw Plates
Brubaker & Bros. Co., W. L., N. Y.
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield.
Morse Twist D. & M. Co., New Bedford

Screws, Cap and Set
Allen Mfg. Co., Hartford.
Bristol Co., Waterbury.
National Acme Co., Cleveland.

Screws, Machine
Allen Mfg. Co., Hartford.
Bristol Co., Waterbury

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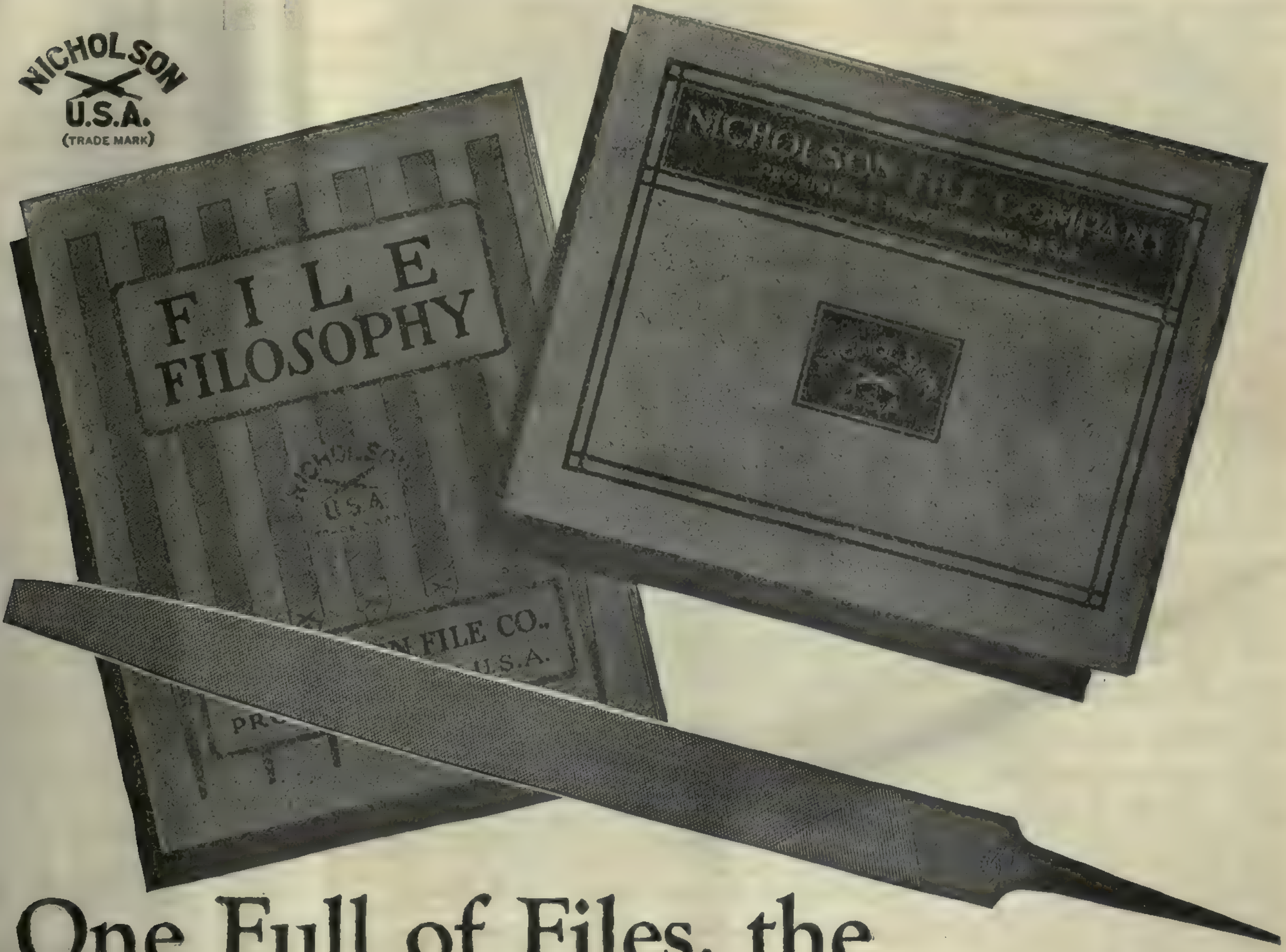

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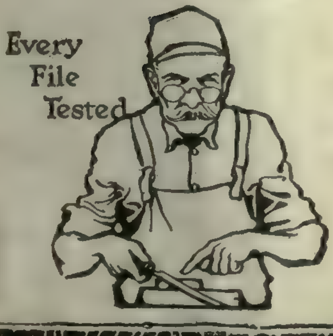

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PROVIDENCE, R.I., U.S.A.

Seamless Steel Tubing (See Tubing, Seamless Steel)

Second-Hand Machinery (See Searchlight Section)
Asher Mchy Co., Newark
Bath & Co., Cyril J., Cleveland
Botwinik Bros., New Haven
Brownell Mchy. Co., Providence.
Cincinnati Planer Co., Cincinnati.
Essley, E. L., Mchy. Co., Chicago
Garvin Mach. Co., N. Y.
Gelb & Co., J., N. Y.
Hill, Clarke & Co., Chicago.
Hyman & Sons, Jos., Philadelphia
Ideal Mchy. Co., Plainsville
Industrial Plants Corp, N. Y.
Lamberg & Co., A., N. Y.
McMullen Mchy. Co., Grand Rapids
Metzler, Robt. J., Newark
Morey & Co., N. Y.
N. J. Mchy. Exch., Newark
Niles & Co., F. H., N. Y.
Niles-Bement-Pond Co., N. Y.
Osborne & Septon Mchy. Co., Columbus
Prentiss & Co., Henry, N. Y.
Purinton & Smith, Hartford
Russell Mach. Co., Pittsburgh
Ryerson & Son, Joseph T., Chicago
Seyfert's Sons, L. F. Philadelphia
Sherritt & Stoer Co., Philadelphia
Simmons Mach. Co., N. Y.
Standard Mchy. Co., New Haven.
Stokvis & Sons, R. S., N. Y.
Toomey, Frank, Philadelphia
Wayne Mchy. Co., Ft. Wayne.
Winterer, H. L., Philadelphia.

Separators, Oil and Waste
Pangborn Corp., Hagerstown, Md.

Shafting
Royersford Fdry. & Mach. Co., Royersford
Strand & Co., N. A., Chicago
Union Drawn Steel Co., Beaver Falls

Shapes, Cold-Drawn Special Steel
Moltrup Steel Products Co., Beaver Falls
New England D. S. Co., Mansfield.
Standard Gauge Steel Co., Beaver Falls
Union Drawn Steel Co., Beaver Falls.

Shaping Machines
American Tool Wks. Co., Cincinnati.
Cincinnati Shaper Co., Cincinnati.
Cochrane-Bly Co., Rochester
Gould & Eberhardt, Newark
Hendey Mach. Co., Torringhon
Kelly Co., R. A., Xenia.
Lynd-Farquhar Co., Boston.
Morton Mfg. Co., Muskegon Heights.
Newton Mach. Tool Wks., Phila.
Niles-Bement-Pond Co., N. Y.
Potter & Johnston Mach. Co., Pawtucket.
Queen City Mch. T. Co., Cincinnati
Ryerson & Son, Joseph T., Chicago
Smith & Mills Co., Cincinnati.
Springfield Mch. T. Co., Springfield, O.
Steel Prod. Eng. Co., Springfield
Whipp Mch. T. Co., Sidney

Shear, Blades
Cleveland (O.) Knife & Forge Co.

Shears, Hand
Armstrong-Blum Mfg. Co., Chicago.
Tucker, W. A. & C. F., Hartford.

Shears, Power
Ferracute Mach. Co., Bridgeton, N. J.
Mitts & Merrill, Saginaw
Royersford Fdry. & Mach. Co., Royersford
Stoll Co., D. H., Buffalo.
Toledo Mach. & Tool Co., Toledo.

Sheet Metal Working Machinery
Ams Mach Co., Max, N. Y.
Bliss Co., E. W., Brooklyn
Ferracute Mach. Co., Bridgeton
Ryerson & Son, Joseph T., Chicago
Savage Co., W. J., Knoxville.
Toledo Mach. & Tool Co., Toledo.

Shelving Steel
Niles-Bement-Pond Co., N. Y.

Slotting Machines
Betts Mach. Co., Rochester.
Cochrane-Bly Co., Rochester
Garvin Mach. Co., N. Y.
National Acme Co., Cleveland.
Newton Mach. Tool Wks., Phila.
Sellers & Co., Wm., Phila.

Sockets and Sleeves
Detroit Twist Drill Co., Detroit

Special Machinery and Tools (See Contract Work)
Speed Reducers
Philadelphia Gear Wks., Phila.

Spring Winders
Hjorth Lathe & T. Co., Boston.

Springs
Newcomb Spring Corp., Brooklyn

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Baldwin Chain & Mfg. Co., Worcester.
Bilgram Mach. Wks., Phila.
Boston Gear Wks., Quincy.
Cullman Wheel Co., Chicago.
Grant Gear Wks., Boston.
Link-Belt Co., Chicago, Phila.
Meisel Press Mfg. Co., Boston.
Morse Chain Co., Ithaca.
Philadelphia Gear Works, Phila.
Whitney Mfg. Co., Hartford

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Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol

Stampings, Metal
Acklin Stamp. Co., Toledo, O.
American Pulley Co., Phila.
Bay State Stamp. Co., Worcester.
Detroit Stamp. Co., Detroit.
Globe Mch. & Stamp Co., Cleveland
Worcester Pressed S. Co., Worcester

Stamps, Steel
Hoggson & Pettis Mfg. Co., New Haven.
Noble & Westbrook Mfg. Co., Hartford.
Pannier Bros. Stamp Co., Pittsburgh
Schwerdtle Stamp Co., Bridgeport

Stands, Portable (See Furniture, Machine Shop)

Steam Specialties
Dart Mfg. Co., E. M., Providence.

Steel, Cold Rolled Strip
Driver-Harris Co., Harrison
Hawkridge Bros. Co., Boston.

Steel Hardness Measuring and Treating Instruments
Shore Instrument & Mfg. Co., N. Y.

Steel Shafting and Free Cutting Screw
Hawkridge Bros. Co., Boston.
Moltrup Steel Products Co., Beaver Falls
New England D. Steel Co., Mansfield
Standard Gauge Steel Co., Beaver Falls.
Union Drawn Steel Co., Beaver Falls.

Steel, Sheet
Colonial Steel Co., Pittsburgh
Hawkridge Bros. Co., Boston.
Jessop & Sons, Wm., N. Y.

Steels, Alloy Carbon, and High Speed
Armstrong Bros. Tool Co., Chicago.
Buffalo Forge Co., Buffalo.
Colonial Steel Co., Pittsburgh
Firth-Sterling Steel Co., McKeesport
Hawkridge Bros. Co., Boston.
Haynes Stellite Co., Kokomo
Jessop & Sons, Wm., N. Y.
Vanadium-Alloys Steel Co., Pittsburgh.
Vulcan Crucible Steel Co., Aliquippa

Stellite
Haynes Stellite Co., Kokomo

Stools, Shop
Manufacturing Equip. & Eng. Co., Framingham.

Straightening Machinery
Shuster Co., F. B., New Haven.
Springfield Mch. T. Co., Springfield, O.
Standard Eng. Wks., Pawtucket.

Stud Setters, Opening
Errington Mechanical Laboratory, N. Y.

Subpresses and Dies
Waltham Mach. Wks., Waltham.

Surface Plates
Simplex Tool Co., Woonsocket

Swaging Machines
Langlier Mfg. Co., Arlington
Torrington Co., Torrington

Switches and Switchbacks
General Elec. Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Tachometers
Bristol Co., Waterbury.

Tap Extensions
Allen Mfg. Co., Hartford.

Tap Holders
Apex Mach. Co., Dayton
Errington Mechanical Laboratory, N. Y.
Gisholt Mch. Co., Madison

Taper Pins
Brown & Sharpe Mfg. Co., Providence.

Tapes, Measuring
Starrett Co., L. S., Athol.

Tapping Machines and Attachments
Acme Machinery Co., Cleveland.
American Tool Wks. Co., Cincinnati
Baker Bros., Toledo
Beaman & Smith Co., Providence
Burke Mch. T. Co., Conneaut
Cincinnati (O.) Bickford Tool Co.
Errington Mechanical Laboratory, N. Y.
Fox Machine Co., Jackson, Mich.
Garvin Mach. Co., N. Y.
Geomtric Tool Co., New Haven, Ct.
Harrington Son & Co., Ed., Phila.
Hoefer Mfg. Co., Freeport
Langelier Mfg. Co., Arlington
McCrosky Tool Corp., Meadville, Pa.
Moline Tool Co., Moline
Nat'l Automatic Tool Co., Richmond
National Machinery Co., Tiffin
Turner Machine Co., Danbury

Taps and Dies
American Tap & Drill Co., Greenfield
Brubaker & Bros Co., W. L., N. Y.
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield.
Morse Twist D. & M. Co., New Bedford
National Tool Co., Cleveland

Taps, Collapsing
Eastern Mach. Screw Corp., New Haven.
Errington Mechanical Laboratory, N. Y.
Geometric Tool Co., New Haven, Ct.
Murchey Mch. & T. Co., Detroit
National Acme Co., Cleveland.
Victor Tool Co., Waynesboro

Thermometers
Bristol Co., Waterbury, Conn.
Englehard, Charles, N. Y.

Thread-Cutting Tools
Eastern Mach. Screw Corp., New Haven
Geometric Tool Co., New Haven
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Machine Co., Waynesboro
Modern Tool Co., Erie
Murchey Mch. & T. Co., Detroit
National Acme Co., Cleveland.
Rivett Lathe & Grinder Co., Boston
Victor Tool Co., Waynesboro

Threading Machines
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Eastern Mach. Screw Corp., New Haven
Geometric Tool Co., New Haven
Hall Planetary Thread Mill Mch. Co., Philadelphia
Landis Mach Co., Waynesboro
National Acme Co., Cleveland
National Machinery Co., Tiffin.
Universal Mech. Co., Bowling Green

Thread Rolling Machines
National Machinery Co., Tiffin.

Tool Holders
Armstrong Bros. Tool Co., Chicago
Gisholt Mch. Co., Madison
Williams & Co., J. H., Brooklyn

Tool Posts, Lathe
Armstrong Bros. Tool Co., Chicago
Williams & Co., J. H., Brooklyn

Tool Work (See Contract Work)

Tools, Small (See Machinists' Small Tools)

Torches, Blow
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Tractors, Industrial
Elwell-Parker Elec. Co., Cleveland

Transformers
Foote Bros. Gear & Mch. Co., Chicago.
General Elect. Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Transmission Machinery
Foote Bros. Gear & Mch. Co., Chicago.
Link-Belt Co., Chicago, Philadelphia
Moore & White Co., Philadelphia.
Morse Chain Co., Ithaca
Oilgear Co., Milwaukee
Royersford Fdry. & Mach. Co., Royersford

Transportation Systems (See Trucks)

Trolleys and Tramways
Curtis Pneu. Mchy. Co., St. Louis
Harrington Son & Co., Edwin. Phila.
Shepard Elec. C. & H. Co., Montour Falls.

Trucks
Lewis-Shepard Co., Boston

Trucks, Industrial Motor
Elwell-Parker Elec. Co., Cleveland

Tubing, Flexible
Almond Mfg. Co., T. R., Ashburnham

Turret Heads
Almond Mfg. Co., T. R., Ashburnham

Turret Machines (See Lathes, Horizontal Turret)

Turrets, Tool Post
American Tool Wks. Co., Cincinnati

Unions, Pipe
Dart Mfg. Co., E. M., Providence

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Elmes Eng. Wks., Chas. F., Chicago
Hydraulic Press Mfg. Co., Mt. Gilead
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Armstrong Bros. Tool Co., Chicago
Brown Eng. Co., Reading
Hartford Special Mchy. Co., Hartford
Hoggson & Pettis Mfg. Co., New Haven.

Vises, Metal Workers'
Athol Mach. & Fdry. Co., Athol
Hartford Special Mchy. Co., Hartford
Parker Co., Chas., Meriden
Reed Mfg. Co., Erie

Vises, Milling Machine
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
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Vises, Pipe
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Vises, Wood Workers
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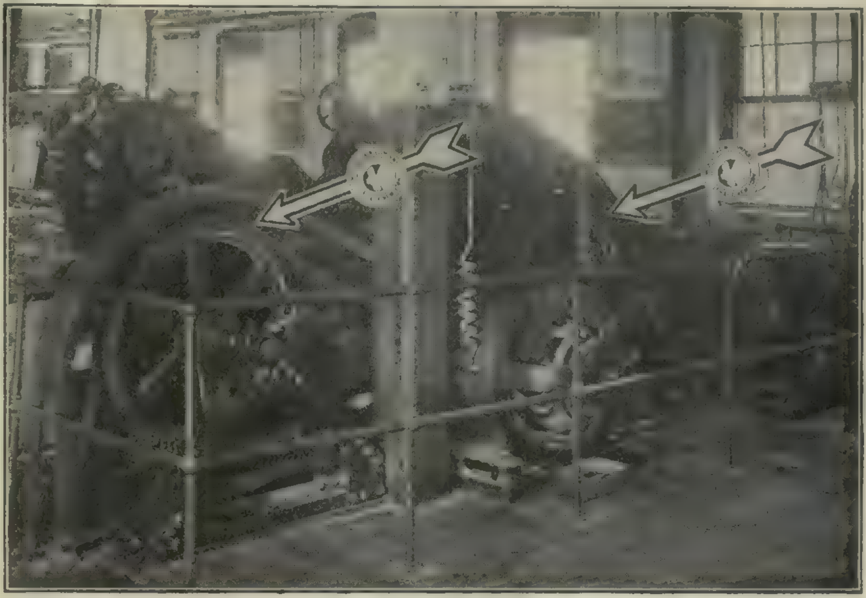

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